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SECTION 01000

GENERAL USE OF SPECIFICATIONS

PART 1 GENERAL

1.01 SUMMARY

- A. These standard specifications are prepared by the City of Cheyenne Engineering Department and the Board of Public Utilities. They are intended solely for construction and maintenance of publically owned improvements and associated utility connections in Cheyenne.

- B. These standard specifications are adopted by the City Council via resolution after a public comment period. They comprise the specifications and/or standards variously referenced in Chapters 12.04, 12.12, 13.04, 13.12, and other Chapters of the Cheyenne City Code.

1.02 CONTRACTUAL PROVISIONS

- A. These standard specifications represent the technical portion of the Contract Documents. They are intended to be used in conjunction with other contract documents, typically in the form of a Project Manual. The Project Manual generally contains the bidding requirements, contract forms, conditions of the contract, specifications, descriptions of modifications to both the standard conditions and specifications for the individual project, and references to the portions of the Contract Documents not bound into the Project Manual.

- B. The City and the BOPU have standard Contract Documents to accompany these specifications for publically contracted projects. These documents are commonly referred to as the “boilerplate”.

- C. Developers, contractors, and other parties doing privately funded work are encouraged to develop Contract Documents to accompany these specifications in consultation with qualified legal advisors.

1.03 PROCEDURE TO AMEND THE STANDARD SPECIFICATIONS

- A. It is the intent of the City of Cheyenne and the BOPU to amend these standard specifications periodically to reflect changes in engineering and construction practices. Anyone may propose

amendments to these standard specifications. Proposed amendments should be made in writing and directed to the attention of the City Engineer and/or BOPU Director as may be appropriate. All proposed amendments should be directed toward a specific section of the standard specifications and be as detailed as possible.

- B. Amending these specifications is not a rulemaking pursuant to the Administrative Procedures Act as they are adopted by legislative action. When the City Engineer and the Director of the BOPU deem it prudent and necessary to amend these standard specifications, the following procedure shall be followed:
1. Proposed amendments shall be developed by the City Engineering Department and the BOPU. Such amendments shall be in a form that clearly depicts additions, deletions, and substitutions or be marked as a completely new section.
 2. Proposed amendments may be informally circulated for review by contractors, developers, engineering consultants, suppliers, and other relevant parties.
 3. The City Engineer and the BOPU Director may form specialized standing committees comprised of knowledgeable and interested persons to advise on specific portions of the specifications. These committees may include Asphalt, Concrete, Utilities, and General Provisions. These committees may be disbanded if interested persons cannot be found or do not have time to advise. Other committees may be formed to address other areas of the specifications.
 4. Major specification changes, in the opinion of the City Engineer or BOPU Director, will be formally provided to the appropriate standing committee (if any) for review, discussion, and recommendation. Recommendations of the standing committees shall not be binding upon the City Engineer and BOPU Director; however written feedback from the standing committees that are not acted upon by the City Engineer and BOPU Director will be forwarded to the Governing Body as an attachment to a proposed specification amendment.
 5. Once a complete proposed amendment package has been prepared, a formal 45 calendar day public comment period shall be opened. During this public comment period,

copies of the proposed amendments shall be available for inspection in the offices of the City Engineer, the City Clerk, and the BOPU. Copies shall also be available electronically on the City's website. All comments shall be made in writing. Electronic mail and/or facsimile are acceptable methods of commenting.

6. Upon the close of the public comment period, the City Engineer and BOPU Director shall prepare a matrix summarizing all comments received, the party making the comments, and a response to the comment, including any action to be taken. The City Engineer and the BOPU Director may, at their sole discretion, elect to publish a revised amendment and conduct another public comment process if they feel that comments received caused significant changes to be made to the proposed amendment.
7. The proposed amendment shall be placed upon the agenda of the Governing Body for adoption via resolution. The matrix summarizing all comments received, the party making the comments, and the City Engineer or BOPU Director's response to the comment, including any action to be taken, shall be provided to the Governing Body along with any written feedback on the proposed specifications from any of the standing committees.
8. Specification changes become effective upon the date specified in the adopting resolution, or, if no effective date is specified, on the publication date of the resolution. Specification changes are not retroactive and all work under contract and permitted prior to the effective date shall be completed under the version of the specifications that was in effect on the date the construction plans were signed off by the City Engineer. Prior to the effective date, the City Engineer will make both fully compiled and individual amendments available in electronic format on the City's website.

END OF SECTION

SECTION 01005

ABBREVIATIONS AND DEFINITIONS

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of abbreviations and definitions used within these specifications, Standard Drawings, and plans. They are to be construed the same as the respective expressions represented.

PART 2 ABBREVIATIONS, DEFINITIONS, AND TERMS

2.01 ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
AB	Aggregate Base
Aban	Abandon
ABC	Aggregate Base Course
AC	Asphalt Cement or Concrete; Asphaltic Concrete
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
ACWS	Asphalt Concrete Wearing Course
AGC	Associated General Contractors of America, Inc.
Agg	Aggregate
Ahd	Ahead
AIA	American Institute of Architects
AIEE	American Institute of Electrical Engineers
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
APA	American Plywood Association
Approx	Approximate
APWA	American Public Works Association
AR	Aged Residue
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
Asph	Asphalt
ASTM	American Society for Testing Materials
ATSSA	American Traffic Safety Services Association
Av, Ave	Avenue
AWWA	American Water Works Association

BC	Begin Curve
BCR	Begin Curb Return
Beg	Beginning
Bk	Book or Back
Blvd	Boulevard
BM	Bench Mark or Board Measure
BOC	Back of Curb
BOPU	Board of Public Utilities
Brg	Bearing
BVC	Begin Vertical Curve
C	Centigrade or Curb
CB	Catch Basin
CC	Center to Center
Cem	Cement
CF	Curb Face
Cfs	Cubic Feet per Second
CIP	Cast Iron Pipe
CITY	City of Cheyenne
CL	Centerline
Cm	Centimeter
CMP	Corrugated Metal Pipe
CO	Clean out
Col	Column
Conc	Concrete
Const	Construction
CP	Concrete Pipe (non-reinforced)
CRSI	Concrete Reinforcing Steel Institute
CTB	Cement Treated Base
Cu	Cubic
D	Storm Drain
Deg	Degree
Dia	Diameter
Dim	Dimension
DIP	Ductile Iron Pipe
Div	Division
Dr	Drive
Drwg	Drawing
Dwy	Driveway
Ea	Each
Ease	Easement
E	East
EC	End of Curve
ECR	End Curb Return

El, Elv	Elevation
Equa, Eq	Equation
EVC	End Vertical Curve
Ex, Exist	Existing
F	Fahrenheit
FE	Floor Elevation
FF	Finish Floor
FH	Fire Hydrant
FL, F	Floor line or Flow line
Fnd	Found
Fps	Feet per Second
FSS	Federal Specifications and Standards
Ft	Foot, Feet
G	Gutter
Ga	Gage
GL	Ground line
Gpm	Gallons per Minute
Gr	Grade
H	High, Height
HC	House Connection
Hdwl	Headwall
Horiz	Horizontal
Hwy	Highway
ID	Interior diameter
IE	Invert Elevation
IEEE	Institute of Electrical and Electronic Engineers
In	Inch
Inv	Invert
IP	Iron Pipe
Irrig	Irrigation
Jct	Junction
Jt	Joint
JS	Junction Structure
LF	Linear Foot
M	Map, Maps
Max	Maximum
Meas	Measured
MH	Manhole
Min	Minimum, Minutes

Misc	Miscellaneous
ML	Monument Line
Mm	Millimeter
Mon	Monolithic, Monument
MPO	Metropolitan Planning Office
MSDS	Material Safety Data Sheet
MUTCD	Manual on Uniform Traffic Control Devices
N	North
NBS	National Bureau of Standards
NCHRP	National Cooperative Highway Research Program
NE	Northeast
NEC	National Electric Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
No	Number
NOI	Notice of Intent
NOT	Notice of Termination
NOTA	Notice of Transfer and Acceptance
NP	Non-Plastic
NPDES	National Pollutant Discharge Elimination System
NPI	Non Pay Item
NSC	National Safety Council
NSF	National Sanitation Foundation
NW	Northwest
OC	On Center
OD	Outside Diameter
OSHA	Occupational Safety and Health Administration
Oz	Ounces
PC, POC	Point of Curvature
PCC	Point of Compound Curve, Portland Cement Concrete
PI	Point of Intersection, Plastic Index
PL	Property Line
PP	Power Pole
Ppm	Parts per million
PRC	Point of Reverse Curve
Prod	Product
Prop	Proposed, Property
Psf	Pounds per square foot
Psi	Pounds per square inch
PT, POT	Point of Tangent

PVC	Polyvinyl Chloride
Pvmt	Pavement
R	Radius
RC	Reinforced Concrete
RCP	Reinforced Concrete Pipe
Rd	Road
Rdwy	Roadway
Reinf	Reinforced, reinforcing
Ret Wall	Retaining Wall
RGRCP	Rubber Gasket Reinforced Concrete Pipe
Rpm	Revolutions per minute
Rt	Right
ROW, R/W	Right-of-way
S	South, Slope
SA	Sanitary
Sdl	Saddle
SE	Southeast
Sec	Second
Sect	Section
Sht	Sheet
Spec	Specifications
Sq Ft, Yd	Square Foot, Yard
SS	Sanitary Sewer
ST	Storm Drain, Storm Sewer
St	Street
Sta	Station
Std	Standard
Struct	Structure, structural
SW	Southwest
SWPPP	Storm Water Pollution Prevention Plan
T	Tangent Distance
Tel	Telephone
Temp	Temporary
TH	Test Hole
TP	Telephone Pole
Tr	Tract
Trans	Transition
TS	Traffic Signal
TSC	Traffic Signal Conduit
Typ	Typical

UL	Underwriter's Laboratories, Inc.
USC & GS	United States Coast and Geodetic Survey
USGS	United States Geodetic Survey
V	Velocity of Flow
VC	Vertical Curve
VCP	Vitrified Clay Pipe
Vert	Vertical
W	West, Width
WDEQ	Wyoming Department of Environmental Quality
WI	Wrought Iron
WS	Wearing Surface
Wt	Weight
WYPDES	Wyoming Pollutant Discharge Elimination System
Yd	Yard
'	Feet, minutes
"	Inches, seconds
%	Percent
#	Number, pound
@	At
/	Per
=	Equals

2.02 DEFINITIONS AND TERMS

Advertisement:

The public announcement, as required by law, inviting bids for work to be performed or materials to be furnished.

Agency:

The governmental agency for which the construction is being done, either by permit or contract.

Approved:

Acceptance of an item submitted for approval. Not a limitation or release for compliance with the Contract Documents or any regulatory requirements.

Architect:

The individual or firm who has accomplished the architectural services for the project, including his representatives.

"As-Built":

A complete set of approved plans with recorded changes from plan design to completed construction.

- Award:** The formal action of the governing body accepting a proposal.
- Backfill:** Material placed in an excavated space to fill such space. For trenches, this space shall be the area from one (1) foot above the top of pipe or conduit to top of subgrade.
- Base Course:** The upper course of the granular base of a pavement or the lower course of an asphalt concrete pavement structure.
- Bedding:** The material placed in the area from the bottom of the trench to the appropriate depth specified.
- Bid Guarantee:**
The security furnished with a bid to guarantee that the bidder will enter into the contract if his bid is accepted.
- Bidder:** Any qualified individual, firm, partnership, corporation or combination thereof, acting directly or through a duly authorized representative who legally submits a proposal for the advertised work.
- Bridge:** A structure, including supports, erected over a depression or an obstruction, as water, highway, or railway, and having a track or passageway for carrying traffic or other moving loads and having a length measured along the center of roadway of more than twenty (20) feet between undercopings of abutments or extreme ends of openings for multiple boxes.
(Length) - The length of a bridge structure is the overall length measured along the line of survey stationing back to back of backwalls of abutments, if present, otherwise end to end of the bridge floor; but in no case less than the total clear opening of the structure.
(Roadway Width) - The clear width measured at right angles to the longitudinal centerline of the bridge between the bottom or curbs or guard timbers or in the case of multiple height of curbs, between the bottom of the lower risers.
- Building:** Any structure built for the support, shelter, or enclosure of persons, animals, or movable property.
- Building Code:**
A regulation adopted by the governing body establishing minimum standards of construction for the protection of the public health, safety, and welfare in terms of measured

performance rather than in terms of rigid specification of materials and methods.

Calendar Day:

Every day shown on the calendar.

Call for Bids: The standard form inviting proposals or bids.

“Careful and prudent manner”:

To conduct excavation in such a way that when it approaches within twenty-four (24) inches of the underground facility located and marked by the owner or operator, by stakes, paint or in some customary manner, the exact location is manually determined, and the uncovered facility is supported and protected.

Change Order:

A written order issued by the ENGINEER to the CONTRACTOR to make changes in the work or to perform extra work, and setting forth conditions for payment and/or adjustment in time of completion.

CITY: City of Cheyenne

City/County Clerk:

The duly authorized person who performs the duties of clerk for the Contracting Agency.

Coarse Aggregate:

Materials retained on a #4 sieve.

Completion Time:

The number of calendar days for completion of an act, including authorized time extensions. In case a calendar date of completion is shown in the proposal in lieu of the number of calendar days, the contract shall be completed by that date. The time within which an act is to be done shall be computed by excluding the first and including the last day; and if the last day be Sunday or a legal holiday, that shall be excluded.

Conflicting Utility:

An existing utility, shown or not shown on the plans is conflicting when any part of the utility falls within the dimensions of the new installation, such that it would be in physical contact with the new installation.

Construction Project:

The erection, installation, remodeling, alteration, of durable facilities upon, under, or over the ground. This shall include, but is not limited to buildings, roadways and utility pipes, lines, poles or other structures.

Contingent Bid Item:

This is a minor bid item which is likely, but not certain, to occur during the course of work. If the ENGINEER determines that this work is required, the CONTRACTOR shall accomplish the work and payment shall be made based on the contingent unit bid price included in the proposal. Since the quantity listed in the proposal is primarily for bid comparison, the amount of work required by the CONTRACTOR may vary materially from this.

Contract:

The written instrument executed by the CONTRACTOR and the Contracting Agency by which the CONTRACTOR is bound to furnish all labor, equipment, and materials and to perform the work specified, and by which the Contracting Agency is obligated to compensate the CONTRACTOR therefor at the prices set forth therein. The Contract Documents are herewith by reference made a part of the contract as if fully set forth therein.

Contract Documents:

All the integral documents of the contract, including but not limited to, Call for Bids, Plans, Standard Specifications and Drawings, Special Provisions, Proposal, Addenda, Performance Bond, Payment Bond, Certificates of Insurance, Ordinance, Contract, and Change Orders.

Contracting Agency:

The legal entity that has contracted for the performance of the work or for whom the work is being performed.

CONTRACTOR:

The individual, firm, partnership, corporation or combination thereof entering into a contract with the Contracting Agency to perform the advertised work.

Council:

The CITY Council which by law constitutes the Legislative Department of the CITY.

County:

Laramie County, organized and existing under and by virtue of the laws of the State of Wyoming.

- Culvert:** Any structure not classified as a bridge, which provides an opening under or adjacent to the roadway.
- Days:** Unless otherwise designated, days shall be understood to mean calendar days.
- Developer:** One who develops real estate for commercial or residential uses.
- Emergency:** Unforeseen occurrences and combinations of circumstances involving the public welfare or the protection of work already done under the Contract Documents, or which endanger life or property and call for immediate action or remedy.
- ENGINEER:** The person, appointed as CITY Engineer by the Council, acting directly or through his duly authorized representative.
- Equipment:** (Construction) - All machinery and equipment, together with the necessary supplies for upkeep and maintenance, and also tools and apparatus necessary for the proper construction and acceptable completion of work.
(Installed) - All material or articles used in equipping a facility as furnishings or apparatus to fulfill a functional design.
- Extra Work:** An item of work not provided for in the contract as awarded but found essential to the satisfactory completion of the contract within its intended scope.
- Final Acceptance:**
A final inspection has been completed by the ENGINEER on all work detailed in the Contract Documents and project is ready for final payment as evidenced in ENGINEER's written recommendation.
- Fine Aggregates:**
Materials passing a #4 sieve.
- Flooding:** The inundation of the entire lift with water, puddled with poles or bars to insure saturation of the entire lift.

- Force Account:** A method of payment for work performed by the CONTRACTOR at the ENGINEER's direction.
- Foundation:** For buildings or structures, this shall be the substructure. For pipe, this shall be the native material or prepared material on which the pipe rests; normally, this is the bottom grade line of the trench.
- Full Depth Pavement:** An asphalt concrete pavement structure in which the granular base and subbase are replaced by proportionate thicknesses of asphalt concrete.
- Holiday:** Any day in which the CITY offices are closed for business other than Saturday and Sunday.
- Improvement District Project:** A project financed by assessments against the property included in a special assessment district authorized under, or implemented by an act of the legislature of the State and/or a procedural ordinance of the CITY or County.
- Inspector:** The ENGINEER's authorized representative assigned to make detailed inspections of contract performance.
- Laboratory:** The established materials testing laboratory of the Contracting Agency's Engineering Department, or other laboratories acceptable to and/or authorized by the ENGINEER to test materials and work involved in the Contract.
- Match Existing:** Construct new work to conform to the existing lines and grades of the site and facilities as acceptable to OWNER.
- Major Item:** A major item shall be the total of any item of work and/or materials specified in the bid schedule.
- Materials:** Any substance specified in the project, equipment and other material used or consumed in the performance of the work.
- Median:** The portion of a divided highway separating the roadways used by traffic going in opposite directions.

Non Pay Item: An item of work for which no separate payment shall be made under the proposal, but which must be included as an incidental cost for payment on an associated item included in the proposal.

Notice of Award:

A letter from the CITY advising the CONTRACTOR that he is the successful bidder and the Council has accepted his proposal.

Notice to Proceed:

A directive issued by the ENGINEER, authorizing the CONTRACTOR to start the work or improvements required in the Contract.

Obligee: One to whom another is obligated.

Open Trench: The excavated area shall be considered as open trench until all the aggregate base course for pavement replacement has been placed and compacted or, if outside of a pavement area, until the excavated area is brought to finish grade or natural grade.

OWNER: The CITY, acting through its legally constituted officials, officers or employees.

Pavement: Any surfacing of streets, alleys, sidewalks, courts, driveways, etc., consisting of mineral aggregate bound into a rigid or semi-rigid mass by a suitable binder such as, but not limited to, portland cement or asphalt cement.

Pavement Structure:

The combination of subbase, base course, and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed.

Pay Item: A detail of work for which separate payments are to be made under the Contract, as specified in the proposal.

Payment Bond:

The security provided by the CONTRACTOR solely for the protection of claimants, supplying labor and materials to the CONTRACTOR or his subcontractors.

Performance Bond:

The security provided by the CONTRACTOR solely for the protection of the Contracting Agency and conditioned upon the faithful performance of the contract in accordance with the plans, specifications and conditions thereof.

Permit: The license to do construction in public rights-of-way and/or easements; issued by an Agency to a CONTRACTOR working for another party.

Plans: All approved drawings or reproductions thereof pertaining to the work and details therefore, which are made a part of the Contract Documents.

Plant: The CONTRACTOR's and/or subcontractor's facilities, including but not limited to small tools and mobile equipment, located on and/or offsite, necessary for preparation of materials and prosecution of work for the project.

Principal: The individual, firm or corporation primarily liable on an obligation, as distinguished from a surety.

Profile Grade: The trace of a vertical plan intersecting the top surface of the proposed wearing surface, usually along the longitudinal centerline of the roadbed. Profile grade means either elevation or gradient of such trace according to the context.

Provide: Furnish and install, complete with all necessary ancillary items, ready for intended use. Pay all related costs.

Project: A specific coordinated construction or similar undertaking identified by a single project number and bid and awarded as one (1) contract. On occasion two (2) or more projects may be bid and awarded as a single contract.

Proposal: The offer of a bidder on the prescribed form, to perform the work and to furnish the labor and materials at the prices quoted.

Referred Documents:

On all work authorized by the Contracting Agency, any referenced documents in the specification, i.e., Bulletins, Standards, Rules, Methods of Analysis or test. Codes and Specifications of other Agencies, Engineering Societies or Industrial Associations, refer to the Latest Edition thereof,

including Amendments, which are in effect and published at the time of Advertising for Bids or the issuing of a permit for the work, unless otherwise stated.

Right-of-way: A general term denoting land, property, or interest therein, usually in a strip, acquired for or devoted to a street, highway, or other public improvement.

Road: A general term denoting a public way for purposes of vehicular travel, including the entire area within the right-of-way.

Roadside: A general term denoting the area adjoining the outer edge of the roadway. Extensive areas between the roadways of a divided highway may also be considered roadside.

Roadside Development:

Those items necessary to the complete roadway which provide for the preservation of landscape materials and features; the rehabilitation and protection against erosion of all areas disturbed by construction through seeding, sodding, mulching and the placing of other ground covers; such suitable planting and other improvements as may increase the effectiveness and enhance the appearance of the roadway.

Roadway: The portion of the right-of-way intended primarily for vehicular traffic, and including all appurtenant structures and other features necessary for proper drainage and protection. Where curbs exist, it is that portion of roadway between the backs of the curbs.

Sewers: Conduits and related appurtenances employed to collect and carry off water and/or waste matter to a suitable point of final discharge.

Shop Drawings:

Drawings or reproduction of drawings, detailing; fabrication and erection of structural elements, false work and forming for structures, fabrication of reinforcing steel, installed equipment and installation of systems, or any other supplementary plans or similar data, which the CONTRACTOR is required to submit for approval.

Shoulder: The portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

Sidewalk: That portion of the roadway primarily constructed for the use of pedestrians.

Special Provisions:
Revisions to the standard and supplementary specifications that apply to a single project.

Specifications:
The descriptions, directions, provisions, and requirement for performing the work as contained in the Contract Documents.

Standard Drawings:
Uniform detail drawings of structures or devices adopted as Standard Drawings by the ENGINEER.

Standard Specifications:
Uniform general specifications adopted as Standard Specifications by the ENGINEER.

Storm Drain: Any conduit and appurtenance intended for the reception and transfer of storm water.

Street: Streets, avenues, alleys, highways, crossings, lanes, intersections, courts, places, and grounds now open or dedicated or hereafter opened or dedicated to public use and public ways.

Structures: Bridges, culverts, catch basins, drop inlets, retaining walls, cribbing, manholes, endwalls, sewers, service pipes underdrains foundation drains, fences, swimming pools, and other features which may be encountered in the work and not otherwise classed herein.

Subbase: The lower course of the base of a roadway, immediately above the subgrade.

Subcontractors:
Those having direct contracts with the CONTRACTOR and those who furnish material worked into a special design according to the Plans and Specifications for the work, but not those who merely furnish material not so worked.

Subgrade: The supporting structures on which the pavement and its special undercourses rest.

Substantial Completion:

The date of substantial completion of a project or specified area of a project is the date when the construction is sufficiently completed, in accordance with the Contract Documents, as modified by any change orders agreed to by the parties, so the OWNER can occupy or utilize the project or specified area of the project for the use for which it was intended.

Substructure: All of that part of the structure or building below the bearings of simple and continuous spans, skewbacks of arches and tops of footings of rigid frames, together with the backwalls, wingwalls and wing protection railings.

Superintendent:

The CONTRACTOR's authorized representative in responsible charge of the work.

Superstructure:

The entire structure or building except the substructure.

Supplemental Specifications:

Revisions to the Standard Specifications.

Supplementary Conditions:

Requirements, or revisions, to the Standard General Conditions, applicable to the work, and to cover conditions or requirements peculiar to the project under consideration.

Surety:

The individual, firm or corporation, bound with and for the CONTRACTOR for the acceptable performance, execution, and completion of the work, and for the satisfaction of all obligations incurred.

Surface Course:

The finished or wearing course of an asphalt concrete pavement structure.

Title or Headings:

The titles or headings of the sections and subsections herein are intended for convenience of reference and shall not be considered as having any bearing on their interpretation.

Township, City, Town or District:

A subdivision of the County used to designate or identify the location of the proposed work.

Traveled Way:

The portion of the roadway for the movement of vehicles, exclusive of shoulders and auxiliary lanes.

Underground Facility:

Any item which shall be buried or placed below ground for use in connection with the storage or conveyance of water, sewage, electronics, telephone or telegraphic communications, electric energy, oil, gas or other substances, and shall include, but not be limited to pipes, sewers, conduits, cables, valves, lines, wires, manholes, attachments and those portions of poles and their attachments below ground.

Utility:

Pipe lines, conduits, ducts, transmission lines, overhead or underground wires, railroads, storm drains, sanitary sewers, irrigation facilities, street lighting, traffic signals, and fire alarm systems, and appurtenances of public utilities and those of private industry, businesses or individuals solely for their own use or use of their customers which are operated or maintained in, on, under, over or across public right-of-way or public or private easement.

Waterworks (Water Supply System):

The reservoirs, pipe lines, wells, pumping equipment, purification works, mains, service pipes, and all related appliances and appurtenances utilized in the procurement, transportation and delivery of an adequate, safe, and palatable water supply for the Contracting Agency.

Work:

Any or all of the improvements mentioned and authorized to be made, and the construction, demolition, reconstruction, and repair of all or any portion of such improvements, and all labor, services, incidental expenses, and material necessary or incidental thereto.

Working Day: A calendar day, exclusive of Saturdays, Sundays, and recognized holidays, on which weather and other conditions not under the control of the CONTRACTOR will permit construction operations to proceed for a minimum of four (4) hours of the day with the normal working force engaged in performing the controlling item or items of work which would be in progress at that time.

END OF SECTION

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.01 SUMMARY

- A. Apply for, obtain, and pay for all permits and licenses necessary prior to performing any of the work. All CONTRACTORS who work in the CITY's right-of-way must be licensed or franchised by the CITY. Plans shall be approved by the ENGINEER prior to issuance of right-of-way permits.
- B. Comply with applicable codes and regulations of authorities having jurisdiction.
- C. Field verify dimensions indicated on drawings before fabricating or ordering materials. Do not scale plans and drawings.
- D. Notify OWNER of existing conditions differing from those indicated on the plans. Verify the existence and location of underground utilities along the route of proposed work. Omission of an existing utility location on the drawings is not to be considered as its nonexistence. Inclusion of existing utility locations on the drawings is not to be considered as its definite location. Do not remove or alter existing utilities without prior written approval.
- E. The Contract Documents are intended to provide the basis for proper completion of the work suitable for the intended use of OWNER. Anything not expressly set forth, but which is reasonably implied or necessary for proper performance of the project shall be included.
- F. Portions of the Contract Documents are written in the imperative mode. Except where specifically intended otherwise, the subject of all imperative statements is CONTRACTOR. For example, "Furnish..." means "CONTRACTOR shall furnish...", "Provide...means the "CONTRACTOR shall provide...".
- G. No change to these Standards and Specifications shall be considered unless approved in advance by the ENGINEER and/or the BOPU Director or through special provisions in the Contract Documents approved by the ENGINEER and/or BOPU Director.

- H. The Permittee shall warranty the completed work to be free of defects in workmanship or materials for a period of two (2) years. All work that fails or deteriorates during the first or second year shall be replaced under this warranty. The Permittee shall be responsible for all costs for material, equipment, labor, and/or traffic control for warranty work. Warranty work shall be completed in accordance with these specifications within thirty (30) days of written notification by the CITY.

END OF SECTION

SECTION 01041

PROJECT COORDINATION

PART 1 GENERAL

1.01 SUMMARY

- A. The CONTRACTOR or DEVELOPER shall apply for, obtain, and pay for all permits prior to performing work in the CITY right-of-way. One permit shall be pulled for all ROW work in association with any development, subdivision or project and must encompass all work in the ROW as shown on the approved construction plans. All CONTRACTORS who work in the CITY right-of-way must be licensed or franchised by the CITY. Two sets of approved civil construction plans shall be submitted with the permit application. No work in the ROW shall commence until the ROW Encroachment Permit has been issued.
- B. **Emergency work** may commence without first obtaining a ROW permit. The CITY Construction office shall be notified immediately by calling 307-637-6288 and a ROW Encroachment Permit applied for prior to 12:00 Noon the next regularly scheduled business day. When CITY offices are closed, the CITY Construction office shall be informed of the emergency work in the ROW prior to 9:00 AM on the next regularly scheduled business day and a ROW Encroachment Permit applied for prior to 12:00 Noon on this same day. Failure to apply for the permit in the required time period shall result in investigative fees, equal to the cost of the ROW Encroachment Permit, in addition to the regular permit fees.
"Emergency work" means an occurrence, including a loss of communications, which demands immediate action to protect the health, safety and welfare of the public and to prevent loss of life, health, property or essential public services.
- C. A preconstruction conference shall be held with the Engineering and Construction Divisions of the CITY, and BOPU a minimum of two (2) working days prior to any construction work (including water or sanitary sewer construction work). The CONTRACTOR, OWNER, DEVELOPER, Project Engineer, assigned City Inspector and assigned supervisory personnel shall attend this conference. A preconstruction meeting shall not be scheduled until plans have been approved by the CITY and BOPU. A traffic control plan shall be provided for CITY approval at this meeting.

- D. Prior to beginning CITY contracted work, the CONTRACTOR is required to make a detailed video of the entire project area documenting all existing conditions and damaged areas. This tape or DVD is required to have a date/time stamp and shall be delivered to the CITY at the preconstruction conference. Any damages claimed to private or public property and not documented as prior damage on the aforementioned video is the CONTRACTOR's responsibility to repair or replace to as good as or better condition and to the ENGINEER's satisfaction.
- E. Water for use during construction shall be obtained by CONTRACTOR at his expense. If he elects to obtain water from the public water utility, he shall make all the arrangements, comply with BOPU regulations, and pay all fees and charges. See Section 02290, WATERING for additional information.
- F. Normal working hours in the right-of-way shall be 7:00 a.m. to 6:00 p.m. No work shall be allowed on Saturdays without OWNER's written permission. No work, except for emergencies, shall be allowed on Sundays or holidays.
- G. The CONTRACTOR shall reimburse the CITY for inspection time that is after or in addition to the CITY Construction Division normal working hours. (7:30 a.m. to 4:30 p.m. Monday through Friday, except holidays). Current hourly rate may be obtained by calling the Construction Division at 307-637-6288.
- H. All construction activities on water and sanitary sewer related work shall be conducted between the hours of 7:30 a.m. and 4:00 p.m., Monday through Friday, except for emergencies and where written approval is granted by the BOPU Engineering Division. The CONTRACTOR shall reimburse the BOPU for inspection services provided during normal working hours. Current hourly rate may be obtained by calling the BOPU Engineering Department at 307-637-6497.
- I. The CONTRACTOR shall reimburse the BOPU for all inspection time that is after or in addition to the BOPU normal working hours. (7:30 a.m. to 4:00 p.m. Monday through Friday, except holidays). Current overtime hourly rate may be obtained by calling the BOPU Engineering Department at 307-637-6497.
- J. Once barricades are placed in the right-of-way, the CONTRACTOR shall show progress of work during normal working days and hours. If no progress of work is recorded for twenty-four (24) hours and no concrete is waiting for strength, the

CONTRACTOR shall remove barricades, re-open the right-of-way, and provide a safe travel way for the public. If the CONTRACTOR does not re-open the right-of-way or show progress of work within twenty-four (24) hours, the CITY shall use any and all means necessary to re-open the area at the CONTRACTOR's expense.

1.02

NIGHT WORK

- A. On designated projects, night work may be required. If required, regular night working hours shall be from 8:00 p.m. to 6:00 a.m. Sunday nights/Monday mornings through Thursday nights/Friday mornings. Work shall not be allowed on Friday or Saturday nights unless specifically approved by the ENGINEER.
- B. Special care should be taken on night projects to ensure that all traffic control devices meet the applicable standards for retroreflectivity and that the work area is illuminated adequately. Light towers shall be positioned so as to not shine directly into oncoming traffic in any direction.

1.03

COORDINATION WITH PUBLIC AND PRIVATE AGENCIES

- A. If other utility companies elect to repair or replace their lines in the project area, their crews shall be permitted access to the area to accomplish their work upon approval of the CITY. Contact all utility companies for location of their facilities. Call at least two (2) working days prior to excavation.
- B. If the utility company involved is working under a current franchise agreement, they shall perform their work in accordance with the conditions of that agreement. This includes obtaining a construction permit from the CITY for each job. If they choose to hire a subcontractor to perform the work, then the subcontractor shall obtain and pay for a license to work in the CITY and they shall be listed on the permit obtained by the prime utility company or shall obtain their own permit if one has not been provided for the work. If a utility company is not franchised by the CITY, then that utility company and any subcontractors they hire shall obtain and pay for a license (or licenses) and a construction permit to cover the work involved.
- C. CONTRACTOR is responsible for dust control, traffic control, erosion control, storm water management, and safety, and shall provide all equipment and personnel necessary to meet the requirements of these responsibilities. CONTRACTOR shall

provide ENGINEER with the name and telephone number of the person and up to four alternates designated to maintain dust control, traffic control, erosion control, storm water management, and safety during evenings, weekends and holidays. If this person or an alternate cannot be contacted, OWNER may use their equipment to correct traffic, erosion, storm water management, or dust problem. In this case, CONTRACTOR shall pay all costs incurred by OWNER.

- D. Do not park vehicles or equipment on private property without written permission from the property owner.

1.04 NOTIFICATION OF LANDOWNERS, RESIDENTS AND BUSINESSES

- A. At least two working days prior to beginning construction operations CONTRACTOR shall notify in writing, all those directly affected by the work, including—the City Construction Division office by faxing to 307-637-6261. The notification shall include the following as a minimum:
 - 1. Name, address, telephone number, and contact person for DEVELOPER, DEVELOPER’s CONTRACTOR, owner, and ENGINEER.
 - 2. A brief description of the proposed work.
 - 3. Name and telephone number of Contractor’s emergency contact. (Phone must be manned 24-7.)
 - 4. Assigned CITY and BOPU inspector’s name and cell phone numbers.
 - 5. A map showing the work area, the traffic control plan, and the planned access to be provided to the affected properties. The map shall also show the property or business owner’s access during construction, and access in case of an emergency for fire, ambulance, police or other emergency service agency vehicles.
 - 6. A schedule for start up and completion of the work. Schedules shall be updated as needed as work progresses.
 - 7. The notification shall also state that if the property owner/resident has a mobility issue to please call the City Inspector so we may be aware of the situation.

8. The notification shall be approved by the ENGINEER prior to being distributed.

1.05 COORDINATION WITH OWNER, ENGINEER, BOPU AND CITY

- A. OWNER shall provide engineering surveys to establish reference points as necessary. All survey work shall be done in accordance to Wyoming State Statutes Title 33, Chapter 29. Construct all work in accordance with the lines and grades shown on the approved plans, or as changed by an Engineer and approved by the CITY.
- B. The DEVELOPER or the CONTRACTOR shall employ and pay for the services of an independent testing laboratory to perform all testing required. The test results shall be provided to the CITY and/or BOPU within twenty-four (24) hours of the availability of the test results with written report to follow within seven (7) working days.

END OF SECTION

SECTION 01050

TRAFFIC CONTROL

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of providing, erecting, continuously maintaining, relocating, and removing of barricades, signs, flashers, striping, flaggers, and other traffic control devices necessary to safely control vehicular and pedestrian traffic through or around the work site. Streets, alleys, and driveways closed to traffic shall be protected.

1.02 TRAFFIC CONTROL DEVICES

- A. All traffic control devices shall be fabricated and used in accordance with the latest editions of Standard Highway Signs and the Manual on Uniform Traffic Control Devices (MUTCD). All traffic control devices shall comply with NCHRP Report No. 350. All traffic control devices used during hours of darkness shall be retroreflective. All retroreflective traffic control devices shall be fabricated using engineering grade sheeting or better.
- B. The CONTRACTOR shall assign a traffic control maintainer who shall be responsible for continuous maintenance, including cleaning, of all traffic control devices. The individual assigned as the traffic control maintainer shall also be certified as a flagger. A daily inspection of the barricades and signing shall be made by the CONTRACTOR. The CONTRACTOR shall replace signs or barricades using the ATSSA Manual for Quality Standard Control and shall take all reasonable precautions for the protection of the work and safety of the public.
- C. Any repair or maintenance of any traffic control device shall be the sole responsibility of the CONTRACTOR.
- D. Liquidated damages in the amount of \$250.00 shall be assessed if damaged or deficient devices are not properly maintained within two (2) hours after notification by the ENGINEER and/or CITY Traffic Department. Thereafter, additional damages in the amount of \$250.00 shall be assessed for each successive two (2) hour period during which the required maintenance is not performed. If more than twenty-five (25) percent of the number of one (1) type of device in use on the roadway is damaged in a single incident of

damage, the assessment of liquidated damages shall be waived for a period not to exceed eight (8) hours after the notification by the ENGINEER and/or CITY Traffic Department, provided suitable arrangements are made with the ENGINEER and CITY Traffic Department for interim traffic control measures.

1.03

TRAFFIC CONTROL PLAN

- A. For any work to be performed within any CITY right-of-way, the CONTRACTOR shall submit a traffic control plan that addresses both vehicular and pedestrian traffic. The traffic control plan shall be submitted for approval by the CITY Traffic Engineer a minimum of two (2) working days prior to beginning any phase of the project unless required at the preconstruction meeting. The traffic control plan shall show the number, type, and spacing of traffic control devices to be used. For projects where the value of the work equals or exceeds \$20,000.00, the traffic control plan shall be developed under the supervision of an ATSSA certified Worksite Traffic Supervisor or Traffic Control Supervisor or a WYDOT certified Traffic Control Supervisor. Development of the traffic control plan by a Worksite Traffic Supervisor or Traffic Control Supervisor shall also be required for all projects involving work on any roadway classified as “Principal Arterial”, “Minor Arterial” or “Collector”. Development of the traffic control plan by a Worksite Traffic Supervisor or Traffic Control Supervisor may be required for phases or sites of lesser value at the discretion of the ENGINEER and/or CITY Traffic Engineer.
- B. In all instances, the traffic control plan shall conform to the latest versions of the MUTCD and the CITY’s Manual of Specifications and Procedures for Setting Up Traffic Control Devices in Construction and Maintenance Areas.
- C. The CONTRACTOR shall provide the name and phone number of the Traffic Control Supervisor to the ENGINEER and the CITY Traffic Engineering Department. This individual shall be available twenty-four (24) hours a day to solve traffic control problems.
- D. Compliance with the approved traffic control plan shall be required; however, compliance with the approved traffic control plan does not relieve the CONTRACTOR from the responsibility to change or adjust traffic control devices when traffic or other considerations warrant modification.

1.04

GENERAL TRAFFIC CONTROL

- A. Access shall be maintained to all adjacent properties without two (2) working day prior notice of closure.
- B. Under no circumstances shall travel on a temporary gravel surface be permitted for longer than fifteen (15) calendar days on any street classified as Collector, Minor Arterial, or Principal Arterial. Any temporary surface expected to be in service longer than fifteen (15) calendar days shall be hard surfaced with a minimum of one and one-half (1-½) inch of AC pavement. Temporary gravel surfaces will be allowed on local streets and for business and/or residential accesses. All temporary surfaces shall be maintained in a smooth and usable condition at all times, including grading and watering if necessary. Maps of street classifications are available from the CITY Metropolitan Planning Office (MPO).
- C. Any temporary striping required shall be the responsibility of the CONTRACTOR. Temporary striping shall be four (4) inches wide unless specified otherwise.
 - 1. Painted temporary striping shall be continuous or intermittent in accordance with the MUTCD. Painted temporary striping shall not be used on the final wearing course of the pavement.
 - 2. Existing pavement markings that are not applicable shall be effectively removed to the satisfaction of the ENGINEER. Painting over existing markings shall not be allowed.
 - 3. All existing pavement markings designated to remain that are damaged, destroyed, or removed during the course of a project shall be replaced in kind at the CONTRACTOR's expense to the satisfaction of the CITY Traffic Engineering Department.

1.05

FLAGGING

- A. Flagging shall be required anytime a traffic lane must be shared between more than one (1) direction of traffic for a short duration of time, unless other arrangements have been made and approved by the CITY Traffic Engineering Department. Flagging may be required at other times as per the traffic control plan.

- B. Proper advance warning signs shall be in place when flaggers are working and removed when flaggers are not actively directing traffic.
- C. Flagging shall be performed by competent, properly equipped flaggers, including wearing fluorescent green vests, hard hats, and having regulation signs and flags. Flaggers shall possess a current identification card giving the name of the flagger, the date the flagging training program was completed, name of the organization giving training, and a statement that the flagger has passed an approved flagger training program. Flaggers shall be monitored by the ENGINEER for conformity with proper flagging procedures. In the event a flagger is found to be consistently in non-compliance with proper flagging procedures, the CONTRACTOR shall be notified for corrective action and flagging hours not approved.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Measurement shall be made by the lump sum unless otherwise indicated in the Special Provisions.
- B. Flagging shall be paid by the hour, measured to the nearest quarter hour the flagger is actively working.

4.02 BASIS OF PAYMENT

- A. Payment shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Traffic Control	Lump Sum
Flagging	Hour

END OF SECTION

SECTION 01054

CONTROL OF WORK

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of control of work on all projects within the CITY.

1.02 AUTHORITY OF THE ENGINEER

- A. ENGINEER shall decide:
 - 1. All questions regarding quality.
 - 2. Acceptability of materials furnished.
 - 3. Work performed.
 - 4. Progress of the work.
 - 5. Questions as to interpretation of the plans and Specifications.
 - 6. Acceptable fulfillment of the contract on the part of CONTRACTOR.
- B. ENGINEER's estimates and decisions shall be final and conclusive.
- C. If a question should arise regarding the Contract Documents, determination or decision of the ENGINEER shall be a condition precedent to the right of the CONTRACTOR to receive final approval of the work being questioned under the contract.
- D. ENGINEER may give instructions to make minor changes in the work, not to include extra work and not inconsistent with the purpose of the work, except in emergencies, endangering life or property.

- E. ENGINEER may suspend work either wholly or in part due to failure of the CONTRACTOR to:
 - 1. Correct conditions unsafe for workmen or the public.
 - 2. Carry out provisions of the contract.
- F. Work suspension may be for periods deemed necessary by the ENGINEER due to unsuitable weather, unsuitable for work, or any other condition or reason deemed to be within the public interest.

1.03 PLANS, SHOP DRAWINGS, AND PERMITS

- A. CONTRACTOR shall submit for review proposed schedule of Shop Drawings and product data submittals. Schedule shall include concrete and asphalt concrete mix designs. Schedules shall show response date for each submittal and indicate the relationship of the submittal to the project construction schedule. See Section 01340, SUBMITTALS for more information.
- B. CONTRACTOR shall have on site a complete set of approved plans, approved Shop Drawings, approved mix designs, and approved permits at all times.

1.04 CONFORMITY WITH PLANS AND SPECIFICATIONS

- A. All work and materials shall conform to the lines, elevations, grades, cross sections, dimensions, and material requirements, including all tolerances, as shown on the plans and/or indicated within the specifications.
- B. If ENGINEER finds materials and/or finished product not in conformance with the plans and specifications, but that reasonably acceptable work has been produced, the ENGINEER shall determine if said work is acceptable and to remain in place. If so, then the ENGINEER shall document the basis of acceptance by a contract modification and adjustment to the contract price for such work and/or materials.
- C. If ENGINEER finds materials and/or finished product not in conformance with the plans and specifications, and said findings are unacceptable, then work and/or materials shall be removed and replaced or otherwise corrected by the CONTRACTOR at no additional cost to the OWNER.

- D. Where items and/or specifications require installation or construction in accordance with either manufacturer's or supplier's recommendation and/or instructions, said recommendations and/or instructions shall be submitted with the applicable portion clearly marked for approval prior to work on that item or portion of the contract.

1.05 CONSTRUCTION STAKES, LINES AND GRADES

- A. Construction stakes shall be set in accordance with Wyoming State Statute Title 33, Chapter 29 to establish line and grade for road work, curbs, gutter, sidewalks, structures, and centerlines for utilities and necessary appurtenances as deemed necessary. Stakes and marks shall constitute field control by and in accordance with which the CONTRACTOR shall establish other necessary controls and perform the work.
- B. CONTRACTOR shall perform work in accordance to the stakes and marks and shall be fully responsible for conformity and agreement of the work with such stakes and marks.
- C. CONTRACTOR shall be responsible for the preservation of all stakes and marks. If construction stakes and marks are destroyed and/or disturbed by the CONTRACTOR, then the CONTRACTOR shall have them replaced at his cost or the price for replacement shall be deducted from the payment of the work.

1.06 DUTIES OF THE INSPECTOR

- A. As employed by the Contracting Agency, Inspectors shall be authorized to inspect all work and materials furnished. Inspections may extend to all or part of the work and to the preparation, fabrication or manufacturing of materials being used.
- B. The Inspector shall not be authorized to issue instructions contrary to the plans and specifications or to act as foreman for the CONTRACTOR.
- C. The Inspector shall have the authority to reject work or materials until any questions at issue can be referred to and decided upon by the ENGINEER.

- D. The ENGINEER may provide the Inspector, assistants, and other staff to assist in observing performance of work done by the CONTRACTOR. Onsite observations of progress work and field checks of materials and equipment shall aid the Inspector in providing protection for the Contracting Agency against defects and deficiencies in the CONTRACTOR's work. However, furnishing such services shall not make the Inspector responsible for or give the Inspector control over construction means, methods, techniques, sequences, or procedures or for safety precautions or programs, or responsibility for the CONTRACTOR's failure to perform the work in accordance with the Contract Documents.

1.07 INSPECTION OF WORK

- A. Direct control shall be the sole responsibility of the CONTRACTOR's foreman and superintendent. Inspection of work by the ENGINEER or representative shall not be considered as direct control of the individual workman and his work.
- B. ENGINEER shall be permitted to inspect all materials and each part or detail of the work at any time. The Inspector shall be furnished with such information and assistance by the CONTRACTOR as required to make a complete and detailed inspection.
- C. Any work done and/or materials used without inspection by the Contracting Agency representative may be ordered removed and replaced at no additional cost to the Contracting Agency. Failure to reject any defective work or materials shall not in any way prevent later rejection when such defect is discovered nor obligate the ENGINEER to final acceptance.
- D. When any unit of government is to pay a portion of the cost of work covered by a contract, its representatives shall have the right to inspect any and all portions of the work. Any communication with the contractor shall be in the presence of the ENGINEER, and all correspondence shall be through the ENGINEER.

1.08 REMOVAL OF UNACCEPTABLE AND UNAUTHORIZED WORK

- A. Any work deemed unacceptable by the ENGINEER, whether the result of poor workmanship, use of defective materials, damage through carelessness or any other, prior to the final acceptance of the work shall be removed immediately and replaced in an acceptable manner. All inspections needed shall be completed on

removed and replaced items. All removal and replacement shall be at the cost of the CONTRACTOR.

- B. Unauthorized work shall be considered work done without lines and grades, work contrary to the plans and specifications, work done beyond the lines shown on the plans or as given, or any extra work done without authority. This work may be ordered to be removed and/or replaced at no additional cost to the OWNER.

1.09 MAINTENANCE DURING CONSTRUCTION

- A. CONTRACTOR/DEVELOPER shall be responsible for maintenance of the work during construction, up to and through final acceptance of the work. Maintenance shall constitute continuous and effective work prosecuted day by day, with adequate equipment and forces to the end so that the right-of-way or structures are kept in satisfactory conditions at all times.
- B. In the case of a contract for the placing of a course upon a course or subgrade previously constructed, the CONTRACTOR shall maintain the previous course or subgrade during construction operations. All costs of the maintenance work during construction and before the acceptance of the project shall be included in the unit bid price on the various bid items.

1.10 ACCEPTANCE

The following pertains to CITY contracted work only.

- A. PARTIAL
 1. The owner may deem it to be in the best interest of the public to occupy one (1) or more completed portions of the project prior to total project completion.
 2. The ENGINEER shall provide written notice to the contractor of the owners' desire for "beneficial occupancy" of these areas.
 3. The contractor shall provide the ENGINEER with a detailed breakdown of additional costs such as site and workmen safety, traffic control, traffic control plan, etc.; and such costs associated with a decrease in production, etc. on which the ENGINEER may evaluate the benefit of occupancy verses the additional costs.

4. If the ENGINEER elects to proceed with the beneficial occupancy of a portion of the project:
 - a. A Change Order of Contract Modification shall be issued to compensate the contractor for the additional costs, if any.
 - b. An inspection of those portions of the project being occupied by the owner shall be conducted and any unacceptable work shall be corrected prior to the owner's occupation.
 - c. Another inspection of those portions of the project being occupied by the owner shall be conducted to verify the corrections are satisfactory. This inspection shall constitute the final inspection for those portions of the project.
 - d. The warranty for those portions of the project turned over to the owner for the owner's beneficial occupancy shall begin on the date of the inspection indicated in paragraph c. above.

B. FINAL

1. After written notice from the CONTRACTOR of substantial completion, the ENGINEER shall make an inspection.
2. If all construction provided for and contemplated by the contract is found to be complete to his satisfaction, this inspection shall constitute the final inspection and the ENGINEER shall make the final acceptance.
3. The CONTRACTOR shall be notified in writing as to the date of the final acceptance.
4. If the inspection shows any work, in whole or part, as being unsatisfactory, the ENGINEER shall give the CONTRACTOR written notification as to the location and type of deficiencies for corrections. The CONTRACTOR shall immediately comply with and execute the instructions. Upon completion of corrections, the ENGINEER shall complete another inspection provided the work has been satisfactorily completed.

5. The required warranty period for those portions of the project not previously occupied by the owner begins at the time of written final acceptance of the project.

1.11 ACCEPTANCE, WARRANTY PROCEDURES AND RECORD DRAWINGS

This Section defines the requirements for approval and acceptance of the Public Improvements performed within the public right-of-way, easements, and private drainage facilities.

A. DEVELOPMENT PROCESS

1. The developer shall be required to meet the following process prior to the acceptance of the public improvements and maintenance by CITY forces as a minimum. When a Development Agreement exist acceptance shall be as allowed within the agreement.

B. COMPLETION OF WORK

1. Developer must complete all public improvements shown on approved construction plans and in accordance with any conditions or agreements made through the City Development Office and the ENGINEER'S office.
2. All testing for public improvements shall be the developer's responsibility. All testing shall be in conformance with the City of Cheyenne & Board of Public Utilities Construction Specifications and Standard Drawings. Compliance with testing requirements rests solely with the developer. All work shall be brought into conformance with testing requirements prior to acceptance of development.
3. Developer shall be responsible for the timely submittal of all testing results to the ENGINEER. No inspection shall commence until all testing results have been forwarded and made available to the ENGINEER. The ENGINEER shall have 5 working days to review test results.
4. All drainage items shall be constructed in full and shall adhere to the approved drainage study and plan prior to acceptance and inspection.

C. NOTIFICATION

1. Upon completion of all work the DEVELOPER shall submit a written request for acceptance of development to the ENGINEER'S office.

D. INSPECTION

1. The ENGINEER shall inspect the development for compliance to the Plans, Standards, and agreements and develop a written list of any observed deficiencies.
2. The developer is responsible for sweeping and cleaning public improvements for inspection. If the developer does not provide a clean site, including having curb flow lines clear of debris and dirt, snow and/or ice, then the inspection shall be postponed until the site is sufficiently clear.

E. CORRECTION OF DEFICIENCIES

1. Developer shall correct all deficiencies shown on list within 30 days. Upon completion of all listed deficiencies the developer shall submit a written request to the ENGINEER'S office for reinspection.

F. SUBMITTAL OF RECORD DRAWINGS

1. Developer shall submit Record Drawings signed and stamped by a Professional Engineer or Land Surveyor registered in the State of Wyoming of all work performed for City facilities. Record Drawings shall be mylar of the same size as the project drawings originally submitted and approved by the CITY. When a computer aided drafting program was utilized to create the construction documents, developer shall submit a complete set of all electronic files on compact disk.
2. The Development Construction plans shall be updated with all design changes that occurred after initial plan approval.
3. Record storm drainage drawings shall document the size and class of all pipe used and invert elevation of all pipes, inlets, riprap, headwalls, detention pond volumes, swale cross-sections and all other storm drainage infrastructure

shown on the construction plans, including those improvements located in areas outside of the public right of way. Record drawing shall also show all pipe and/or drainageway/swale grade percentages.

4. Water and Sanitary Sewer record drawings shall also be submitted to the BOPU in accordance with the publication "Rules and Regulations for Establishing Policies & Design Criteria of the Board of Public Utilities" March 1, 2001 and all amendments.
5. Street Construction record drawings shall identify the actual pavement type and grade or mix used; if the subgrade was treated; and document all changes to widths and lengths for streets, sidewalks, curbs and valley pans. Record drawings shall identify all signage, striping and traffic signal controller locations as actually placed in the project. For any longitudinal slopes of less than one (1) percent, a survey at fifty (50) foot intervals shall be required. Any grade changes exceeding .10 foot from planned elevation shall be noted on the record drawings.
6. Record drawings shall verify other information as specifically requested by the ENGINEER. No acceptance shall be issued until Record drawings have been reviewed and accepted.

G. INFRASTRUCTURE ASSET SHEET

1. The DEVELOPER shall complete and turn in the Infrastructure Asset Sheet along with the record drawings.

H. DRAINAGE CERTIFICATE

1. The PROJECT ENGINEER shall present a Drainage Certificate stating the development or subdivision drainage is in general conformance with the drainage study and plans. Certificate shall call out volume of all detention ponds. Drainage certificate shall be signed and stamped by a Professional Engineer registered in the State of Wyoming.

H. ACCEPTANCE

1. Upon satisfactory completion of the work in accordance with these specifications a written acceptance shall be

granted and forwarded to the developer. The written acceptance shall specify the date on which the warranty period commences.

I. WARRANTY PERIOD

1. The specified date in the written acceptance shall be the effective date for the beginning of the two year warranty period.

J. INSPECTION BEFORE THE END OF WARRANTY PERIOD

1. Prior to the end of the Warranty Period, the ENGINEER shall inspect the development for defects in workmanship or material. A written deficiency list shall be developed and provided to the developer. Normal wear and tear shall not be considered a deficiency.

K. WRITTEN NOTIFICATION OF FINAL RELEASE

1. Upon satisfactory completion of all repairs or replacements by the developer, a written notification shall be issued by the ENGINEER releasing the DEVELOPER from warrantee obligations for the public improvements.

END OF SECTION

SECTION 01090

REFERENCES

PART 1 GENERAL

1.01 COORDINATION OF CONTRACT DOCUMENTS

- A. The various portions of the Contract Documents, of which these specifications are a part, are essential parts of the Agreement, and a requirement occurring in any portion or part is as binding as though occurring in all. All portions are intended to be complementary and to describe and provide for a complete work. In case of discrepancy, the following hierarchy shall be observed:
1. CITY approved Special Provisions shall govern over,
 2. CITY approved Supplementary Specifications, which shall govern over,
 3. CITY approved Project Drawings, which shall govern over,
 4. These Specifications and Standard Drawings.
- B. CONTRACTOR shall not take advantage of any apparent error or omission in the Contract Documents. If CONTRACTOR discovers an error or omission, CONTRACTOR shall immediately notify ENGINEER. ENGINEER shall pursue such corrections and interpretations as may be necessary for fulfilling the intent of the Contract Documents.

END OF SECTION

SECTION 01231

SAFETY

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of safety requirements on all projects within the CITY.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 REQUIREMENTS

- A. CONTRACTOR shall be responsible to, including all equipment and personnel, safely conduct all activities throughout all phases of construction, including all work suspensions, up to and through final acceptance of the project.
- B. Safety shall comply with the latest OSHA standards, CITY Standard Specifications, MUTCD and CITY Manual of Specification and Procedures for Setting up Traffic Control Devices in Construction and Maintenance Areas.
- C. CONTRACTOR shall take steps, procedures, and means to maintain safety during all construction activity, including staging areas, temporary yards, and disposal sites.
- D. CONTRACTOR shall provide the ENGINEER with the name and telephone number of the person designated to maintain all site control during evenings, weekends and holidays. If person cannot be contacted, OWNER shall use equipment to address the safety issue. In this case, CONTRACTOR shall pay all costs incurred by the OWNER.
- E. Failure of CONTRACTOR to comply with ENGINEER's requests for safety shall result in a work suspension until the condition is corrected. No additional compensation and/or time shall be allotted for such suspension.
- F. Site Safety shall include furnishing of materials, labor, and equipment to construct temporary pedestrian corridors to provide

access to public sidewalks, adjacent businesses and office buildings. Temporary sidewalks shall provide continuous, level, hard surfaced path and be in accordance with ADA requirements from existing or new concrete walks to the business door for access by personell and patrons. The CONTRACTOR shall also provide temporary, thirty-six (36”) inch florescent plastic fencing, sturdily erected and continuously maintained, around all excavations, trenches and other hazardous sites to cordon off and protect the public from the construction activities. Proposed site safety and construction site protection shall be coordinated with the City of Cheyenne, ENGINEER and the BOPU.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for items under this section.

4.02 BASIS OF PAYMENT

- A. No separate payment shall be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 01330

SURVEY MONUMENTS AND CONTROL POINTS

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of the perpetuation of U.S. Public Land Survey Corners, property corners, CITY control points, and CITY street monuments before, during, and after construction.

1.02 MONUMENTATION

- A. All monuments or corners found or set within the construction limits prior to and during construction shall be tied to local control and referenced by a Wyoming Professional Land Surveyor or under their supervision using accepted standard land survey practices at the time.
- B. All monuments or corners disturbed or destroyed during construction activities shall be replaced by a Wyoming Professional Land Surveyor using the guidelines set forth by the Wyoming State Board of Registration for Professional Engineers and Land Surveyors, Rules and Regulations, Chapter V, Section 4, Monumentation and Section 5, Rehabilitation of Original Public Land Survey System Monuments and standard land survey practices at the time.
- C. All street monuments disturbed or destroyed shall be reset using the guidelines set forth above and enclosed in a monument box as shown in Standard Drawing No. 01330-01.
- D. CITY control points that are disturbed or destroyed during construction activity shall be reset using the guidelines set forth above and enclosed in a monument box as shown in Standard Drawing No. 01330-01.

1.03 REFERENCES

- A. ASTM A48: Standard Specification on Grey Iron Casting.

PART 2 PRODUCTS

2.01 MONUMENT BOX

- A. East Jordan Iron Works Product # 06800014 or approved equal shall be used for the drop lid and skirt.
- B. East Jordan Iron Works Product # 85507010 or approved equal shall be used for the valve box top.
- C. East Jordan Iron Works Product # 85506007 or approved equal shall be used for the bottom screw base.

PART 3 EXECUTION

3.01 METHOD OF CONSTRUCTION

- A. All existing survey monument boxes shall be brought to grade by either lowering or raising as required in accordance with the details shown on the plans.
- B. Survey monument boxes shall be excavated and exposed so as to readily determine whether height adjustment can be made without substituting a longer section. Survey monuments shall not be adjusted laterally.
- C. All existing survey monument boxes shall be lowered prior to the start of asphalt milling operations. All monument boxes shall then be raised to grade following asphalt installation.
- D. Survey monument boxes shall be adjusted to final grade before the seal coat is applied. Preliminary adjustment may be required to allow placing of base courses and paving over the survey monument boxes.
- E. Backfill shall be in conformance with SECTION 02210, EXCAVATION, EMBANKMENT, AND COMPACTION.
- F. Before final acceptance, all survey monument boxes shall be cleaned by the CONTRACTOR and verified by the CITY Surveyor.

3.02 REQUIREMENTS FOR ACCEPTANCE

- A. Any CITY control monuments replaced following construction shall have a data sheet completed in accordance with the CITY

Control Monument Book. The control monument shall be tied to the CITY Control Network and the data sheet shall include but not limited to a location map, description of the monument, at least three (3) reference ties, coordinates in both ground datum and State Plane (NAD 1927 feet) (NAD 1983-92 meters), and elevation in NGVD 1929 (feet). Data sheets shall also include a survey certificate and be stamped and signed by a Wyoming Professional Land Surveyor. The data sheet must be approved by the CITY Surveyor and on file with the CITY prior to acceptance.

- B. Any public land survey monuments replaced following construction shall have a corner recordation form completed in accordance with Wyoming State Statutes Section 33-29-140 thru 33-29-149 Corner Perpetuation and Filing Act. Corner recordation forms must be on file with Laramie County Clerks Office and the CITY prior to acceptance.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Adjustment of survey monuments:
 - 1. These items shall be measured by the number of existing and/or placed facilities adjusted, complete in place.

4.02 BASIS OF PAYMENT

- A. Payment shall be made at the contract unit price bid for each item multiplied by the respective number of units adjusted or placed.
- B. Payment shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Adjusted Survey Monuments	Per Each
Placed Survey Monuments	Per Each

- C. Payment shall constitute full compensation for all materials, excavation, backfill, compaction, cleaning, labor, tools and incidentals necessary to complete each item.

END OF SECTION

SECTION 01340

SUBMITTALS

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of minimum requirements for submittals for preconstruction and finalization of projects.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 PRECONSTRUCTION

- A. Comply with submittal format requirements as specified in the Contract Documents. If not specified elsewhere, provide according to this section.
- B. Provide the numbers and types of submittals listed in individual sections of the Contract Documents. If not specified elsewhere, provide the following at a minimum:
1. Shop Drawings: One (1) reproducible and two (2) blue line or photocopy prints. Reviewed and annotated by CONTRACTOR.
 2. Product data: Four (4) copies.
 3. Samples: Two (2) each plus extra samples as required to indicate range of color, finish, and texture.
 4. Mock-ups: Number as required in the individual sections.
- C. Provide required re-submittals in the appropriate distribution if original submittals are not approved.
- D. Samples and Shop Drawings shall be prepared specifically for a project. Shop Drawings shall include dimensions and details, including adjacent construction and related work. Note any special coordination required. Note any deviations from requirements of the Contract Documents.

- E. Any submittals not feasible for approval during the preconstruction phase shall be submitted fourteen (14) days prior to incorporation into the work.

3.02 MATERIALS

- A. All materials incorporated into work within the CITY right-of-way shall have the following submitted to the CITY Construction Division for approval a minimum of seven (7) days prior to use:
 - 1. Manufacturer's specifications, test data, MSDS, and other data required to prove compliance with the specified requirements.
 - 2. Manufacturer's recommended installation procedures which, when approved by ENGINEER, shall become the basis for accepting or rejecting actual installation procedures used in the work.
- B. CONTRACTOR shall submit for review proposed schedule of Shop Drawings and product data submittals. Schedule shall include concrete and asphalt concrete mix designs. Schedules shall show response date for each submittal and indicate the relationship of the submittal to the project construction schedule.
- C. CONTRACTOR shall have on site a complete set of approved plans, approved Shop Drawings, approved mix designs, and approved permits at all times.

3.03 CLOSE-OUT and WARRANTY

- A. Close-out submittals shall contain:
 - 1. Two (2) reproducible copies of "As-Builts". These shall be sealed and signed by a Professional Engineer or Professional Land Surveyor registered by the State of Wyoming.
 - 2. Booklet style copy of all tests with letter stating that all tests conform to minimum standards and are passing. This letter shall be sealed and signed by a Professional Engineer registered by the State of Wyoming responsible for the material testing.
 - 3. Copy of completed permit with approved inspections.

- B. Warranty and Operation and Maintenance submittals shall contain:
1. Four (4) copies.
 2. Warranties as specified. Warranties shall not limit length of time for remedy of damages OWNER may have by legal statute. Warranties shall be signed by CONTRACTOR, supplier or installer responsible for performance of warranty.
 3. Assemble a complete set of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 - a. Operation data shall include, but is not limited to:
 - 1) Emergency instructions and procedures.
 - 2) System, subsystem, and equipment descriptions, including operating standards.
 - 3) Operating procedures, including startup, shutdown, seasonal, and weekend operations.
 - 4) Description of controls and sequence of operations.
 - 5) Any diagrams, Shop Drawings, plans, and specifications.
 - b. Maintenance data shall include, but is not limited to:
 - 1) Manufacturer's information, including list of spare parts.
 - 2) Name, address, and telephone number of installer and supplier.
 - 3) Maintenance procedures.
 - 4) Maintenance and service schedules for preventive and routine maintenance.
 - 5) Maintenance record forms.

- 6) Sources of spare parts and maintenance materials.
 - 7) Copies of maintenance service agreements.
 - 8) Copies of warranties and bonds.
- c. Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data in a heavy-duty, three (3) ring, vinyl-covered, loose-leaf binder, sized to accommodate contents, with pockets inside to receive folded oversized sheets. Identify each binder on front and spine with the printed title "Operation and Maintenance Manual", Project name, and subject matter contents.
- C. All close-out documents, warranty certifications, and operation and maintenance manuals shall be submitted to the CITY along with written request for the final inspection.

END OF SECTION

SECTION 01505

TEMPORARY FACILITIES

PART 1 GENERAL

1.01 SUMMARY

- A. Furnish temporary services and utilities, including use fees and operation costs:
 - 1. Potable and non-potable water.
 - 2. Lighting and power.
 - 3. Materials storage.
- B. Furnish construction facilities, including utility costs:
 - 1. Construction equipment.
 - 2. Dewatering and pumping.
- C. Furnish security and protection requirements:
 - 1. Fire extinguisher.
 - 2. Site enclosure fence, barricades, warning signs, and lights.
 - 3. Snow and ice removal, if applicable.
- D. Furnish personnel support facilities:
 - 1. First aid facilities.
 - 2. Coordinate emergency medical services.
 - 3. Trash removal.
 - 4. Sanitary facilities.
 - 5. Drinking water.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 JOB OFFICES AND SANITATION FACILITIES

- A. The CONTRACTOR and SUBCONTRACTORS may maintain such office and storage facilities on the site as are necessary for the proper conduct of work. These shall be located so as to cause no interference to any work to be performed on the site. The City shall be consulted with regard to locations. Upon completion of the improvements, or as directed by the CITY, the CONTRACTOR shall remove all such temporary structures and facilities from the site, same to become the CONTRACTOR's property. The CONTRACTOR shall leave the site of the work in the condition required by the Contract.
- B. The CONTRACTOR shall provide and maintain in a neat and sanitary condition on-site toilet facilities and trash receptacles for the use of his employees as may be necessary to comply with the requirements and regulations as enforced by the County Health Officer. The CONTRACTOR shall not allow such facilities to become a public nuisance and shall remove all trace of these facilities prior to completion of the project.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for items under this section.

4.02 BASIS OF PAYMENT

- A. No separate payment shall be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 01562

DUST CONTROL and CLEAN UP

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of dust control and clean up requirements on all projects within the CITY.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 DUST CONTROL

- A. CONTRACTOR shall be responsible, including all equipment and personnel, for dust control activities throughout all phases of construction, including all work suspensions, up to and through final acceptance of the project.
- B. CONTRACTOR shall take steps, procedures, and means to prevent any dust nuisances from any and all construction activity, including staging areas, temporary yards, and disposal sites. Dust control shall be maintained at all times to the satisfaction of the ENGINEER. When using water for dust control, enough shall be used to eliminate dust, abate air pollution, and for the protection and safety of traffic.
- C. CONTRACTOR shall provide the ENGINEER with the name and telephone number of the person designated to maintain all site control during evenings, weekends and holidays. If person cannot be contacted, OWNER shall use equipment to address the dust control issue. In this case, CONTRACTOR shall pay all costs incurred by the OWNER.
- D. Failure of CONTRACTOR to comply with ENGINEER's requests for dust control may result in a work suspension until the condition is corrected. No additional compensation and/or time shall be allotted for such suspension.
- E. CONTRACTOR shall be responsible for controlling dust and mud within the project limits and on any street which is utilized by his equipment for the duration of the project. The CONTRACTOR shall be prepared to use watering trucks, power sweepers and other

pieces of equipment as deemed necessary by the ENGINEER, to avoid creating a nuisance.

Complaints on dust, mud, or unsafe practices and/or property damage to private ownership shall be transmitted to the CONTRACTOR and prompt action in correcting will be required. Written notice of correction of complaint items shall be required should repetitive complaints be received by the CITY.

3.02 SITE CLEAN UP

- A. CONTRACTOR shall be responsible, including all equipment and personnel, for all cleanup required throughout all phases of construction, including all work suspensions, up to and through final acceptance. Work area shall be kept clean of rubbish, excess materials and debris created by construction activity.
- B. CONTRACTOR shall take steps, procedures, and means to keep the work areas, any temporary yards, storage areas, staging areas, and disposal areas clean of any debris, rubbish, and excess materials.
- C. Failure of CONTRACTOR to comply with ENGINEER's requests for clean up may result in a work suspension until the condition is corrected. No additional compensation and/or time shall be allotted for such suspension.
- D. Final Cleanup. The CONTRACTOR shall repair, replace, or clean all sidewalks, streets and other areas affected by construction, removing all loose surface materials. All piles of excess excavation, rocks, rubbish, or other debris throughout the site shall be cleaned up and disposed of. This clean up shall include sweeping of pavements, curb and gutter, sidewalks, and alleyways prior to opening to traffic. All excess asphalt, gravel and other construction debris shall be removed from the gutters and properly disposed of. Any remaining locate flags shall be removed. Damage to any areas by the CONTRACTOR will be repaired or replaced by the CONTRACTOR at no expense to the CITY. No extra compensation will be allowed for final cleaning of the site, but the cost thereof shall be included in the unit price bid for other items in the Proposal.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for items under this section.

4.02

BASIS OF PAYMENT

- A. No separate payment shall be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 01563

SEDIMENT, EROSION CONTROL AND STORM WATER MANAGEMENT

PART 1 GENERAL

1.01 SUMMARY

This work consists of constructing, installing, maintaining and removing when required, Best Management Practices (BMPs) during the life of any construction, development, or building project within the CITY to prevent or minimize erosion, sedimentation, and pollution of any surface waters, including wetlands. BMPs means techniques, processes, activities, or structures used to reduce pollutant discharges in stormwater.

1.02 SUBMITTALS

- A. Small construction activities, those disturbing at least one acre but less than five acres, are required to obtain coverage from the Wyoming Department of Environmental Quality (DEQ) under the State's Wyoming Pollutant Discharge Elimination System (WYPDES) Small Construction General Permit (WYR10-A000). For projects disturbing 5 acres or more, the CONTRACTOR shall submit to the DEQ for coverage under the WYPDES permit for Storm Water Discharge Associated with Large Construction Activities (Permit No. WR10-0000). In accordance with these permits, the CONTRACTOR shall develop a Storm Water Pollution Prevention Plan (SWPPP) and perform periodic inspections and maintenance of site BMPs.
- B. The CONTRACTOR shall also be required to obtain coverage under the State's General Permit for discharge of water from hydrostatic and disinfection testing of new water mains, if such work is included in the project.
- C. Copies pertaining to all WYPDES permits including, but not limited to, approved Notice of Intent (NOI) and SWPPP plans shall be on file with the CITY Construction Division, shall be forwarded to the CITY and the ENGINEER prior to application for any CITY permit and/or prior to the start of construction. During work, the CONTRACTOR shall give the CITY copies of required monitoring reports and necessary SWPPP revisions. This information is not for approval but will be used to document the Erosion Control and Storm Water Management pay item if

included in the contract. Copies of all Notice of Terminations (NOT) shall also be forwarded to the CITY and the ENGINEER at such time that vegetation is reestablished to the degree required by permit and prior to final acceptance of the project by the CITY.

PART 2 PRODUCTS

2.01 BMP MATERIALS

- A. The material for BMPs shall conform to the following:
1. Erosion Bales. Material for erosion bales shall consist of certified weed free hay or straw. Erosion bales should have approximate external dimensions of 18 in X 18 in X 36 in, weighing from 40 lb to 70 lb, and shall be tightly bound with wire ties or nylon twine. They shall be secured using 3-foot wooden stakes with a nominal dimension of 2 in X 2 in.
 2. Silt Fence. Silt fence geotextile shall conform to the Silt Fence requirements of WYDOT Section 805 Geotextiles, Membrane, and Fabrics. Silt fence posts shall be a nominal wood size of 2 in X 2 in or steel T-post weighing at least 1.25 lb/ft. Silt fence shall be tied to the post with wire, cord, staples, pockets, or other approved means.
 3. Silt Dikes. Silt dikes shall be pre-manufactured triangular shaped urethane foam covered with a woven geotextile fabric. Provide silt dikes with a center height of 8 to 10 in, sides of equal length, base of 16 to 20 in, standard length of 3 to 7 ft, and with fabric aprons extending 24 in. To secure, use U-pin wire staples at least 8 inches long.
 4. Sediment Log. Sediment logs shall be made of wood excelsior that is encased in a tube of polypropylene netting, having a minimum diameter of 12 in, a standard length of 10 ft, and a weight of approximately 4.0 lb/ft. Sediment logs shall be embedded 2 inches into the soil and secured using 3-foot wooden stakes with a nominal dimension of 2 in X 2 in.
 5. Gravel Bag. Gravel bags shall consist of aggregate filled woven geotextile fabric with a diameter of 4 to 6 inches and a minimum section length of 8 ft. Aggregate contained in the gravel bags shall consist of free draining gravel or crushed stone.

6. Storm Catch Basin Protection. Storm catch basin protection shall consist of an aggregate filled woven geotextile fabric bag, with attached grate apron or bag insert, capable of conforming to the shape of the curb while providing overflow space of at least 1 in along the total face of the curb inlet.
7. Vehicle Tracking Pads. Vehicle tracking pads shall be 9 in. thick No. 3 Course Aggregate (from AASHTO M 43) over a non-woven geotextile fabric, 20 feet wide by 50 feet long.
8. Construction Fence. Construction fence shall be composed of orange, contractor-grade material that is at least 4' high. Studded steel tee posts shall be used to support the construction fence. Maximum spacing for the steel tee posts shall be 10'. Construction fence shall be securely fastened to the top, middle, and bottom of each post. Metal posts should have a plastic cap for safety.
9. Other BMPs not listed herein may be used, when approved by ENGINEER.

PART 3 EXECUTION

3.01 SWPPP

- A. Erosion control and storm water management requirements shall comply with DEQ rules and regulations. CONTRACTOR shall develop, implement, and monitor a SWPPP for the project, including temporary erosion control measures necessary, in addition to those that may be specified, and shall provide associated labor, materials, equipment, and incidentals needed to fully implement the plan and comply with all rules, regulations, and restrictions imposed by EPA or DEQ as part of the WYPDES permit program.

Temporary erosion and sediment control details and specified information, if supplied by the ENGINEER, may be used in developing and implementing a SWPPP. Other methods are available that may be more appropriate depending on circumstances.

Implementing the SWPPP is a dynamic, not static process. CONTRACTOR is responsible for adapting the original plan so as to effectively reduce erosion and sediment, and comply with any

modifications as required by the CITY or other jurisdiction having authority.

- B. Upon final acceptance of the project, CONTRACTOR shall submit to the DEQ a NOT. If permanent vegetation has not been established at the time of request for final acceptance, and ownership of the SWPPP is to be transferred to either the DEVELOPER or CITY, the CONTRACTOR shall obtain signed approval of the transfer from the DEVELOPER and/or CITY prior to submittal to DEQ for approval of the transfer.

3.02

EROSION CONTROL SUPERVISOR

- A. CONTRACTOR shall assign to the project an individual to serve in the capacity of the Erosion Control Supervisor (ECS). The ECS shall be a person other than the Superintendent and shall not be directly responsible to the Superintendent. The ECS shall act as the SWPPP Administrator on the project, and shall be responsible for oversight of the implementation, maintenance, and revision of the SWPPP for the duration of the project. The ECS shall attend the Preconstruction Conference and any other meetings regarding construction that could impact water quality.
- B. CONTRACTOR shall provide the ENGINEER and CITY with the name and telephone number of the ECS and the person designated to maintain all site control during evenings, weekends and holidays. If that person or the ECS cannot be contacted, OWNER shall use equipment to address the erosion control and/or storm water management issue. In this case, CONTRACTOR shall pay all costs incurred by the OWNER.
- C. The ECS shall immediately report to the ENGINEER and the CITY the following instances of noncompliance:
 - 1. Noncompliance which may endanger health or the environment.
 - 2. Spills or discharge of hazardous substance or oil which may cause pollution of waters of the State.
 - 3. Discharge of stormwater which may cause an exceedance of a water quality standard.

EROSION CONTROL AND STORM WATER MANAGEMENT

- A. CONTRACTOR shall take steps, procedures, and means to maintain and protect all erosion control and storm water management from any and all construction activity, including staging areas, temporary yards, and disposal sites. Erosion control and storm water management shall be maintained at all times in accordance with the NOI and/or SWPPP.
- B. CONTRACTOR shall coordinate temporary and permanent sediment and erosion control work to provide effective control throughout the construction period. CONTRACTOR shall protect locations of exposed, erodible earth with correctly installed, functional erosion control measures and shall maintain measures to ensure maximum sediment reduction.
- C. CONTRACTOR shall complete erosion control work, temporary and permanent, as soon as practical and in conjunction with other construction work and subject to seeding date and anticipated weather restrictions. CONTRACTOR shall restore and seed haul roads, material sources, staging areas, and other disturbed areas as work is completed and subject to seeding date restrictions.
- D. Clearing and grubbing operations shall be scheduled and performed so that grading operations and final stabilization measures can follow immediately thereafter if the project conditions permit. Otherwise temporary stabilization measures shall be taken between successive construction stages. Additional work required because the CONTRACTOR has failed to properly coordinate the entire erosion control schedule, thus causing previously seeded areas to be disturbed by operations that could have been performed prior to the seeding shall be performed at the CONTRACTOR's expense.
- E. CONTRACTOR shall be responsible, including all equipment and personnel, for sediment and erosion control, and storm water management activities throughout all phases of construction, including all work suspensions, up to and through acceptance of transfer of ownership for the SWPPP or final acceptance of the project.
- F. Whenever sediment collects on the paved surface, the surface shall be cleaned. Street washing will not be allowed. Storm catch basin protection shall be in place prior to shoveling, sweeping, or vacuuming. Sweeping shall be completed with a pickup broom or

equipment capable of collecting sediment. Sweeping with a kick broom will not be allowed.

- G. Material from pavement saw cutting operation shall be cleaned from the roadway during operations using a vacuum. A BMP, such as a berm, shall be placed to contain the slurry from joint flushing operations until the residue can be removed from the surface. Erosion logs or other permeable BMPS shall not be used.
- H. Upon project completion, the CONTRACTOR shall remove and dispose of temporary erosion control measures not specified or designated by the ENGINEER to remain as permanent erosion control measures. If removed, the areas in which these temporary erosion control measures were constructed shall be returned to a condition similar to that which existed prior to its disturbance. Removed BMPs shall become the property of the CONTRACTOR.
- I. Failure of CONTRACTOR to comply with ENGINEER's requests for erosion control and storm water management may result in a work suspension until the condition is corrected. No additional compensation and/or time shall be allowed for such suspension.

3.04 BEST MANAGEMENT PRACTICES (BMPs)

Erosion control BMPs limit the amount and rate of erosion occurring on disturbed areas. Sediment control BMPs attempt to capture the soil that has been eroded before it leaves the construction site. Construction BMPs include not only erosion and sediment control BMPs, but also material management and site management BMPs. Construction sites may include, but are not limited to, the following BMPs. Manufacturer's recommended installation procedures which, when approved by ENGINEER, shall become the basis for accepting or rejecting actual installation procedures used in the work.

A. SILT FENCE

Install silt fence at specified locations and elsewhere as needed to prevent sheet flows and erosion of ditch channels prior to any grubbing or grading activity. Use a wire-reinforced silt fence (woven wire) above DEQ class I waters and in high wind areas.

Build fences and grade fence locations so that water is spread uniformly along the fence. Taper the ends of the fence uphill. Where it is impossible to drive the posts to the depth required in the plans, adequately secure the fence to prevent overturning.

Attach fabric to each post using at least two ties through the top 8 in of fabric. Construct the fence to handle the stress of the sediment loading.

Maintain the silt fence until the fence is removed. Check the fabric after each rainfall or high wind event to ensure it is free of rips, tears, and other types of deterioration, and replace as needed. Remove sediment deposits when the deposit reaches one half the height of the silt fence.

B. DITCH CHECKS

Install ditch checks to control ditch, channel and non-roadway inlet erosion. Install ditch checks to ensure that water does not flow around, between, or under the devices. Construct ditch checks using either Erosion Bales or Sediment Logs. Triangular Silt Dikes, without aprons, may also be used in ditch and channels.

Inspect ditch checks frequently and replace deteriorated or damaged devices that are not functioning properly. Removed devices may be used to mulch areas of sediment disposal.

C. ROCK CHECK DIKES

Install rock check dikes to control ditch and channel erosion, as specified. Use rock with diameters from 3 in to 6 in intermixed with gravel. To maintain filtering capability, do not use larger rock. Establish the flow line from 6 in to 12 in below the side elevations.

D. STORM CATCH BASIN AND CULVERT PROTECTION

All catch basins and culverts shall be protected during construction. Appropriate protection of each new culvert and catch basin shall be installed immediately upon its completion. When riprap is called for at the outlet of a culvert, it shall be installed within 24 hours of completion of each pipe.

The use of sediment logs will not be allowed around catch basins that are within the paved roadway. Only Storm Catch Basin Protection items listed in 2.01.F above will be allowed. The ends of catch basin protection shall extend a minimum of 1 foot past each end of the inlet. In unpaved areas, sediment logs, erosion bales, or silt fence will be allowed around catch basins as long as designed and installed properly to prevent floatation or collapse of the devices.

Sediment logs or gravel bags may be used in advance of inlets to intercept sediment prior to entering inlets, but they shall be weighted and sized so as to not float during high flows. Additional protection, such as silt fence, silt dikes, sediment logs, etc, shall be used behind the curb to intercept sediment within and from the construction site prior to it entering the street.

All inlet protection shall be inspected and maintained, with removal of accumulated sediment, weekly and within 24 hours of a storm event.

E. VEHICLE TRACKING PADS

Vehicle tracking pads shall be used at all vehicle and equipment access points to the site to prevent sediment exiting the project site onto any paved roadways. Access shall be provided only at locations approved by the ENGINEER with locations recorded on the SWPPP site map. Construction of approved vehicle tracking pads shall be completed before any excavation or work begins.

The CONTRACTOR shall maintain each pad during the entire time that it is in use for the project. The vehicle tracking pad shall be removed at the completion of the project unless otherwise approved by the ENGINEER.

F. CONCRETE WASHOUT

The CONTRACTOR shall construct a water tight concrete washout structure that will contain washout from concrete placement and construction equipment cleaning operations. Concrete wasted on the ground during construction shall be collected, removed from the project site, and disposed of properly. Surface discharges of concrete washout water from construction sites are prohibited.

Fabricated concrete washout structures may be used. After use, the structure shall be removed from the project site and disposed of at the Contractor's expense.

G. CONSTRUCTION FENCE

Construction Fence shall restrict site access to designated entrances and exits, delineate construction site boundaries, and keep construction out of sensitive areas.

PART 4 METHOD OF MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Lump Sum Basis: When the bid schedule contains a Sediment, Erosion Control and Storm Water Management lump sum item, no measurement of individual items will be made.
- B. When the bid schedule stipulates unit prices each item, complete in place, shall be measured at the bid schedule unit of measurement.
- C. When the Bid Schedule does not contain a bid item for Sediment, Erosion Control and Stormwater Management no measurement shall be made for this item but shall be considered as a subsidiary obligation of the CONTRACTOR under other bid items.

4.02 BASIS OF PAYMENT

- A. Lump Sum: Payment shall be made at the lump sum quote for this item in the Bid Schedule. Payment for Sediment, Erosion Control and Storm Water Management will not be made when the BMP's are not being properly maintained. When properly maintained payment shall be as follows:
 - 1. On the first estimate following award, 10 percent of the Sediment, Erosion Control and Storm Water Management pay item or 1 percent of the original contract amount, whichever is less will be paid.
 - 2. When 5 percent of the original contract amount is earned, 25 percent of the amount bid for Sediment, Erosion Control and Storm Water Management or 2 percent of the original contract amount, whichever is less will be paid.
 - 3. When 10 percent of the original contract amount is earned, 50 percent of the amount bid for Sediment, Erosion Control and Storm Water Management or 5 percent of the original contract amount, whichever is less will be paid.
 - 4. When 25 percent of the original contract amount is earned, 60 percent of the amount bid for Sediment, Erosion Control and Storm Water Management or 6 percent of the original contract amount, whichever is less will be paid.
 - 5. When 50 percent of the original contract amount is earned, 70 percent of the amount bid for Sediment, Erosion Control

and Storm Water Management or 7 percent of the original contract amount, whichever is less will be paid.

6. When 70 percent of the original contract amount is earned, 100 percent of the amount bid for Sediment, Erosion Control and Storm Water Management or 10 percent of the original contract amount, whichever is less will be paid.
 7. Upon completion of all work on the project, payment on any amount bid for Sediment, Erosion Control and Storm Water Management in excess of 10 percent of the original contract amount will be paid.
- B. Unit Price – Payment for specific BMP’s shall be paid on a unit basis for each BMP properly installed.
- C. When the “Bid Schedule” does not contain pay items for Sediment, Erosion Control and Storm Water Management, the work shall not be paid for directly, but shall be considered as a subsidiary obligation of the CONTRACTOR under other bid items.

END OF SECTION

SECTION 02050

REMOVAL AND DISPOSAL OF STRUCTURES AND OBSTRUCTIONS

PART 1 GENERAL

1.01 SUMMARY

- A. The section consists of removing and satisfactorily disposing of existing asphalt pavement, portland cement pavement, concrete curb, combined curb and gutter, sidewalk, private driveways, crosswalks, fences, abandoned pipe lines, buildings and any other structure or obstruction designated for removal on the plans.
- B. Removed items shall be properly disposed of as required by Federal, State, and Local Government regulations. The ENGINEER shall receive written notification of disposal procedures and may require the CONTRACTOR to certify that proper disposal methods were used.
- C. It shall also include the salvaging of designated material, as shown on the plans, and backfilling the resulting trenches, holes, and pits.
- D. Materials removed and not designated to be salvaged or incorporated into the work shall become the property of the CONTRACTOR.

1.02 RELATED WORK

- A. Section 02075 - Demolition of Asphalt and Portland Cement Concrete.
- B. Section 02110 - Clearing and Grubbing.
- C. Section 02115 - Selective Clearing.
- D. Section 02210 - Excavation, Embankment, and Compaction.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 CONSTRUCTION METHODS

A. Demolition and disposal

1. All existing pavement, curb, gutter, sidewalks, driveways, crosswalks, fences, abandoned pipelines, buildings or any other structure or obstruction specified for removal on the plans or as directed by the ENGINEER, shall be removed and disposed of by the CONTRACTOR. Work shall conform to SECTION 02075, DEMOLITION OF ASPHALT AND PORTLAND CEMENT CONCRETE.
2. Care shall be exercised in such removal to assure that adjacent facilities or structures which are to remain shall not be disturbed.
3. Any damage to such existing facilities or structures resulting from carelessness or negligence on the CONTRACTOR's part shall be satisfactorily restored to its original or better condition to the satisfaction of the ENGINEER at the CONTRACTOR's expense.
4. Existing pavement shall be sawcut and removed to the lines indicated on the plans, or as directed by the ENGINEER.
5. Existing private concrete driveways or sidewalks which interfere with construction of street improvements or which do not match for grade shall be removed as shown on the plans or as directed by the ENGINEER. Removal shall be on a neat line produced by a concrete saw cut.
6. Any voids left as a result of pipe or other objects being removed shall be slurry filled or backfilled by conventional methods. No voids will be allowed to remain.

3.02 REMOVAL OF PIPE

- A. Pipe designated for salvage shall be removed and cleaned. Every precaution shall be taken to avoid breaking or damaging the pipe. Pipes to be re-laid, shall be removed and stored so that there will be no loss or damage before relaying. The CONTRACTOR shall replace at his expense, sections lost from storage or damaged by negligence or by use of improper methods.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. When the contract stipulates a lump sum basis, no measurement of individual items shall be required.
- B. When the contract stipulates unit prices, each item removed shall be measured at the bid schedule unit of measurement.

4.02 BASIS OF PAYMENT

- A. Lump Sum - Payment shall be made at the lump sum quote for this item in the “Bid Schedule” and shall be for the removal of all obstructions including pipe, and structures encountered. Payment shall include required excavation and backfill.
- B. Unit Price - Payment for specific obstruction items including pipe shall be paid for at the measured quantities removed multiplied by the unit price per each as called out in the “Bid Schedule”.
- C. When the “Bid Schedule” does not contain pay items for removal of structures and obstructions including pipe removal, the work shall not be paid for directly, but shall be considered as a subsidiary obligation of the CONTRACTOR under other contract items.

END OF SECTION

SECTION 02051

ABANDON PIPE SYSTEMS

PART 1 GENERAL

1.01 SUMMARY, ABANDON PIPE SYSTEM

- A. With the finite real estate available within the City ROW it is the City's desire to remove any pipes and other appurtenances which are no longer required from the ROW. Special permission to abandon in place is required from the City Engineer. When permission is granted to abandon in place the following abandonment procedures shall be followed.
- B. Abandonment of existing manholes will require the CONTRACTOR to remove the top 6' of the existing manhole, slurry plugs in all lines, fill remaining manhole with slurry and backfilling of upper excavation with on-site material. Removed materials shall be properly disposed of by the CONTRACTOR. Existing inlets will be removed as described in the Section 02050, REMOVAL AND DISPOSAL OF STRUCTURES AND OBSTRUCTIONS. The lateral lines will be removed as shown on the drawings.

1.02 RELATED WORK

- A. Section 02225 – Trench Backfill.
- B. Section 02050 – Removal and Disposal Of Structures and Obstructions

PART 2 PRODUCTS

2.01 MATERIALS

- A. The FLASH FILL® (or equivalent) required to fill the existing storm sewer pipes shall conform to the following:

Cement Content:	140 lbs/cy
Water Content:	105 gal/cy
Fly Ash (Class F):	1,850 lbs/cy

FLASH FILL® (or equivalent) shall be mixed adequately to provide a liquid state in which the existing storm sewer pipes can be filled entirely at designated points no greater than 300 feet.

The mix shall meet a desired density of 110 lbs per cubic foot after a duration no greater than 28 days.

The CONTRACTOR shall submit a mix design to an independent testing laboratory for approval and verification of density requirements prior to placing the FLASH FILL®.

- B. Concrete pipe plugs shall be constructed with 3,000 psi. concrete.

PART 3 EXECUTION

3.01 PIPE CULVERTS, PIPES AND LATERALS

- A. Remove pipes and laterals and backfill with suitable material or plug pipe ends and fill pipe with slurry. If the CONTRACTOR elects to completely remove pipes and laterals in areas under pavement that will not be reconstructed, the CONTRACTOR shall backfill the trench, then replace the base and pavement at no additional cost to the OWNER.
- B. The thickness of pipe plug shall be one and one half (1-1/2) times the inside diameter of the pipe with a minimum thickness of eighteen (18) inches. Pipe plug shall be tight and thoroughly compacted to prevent any soils from entering the pipe.

3.02 MANHOLES

- A. Remove the top 6' of the existing manhole, install plugs in all lines, fill remaining manhole with slurry and backfilling of upper excavation with on-site material or other suitable backfill material as described in Section 02225, TRENCH BACKFILL and restore surface.

3.03 INLETS

- A. Remove the entire inlet, remove laterals and install plugs in lines indicated and backfill upper excavation with on-site material or other suitable backfill material as described in Section 02225, TRENCH BACKFILL and restore surface.

3.04 WATER VALVES

- A. Concrete Diamond shall be removed, valve box shall be cut down to twelve (12) inches below final grade and filled with slurry. Backfill upper excavation in accordance with Section 02225, TRENCH BACKFILL and restore surface.

3.05 FIRE HYDRANTS

- A. Fire Hydrants shall be removed at flange and lower barrel section and rod shall be cut off twelve (12) inches below final grade and filled with slurry. Backfill upper excavation in accordance with Section 02225 TRENCH BACKFILL and restore surface.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. FLASH FILL® will be measured by the cubic yard of flash fill placed in accordance with the specifications.
- B. Payment for FLASH FILL® will be by the cubic yard of flash fill placed at the CONTRACTOR’s unit price bid, which shall constitute full compensation for furnishing and installing all materials, equipment, labor, tools and incidentals necessary to complete the work.

4.02 BASIS OF PAYMENT

- A. Work performed and materials furnished as prescribed by this item and measured as provided under “Measurement” will be paid for as follows:
- B. Payment for Concrete Pipe plugs will be by the number of plugs measured, regardless of size, complete in place, at the contract unit price bid, which price and payment shall constitute full compensation for furnishing and installing all materials required for all excavation, sawcutting, forming and placing concrete, compaction, labor, tools and incidentals necessary to complete the item.

<u>Pay Item</u>	<u>Pay Unit</u>
Concrete Pipe Plug	EA
Pipe Fill	CUYD

END OF SECTION

SECTION 02075

DEMOLITION OF ASPHALT AND PORTLAND CEMENT CONCRETE

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of removal of all surfacing material encountered.

1.02 RELATED WORK

- A. Section 02050 - Removal and Disposal of Structures and Obstructions.
- B. Section 02110 - Clearing and Grubbing.
- C. Section 02115 - Selective Clearing.
- D. Section 02515 - Asphalt Patching.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 ASPHALT AND CONCRETE REMOVAL

- A. Where trench excavation or structure excavation requires the removal of curb and gutter, concrete sidewalks, driveways, or asphaltic concrete or concrete pavement, the pavement or concrete shall be sawcut in a straight line parallel to the edge of the excavation. Sawcuts shall be made full-depth, straight, with clean vertical edges by an ENGINEER approved method. This method shall be approved prior to the start of sawcutting. Final pavement sawcuts shall be a minimum of two (2) feet wider than the actual trench opening and centered over such trench. Removal areas shall follow the approved plan or at the ENGINEER's discretion. Concrete removal shall be to existing joints. Any spalling, cracking, breaking or similar damage shall be repaired at the CONTRACTOR's expense.
- B. Curb and gutter, concrete sidewalks, driveways, and concrete pavement shall be removed to the nearest joint. Partial replacement of panels shall not be allowed.

- C. When concrete removal areas are adjacent to asphalt pavement, the asphalt pavement shall be cut back a minimum of two (2) foot and patched following concrete placement.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. When the contract stipulates a lump sum basis, no measurement of individual items shall be required.
- B. When the contract stipulates unit prices, each item removed shall be measured at the bid schedule unit of measurement.

4.02 BASIS OF PAYMENT

- A. Lump Sum - Payment shall be made at the lump sum quote for this item in the “Bid Schedule” and shall be for the removal of all concrete sidewalks, driveways, curb and gutter, asphalt pavement, and concrete pavement within the designated removal area(s). Payment shall include required excavation.
- B. Unit Price – Payment shall be made at the measured quantity of concrete sidewalks, driveways, asphalt pavement, and concrete pavement removed multiplied by the unit price per area as called out in the “Bid Schedule”. Payment shall be made at the measured quantity of curb and gutter removed multiplied by the unit price per length as called out in the “Bid Schedule”.
- C. When the “Bid Schedule” does not contain pay items for removal of asphalt and portland cement concrete, the work shall not be paid for directly, but shall be considered as a subsidiary obligation of the CONTRACTOR under other contract items.

END OF SECTION

SECTION 02076

COLD MILLING EXISTING PAVEMENT

PART I GENERAL

1.01 SUMMARY

This work shall consist of cold milling, removing, and disposing of milled pavement materials in accordance with this supplementary specification and details shown on the plans.

PART 2 PRODUCTS-NOT USED

PART 3 EXECUTION

3.01 CONSTRUCTION

- A. The designated existing bituminous pavement shall be removed by cold-milling to the lines and limits shown on the plans or established by the Engineer. The asphalt pavement shall be removed without damage to the underlying base course or pavement surface. The cold-milling equipment shall be a power operated planing machine with the minimum capability of removing, in one pass, two (2") inches in depth. The cold-milling machine shall be capable of accurately establishing profile grades by reference of the existing pavement or from an independent grade control and shall have a positive means of controlling cross slope grade. The cold-milling machine shall be self propelled with sufficient power, traction and stability to maintain an accurate depth of cut. The cold-milling machine shall also have an effective means of preventing dust from escaping into the air. The resulting pavement surface shall be smooth and free of excessive scarification marks or other damage, as determined by the Engineer. Correct vertical distances greater than three-eighths (3/8) inch between adjacent peak and valleys of the milled surface. Correct surface irregularities resulting from milling activities using cold milling equipment or other means acceptable to the ENGINEER at no additional cost to the City. Milled pavement materials shall become the property of the contractor. The sequence for milling will be determined based on the Contractor's milling equipment, width of street, cross slope and thickness of pavement. The cold milling machine shall weigh not more than 75,000 pounds in full operating order with three (3) skis or 100,000 pounds in full operating order with four skis. Sweeping of streets shall be accomplished with the use of a pickup broom with sufficient water to mitigate dust.
- B. When Profile Milling is specified ensure the machine is equipped with a thirty (30) foot mobile reference (ski). Milling depths will vary across the roadway's width, length or both.

- B. Once milling is complete the ENGINEER shall inspect and mark any areas requiring patching prior to paving. CONTRACTOR shall have crews available to saw cut existing asphalt, excavate a minimum of 10 inches of material, and replace with 6" compacted base and 4" of asphalt to be paid separately as asphalt patching.
- C. Paving shall commence immediately after milling and patching has been completed. Any damage caused to surface due to neglect of the CONTRACTOR to pave the section in a timely matter will be repaired by the CONTRACTOR to the CITY'S satisfaction, at the CONTRACTOR's expense, with no additional cost to the CITY.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Cold-milling existing pavement will be measured for payment by the square yard for each two (2") inches of depth of material removed. No measurement will be made for milling subgrade materials.
- B. Profile milling will be measured for payment by the square yard regardless of depth milled.

4.02 BASIS OF PAYMENT

- A. The accepted quantities of cold-milling existing pavement will be paid for at the contract unit price per square yard; which payment will be full compensation for removing, loading, hauling, complete clean up including sweeping and disposal of the material and for furnishing all labor, materials, equipment, tools, and incidentals necessary to complete the work.
- B. The accepted quantities of Profile Milling existing pavement will be paid for at the contract unit price per square yard; which payment will be full compensation for removing, loading, hauling, complete clean up including sweeping and disposal of the material and for furnishing all labor, materials, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Cold Milling Existing up to 2"	Square Yard
Profile Milling	Square Yard

END OF SECTION

SECTION 02110

CLEARING AND GRUBBING

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of clearing, grubbing, removing, and disposing of all vegetation and debris within the limits of the construction area. Vegetation and objects designated to remain shall be preserved from injury or defacement.

1.02 RELATED WORK

- A. Section 02050 - Removal and Disposal of Structures and Obstructions.
- B. Section 02075 - Demolition of Asphalt and Portland Cement Concrete.
- C. Section 02115 - Selective Clearing.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 CONSTRUCTION

- A. Unless otherwise established by the ENGINEER, all areas between lines two (2) feet outside the back of sidewalk, curb and/or curb and gutter, or within the neat lines of cut or fill areas shall constitute the clearing and grubbing limits. Where sidewalk, curb and/or curb and gutter is not required, the clearing limits shall be two (2) feet outside the edge of pavement or within the neat lines of cut or fill areas.
- B. Prior to planting, pruning, removing or structurally altering any tree or shrub within the public street, alley, or sidewalk right-of-way, or other public place within the CITY, a written permit must be obtained from the CITY Forester.
- C. All stumps, roots, logs or other timber more than three (3) inches in diameter, and all brush, matted roots and other debris within the grubbing limits not suitable for street foundations shall be pulled or otherwise removed to a depth of not less than six (6) inches below the

original ground or twelve (12) inches below street subgrade.

- D. The refuse resulting from the clearing and grubbing operation shall be hauled to an available waste site and shall be disposed of in such a manner as to meet all requirements of state, county and municipal regulations regarding health, safety, and public welfare. When authorized in writing by the proper fire authorities, the CONTRACTOR may dispose of such refuse by burning on the site of the project provided all requirements set forth by the authorities are met.
- E. On easements through private property, the CONTRACTOR shall not burn on the site unless specifically permitted by the property owner in which case he shall obtain permission as previously stated.
- F. In all cases, the authority to burn shall not relieve the CONTRACTOR in any way from damages which may result from his operations. In no case shall any material be left on the project, shoved onto abutting private properties, or be buried in embankments or trenches on the project.
- G. The CONTRACTOR shall avoid, as far as practicable, injury to shrubbery, vines, plants, grasses and other vegetation growing on areas outside of the grading area, or on parking strips or adjacent lots.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Measurement shall be by one (1) or more of the following alternate methods:
 - 1. Area Basis: The work to be paid for shall be the number of acres and fractions thereof acceptably cleared or grubbed, or both, within the limits shown on the plans or staked for clearing and grubbing by the ENGINEER. Areas not shown on the plans, or not staked for clearing and grubbing, shall not be measured for payment.
 - 2. Lump Sum Basis: When the bid schedule contains a clearing and grubbing lump sum item, no measurement of area shall be made.

3. Individual Unit Basis:
 - a. The diameter of trees shall be measured at a height of twenty-four (24) inches above the ground. Trees less than four (4) inches in diameter shall be classified as brush.
 - b. When the bid schedule indicates measurement by individual unit basis, the units shall be designated and measured in accordance with the following schedule of size:

<u>Diameter of Tree at Height of 24 inches</u> (in)	<u>Pay Items Designation</u>
4 to 8	6-inch size each
Over 8 to 12	10-inch size each
Over 12 to 24	18-inch size each
Over 24 to 36	30-inch size each
Over 36 to 60	48-inch size each
Over 60	60-inch size each

- c. Stumps shall be measured by taking the average diameter at the cutoff.

4.02 BASIS OF PAYMENT

- A. The accepted quantities of clearing and grubbing shall be paid for at the contract unit prices as follows:
 1. Area Basis: The quantities determined shall be paid for at the contract unit bid price per acre for each of the particular pay items listed on an area basis under this subsection.
 2. Lump Sum Basis: When the bid schedule contains a lump sum item, the lump sum price shall be full compensation for all clearing, grubbing, or clearing and grubbing required.
 3. Individual Unit Basis: When individual unit quantities are shown on the bid schedule, the accepted quantities shall be paid for at the contract unit price for the respective items.
 4. Exclusions: When the bid schedule does not contain an estimated quantity or lump sum item for clearing and grubbing, the work shall not be paid for directly, but shall be considered as a subsidiary obligation of the CONTRACTOR

under other contract items.

B. Payment shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Clearing	Acre, LS
Grubbing	Acre, LS
Clearing and Grubbing	Acre, LS
Clearing Trees Diameter	Ea.

END OF SECTION

SECTION 02115

SELECTIVE CLEARING

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of all necessary clearing, grubbing and site preparation removal of all material of whatever description that may be encountered, and removal and disposal of debris.

1.02 RELATED WORK

- A. Section 02050 - Removal and Disposal of Structures and Obstructions.
- B. Section 02075 - Demolition of Asphalt and Portland Cement Concrete.
- C. Section 02110 - Clearing and Grubbing.
- D. Section 02280 - Topsoil.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 STRIPPING

- A. When crossing existing or prospective cultivated areas, gravel streets or other developed surfaces, the CONTRACTOR shall strip the cover material to full depth of the existing surface. This surfacing shall be stockpiled and placed back over the trench after backfilling to the extent that it is acceptable and useable for that purpose. Topsoil shall be removed to full depth of the topsoil, unless otherwise directed by the ENGINEER, or to a maximum depth of twelve (12) inches.
- B. All established lawn areas cut by the trench or damaged during the course of the work shall be restored to a condition equal to or better than its surrounding area and to the complete satisfaction of the ENGINEER.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. No separate measurement shall be made for items under this section.

4.02 BASIS OF PAYMENT

A. No separate payment shall be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 02150

SHORING AND UNDERPINNING

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of all necessary bracing, shoring and protection required for open excavations.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 CONSTRUCTION

- A. All excavation, trenching and shoring, and the like, under this contract, shall be performed in a manner that meets with the latest edition of the OSHA Regulations for Construction.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for items under this section.

4.02 BASIS OF PAYMENT

- A. No separate payment shall be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 02190

AGGREGATES

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of preparation and stockpiling of aggregates for portland cement concrete, bases, bituminous pavements and surface treatments, cover coats, bed courses, drains, pervious backfill and riprap.
- B. This section is a material specification only and is subsidiary to other sections which address placement of the materials.

1.02 RELATED WORK

- A. Section 02210 - Excavation, Embankment, and Compaction.
- B. Section 02225 - Trench Backfill.
- C. Section 02226 - Backfilling for Appurtenances.
- D. Section 02231 - Aggregate Subbase and Base Course.
- E. Section 02273 - Riprap.
- F. Section 02512 - Plant Mix Pavements.
- G. Section 02515 - Asphalt Patching.
- H. Section 02552 - Seal Coat.
- I. Section 02553 - Bituminous Surface Treatment.
- J. Section 03304 - Portland Cement Concrete.

2.02

AGGREGATE FOR PORTLAND CEMENT CONCRETE

- A. Aggregate for concrete shall conform to ASTM C33. Testing and sampling for concrete aggregate shall be done in accordance with the applicable ASTM. Coarse aggregate shall follow the gradation limits as set forth in the table below:

COARSE AGGREGATE GRADATIONS
(% by Weight Passing)

SIEVE DESIGNATION	TYPE No. 57	TYPE No. 67
1-1/2"	100	100
1"	95 - 100	100
3/4"	-----	90 - 100
1/2"	25 - 60	-----
3/8"	-----	20 - 55
# 4	0 - 10	0 - 10
# 8	0 - 5	0 - 5
# 200	0 - 3	0 - 3

2.03

AGGREGATE FOR UNTREATED SUBBASE AND BASE

- A. The composite materials shall be free from clay balls, vegetable matter, and other deleterious substances, and shall not contain an excess of thin or elongated pieces.
- B. Crushed subbase and crushed base shall be crushed stone or crushed gravel and an approved soil binder or natural filler, where required, conforming to the following requirements unless otherwise provided for in the Contract Documents or as approved by the ENGINEER.
1. Coarse aggregate shall consist of hard, durable particles or fragments of stone or gravel. Materials that break up when alternately frozen and thawed or wetted and dried shall not be used. Unless otherwise specified, the coarse aggregate shall have a percentage of wear of not more than fifty (50) percent.
 2. Fine aggregate shall consist of crushed stone, crushed gravel, or natural sand. The liquid limit shall not be more than thirty (30).

3. Crushed base and crushed subbase shall meet one (1) of the following gradation requirements as specified in the Contract Documents.

CRUSHED BASE AND SUBBASE GRADATIONS
(% by Weight Passing)

SIEVE DESIGNATION	GRADING D	GRADING G	GRADING H	GRADING J	GRADING K	GRADING W
2"	100	-----	-----	100	-----	-----
1-1/2"	90 - 100	90 - 100	-----	90 - 100	100	100
1"	-----	-----	100	-----	90 - 100	90 - 100
3/4"	-----	-----	90 - 100	-----	-----	-----
1/2"	-----	-----	60 - 85	-----	-----	60 - 85
# 4	50 - 85	-----	45 - 65	35 - 75	40 - 65	45 - 65
# 8	40 - 70	-----	33 - 53	-----	30 - 55	33 - 53
# 200	2 - 15	0 - 15	3 - 12	0 - 15	3 - 15	3 - 12

- C. Crusher run subbase and crusher run base shall be crusher run material of the maximum size as called for in the Contract Documents, not to exceed three (3) inches.
- D. Pit run or screened subbase and base shall be pit run or screened material of the maximum size called for in the Contract Documents.
- E. Placement of subbase materials with aggregates greater than three (3) inches shall not be allowed unless provided for in the Contract Documents or as approved by the ENGINEER.

2.04 AGGREGATE FOR PLANT MIX BITUMINOUS BASE

- A. Aggregate shall be composed of coarse and fine aggregates combined in the proper proportions to meet the grading requirements for Grading W of Subsection 2.03 herein, AGGREGATE FOR UNTREATED SUBBASE AND BASE, unless otherwise provided for in the Contract Documents or as approved by the ENGINEER. Aggregates shall be composed of clean, tough, durable fragments free from an excess of flat, elongated, soft, or disintegrated pieces and free from fragments coated with dirt or other objectionable matter.
- B. Coarse aggregate shall be crushed stone, crushed gravel, or natural gravel.

- C. Fine aggregate shall consist of crushed stone, crushed gravel, or natural sand. The fraction passing the #40 sieve shall have a liquid limit not greater than twenty-five (25) and a plasticity index not greater than three (3), except that when the plasticity index is nonplastic (NP), the liquid limit shall be not more than thirty (30).

2.05

AGGREGATE FOR FLEXIBLE PAVEMENTS

- A. When producing aggregates for flexible pavement which is to be applied to a street classified as a collector or arterial, aggregates shall be from a granite quarry. All aggregates shall be of uniform quality, crushed to size as necessary, and shall be composed of sound, tough, durable pebbles or fragments with or without natural or mineral fillers, as required. The aggregate shall be free from vegetable matter, lumps or balls of clay, adherent films of clay or other matter that would prevent thorough coating with bituminous material and shall be free from an excess of flat or elongated pieces. The crushed aggregate shall have a percentage of wear of not more than forty (40), show a sodium sulfate loss of not more than twelve (12) percent, and the plasticity index shall not exceed three (3) unless otherwise provided for in the Contract Documents or as approved by the ENGINEER.
- B. Coarse aggregate shall be crushed stone or crushed gravel with ninety-five (95) percent having one or more fractured faces and ninety (90) percent having two or more fractured faces. Coarse aggregate shall be of such gradation that when combined with other required aggregate fractions and fillers in proper proportion, the resultant mixture shall meet the gradation requirements under the composition of mixture for the specific material type. Only one (1) kind shall be used on the project except as approved by ENGINEER.
- C. Fine aggregate shall consist of crushed stone, crushed gravel, or natural sand. Fine aggregate angularity shall be a minimum of forty-five (45) percent. Fine aggregate shall be of such gradation that when combined with other required aggregate fractions in proper proportion, the resultant mixture shall meet the gradation requirements under the composition of mixture for the specific material type. Only one (1) kind shall be used on the project except as approved by ENGINEER.

2.06

AGGREGATE FOR HOT PLANT MIX BITUMINOUS PAVEMENT

- A. Type I Pavement aggregate shall be composed of coarse and fine aggregates combined as shown and in conformance with

Subsection 2.04 herein, AGGREGATE FOR PLANT MIX BITUMINOUS BASE. Not approved for use in the CITY, unless approved in writing by the ENGINEER.

- B. Type II Pavement aggregate material, prior to crushing, (one hundred (100) percent crushed) shall be of such size that not less than ninety-five (95) percent shall be retained on a sieve with square openings one-quarter ($\frac{1}{4}$) inch larger than the maximum size mineral aggregate being produced, unless otherwise provided for in the Contract Documents or as approved by the ENGINEER.
- C. Type III Pavement aggregate shall have not less than fifty (50) percent of the materials by weight retained on the #4 sieve with at least one (1) fractured face, unless a different percentage of fractured faces is otherwise specified in the Contract Documents. Not approved for use in the CITY, unless approved in writing by the ENGINEER.
- D. The aggregate fractions for the mixture shall be sized, graded, and combined, (including RAP when specified) in such proportions that the resulting composite blend meets one (1) of the grading requirements in the following table as specified in the Contract Documents. If not specified, CONTRACTOR shall use the three-quarter ($\frac{3}{4}$) inch maximum material grading specification.
- E. Crush and screen reclaimed asphalt pavement (RAP) greater than two (2) inch so that all material is prepared for recycling and a uniform mixture is maintained. Handle, screen, and crush material so as not to produce unnecessary fractured aggregate or cause undue degradation. Ensure that one hundred (100) percent of RAP used for recycled plant mix pavement passes through a two (2) inch sieve. Stockpile in its own pile. Ensure that the combined virgin aggregate gradation meets the narrow band specification developed during the mix design.

GRADATION REQUIREMENTS
(% by Weight Passing)

SIEVE SIZES	1 " MAX	3/4" MAX		1/2" MAX		3/8" MAX
	Grading E	Grading A	Grading B	Grading C	Grading D	Grading G
1-1/4"	100					
1"	90-100	100	100			
3/4"	70-90	90-100	90-100	100	100	
1/2"	55-80	60-85		90-100	90-100	100
3/8"			60-85	60-85		90-100
# 4	35-55	40-60	40-65	40-60	50-70	45-85

# 8	20-40	25-45	25-55	25-45	25-55	30-65
# 30	10-25	10-30	10-30	10-30	10-30	10-40
# 200	2-7	2-7	2-10	2-7	2-11	2-7

2.07 AGGREGATE FOR PLANT MIX WEARING COURSE

- A. The aggregate for plant mix wearing course shall be crushed stone or gravel composed of hard, durable pebbles or fragments and a filler of finely crushed stone, gravel, or sand, where required, to provide a composition of aggregates meeting the following requirements for the type specified:

TYPE OF AGGREGATE GRADATIONS
(% by Weight Passing)

SIEVE DESIGNATION	TYPE A	TYPE B
1/2"	100	100
3/8"	97 - 100	97 - 100
# 4	25 - 45	20 - 40
# 8	10 - 25	10 - 20
# 200	2 - 7	2 - 7

- B. The aggregate shall be free from vegetable matter, lumps, or balls of clay, adherent films of clay, or other matter that would prevent thorough coating with bituminous material. Unless otherwise shown on the plans, ninety-five (95) percent of the material by weight retained on the #4 sieve shall be particles having two fractured faces and ninety percent (90) percent having at least one (1) fractured face and shall have a percentage of wear of not more than thirty-five (35).
- C. When either Type A or Type B wearing course is specified, the aggregate material, prior to crushing, shall be of such size that not less than ninety-seven (97) percent shall be retained on a sieve with square openings of three-eighths ($\frac{3}{8}$) inch.

2.08 AGGREGATE FOR COVER COAT

- A. Only one (1) type of aggregate shall be used on the project unless alternate types are approved in writing by the ENGINEER.
- B. Cover aggregate for seal coats shall be crushed stone, crushed ledge rock, crushed or natural gravel, or sand.

- C. Cover aggregate material for bituminous surface treatment shall consist of clean, tough, durable fragments free from an excess of flat, elongated, soft or disintegrated pieces and free from coatings of dirt or other objectionable matter. The aggregate shall have neither a percentage of wear of more than forty (40) nor a plasticity index in excess of three (3). The aggregate material shall be well graded from coarse to fine within the following limits:

COVER COAT AGGREGATE GRADATION

SIEVE DESIGNATION	% BY WEIGHT PASSING
3/4"	100
1/2"	95 - 100
# 4	50 - 70
# 8	33 - 63
# 200	3 - 10

- D. Type A, B, C, D, E and S aggregate material produced shall be well graded from coarse to fine within the following limits:

TYPE AGGREGATE FOR COVER COAT

(% by Weight Passing)

SIEVE DESIGNATION	TYPE A	TYPE B	TYPE C	TYPE D	TYPE E	TYPE S
1"	100	-----	-----	-----	-----	-----
3/4"	95 - 100	100	-----	100	100	-----
1/2"	30 - 60	95 - 100	100	95 - 100	95 - 100	100
3/8"	-----	-----	95 - 100	-----	-----	95 - 100
# 4	0 - 15	0 - 15	0 - 20	0 - 15	35 - 70	85 - 100
# 8	0 - 7	0 - 7	0 - 5	-----	-----	-----
# 200	0 - 2	0 - 2	0 - 2	0 - 10	0 - 10	0 - 5

- E. Material used for the production of Type A, B, or C cover aggregate shall be stone, ledge rock, or boulder of such size that prior to crushing not more than five (5) percent will pass a three-quarter (¾) inch screen for Type A or a one-half (½) inch screen for Type B and Type C.
- F. Type D cover aggregate shall be crushed stone, crushed gravel, or clean pea gravel.

- G. Types A, B, C, or D shall have a percentage of wear of not more than thirty-five (35), unless otherwise provided for in the Contract Documents or as approved by the ENGINEER.
- H. Type E cover aggregate shall be crushed sand-gravel. Type S cover aggregate shall be screened or pit-run sand. The plasticity index of either Type E or Type S shall not exceed three (3).

2.09 AGGREGATE FOR FILLER

- A. Filler shall consist of clean, hard, durable grains of naturally occurring granular material taken either from locations shown on the plans or from approved sources as otherwise specified in the Contract Documents.

2.10 AGGREGATE FOR BED COURSE MATERIAL

- A. Bed course material for sidewalks and curbing shall consist of graded gravel, crushed stone, or other approved material of such that all particles shall pass through a sieve having one-half (1/2) inch square openings.

2.11 AGGREGATE FOR DRAINS

- A. Gravel for drains shall be crushed or natural sand and gravel or other approved free-draining material. The material shall be uniformly graded from coarse to fine within the following gradation requirements for the material type indicated in the Contract Documents. When the grading is not indicated in the Contract Documents, Grading B shall be used.

GRADATION FOR DRAIN AGGREGATES
(% by Weight Passing)

SIEVE DESIGNATION	GRADING A	GRADING B	GRADING C
2"	100	-----	-----
1 - 1/2"	95 - 100	100	-----
1"	-----	95 - 100	-----
3/4"	35 - 70	-----	100
3/8"	10 - 30	-----	95 - 100
# 4	0 - 5	0 - 10	-----
# 8	-----	-----	45 - 95
# 16	-----	-----	5 - 45
# 100	-----	-----	0 - 10

2.12 **AGGREGATE FOR PERVIOUS BACKFILL MATERIAL**

- A. Pervious backfill material shall consist of gravel, crushed gravel, crushed rock, natural sands, manufactured sands, or combinations thereof, and shall meet the following gradation requirements:

PERVIOUS BACKFILL GRADATION

SIEVE DESIGNATION	% BY WEIGHT PASSING
2"	100
# 4	0 - 50
# 30	0 - 35
# 100	0 - 10
# 200	0 - 4

- B. In addition, the fraction passing the #40 sieve shall be non-plastic (NP) and shall have a liquid limit not greater than thirty (30).

2.13 **AGGREGATE FOR RIPRAP**

- A. Aggregate for riprap shall be hard, durable, crushed quarried, or natural stone having an apparent specific gravity of 2.4 or greater. The absorption shall not exceed four (4) percent unless otherwise provided for in the Contract Documents or as approved by the ENGINEER. The stone shall be free of weak lamination and cleavages, and shall be of a quality that will not disintegrate on exposure to water or weathering. The aggregate for the various types of riprap shall meet the following additional requirements.

1. Class 1 riprap aggregate shall consist of two (2) sizes of stone.
 - a. Primary stones shall be not less than three (3) inches thick and shall weigh not less than fifty (50) pounds. At least sixty (60) percent of the stones shall weigh more than eighty (80) pounds each.
 - b. Choke stones shall be fragments or spalls of the proper size to satisfactorily wedge between the primary stones as placed.
2. Class 2 riprap aggregate shall be graded with a sufficient amount of smaller stones uniformly distributed throughout. At least sixty (60) percent of the stones shall weigh more than eighty (80) pounds each.
3. Grouted riprap aggregate shall conform to the specifications for Class 1 or Class 2 riprap. If not specified, Class 1 riprap shall be used.
4. Wire enclosed riprap aggregate shall be round or angular stones. Not less than ninety-five (95) percent of the stone shall be retained on a screen or wire having two (2) inch square openings.
5. Sacked concrete riprap aggregate shall consist of either a sandy or gravelly pit-run material. This material shall be clean and free from roots, vegetable matter, or other deleterious substances. The aggregate shall meet the following gradation requirements:

SACKED CONCRETE RIPRAP AGGREGATE GRADATION

SIEVE DESIGNATION	% BY WEIGHT PASSING
2 "	80 - 100
# 4	0 - 4

2.14 AGGREGATE FOR RIPRAP FILTER

- A. Filter aggregates for riprap shall be hard, durable particles or fragments of crushed stone or natural gravel, screened or crushed to meet the following gradation requirements:

FILTER AGGREGATE AGRADATIONS

SIEVE DESIGNATION	% BY WEIGHT PASSING
3 "	100
# 4	20 - 50
# 200	0 - 10

PART 3 EXECUTION

3.01 PROTECTION FOR AGGREGATE

- A. The equipment and methods utilized in the production, storage, transportation and final placement of aggregate materials shall be such as to provide in-place materials meeting all requirements as specified.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for items under this section.

4.02 BASIS OF PAYMENT

- A. No separate payment shall be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 02205

DIRECTIONAL BORING

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of directional guided boring within the public right-of-way.

1.02 REFERENCES

- A. ASTM F1962: Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit Under Obstacles, Including River Crossings.

1.03 SUBMITTALS

- A. The CONTRACTOR shall submit two (2) copies of a work area layout drawing. The drawing shall indicate the layout of the work area including the location and depth of all utilities in the corridor within fifteen (15) feet horizontally of proposed boring. Where water or sanitary sewer main is closer than ten (10) feet horizontally from proposed utility, written permission from the Board of Public Utilities to place utility closer is required and shall be submitted with drawings. No utility shall be placed closer than five (5) foot from any fire hydrant. The drawings shall show all bore pit locations and size. The CONTRACTOR shall submit a complete guided boring plan and program proposal to the ENGINEER for review and acceptance not less than two (2) weeks before the guided boring of the site is proposed to begin. No work shall commence until plans are approved by the ENGINEER.
- B. The program proposal shall include a complete description of the components of the drilling fluid. This shall include the ratios of water, bentonite, and additives that will be used along with a MSDS for the bentonite and additives. The composition of the drilling fluid shall not be changed during the course of the drilling operation without submitting the revised composition and new MSDS to the ENGINEER.
- C. The program proposal shall include a plan for containing and handling drilling fluid which may upwell to the surface. An emergency procedure shall be included for containing fluids which may be discharged into a body of water or storm sewer, and shall

include a complete list of the appropriate governmental agencies which shall be immediately notified of the discharge. Alternatives shall be proposed which could be implemented to maintain or reestablish return of fluid to the entry pit.

- D. The program proposal shall include a statement that the CONTRACTOR has reviewed the site geology.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 PIPE/DUCT PLACEMENT

- A. Pipe/duct shall be installed to a minimum depth of three (3) feet unless otherwise approved by the ENGINEER. It shall be at the determination of the CONTRACTOR as to the size and type of horizontal bore/drill equipment necessary to complete the required work based upon length of crossing, subsurface conditions, and all other factors influencing successful completion of the work.

- 1. Pipe/duct may be required as a casing under paved areas in some situations. Where boring operations are conducted for water and/or sewer applications, see that section.
- 2. The CONTRACTOR shall be responsible for dewatering, diverting water, and controlling downstream water turbidity as required for the site conditions. The construction work shall be in accordance with all applicable safety and environmental regulations.

B. DRILLING FLUID

- 1. Drilling fluid shall be contained and disposed of properly in accordance with WDEQ regulations.

C. DEVIATIONS FROM PROPOSED GRADE

- 1. Any deviations from proposed grade shall be noted on the plans and such deviations shall be included in the "Record Drawings" that are to be submitted to the CITY at project end.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Measurement shall be by the linear foot for various sizes of conduit.

4.02 BASIS OF PAYMENT

- A. Payment shall constitute full compensation for all material, potholing, excavation, backfill, surface restoration, equipment, tools and labor and for the performance of all work and incidentals necessary to complete this item.

END OF SECTION

SECTION 02206

POTHOLING

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of non destructive excavation methods to be utilized to determine the horizontal and vertical placement of utilities prior to open-cut excavations and trenchless installation methods.

1.02 RELATED WORK

- A. Section 02205 – Directional Boring
- B. Section 02210 – Excavation, Embankment and Compaction
- C. Section 02220 – Trench Excavation

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 METHODS OF POTHOLING

A. HAND DIGGING

- 1. Hand digging shall be by means of manual, hand held, non-mechanical equipment such as a shovel. At no time shall a pick or other sharp object be utilized.

B. VACUUM EXCAVATING

- 1. Vacuum excavation shall consist of air or water pressure to break up the soil and a vacuum device to collect the spoil. The CONTRACTOR shall determine if the air or water vacuum excavation shall be used dependent upon specific site and environmental characteristics. Soil type such as heavy clay may require water vacuum excavation. Air vacuum excavators shall be utilized if damage to utilities, such as cutting through cables, will occur with the use of water vacuum excavators.

- a. Air vacuum excavators shall utilize a high velocity air stream to penetrate, expand, and break-up the soil. The loosened particles of soil and rock shall be removed from the excavation through the use of a vacuum.
- b. Water vacuum excavation systems shall excavate the pothole using high pressure water to reduce and loosen the soil. The wet soil and mud slurry shall be removed to a spoil tank using a vacuum.

C. SIZE OF POTHOLE

1. Maximum size of pothole shall be twelve (12) inch diameter or twelve (12) by twelve (12) inch square or as determined in the field and approved by the ENGINEER. When a larger hole is required it shall be considered a trench and backfilled in accordance with Section 02225 Trench Backfill.

D. CONSTRUCTION DRAWINGS

1. Construction drawings indicating the proposed construction and existing utilities shall be present and utilized during potholing activities. The construction drawings shall be compared to the locate paint marks to determine if all existing utilities shown on the drawings have been identified in the field. If the drawings and locate paint marks do not match, additional potholing shall be completed to determine accurate locations

E. MIS-DESIGNATED UTILITIES

1. If locate paint marks have improperly designated the location of a facility, and the facility is exposed during potholing, the facility owner and Wyoming One Call shall be notified. The entity which exposed the facility shall document the horizontal and vertical location of the facility and communicate the location to the facility owner.

F. CONDITIONS REQUIRING POTHOLING

1. Potholing for open-cut excavations shall be completed to expose existing utilities, including mains and service lines, when open-cut excavations are within the tolerance zone.

The tolerance zone is a strip of land equal to the width of the underground utility plus two feet on each side.

2. Potholing for trenchless installations that parallel a utility (mains and service lines) within three (3') feet of the tolerance zone, shall be completed at the beginning and end of the bore and every fifty (50') feet along the route as a minimum. For trenchless operations with a bore path that parallels a utility (mains and service lines) within five (5') feet of the tolerance zone, potholing shall be required at the beginning and end of the bore and every two hundred (200') feet along the route as a minimum. Potholing shall be completed for all utilities (main and service lines) crossing the path of trenchless operations.
3. Areas containing several utilities in close proximity and/or crisscrossing each other shall be potholed as is warranted and prudent to avoid damaging existing utilities.

G. PROTECTION OF EXPOSED UTILITIES

1. Utilities exposed during potholing shall be protected throughout the project. Utilities that are rendered unsupported due to potholing shall be temporarily supported by shoring or other means. The utility shall be protected at all times from damage.

H. BACKFILLING AND RESTORATION

1. Potholes shall be restored within twenty-four (24) hours after the utility has been located or as otherwise directed by the CITY.
2. Potholes shall be backfilled with coarse common sand which is vibrated in with a pencil vibrator on each 10" lift.
3. Surface restoration shall be high strength non-shrink grout in concrete areas or asphalt areas and shall be a minimum of six (6) inches thick.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. When unit prices are called for in the Bid Schedule measurement shall be by each pothole completed.

- B. When unit prices are not called for on the Bid Schedule, the work of potholing shall be subsidiary to other work. No separate measurement shall be made for this item.

4.02

BASIS OF PAYMENT

- A. When unit prices are called for in the Bid Schedule payment shall constitute full compensation for all material, potholing, excavation, backfill, surface restoration, equipment, tools and labor and for the performance of all work and incidentals necessary to complete this item.
- B. When unit prices are not called for on the Bid Schedule no separate payment shall be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 02210

EXCAVATION, EMBANKMENT AND COMPACTION

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of excavation, disposal, or compaction of all materials not being removed under some other item, which is encountered within the limits of the work necessary for the construction of the roadway in accordance with the specifications and in conformity with the lines, grades, thicknesses, and cross sections shown on the plans. All excavation shall be denoted as borrow excavation, rock excavation, muck excavation, or unclassified excavation as hereafter described.

1.02 RELATED WORK

- A. Section 02110 - Clearing and Grubbing.
- B. Section 02115 - Selective Clearing.
- C. Section 02220 - Trench Excavation.
- D. Section 02225 - Trench Backfill.
- E. Section 02226 - Backfilling for Appurtenances.
- F. Section 02280 - Topsoil.
- G. Section 02290 - Watering.

1.03 REFERENCES

- A. ASTM D4318: Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- B. ASTM D698: Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cuft (600 Kn-m/m cuft)).
- C. ASTM D1556: Density and Unit Weight of Soil in Place by the Sand Cone Method.

- D. ASTM D5195: Density of Soil and Rock In-Place at Depths Below the Surface by Nuclear Method.
- E. ASTM D2922: Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Method (Shallow Depth).

PART 2 PRODUCTS

2.01 BORROW EXCAVATION

- A. Borrow excavation shall consist of excavation made from borrow areas within the project limits and outside the normal grading limits for the completion of embankments. Borrow areas or areas within the project limits from which the borrow may be obtained shall be designated on the plans.
- B. Borrow excavation shall be made only at those designated locations and within the horizontal and vertical limits as stated or directed. On completion of borrow operations, the borrow area shall be adequately drained and finished to a neat and uniform grade acceptable to the ENGINEER.

2.02 IMPORTED BORROW EXCAVATION

- A. Imported borrow excavation shall consist of excavation made from borrow areas outside the project limits and outside the normal grading limits for the completion of the embankments. Borrow areas or areas outside the project pits from which the imported borrow may be obtained shall be designated. However, any source chosen by the CONTRACTOR shall be subject to approval by the ENGINEER.

2.03 ROCK EXCAVATION

- A. Rock excavation shall consist of the removal and disposal of igneous, metamorphic, sedimentary rock, and cemented soils which cannot be excavated without blasting or using rippers, and all boulders or other detached stones each having a volume of one-half ($\frac{1}{2}$) cubic yard or more.

2.04 MUCK EXCAVATION

- A. Muck excavation shall consist of the removal and disposal of saturated organic mixtures of soils or organic matter from within the roadway, not associated with culvert installations, which requires additional work or equipment which would not normally be required for unclassified excavation. When it is necessary that the muck excavation be stockpiled prior to final placement, classification of material for the second handling shall be determined by the ENGINEER.

2.05 UNCLASSIFIED EXCAVATION

- A. Unclassified excavation shall consist of the excavation and disposal of all material encountered in the work, including excavation obtained from borrow sources, not classified under other items of the contract.

PART 3 EXECUTION

3.01 CONSTRUCTION

- A. All excavation and embankment work shall be constructed to the neat lines and elevations staked by the CONTRACTOR, or shown on the plans. No materials shall be wasted without permission from the ENGINEER. All grading and related operations shall be conducted so that the terrain outside of the limits of slopes shall not be disturbed. Prior to the commencement of grading operations, all necessary clearing and grubbing in the area shall have been performed in accordance with the SECTION 02110, CLEARING AND GRUBBING.
- B. When embankments are to be placed on a hillside, or where new fill is to be placed against an existing embankment, the slope of the original hillside, or old fill respectively, shall be benched or stepped by cutting horizontally, for a minimum distance of twelve (12) inches to provide for secure bonding of the embankment while it is being brought up in layers. Each bench shall be cut as close to the one below as the slope of the ground will permit. Material thus cut out of the benches shall be incorporated into the new fill at the CONTRACTOR's expense.
- C. If it should become necessary because of weather or other conditions, to suspend grading operations, the entire area shall be bladed until smooth, free of depressions and ruts, and crowned so that no water can collect.

- D. Embankment placed adjacent to structures shall be brought up in equal layers on all sides to prevent distortion of any of these parts. If it is necessary to deposit embankment on only one (1) side of abutment, wing walls, piers, or culvert headwalls, compaction shall be accomplished without causing overturning of or excessive pressure against the structure. Areas inaccessible to tamping rollers or power rollers shall be compacted by hand or mechanical tampers or other means until the density conforms to adjacent embankment, compacted in accordance with specifications.
- E. Embankment material shall be placed in uniform approximate horizontal layers not exceeding eight (8) inches in loose thickness, for the entire width of the embankment. Each layer of embankment shall be completed, leveled and compacted before succeeding layer is placed.
- F. Embankment which has been subjected to freezing shall be refinished to grade, cross section and compaction requirements after frost is out of the ground and the embankment is in suitable condition of work.

3.02

MOISTURE AND DENSITY CONTROL

- A. The CONTRACTOR shall provide watering and rolling as required to obtain a minimum of ninety-five (95) percent of maximum dry density as determined by ASTM D698 for the entire embankment placed. No separate compensation shall be allowed for rolling and watering other than the earthwork bid item or items listed on the Proposal. In the case of embankment materials with plasticity indexes greater than zero (0) as determined by ASTM D4318, the amount of water required for rolling shall be within plus two (2) or minus four (4) percentage points of optimum moisture content as determined by ASTM D698.
- B. Within the areas indicated on the plans or as directed by the ENGINEER, earth shall be removed to the designated depth below subgrade, except for the lower eight (8) inch layer. This eight (8) inch layer shall be thoroughly scarified, the moisture content increased or reduced as necessary, and then compacted to a minimum of ninety-five (95) percent of the maximum dry density as determined by ASTM D698. Tests shall be performed by using ASTM D2922, D1556, or D5195. The remainder of the area up to the subgrade elevation shall be constructed of suitable material compacted to a minimum of ninety-five (95) percent of maximum dry density. Soils with a plasticity index greater than four (4) shall be compacted with a moisture content of plus two (2) to minus four

(4) percent of optimum moisture per ASTM D698. Granular soils with a plasticity index of four (4) or less shall be compacted with sufficient moisture to facilitate required compaction Tests shall be performed be using ASTM D2922, D1556, or D5195.

- C. Frequency of testing shall be every two hundred-fifty (250) feet horizontally and every twelve (12) inches vertically per lane. Areas of embankment not intended for roadway shall be tested every ten thousand (10,000) square feet horizontally and every two (2) feet vertically.
- D. Copies of all testing results for work performed in the CITY right-of-way, or to become CITY right-of-way, shall be faxed to the CITY Construction Department at 307-637-6261. All density test results shall be on file at the CITY Construction Department prior to commencement of paving.
- E. It shall be the responsibility of the CONTRACTOR to schedule and obtain compaction tests by an independent construction laboratory. The CONTRACTOR shall be responsible for providing copies of all tests results to the CITY's Construction Department. All compaction tests shall be paid for by the CONTRACTOR.

3.03 HAUL

- A. When constructing embankments as specified, or wasting, as the case may be, no haul shall be allowed on excavated materials as a haul item but shall be included in the contract unit price bid for earthwork item or items listed on the Proposal.

3.04 FINE GRADING

- A. After the earthwork has been substantially completed and after all utilities, manholes, catch basins, valve boxes, etc., have been installed or adjusted to grade, the subgrade shall be brought to the lines, grades, and cross-sections shown on the plans, and compacted to the required density.
- B. All soft and unstable material and other portions of the subgrade, which in the opinion of the ENGINEER, cannot be compacted satisfactorily shall be removed to the lines and grades as directed by the ENGINEER.

- C. All boulders appearing in the earth excavation shall be removed or broken off to a depth not less than four (4) inches below subgrade. All rock sections shall be brought to grade by depositing a satisfactory cushion material to a depth authorized by the ENGINEER.
- D. If the surface of an old stone or gravel roadbed conforms approximately to the surface of the finished subgrade, such sections shall be scarified superficially for the full width of the subgrade to a depth sufficient to eliminate all depressions and to permit uniform reshaping and compaction.
- E. At all times, ditches and drains along the subgrade shall be so maintained as to drain effectively. When ruts of two (2) inches or more in depth are formed, the subgrade shall be brought to grade and, if necessary, be reshaped and re-rolled. In no case shall any surface course or pavement be placed on a frozen or muddy subgrade. The top eight (8) inches of the subgrade shall have a minimum compacted density as specified for embankment.
- F. In addition, the finished subgrade shall not deviate by more than one-tenth (0.10) of a foot at any point from staked elevation. Until the subgrade has been checked and approved, no surface course or pavement shall be laid thereon.
- G. The road bed shall be tested for soft spots by proof rolling. The proof roll test shall be done after passing the in-place compaction tests. Copies of the passing compaction tests, including the proctor, shall be provided to the ENGINEER prior to the proof roll. Each succeeding pass of the proof roller over the road bed shall be offset by no greater than four (4) tire widths. The proof roller shall be uniformly loaded.
 - 1. The ENGINEER shall initial the permit after the successful completion of the proof roll test. A copy of the completed permit with the approved inspections shall be submitted with the "As-Built" plans and specifications when the notification for CITY acceptance is requested.
 - 2. The proof roller shall be the weight of a fully loaded ten (10) yard dump truck (approx. 50,000 lbs or more on ten (10) wheels).
 - 3. Areas which exhibit movement, cracking, or deflection of the material shall be removed, replaced, and retested to ensure proper compaction.

- H. A string line test shall be done after a passing proof roll test. The CONTRACTOR shall place blue tops at centerline of the road every fifty (50) feet and at all grade breaks and crown transitions. If the roadway is greater than forty (40) feet from face of gutter to centerline, then the CONTRACTOR shall also place quarter blue tops. The blue tops shall be placed using a generally accepted industry standard as approved by the ENGINEER. String line tests shall be performed for all sections of the road profile complete (i.e.: subgrade, subbase, and base). Tolerances for string line shall be one-tenth (0.10) of a foot for subgrade, three-quarter ($\frac{3}{4}$) inch for subbase, and one-half ($\frac{1}{2}$) inch for base materials. If a string line test fails, the CONTRACTOR shall rework the area to compliance. Passing string line and proof roll tests are required prior to any placement of pavement. A blue top shall be set within two feet of each manhole and the elevation checked to verify the structure is at the proper grade and will not require more than 6" of adjusting rings to bring to final grade. If the string line test shows more than 6" of adjusting rings will be required the manhole shall be brought into compliance by removal and replacement of sections. The area shall be backfilled and compacted in accordance with Section 02226 Backfilling For Appurtenances.
- I. No additional compensation shall be paid to the CONTRACTOR for the required tests.
- J. Scheduling for the proof roll and string line tests shall be done a minimum of twenty-four (24) hours in advance with the ENGINEER.

3.05 DEWATERING

- A. Where ground water is encountered or storm water is allowed to flow into excavation, it shall be removed promptly to avoid damage to subgrade and interfering with construction operations.
- B. Discharge from dewatering operations shall be directed to an approved natural drainage or storm sewers as appropriate.
- C. Discharge from dewatering operations shall be in accordance with rules and regulations established by the WDEQ. These activities require coverage under a WYPDES permit. WDEQ has issued a general permit for temporary discharges. The general permit for temporary discharge currently authorizes the discharge of wastewaters to surface waters of the state associated with: hydrostatic testing of pipes, tanks or similar vessels, disinfection of potable water lines, pump tests wells, or construction dewatering.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. UNCLASSIFIED EXCAVATION - SQUARE YARD BASIS.
This item shall be measured by the square yard surface area.
- B. UNCLASSIFIED EXCAVATION - CUBIC YARD BASIS.
This item shall be measured by the cubic yards, measured in its original position, computed to the neat lines and grades shown on the plans, except as these lines and grades may be modified in the field by the ENGINEER during construction, with measurement to be made by the method of average end area of material acceptably excavated as herein specified. It shall be specifically understood that the top limit of cross sections for determining end area shall be the top of the existing surface.
- C. EXCAVATION WITHOUT BACKFILL.
This item shall be measured by the average end area method of calculating cubic yards of material removed.
- D. BORROW EXCAVATION.
Borrow excavation shall be measured by the same method as Unclassified Excavation.
- E. IMPORTED BORROW EXCAVATION.
Imported borrow excavation shall be measured by the same method as Borrow Excavation.
- F. ROCK EXCAVATION.
When the plans call for payment to be made under the item rock excavation by volume, the quantity shall be computed by the average end area method.
- G. MUCK EXCAVATION.
Muck excavation shall be by cross section. If the material does not meet the requirements for muck excavation, it shall be measured as unclassified excavation.

4.02 BASIS OF PAYMENT

- A. UNCLASSIFIED EXCAVATION - SQUARE YARD BASIS.
This item shall be paid for at the contract unit price bid multiplied by the number of units (sq.yd.) measured as excavated, which price and payment shall constitute full compensation for all labor,

equipment, tools and incidentals necessary to accomplish all clearing, grubbing, street and drainage excavation, including excavation for sidewalk, curb and/or combined curb and gutter and grading behind sidewalk, curb and/or combined curb and gutter as shown on the plans: to construct, shape and slope embankments, cuts, subgrades, shoulders, gutters, ditches, streets and alley intersections, approaches and private driveway entrances in the locations, to the elevations and according to details shown on the plans; to backfill ditches, depressions and behind sidewalks, curb and/or combined curb and gutter; to remove and to make satisfactory disposal of all unsuitable and surplus materials occurring within the limits of the work; to compact, water and fine grade embankment, backfill and compact areas where unstable material has been removed and all other incidental items and operations to complete this item.

- B. UNCLASSIFIED EXCAVATION - CUBIC YARD BASIS.
This item shall be paid for at the contract unit price bid multiplied by the number of units (cu.yd.) measured as excavated, which price and payment shall constitute full compensation for all labor, equipment, tools and incidentals necessary to accomplish all clearing, grubbing, street and drainage excavation, including excavation for sidewalk, curb and/or combined curb and gutter and grading behind sidewalk, curb and/or combined curb and gutter as shown on the plans: to construct, shape and slope embankments, cuts, subgrades, shoulders, gutters, ditches, streets and alley intersections, approaches and private driveway entrances in the locations, to the elevations and according to details shown on the plans; to backfill ditches, depressions and behind sidewalks, curb and/or combined curb and gutter; to remove and to make satisfactory disposal of all unsuitable and surplus materials occurring within the limits of the work; to compact, water and fine grade embankment, backfill and compact areas where unstable material has been removed and all other incidental items and operations to complete this item.
- C. EXCAVATION WITHOUT BACKFILL - This item shall be paid for by the cubic yards of material removed at the contract unit price bid for "Excavation Without Backfill" which price and payment shall constitute full compensation for all labor, equipment, tools and incidentals, necessary to complete the excavation and disposal of all material.
- D. BORROW EXCAVATION - This item shall be paid for by the same method as "Unclassified Excavation - Cubic Yard Basis".

- E. IMPORTED BORROW EXCAVATION - This item shall be paid for by the same method as "Unclassified Excavation - Cubic Yard Basis".
- F. ROCK EXCAVATION - This item shall be paid for by the same method as "Unclassified Excavation - Cubic Yard Basis".
- G. MUCK EXCAVATION - This item shall be paid for by the same method as "Unclassified Excavation - Cubic Yard Basis".

END OF SECTION

SECTION 02220

TRENCH EXCAVATION

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of excavation and trenching for pipelines, handling and storage of materials, preparation of subgrade, pumping and dewatering, and dressing and surface restoration.

1.02 RELATED WORK

- A. Section 02050 - Removal and Disposal of Structures and Obstructions.
- B. Section 02075 - Demolition of Asphalt and Portland Cement Concrete.
- C. Section 02110 - Clearing and Grubbing.
- D. Section 02115 - Selective Clearing.
- E. Section 02150 - Shoring and Underpinning.
- F. Section 02210 - Excavation, Embankment, and Compaction.
- G. Section 02222 - Rock Excavation.
- H. Section 02225 - Trench Backfill.
- I. Section 02226 - Backfilling for Appurtenances.
- J. Section 02280 - Topsoil.
- K. Section 02290 - Watering.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 CONSTRUCTION

- A. During excavation, materials suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides and cave-ins. Excavated material shall be piled on one (1) side of the trench only to permit ready access to existing fire alarm boxes, fire hydrants, valves, manholes and other appurtenances. Surface drainage of adjoining areas shall be unobstructed.
- B. All excavated material not required or suitable for backfill shall be removed from the site prior to starting backfill operations and disposed of in a manner and/or methods acceptable to jurisdictional government agencies. The ENGINEER may require certification of proper disposal procedures.
- C. Grading shall be done as may be necessary to prevent surface water from flowing into excavations, and any other water accumulating therein shall be promptly removed. Any pipe having its alignment changed as a result of a flooded trench shall be re-laid at no additional cost to the OWNER. Dewatering shall be in accordance with this section.
- D. Adequate provisions shall be made for maintaining flows of sewers, drains and water courses encountered during construction. Culverts, ditches, fences, crosswalks and other structures which are disturbed by this construction shall be restored to their original condition or better upon completion of the work to the satisfaction of the ENGINEER.
- E. Any trench to be excavated in existing pavement shall be neatly saw cut and removed without damage to the edges. Any damage to the edge shall be recut to a neat edge and removed and replaced at the CONTRACTOR's expense. See SECTION 02515, ASPHALT PATCHING for additional requirements.

3.02 SITE CONDITIONS

- A. CONTRACTOR's safety requirements:
 - 1. The CONTRACTOR shall be responsible for enforcing safety and maintaining safe working conditions in all trenching, shoring, and blasting operations in accordance with OSHA regulations.

2. The CONTRACTOR shall employ qualified, properly trained personnel to design shoring, perform safety inspections of the trenches and supervise the handling of explosives and other operations involving safety procedures.

3.03 TRAFFIC CONTROL AND WARNING DEVICES

- A. The CONTRACTOR shall plan and construct the project in such a manner as to minimize the interruption of the use of roads, highways, streets and sidewalks involved and shall provide for emergency access to adjacent property and fire hydrant access at all times.
- B. The CONTRACTOR shall be responsible for providing and maintaining adequate barricades of high visibility design, flares, lanterns, signs, flaggers and pre-warning devices to alert public, motorists and pedestrians of hazardous conditions in accordance with the latest edition of the MUTCD for Streets and Highways. Work shall also be done in accordance with the MUTCD for Work Zone Areas and SECTION 01050, TRAFFIC CONTROL.
- C. The CONTRACTOR shall submit his traffic control plan to the CITY Traffic Engineer's office a minimum of two (2) working days prior to beginning any work in the right-of-way unless previously required at the preconstruction meeting.

3.04 STRUCTURES

- A. The CONTRACTOR shall exercise every precaution to prevent damage to existing buildings or structures in the vicinity of his work. In the event of such damages, CONTRACTOR shall repair them to the satisfaction of the owner of the damaged structure and the ENGINEER at the CONTRACTOR's expense.

3.05 OVERHEAD UTILITIES

- A. The CONTRACTOR shall use extreme caution to avoid a conflict, contact or damage to overhead utilities, such as power lines, street lights, telephone lines, television lines, poles or other appurtenances during the course of construction on any project. The CONTRACTOR shall bear all cost related to the repair and/or replacement of any overhead utilities damaged as a result of his operations.

3.06 SURVEY MARKERS AND MONUMENTS

- A. The CONTRACTOR shall use every care and precaution to protect and not disturb any survey markers or monuments, such as those that may be located at lot or block corners, property pins, or intersection of street monuments or additional line demarcation. Such protection shall include marking with flagged high lath and close supervision. No monument shall be disturbed without prior approval from the OWNER and ENGINEER. Any survey marker or monument that is disturbed or destroyed by the CONTRACTOR during construction shall be replaced by a Wyoming Professional Land Surveyor at the expense of the CONTRACTOR. Any survey monument or marker disturbed or destroyed shall be replaced per SECTION 01330, SURVEY MONUMENTS AND CONTROL POINTS.

3.07 CLEANUP

- A. As work progresses, that portion of the work completed shall be cleared of debris and brought to the finished grade. Upon completion of the work, the entire site shall be cleared of all debris and ground surfaces shall be finished to smooth, uniform slopes and shall present a neat and workmanlike appearance. All rocks brought to ground surface by excavation or backfilling operations shall be removed.

3.08 TRENCH EXCAVATION

- A. Trench excavation shall be performed in accordance with minimum requirements of OSHA regulations.

3.09 PREPARATION

- A. Protection of Existing Properties
 - 1. Prior to beginning construction, the CONTRACTOR shall fulfill and meet the requirements of Wyoming Statutes 37-12-301 through 37-12-304 relating to public utilities; providing that notice of intended excavation be given to public utilities with underground facilities located in the area of proposed excavation; and providing for exceptions.
 - 2. Existing utilities which will intersect with the new pipelines or structures shall be relocated by the OWNER or CONTRACTOR when authorized in writing.

3. Existing water or sewer services from the mains to private property which interfere with trenching operations may be cut and replaced at the CONTRACTOR's expense. Prior to cutting water or sewer services, the CONTRACTOR shall obtain written approval from the BOPU and give twenty-four (24) hours advanced notice to the customers affected. The use of such services shall in no case be interrupted for more than four (4) hours, unless temporary service is provided.
4. Existing water mains and water services shall be protected at all times during construction operations.

3.10 PRIVATELY OWNED UTILITIES

- A. Gas mains, underground electrical and telephone cables, telephone poles etc, required to be moved to make way for new construction shall be moved by others. The CONTRACTOR shall assure that all necessary arrangements are made with the appropriate utility owner(s) prior to beginning work in the affected area, and he shall assure that all required work is coordinated with the appropriate utility owner(s) as work progresses.

3.11 EXPLORATORY EXCAVATION

- A. Location of buried utilities that might interfere with alignment or grade shall be verified by exploratory excavation prior to construction. If any existing utility interferes with the work in either alignment or grade and has to be moved, such work shall be done by the CONTRACTOR or OWNER. Cost for exploratory excavation shall be paid by special provision or force account.

3.12 SHORING, SHEETING AND BRACING

- A. The CONTRACTOR shall do all shoring, bracing and tight sheeting required to prevent caving and to protect his workmen, in accordance with OSHA and to protect adjacent property and structures.

3.13 DEWATERING

- A. Where ground water is encountered or storm water is allowed to flow into excavation, it shall be removed promptly to avoid interfering with pipe laying, damage to subgrade, and interfering with construction operations

- B. Discharge from dewatering operations shall be directed to an approved natural drainage or storm sewers as appropriate.
- C. Discharge from dewatering operations shall be in accordance with rules and regulations established by the WDEQ. These activities require coverage under a WYPDES permit. WDEQ has issued a general permit for temporary discharges. The general permit for temporary discharge currently authorizes the discharge of wastewaters to surface waters of the State associated with hydrostatic testing of pipes, tanks or similar vessels, disinfection of potable water lines, pump test wells, or construction dewatering.

3.14 GENERAL EXCAVATION OPERATIONS

- A. The CONTRACTOR shall excavate as necessary at the locations shown on the approved plans, staked in the field, or otherwise specified for the installation of pipelines.
- B. The CONTRACTOR shall take precautions and protect all adjoining private and public property and facilities, including underground and overhead utilities, curbs, sidewalks, driveways, structures, and fences. Any disturbed or damaged facilities shall be suitably restored or replaced by the CONTRACTOR at his expense and to the satisfaction of the ENGINEER.
- C. Crossings under sidewalks or curbs shall not be tunneled. The CONTRACTOR shall remove a portion of the sidewalk and/or curb by making neat sawed joints corresponding to existing joints, compact the backfill as specified, and pour a new concrete sidewalk or curb section.
- D. Excavations for manholes, hydrants, structures and other appurtenances shall be sufficient to leave clearance adequate for proper compactive effort on all sides. The depth, provisions for removing water and other applicable portions of specifications shall apply to excavations and appurtenances.

3.15 TRENCH DIMENSIONS

- A. Trench width from the bottom to one (1) foot above the top of pipe shall be no less than the outside diameter of the pipe plus twelve (12) inches, but not more than twenty-four (24) inches plus the pipe outside diameter. The width of the trench from the bottom of the trench to existing ground surface shall be adequate to allow proper compactive effort along both sides of the pipe.

- B. After backfilling of trench and prior to paving, an additional one (1) foot of asphalt from each side of the trench area shall be sawcut, removed, and replaced. If face of gutter is less than four (4) feet from the edge of the sawcut asphalt edge, then all the asphalt to the face of gutter shall be removed and replaced.
- C. Trench depth shall be as required for the invert grade or pipe bury shown on the plans. Care shall be taken not to excavate below the required depth. When soft or unstable material or rock is encountered at the subgrade which will not uniformly support the pipe, such material shall be excavated to an additional depth as necessary and backfilled with Type 2 bedding material.
- D. The bottom of trenches shall be accurately graded to the line and grade shown on the approved plans. Bedding material shall provide uniform bearing and support for each section of the pipe at every point along its entire length. Bell holes and depressions for joints shall be dug after the trench bedding has been graded, and shall be only of such length, depth and width as required for properly making the particular joint type. Unauthorized over depths shall be backfilled with bedding material at the CONTRACTOR's expense.

3.16 TIME OF OPEN TRENCHES

- A. The CONTRACTOR shall be required to conduct his work so that trenches will remain open a minimum possible time.
- B. No trench excavation shall begin until approved compaction equipment is at the site where the excavating is to take place. All backfill and compacting shall be completed in all trenching and structural excavations within a maximum distance of two hundred (200) feet behind the end of newly installed pipe and the excavator. For each work group consisting of trench excavator, a pipe laying crew, and a backfilling and compacting crew, the maximum allowable open trench at any time shall be four hundred (400) feet.
- C. Certain conditions may necessitate the closing of certain sections of trench prior to daily, weekend, or holiday shutdown.

3.17 EQUIPMENT

- A. The use of trench digging machinery shall be permitted except in places where its operation will cause damage to existing structures or features, in which case hand methods shall be employed.

- B. Any equipment on tracks, which is to be used on pavement, shall be equipped with suitable pads to prevent damage to the pavement. All pavement damaged during construction by the CONTRACTOR's equipment shall be restored to its original or better condition by the CONTRACTOR at his expense and to the satisfaction of the ENGINEER.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for items under this section.

4.02 BASIS OF PAYMENT

- A. No separate payment shall be made for items under this section. Full compensation shall be considered as included in the prices paid for various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 02222

ROCK EXCAVATION

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of requirements for rock removal and the use of explosives to assist in rock removal.

1.02 RELATED WORK

- A. Section 02210 - Excavation, Embankment, and Compaction.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 CONSTRUCTION

- A. Blasting for excavation shall be permitted only after securing the written approval of the ENGINEER. The CONTRACTOR shall use utmost care to protect life and property. All explosives shall be safely and securely stored in compliance with Federal, State, and local laws and ordinances, and all such storage places shall be clearly marked "Dangerous Explosives". No explosives shall be left unprotected where they could endanger persons or property.
- B. When blasting rock in trenches, the CONTRACTOR shall cover the area to be shot with earth backfill or approved blasting mats that will prevent the scattering of rock fragments outside the excavation. Prior to blasting, the CONTRACTOR shall station men and provide signals of danger in suitable places to warn people and stop vehicles. The CONTRACTOR shall be responsible for all damage to property and injury to persons resulting from blasting or accidental explosions that may occur in connection with his use of explosives.
- C. The CONTRACTOR shall furnish the following information to the OWNER and ENGINEER prior to commencing blasting operations: Name of his powder man, powder man's experience, type of shot, type of explosives and detonator being used, proof of insurance covering liability for such operation, traffic control plans and planned procedures for protecting the public.

- D. The CONTRACTOR's blasting procedures shall conform to Federal, State, and local ordinances. The CONTRACTOR shall acquire all required permits prior to the start of blasting.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for items under this section.

4.02 BASIS OF PAYMENT

- A. There shall be no differentiation between common and rock trench excavation, except when listed as separate items on the bid proposal or bid form. Excavation shall include the removal and subsequent handling of all earth, gravel, rock or other material encountered regardless of the type, character, composition or condition of the material. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 02225

TRENCH BACKFILL

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of handling and storage of materials to be used for fill, backfill, and final grading.

1.02 RELATED WORK

- A. Section 02210 - Excavation, Embankment, and Compaction.
- B. Section 02226 - Backfilling for Appurtenances.
- C. Section 02231 - Aggregate Subbase and Base Course.
- D. Section 02665 - Water Distribution and Transmission Systems.
- E. Section 02700 - Sanitary Sewer Systems.
- F. Section 02725 - Storm Drains and Culverts.

1.03 REFERENCES

- A. ASTM D698: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
- B. ASTM D2487: Standard Practice for Classification of Soils for Engineering Purposes.
- C. ASTM D4253: Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
- D. ASTM D4254: Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculations of Relative Density.
- E. ASTM D2922: Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).
- F. ASTM D3017: Water Content of Soils and Rock in Place by Nuclear Methods.

- G. ASTM D1556: Density and Unit Weight of Soil in Place by the Sand Cone Method.

PART 2 PRODUCTS

2.01 MATERIALS

A. PIPE BEDDING MATERIALS

- 1. Type 1 Bedding material around the pipe from six (6) inches under the pipe to twelve (12) inches over the pipe shall consist of select coarse grained soils, one hundred (100) percent passing one-half ($\frac{1}{2}$) inch and less than five (5) percent passing the number 200 sieve such as pea gravel or sand meeting unified soil classification requirements as per ASTM D2487 for type GW, GP, SW, SP. When specifically approved in writing by the CITY for storm sewers and the BOPU for water or sanitary sewer lines other bedding materials may be used. All bedding materials shall be free from clods, frozen material or deleterious material. The BOPU or ENGINEER may request laboratory testing of bedding material (at the CONTRACTOR's expense) as they deem necessary.
- 2. Type 2 Bedding material is required for foundation in over excavated trenches and shall consist of the bedding material from six (6) inches under the pipe and below. The bedding material shall consist of a durable crushed material with particles ranging from three-quarter ($\frac{3}{4}$) inch to four (4) inches on the particles largest dimension. Crushed concrete or other acceptable material is permitted, if approved by the ENGINEER. Crushed asphalt shall not be permitted.

B. CEMENT TREATED FILL

- 1. The following mixes are approved for use in the CITY:

CITY MIX # 3	
Cement	42lb/cy
Water	39 gals. (or as needed)
Coarse Aggregate	1700 lbs/cy (size # 57)
Sand	1845 lbs/cy (ASTM C33)

CITY MIX # 4	
Cement	94 lbs/cy
Water	45 gals. (or as needed)
Pea Gravel/Reject	1800 lbs/cy
Sand	1520 lbs/cy (ASTM C33)

CITY MIX # 5	
Cement	94 - 100 lbs/cy
Water	50 - 52 gals. (or less for quicker set)
Aggregate*	3000 lbs/cy

* AGGREGATE GRADATION	
SIEVE SIZE	% PASSING
3/4 "	100
# 200	0 - 12

2. The desired strength for CITY Mix #3 material shall be between thirty (30) psi and sixty (60) psi as tested by a qualified laboratory. The desired strength of CITY Mix # 4 and # 5 shall be between sixty (60) psi and one hundred fifty (150) psi as tested by a qualified laboratory. All mixes shall be approved prior to commencing work. Other cement treated fill designs may be submitted to the ENGINEER for review and approval.

3. During placement, the material shall be vibrated with a mechanical vibrator and the slump shall be between five (5) and eight (8) inches. The excavated area shall be overfilled a minimum of one (1) inch when possible to allow water to escape to allow for a quicker curing period. If the slurry is kept below the finished grade of the excavation, the area is to remain closed to allow for extra time for the material to dry before the placement of asphalt or cement over it.

4. When cement treated fill is required within the right-of-way, CITY Mix #3 shall be utilized unless otherwise specified.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. COMMON AND IMPORT BACKFILL

1. All trenches shall be backfilled immediately after grade, alignment and jointing of the pipe has been inspected and approved. Leakage tests, pressure tests or tests for alignment and grade shall be performed after backfill.
2. All storm sewer pipes shall be backfilled in accordance with SECTION 02725, STORM DRAINS AND CULVERTS.
3. After the select pipe bedding material has been placed and compacted as specified, the remainder of the trench backfilling shall be done. All backfill material shall be free from cinders, ashes, refuse, organic and frozen material, boulders, or other materials that are unsuitable. From one (1) foot above the top of the pipe to six (6) inches below the ground surface, or to the subgrade elevation for streets and paved surfaces, material containing stones up to four (4) inches in the greatest dimension may be used.
4. Trench backfill from the top of the pipe bedding material to ground surface or to the subgrade of street surfacing is separated into two (2) classifications.
 - a. Type "A" trench backfill refers to compacted backfill in streets, paved areas, or alleys where the trench exceeds thirty (30) inches in width.
 - b. Type "B" trench backfill is designated for fields, borrow pits, unimproved streets or other unsurfaced areas where special compaction of the trench backfill is not required. Locations of the types of backfill required shall be shown on the plans.
5. Where shown on the plans, the CONTRACTOR shall provide embankment over the pipe above the original ground surface to a height which will satisfy the minimum

depth cover requirements. Such embankment shall be constructed to the cross section shown on the plans.

6. All excavations remain the CONTRACTOR's responsibility up to and through written Final Acceptance.

B. TYPE "A" TRENCH BACKFILL

1. Materials used for backfill shall be carefully deposited in depth layers suitable to soil conditions and equipment used for compaction, wetted to between minus four (4) percent and plus two (2) percent of optimum moisture content for soils with a plasticity index greater than four (4) and to sufficient moisture for granular soils with a plasticity index of four (4) or less. Soils shall be compacted to ninety-five (95) percent of maximum dry density as determined by ASTM D698. Tests shall be performed by using ASTM D2922, D1556, or D5195. For compaction equipment used by hand, the lift shall not exceed eight (8) inches. For self propelled equipment, the lift shall not exceed sixteen (16) inches.
2. Backfilling by flooding shall not be permitted.
3. If the trench has not been tested at required intervals during backfilling, the CONTRACTOR shall provide excavation equipment and personnel to dig compaction test holes through each layer of backfill. Test hole locations shall be selected by the ENGINEER. Test holes shall be made in the presence of the ENGINEER. Compaction tests shall be required for each sixteen (16) inch layer of backfill at intervals not to exceed one hundred (100) linear feet whether tests are performed during backfilling or via test holes. All test holes shall be in compliance with OSHA standards. Should tests fail, the CONTRACTOR shall remove all trench backfill, fifty (50) feet each side of failed test, above the failed lift and rework to passing compaction the area of deficiency. In no case shall it extend into areas of known acceptable compaction. All work required to bring the failed test area into compliance shall be at the CONTRACTOR's expense. Passing backfill tests only assures the OWNER that the minimum acceptable level of testing was achieved. The passing tests do not relieve the CONTRACTOR of his responsibility to compact the entire trench and does not relieve his guarantee of the trench as identified in this specification.

4. Graveled streets and alleys shall be restored in accordance with SECTION 02227 ALLEY AND GRAVEL STREET RESTORATION.
5. Each service line shall be backfilled and compacted to the same requirements as the main line trench. Each service shall have at least one (1) passing compaction test at a point midway through the vertical trench section.
6. Once trench backfill has been approved by the ENGINEER to subgrade level, CONTRACTOR shall conform with SECTION 02231, AGGREGATE SUBBASE AND BASE COURSE and SECTION 02512, PLANT MIX PAVEMENTS, SECTION 02515, ASPHALT PATCHING, or SECTION 03320, PORTLAND CEMENT CONCRETE PAVEMENT, which ever applies, or as shown on the approved plans.

C. TYPE "B" BACKFILL

1. Materials used for Type "B" trench backfill shall be compacted in layers to achieve density equal to that of the existing soil.
2. The CONTRACTOR may be required to mound excess earth over the top of the trench so that a depression will not be formed after the trench settles. In cultivated areas, stripped topsoil shall be placed uniformly over the backfilled trench. The topsoil shall not be compacted but shall be graded to provide smooth surface conforming to the adjoining ground surfaces.

3.02 COMPACTION

- A. Bedding material under and around the pipe to twelve (12) inches above the top of the pipe shall be distributed by hand in maximum layers of six (6) inches and thoroughly consolidated by knifing, slicing or vibrating in a manner acceptable to the ENGINEER. Special care shall be taken to assure complete consolidation under the haunches of the pipe to twelve (12) inches above the pipe.
- B. Bedding material shall be placed in the trench for its full width on each side simultaneously. Top of the bedding shall be a smooth, even surface.

- C. An approved CITY Mix #3 cement treated fill (slurry) shall be used in any trench thirty (30) inches in width or less that is under a paved area.
- D. An approved CITY Mix #3 cement treated fill (slurry) may be used at the option of the CONTRACTOR.

3.03 TESTING

- A. Compaction tests shall be performed by an independent testing agency using one of the following methods: ASTM D2922, D3017, D5195, and D1556.
- B. The CONTRACTOR and testing firm shall follow the requirements as stated in SECTION 01041, PROJECT COORDINATION. The CITY/BOPU shall not hire, nor pay the testing firm. The CONTRACTOR shall pay for all required testing.
- C. Compaction tests shall be performed every one hundred (100) linear feet or fraction thereof of trench and for each sixteen (16) inch level of material placed and compacted. Each appurtenance shall be tested within two (2) feet of the appurtenance and for each sixteen (16) inches of material placed and compacted. Each manhole or vault shall be tested at two (2) separate locations above the pipe within two (2) foot of manhole or vault and for each sixteen (16) inches of material placed and compacted.
- D. It shall be the responsibility of the CONTRACTOR to schedule and obtain compaction tests by an independent construction laboratory. The CONTRACTOR shall be responsible for providing copies of all tests results to the CITY's Construction Division. All compaction tests shall be paid for by the CONTRACTOR.
- E. The road bed shall be tested for soft spots by proof rolling. The proof roll test shall be done after passing the in-place compaction tests. Copies of the passing compaction tests, including the proctor, shall be provided to the ENGINEER prior to the proof roll. Each succeeding pass of the proof roller over the road bed shall be offset by no greater than four (4) tire widths. The proof roller shall be uniformly loaded.
 - 1. The ENGINEER shall initial the permit after the successful completion of the proof roll test. A copy of the completed permit with the approved inspections shall be submitted with the "As-Built" plans and specifications when the written notification for CITY acceptance is requested. The

proof roller shall be the weight of a fully loaded ten (10) yard dump truck (approx. 50,000 lbs or more on ten (10) wheels).

2. Areas which exhibit movement, cracking, or deflection of the material shall be removed, replaced, and retested to ensure proper compaction.
- F. A string line test shall be done after a passing proof roll test. The CONTRACTOR shall place blue tops at centerline of the road every fifty (50) feet and at all grade breaks and crown transitions. If the roadway is greater than forty (40) feet from face of gutter to centerline, then the CONTRACTOR shall also place quarter blue tops. The blue tops shall be placed using a generally accepted industry standard as approved by the ENGINEER. String line tests shall be performed for all sections of the road profile complete (i.e.: subgrade, subbase, and base). Tolerances for string line shall be one-tenth (0.10) of a foot for subgrade, three-quarter ($\frac{3}{4}$) inch for subbase, and one-half ($\frac{1}{2}$) inch for base materials. If a string line test fails, the CONTRACTOR shall rework the area to compliance. Passing string line and proof roll tests are required prior to any placement of pavement. A blue top shall be set within two feet of each manhole and the elevation checked to verify the structure is at the proper grade and will not require more than 6" of adjusting rings to bring to final grade. If the string line test shows more than 6" of adjusting rings will be required the manhole shall be brought into compliance by removal and replacement of sections. The area shall be backfilled and compacted in accordance with SECTION 02226 BACKFILLING FOR APPURTENANCES.
- G. No additional compensation shall be paid to the CONTRACTOR for the required tests.
- H. Scheduling for the proof roll and string line tests shall be done a minimum of two (2) working days in advance with the ENGINEER.

3.04 TRENCH GUARANTEE

- A. The CONTRACTOR shall, for a period of two (2) years after completion and final acceptance of the work, repair any trench settlement which may occur and shall make suitable repairs to any pavement, sidewalks, or other structures which may become damaged as a result of backfill settlement.

- B. If the CONTRACTOR uses a subcontractor to make such repairs they shall notify the OWNER and/or ENGINEER of their intentions to subcontract this work as evidence of their faithful intention to perform the work.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for items under this section.

4.02 BASIS OF PAYMENT

- A. No separate payment shall be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 02226

BACKFILLING FOR APPURTENANCES

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of requirements of backfilling for appurtenances.

1.02 RELATED WORK

- A. Section 02225 - Trench Backfill.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 BACKFILL REQUIREMENTS

- A. Backfill around appurtenances shall be deposited in such a manner as not to disturb the appurtenance from its original alignment, and compacted to the finished grade. Backfill material, compaction and backfill procedures shall conform to the requirements of the related Type "A" or Type "B" backfill as specified for trenches.
- B. Compaction tests shall be performed every one hundred (100) linear feet of trench for each sixteen (16) inch level of material placed and compacted. Each appurtenance shall be tested within two (2) feet of the appurtenance and for each sixteen (16) inches of material placed and compacted. Each manhole or vault shall be tested at two (2) separate locations above the pipe within two (2) foot of manhole or vault and for each sixteen (16) inches of material placed and compacted.
- C. The CONTRACTOR shall, for a period of two (2) years after completion and final acceptance of the work, repair any settlement which may occur and shall make suitable repairs to any pavement, sidewalks, or other structures which may become damaged as a result of backfill settlement.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for items under this section.

4.02

BASIS OF PAYMENT

- A. No separate payment shall be made for items under this section. Full compensation shall be considered as included in the prices paid for various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 02227

ALLEY AND GRAVEL STREET RESTORATION

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of requirements that are applicable to all types of work that impact the original condition of an alley or gravel street.

1.02 RELATED WORK

- A. Section 02210 - Excavation, Embankment, and Compaction.
- B. Section 02226 - Backfill for Appurtenances.
- C. Section 02231 - Aggregate Subbase and Base Course.
- D. Section 02665 - Water Distribution and Transmission Systems.
- E. Section 02700 - Sanitary Sewer Systems.
- F. Section 02725 - Storm Drains and Culverts.

1.03 REFERENCES

- A. ASTM D698: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
- B. ASTM D2487: Standard Practice for Classification of Soils for Engineering Purposes.
- C. ASTM D4253: Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
- D. ASTM D4254: Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculations of Relative Density.
- E. ASTM D2922: Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).

- F. ASTM D3017: Water Content of Soils and Rock in Place by Nuclear Methods.
- G. ASTM D1556: Density and Unit Weight of Soil in Place by the Sand Cone Method.

PART 2 PRODUCTS

2.01 MATERIALS

A. ALLEY ROCK

- 1. Alley rock shall consist of a hard durable, crushed, natural stone. Alley rock shall be of such gradation that one hundred (100) percent shall pass the one and one half (1-1/2) inch sieve and no less than ninety (90) percent by weight shall be retained on a three-quarter (3/4) inch sieve.
- 2. Grading "W" base as defined in SECTION 02190. Recycled concrete base may be used when gradation meets the gradation requirements of Grading "W".

PART 3 EXECUTION

3.01 CONSTRUCTION

A. SURFACE RESTORATION

- 1. Once the construction activities are complete the CONTRACTOR shall return the disturbed alley or gravel street in the following manner.
 - a. If the construction was two (2) feet or less depth the CONTRACTOR shall backfill with existing material and place two (2) inches of alley rock over area of disturbance. Both the existing material layer and the alley rock layer shall be compacted with the use of mechanical compaction device. Finish alley rock grade shall match existing alley grade.
 - b. If the construction was greater than two (2) feet in depth the CONTRACTOR shall restore the alley or gravel street in the following manner. The CONTRACTOR shall remove eight (8) inches of existing material across the entire width and down

the entire length of the disturbed portion of the alley or street. The CONTRACTOR is responsible for the proper disposal of the removed material. The CONTRACTOR shall schedule a proof roll with the CITY. Upon repairs of all soft spots to the CITY's satisfaction the CONTRACTOR shall place six (6) inches of Grading "W" base and compact to ninety-five (95) percent of maximum standard proctor in accordance with SECTION 02231 AGGREGATE SUBBASE AND BASE COURSE. The CONTRACTOR shall then place two (2) inches of alley rock on top of base layer. The alley rock layer shall be compacted with a mechanical compaction device. Finish alley rock shall match existing alley grade.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Alley and gravel street restoration shall be measured by the square yard of surface area restored.

4.02 BASIS OF PAYMENT

- A. Payment shall constitute full compensation for all material, excavation, base course, alley rock, equipment, tools and labor, and for the performance of all work and incidentals necessary to complete this item.

END OF SECTION

SECTION 02231

AGGREGATE SUBBASE AND BASE COURSE

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of furnishing and placing one (1) or more courses of aggregate and additives, if required, on a prepared surface in accordance with these specifications and in reasonably close conformity with the lines, grades, thickness, and typical cross sections shown on the plans or established by ENGINEER.

1.02 RELATED WORK

- A. Section 02190 - Aggregates.
- B. Section 02210 - Excavation, Embankment, and Compaction.
- C. Section 02225 - Trench Backfill.
- D. Section 02895 - Engineering Fabric.

1.03 REFERENCES

- A. ASTM C911: Quick Lime, Hydrated Lime and Limestone for Chemical Uses.
- B. AASHTO M85: Portland Cement.
- C. ASTM D698: Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cuft (600 Kn-m/m cuft)).
- D. ASTM D1556: Density and Unit Weight of Soil in Place by the Sand Cone Method.
- E. AASHTO T99: Moisture Density Relations of Soils using a 5.5 lb (2.5 kg) Rammer and a 12 inch (305mm) Drop.
- F. ASTM D5195: Density of Soil and Rock In-Place at depths Below the Surface by Nuclear method.

- G. ASTM D5519: Particle Size Analysis of Natural and Man-Made RipRap Materials.
- H. AASHTO T191: Modified Proctor Moisture Density Relations of Soils using a 10 lb (4.54 kg) Rammer and an 18in (457 mm) Drop.
- I. ASTM C311: Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland Cement Concrete.
- J. ASTM C618: Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- K. ASTM D4318: Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- L. ASTM D2922: Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Method (Shallow Depth).

1.04 SUBMITTALS

- A. When the stationary plant method is used, the aggregate shall be accepted immediately before mixing and prior to the addition of water based on periodic samples taken from the pug mill output.
- B. When a road mix method is used, the aggregate shall be accepted after necessary blending and before laying, based on samples taken from the combined windrow for each lift.

PART 2 PRODUCTS

2.01 MATERIALS

- A. The aggregates shall meet the requirements of SECTION 02190, AGGREGATES.
- B. Stockpiled materials shall meet the requirements of SECTION 02190, AGGREGATES.
- C. Commercial additives, when required, shall meet the following requirements:
 - 1. Hydrated lime shall conform to the requirements of ASTM C911.

2. Portland cement shall conform to the requirements of AASHTO M85. Unless otherwise designated or permitted, Types I or II shall be used.
 3. Fly ash shall conform to the requirements of ASTM C311 and ASTM C618 (including Table 1A) for either Class C or F, as specified in the Contract Documents. Aggregates determined to be reactive shall require the use of ASTM C618, Table 2A, Supplementary Optional Physical Requirements.
- D. Unless otherwise permitted by ENGINEER, the product of only one (1) mill for any one (1) brand and type of portland cement shall be used on the project.
 - E. CONTRACTOR shall provide suitable means for storing and protecting the additives against dampness and other forms of damage. Cement additives which, for any reason, have become partially set or which contain lumps of caked cement shall be rejected. Cement additives may not be salvaged from discarded or used bags.
 - F. Other additives, when specified, shall meet the requirements set forth in the Special Provisions.
 - G. Materials to be used as subbase shall be Gradings D, H, K, or W as referenced in SECTION 02190, AGGREGATES.
 - H. Material to be used as base course shall be Grading W as referenced in SECTION 02190, AGGREGATES.

PART 3 EXECUTION

3.01 PREPARATION

- A. All subbase or base course material shall not be placed on any subgrade until the subgrade meets the specifications in this section.
- B. CONTRACTOR shall mix the aggregate, water, and commercial additive by the stationary plant method unless otherwise provided for in the Contract Documents or as approved by the ENGINEER.
- C. The stationary plant method shall meet the following requirements when adding a commercial additive.
 1. The aggregate and water shall be mixed in an approved pug mill mixer. Water shall be added during the mixing operation in the amount necessary to maintain the required moisture

content for compacting.

2. The mixer shall be capable of uniformly distributing the aggregate, additives, and water throughout the mixture without evidence of over-wet or dry pockets of material when the equipment is operated at CONTRACTOR's desired capacity.

3.02 APPLICATION

- A. Stationary Plant Method - Materials mixed by the stationary plant method shall be transported to the job site while it contains the proper moisture content, and shall be placed on the roadbed by means of an approved method.
- B. Travel Plant Method - After the material for each layer has been placed through an aggregate spreader, windrow sizing device or aggregate hopper, the material shall be uniformly mixed by a traveling mixing plant. During mixing, water shall be added in an amount sufficient to maintain the required moisture content for compacting.
- C. Road Mix Method - After material for each layer of the course has been placed, the materials shall be mixed while in the range of plus two (2) percent and minus four (4) percent of optimum moisture content, by means of motor graders or other approved equipment until the mixture is uniform throughout.
- D. Stockpile Method - Commercial additives, if required, shall be introduced into the aggregate during stockpiling operations. Water shall be introduced by pre-wetting the stockpile of aggregate and additive. Additional water may have to be introduced during the placing of the aggregate courses.

3.03 SHAPING, COMPACTION, AND TESTING

- A. All subbase or base course material shall not be placed on any subgrade until subgrade has been accepted as per Section 02225, TRENCH BACKFILL.
- B. The moisture content of materials with a plasticity index greater than four (4) shall be within plus two (2) and minus four (4) percentage points of optimum. Granular materials with a plasticity index of four (4) or less shall be compacted with sufficient moisture to facilitate required compaction.

- C. If the required compacted depth of subbase course exceeds six (6) inches, the course shall be constructed in two (2) or more layers. The maximum compacted thickness of any one (1) layer shall not exceed six (6) inches. When vibrating or other approved types of special compacting equipment are used, the depth of a single layer of the course may be increased upon approval by ENGINEER.
- D. Each layer shall be compacted to a density of a minimum of ninety – five (95) percent of maximum dry density as determined in accordance with ASTM D698. Tests shall be performed by using ASTM D2922, D1556, or D5195. The surface of each layer shall be maintained during the compaction operations in such a manner that a uniform texture and surface is produced and the aggregates firmly keyed. Water shall be uniformly applied over the materials during compaction in the amount necessary for proper consolidation.
- E. The minimum number of tests taken shall be one (1) compaction test per two hundred-fifty (250) linear feet per every twelve (12) inches or material change per driving lane.
- F. It shall be the responsibility of the CONTRACTOR to schedule and obtain compaction tests by an independent testing laboratory. The CONTRACTOR shall be responsible for providing copies of all tests results to the CITY’s Construction Division All tests shall be paid for by the CONTRACTOR.
- G. The base course under pavement sections shall be tested for soft spots by proof rolling. The proof roll test shall be done after passing the in-place compaction tests. Copies of the passing compaction tests, including the proctor, shall be provided to the ENGINEER prior to the proof roll. Each succeeding pass of the proof roller over the road bed shall be offset by no greater than four (4) tire widths. The proof roller shall be uniformly loaded.
 - 1. The ENGINEER shall initial the permit after the successful completion of the proof roll test. A copy of the completed permit with the approved inspections shall be submitted with the “As-Built” plans and specifications when the notification for CITY acceptance is requested.
 - 2. The proof roller shall be the weight of a fully loaded ten (10) yard dump truck (approx. 50,000 lbs or more on ten (10) wheels).

3. Areas which exhibit movement, cracking, or deflection of the material shall be removed, replaced, and retested to ensure proper compaction.
- H. A string line test shall be done after a passing proof roll test. The CONTRACTOR shall place blue tops at centerline of the road every fifty (50) feet and at all grade breaks and crown transitions. If the roadway is greater than forty (40) feet from face of gutter to centerline, then the CONTRACTOR shall also place quarter blue tops. The blue tops shall be placed using a generally accepted industry standard as approved by the ENGINEER. String line tests shall be performed for all sections of the road profile complete (i.e.: subgrade, subbase, and base). Tolerances for string line shall be one-tenth (0.10) of a foot for subgrade, three-quarter ($\frac{3}{4}$) inch for subbase, and one-half ($\frac{1}{2}$) inch for base materials. If a string line test fails, the CONTRACTOR shall rework the area to compliance. Passing string line and proof roll tests are required prior to any placement of pavement.
- I. No additional compensation shall be paid to the CONTRACTOR for the required tests.
- J. Scheduling for the proof roll and string line tests shall be done a minimum of twenty-four (24) hours in advance with the ENGINEER.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Aggregate base and subbase courses shall be measured by the ton. Natural moisture and water added to the material prior to the material being weighed will be measured as the material and shall not be deducted from the weight measurement. Water added to the material prior to the material being weighed shall not be measured separately for payment.

4.02 BASIS OF PAYMENT

- A. The accepted quantities of aggregate subbase and base course of size specified shall be paid for at the contract prices per ton for aggregate subbase, base course, and additives, complete in place.

B. Payment shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Crushed Base	Ton
Pit Run Subbase	Ton
Crusher Run Subbase	Ton
Subbase	Ton
Pit Run Base	Ton
Crusher Run Base	Ton
Commercial Additives	Ton

END OF SECTION

SECTION 02273

RIPRAP

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of the bank or water course protection courses in accordance with these specifications and in reasonable close conformity with the lines, grades, and thickness shown on the plans or established by ENGINEER.

1.02 RELATED WORK

- A. Section 02190 - Aggregates.
- B. Section 02210 - Excavation, Embankment, and Compaction.
- C. Section 02895 - Engineering Fabric.
- D. Section 03600 - Grout.

1.03 REFERENCES

- A. ASTM A116: Specification for Metallic-Coated Steel Woven Wire Fence Fabric.
- B. ASTM F626: Standard Specification for Fence Fittings.
- C. ASTM C881: Epoxy-Resin-Base Bonding System for Concrete.
- D. ASTM A974: Standard Specification for Welded Wire Fabric Gabions and Gabion Mattresses (Metallic Coated or Polyvinyl Chloride (PVC) Coated).
- E. ASTM D7014: Standard Practice for Assembly and Placement of Double-Twisted Wire Mesh Gabions and Revet Mattresses.

1.04 SUBMITTALS

- A. Wire and wire hardware shall be accepted based upon the manufacturer's certificate of compliance.

1.05

DEFINITIONS

- A. Class 1 riprap - hand placed stones on earth or gravel bedding.
- B. Class 2 riprap - machine placed stones on earth or gravel bedding.
- C. Grouted riprap - class 1 or 2 riprap as described above with voids filled with sand-cement grout.
- D. Wire enclosed riprap - stones placed in wire fabric enclosures.
- E. Sacked concrete riprap - hand placed sacked concrete.

PART 2

PRODUCTS

2.01

MATERIALS

- A. Aggregates used for riprap shall meet the requirements of SECTION 02190, AGGREGATES.
 - 1. Woven wire shall be 2"x 4" V-mesh fabric having twelve and one-half (12-½) gauge horizontal wires of two (2) strand, twisted construction and twelve and one-half (12-½) gauge cross wires. All wire shall meet the requirements of ASTM A116, and be Class 1 or better.
 - 2. Lacing and tie wire shall be galvanized, twelve and one-half (12-½) gauge smooth steel wire. In lieu of lacing, nine (9) gauge galvanized hog rings at four (4) inch spacing may be used for fastening ends, sides, and top panels.
- B. Anchorage for wire enclosed riprap shall meet the following requirements.
 - 1. Steel stakes may be crane rails, three (3) inch nominal standard pipe, or 4"x 4" x ⅜" angles. Stakes shall not be less than five (5) feet in length.
 - 2. Used materials are acceptable provided that the material is not rusted or damaged to an extent that would affect the strength of the stake.
- C. Grout for grouted riprap shall consist of one (1) part portland cement and three (3) parts of sand, thoroughly mixed with water to produce a workable mix.

- D. Sacks for sacked concrete riprap shall be made of at least ten (10) ounce burlap. Sacks shall be approximately 19- $\frac{1}{2}$ " x 36" measured inside the seams when the sack is laid flat, with an approximate capacity of one and one-quarter ($1\frac{1}{4}$) cubic feet. Sound, reclaimed sacks may be used.
- E. Concrete for sacked concrete riprap shall consist of a mixture of not less than four (4) sacks (three hundred-seventy six (376) pounds total weight) of portland cement per cubic yard and sufficient water to obtain a slump of three (3) to five (5) inches.

PART 3 EXECUTION

3.01 PREPARATION

- A. Slopes on which the riprap is to be placed shall be shaped to allow the full thickness of the specified riprap and any bedding or filter gravel, where required. The slopes shall not be steeper than the natural angle of repose of the slope as shown on the plans or directed by ENGINEER. Whenever possible, the excavation shall be undisturbed material or, where this is not possible, the underlying material shall be compacted to a minimum of ninety-five (95) percent of maximum dry density at optimum moisture content in accordance with SECTION 02210, EXCAVATION, EMBANKMENT, AND COMPACTION.

3.02 APPLICATION

- A. A layer of filter gravel shall be placed on the slope immediately prior to placement of the riprap stone. The layer shall be shaped to provide the minimum thickness specified. The surface should generally fit the bottom surface of the riprap.
- B. At the completion of slope protection work, the footing trench shall be filled with excavated material and compaction shall not be required.
- C. **CLASS 1 RIPRAP**

Class 1 riprap shall meet the following requirements:

1. The larger stones shall be placed first with close joints.
2. The larger stones shall be placed in the footing trench.

3. Stones shall be placed with their longitudinal axis normal to the embankment face and arranged so that each rock above the foundation course has a three (3) point bearing on the underlying stones. The foundation course is the course placed on the slope in contact with the ground surface. Bearing on smaller stones which may be used for chinking voids shall not be acceptable. Placing of stones by dumping shall not be permitted. Interstices shall be as nearly filled as practicable with smaller stones and spalls.

D. CLASS 2 RIPRAP

Class 2 riprap shall meet the following requirements:

1. Stones shall be so placed as to provide a minimum of voids, and the larger stones shall be placed in the toe course and on the outside surface of the slope protection.
2. The stones may be placed by dumping and may be spread in layers by bulldozers or other suitable equipment.

E. WIRE ENCLOSED RIPRAP

1. Wire enclosed segments shall be hand or machine formed to the dimensions shown on the plans. Enclosure segments shall be placed, laced, and filled in a workmanlike manner to provide a uniform, dense, protective coat over the area specified.

F. GROUTED RIPRAP

1. Clean stone shall be placed on the slope in accordance with the class specified. After the stone has been placed, it shall be thoroughly moistened with water. The mixed grout shall be applied while the stone is still moist. During application, the grout shall be worked into the interstices to completely fill the voids with grout.
2. Where the depth specified for grouting is in excess of twelve (12) inches, such as in cut off walls, the riprap stone shall be placed in twelve (12) inch lifts. Each lift shall be grouted prior to placement of the next lift. The succeeding lifts shall be constructed and grouted before the grout in the previous lift has set.

3. Grout shall be placed only when the weather is suitable for such work and shall be protected from freezing for at least five (5) days if frost is imminent. The surface of grouted riprap shall be covered with moist earth or wet burlap for not less than three (3) days after placing to allow the grout to properly cure.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Class 1 riprap, class 2 riprap, grouted riprap, sacked concrete, and filter gravel shall be measured by the cubic yard in place.
- B. Wire enclosed riprap shall be measured by the square yard of top surface area.
- C. Excavation and backfill unless included under some other item, grouting materials, hauling, placing or shaping, and other incidentals necessary for the completion of the work shall not be measured for payment, but shall be considered as subsidiary to other items of the contract.

4.02 BASIS OF PAYMENT

- A. The accepted quantities of riprap, sacked concrete, and filter gravel shall be paid for at the contract unit price per cubic yard or square yard, complete in place. Payment shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Riprap, Class	Cu Yd
Wire Encl. Riprap	Sq Yd
Grouted Riprap, Class	Cu Yd
Filter Gravel	Cu Yd
Sacked Concrete	Cu Yd

END OF SECTION

SECTION 02280

TOPSOIL

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of the requirements for removing, storing, and placing topsoil.

PART 2 PRODUCTS

2.01 TOPSOIL

- A. Topsoil is soil suitable for the growth of grass or other cover crops, reasonably free of hard dirt, clay, rocks, or other materials that would inhibit germination or growth. Provide topsoil that is fertile material; loam; or sandy clay loam. Do not provide topsoil that is saline or sodic or contains noxious weeds, toxic substances, stones or sticks greater than two (2) inch in diameter, or similar objectionable matter.

PART 3 EXECUTION

3.01 STRIPPING TOPSOIL

- A. Before removing topsoil, clear and mulch overlying brush, grass, crops, and other suitable material, and incorporate them into the topsoil. Mulch the material by chopping with brush chopper, shredding with a rotary blade mower, or by other methods approved by the ENGINEER.
- B. Topsoil shall be removed to full depth of the topsoil, unless otherwise directed by the ENGINEER, or to a maximum depth of twelve (12) inches.
- C. Unless it can be placed directly on the prepared slopes, topsoil shall be stockpiled for later incorporation into the work. Stockpiles shall be placed at the location and to the dimensions designated by the ENGINEER.

3.02 TOPSOIL STORAGE

- A. Topsoil storing consists of removing and stockpiling topsoil within the limits of the project, in uniform piles, and out of the way of other activities.
- B. Clear and grub stockpile sites in accordance with SECTION 02110, CLEARING AND GRUBBING. The sites shall be firm, smooth and well drained.

3.03 PREPARATION OF AREAS

- A. The embankment or cut slope areas to be covered with topsoil shall be completed to the designated lines and grades. Areas shall be scarified to a uniform depth of six (6) inches, prior to placement of the topsoil.

3.04 PLACING TOPSOIL

- A. Topsoil shall be placed in uniform manner to a depth commensurate with the quantity of topsoil available and the area to be covered.
- B. After the topsoil has been spread, clods, stones, or other foreign material that would lessen effectiveness or appearance of the topsoil, shall be raked up and removed from the area. Do not remove mulch. Topsoil shall be keyed to the underlying material by scarifying.
- C. Water shall be applied to the topsoil at the locations and in the amounts designated. Water shall be applied in a fine spray by nozzles or spray bars in such a manner that it will not wash or erode the topsoil areas.

3.05 TOPSOIL BORROW

- A. Topsoil borrow is topsoil either obtained from a borrow source outside the project limits and hauled directly to its final location or obtained within the limits of the project and hauled across a balance station in the earthwork for final placement.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Topsoil borrow shall be measured by the cubic yard, using volumetric measurements determined by preliminary and final cross-sections of the borrow source. When topsoil borrow is handled repeatedly for the CONTRACTOR's convenience, no additional measurements shall be made.
- B. Topsoil placing and topsoil storing shall be measured by the cubic yard using volumetric measurements.
 - 1. Topsoil storing shall be measured by the cubic yard by a cross-section for the amount placed in the stockpile.
 - 2. Topsoil placing shall be measured by the cubic yard by the difference in cross-sections from the stockpile before and after placement is complete.
- C. Topsoil stripped from its original position within the project limits and placed directly in its final position shall be measured as topsoil placing unless it is hauled across an earthwork balance station, in which case it shall be measured as topsoil borrow. Quantities shall be determined from preliminary and final volumetric measurements of the stripped area.

4.02 BASIS OF PAYMENT

- A. The accepted quantities of topsoil shall be paid for at the contract price per cubic yard, complete in place.
- B. Payment shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Topsoil Placing	Cu Yd
Topsoil Borrow	Cu Yd
Topsoil Storing	Cu Yd

END OF SECTION

SECTION 02290

WATERING

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of furnishing and applying water required in the compaction of embankments, subgrades, base courses and surface course, and for the control of dust for the safety and convenience of the public, for the reduction of the dust nuisance with adjacent property, and for other purposes as directed by the ENGINEER.

PART 2 MATERIALS

2.01 WATER SOURCE

- A. Water required for compaction, dust control and other purposes shall be the responsibility of the CONTRACTOR to obtain. Water quality shall meet or exceed that required by Federal, State, or local government agencies of authority.

PART 3 EXECUTION

3.01 WATER ADDED

- A. Deficiencies in moisture content of embankment materials, aggregate subbase, base, or surfacing courses shall be corrected by the addition of water by approved water distribution equipment. Water for dust control, finishing operations, and seeding shall be applied by approved distributor equipment.
1. Grading Operations: Prewetting does not guarantee that additional water will not be required. Water added to embankment material during grading operations shall be distributed in a manner that will avoid ponding or overwetting materials for the full width of each layer of material placed.
 2. Aggregate Courses: Water added to aggregate courses shall be applied to the material immediately prior to mixing and placing the material.

3. Finishing Operations: Water added during finishing operations shall be uniformly applied in a fine spray across the full width of the course by means of controllable pressures and spray bars or nozzles.
4. Seeding: Water added to seeded areas shall be applied in a spray that will not wash or erode the seeded area.
5. Dust Control: Water added for dust control measures for the protection and safety of traffic, for abatement of air pollution, and for other purposes, shall be applied in a manner that will best accomplish the elimination of dust.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for items under this section.

4.02 BASIS OF PAYMENT

- A. No separate payment shall be made for items under this section. Full compensation shall be considered as included in the prices paid for various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 02510

PORTLAND CEMENT TREATED MIXTURES

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of portland cement treated mixtures over prepared subbase as a cement treated base.

1.02 RELATED WORK

- A. Section 02190 - Aggregates.
- B. Section 02210 - Excavation, Embankment, and Compaction.
- C. Section 02225 - Trench Backfill.
- D. Section 02231 - Aggregate Subbase and Base Courses.
- E. Section 03304 - Portland Cement Concrete.

1.03 QUALITY ASSURANCE

- A. Deliver, handle, and store materials in accordance with manufacturer's recommendations.

1.04 SUBMITTALS

- A. Submit for approval manufacturer's specifications, product data, test results and data, all other data, MSDS, and mix design to the ENGINEER.
- B. Manufacturer's recommended installation procedures which, when approved by ENGINEER, shall become the basis for accepting or rejecting actual installation procedures used in the work.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Cement and water: Comply with SECTION 03304, PORTLAND CEMENT CONCRETE.

- B. Aggregate:
 - 1. Cement treated base: Comply with pavement base course specification under SECTION 02231, AGGREGATE SUBBASE AND BASE COURSES.
- C. Admixtures (when required): Comply with pozzolan admixture, or fly ash specification, under SECTION 03304, PORTLAND CEMENT CONCRETE, and with ASTM C311 and C618, Class C or F.
- D. Bituminous curing/sealing compound: Comply with liquid or emulsified asphalt specification under SECTION 02545, BITUMINOUS MATERIALS.

PART 3 EXECUTION

3.01 PROPORTIONING OF MATERIALS

- A. Cement treated base:
 - 1. Comply with applicable measurement, proportioning, and mixing specifications under SECTION 03304, PORTLAND CEMENT CONCRETE.
 - 2. Mixing can be performed as follows, at the CONTRACTOR's option:
 - a. Roadbed: Uniform windrows of untreated base shall be shaped and the tops slightly flattened to receive the cement. The size of the windrows shall be limited such that all the material can pass through the mixing machine in one (1) operation. Cement shall be spread uniformly on the base material, and completely mixed. Water shall be applied under pressure with controlled distributing equipment, and mixing shall continue until the base is a homogeneous mixture with uniform moisture content.
 - b. Central plant: Cement, water, aggregate and admixture(s), if required, shall be stored separately. Plants shall use an approved pug mill or continuous flow mixer, to produce a homogeneous mixture of uniformly distributed and properly coated aggregates with consistent appearance. The total

elapsed time between the addition of water to the mixture and the start of compaction shall not exceed forty-five (45) minutes. The mixture shall be transported to the site in clean equipment with suitable protective devices to prevent material loss and significant moisture change.

3.02 INSTALLATION

- A. Comply with applicable subgrade preparation and compaction specifications under SECTIONS 02210, EXCAVATION, EMBANKMENT, AND COMPACTION and 02225, TRENCH BACKFILL. Subgrade shall conform to the lines, grades, and cross sections shown on the plans.
- B. Spread mixture with a jersey spreader and motorgrader over properly prepared subgrade. Uniformly compact the treated base with pneumatic rollers to a minimum of ninety-five (95) percent of maximum dry density determined in accordance with ASTM D698. The maximum compacted thickness of any one (1) layer shall not exceed six (6) inches. The surface of the base course shall be lightly scarified, regraded, reshaped, and recompacted to the lines, grades, and cross sections shown on the plans.

3.03 CURING AND PROTECTION

- A. Exposed surfaces of cement treated base shall be kept continuously moist with a fog spray for seven (7) days.
- B. Bituminous seal: Immediately after final rolling, bituminous curing of either liquid or emulsified asphalt, shall be applied in sufficient quantity to provide a continuous membrane over the treated mixture, at a rate of between one-tenth (0.10) and two-tenths (0.20) gallons per square yard of surface area.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for items under this section.

4.02

BASIS OF PAYMENT

- A. No separate payment shall be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 02512

PLANT MIX PAVEMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of general requirements that are applicable to all types of bituminous pavements of the plant mix type irrespective of gradation of aggregate, kind, and amount of bituminous material or pavement use. Deviations from these general requirements shall be indicated in the specific requirements for each type.
- B. This section consists of one (1) or more courses of bituminous mixture constructed on the prepared foundation in accordance with these specifications and the specific requirements of the type under contract, and in reasonably close conformity with the lines, grades, thickness and typical cross sections shown on the plans or established by ENGINEER.

1.02 RELATED WORK

- A. Section 02190 - Aggregates.
- B. Section 02514 - Crack Sealing of Asphalt Pavements.
- C. Section 02515 - Asphalt Patching.
- D. Section 02545 - Bituminous Materials.
- E. Section 02551 - Tack Coat.
- F. Section 02552 - Seal Coat.

1.03 REFERENCES

- A. ASTM C150: Standard Specification for Portland Cement.
- B. AASHTO M303: Lime for Asphalt Mixtures.
- C. AASHTO T283: Resistance of Compacted Asphalt Mixtures to Moisture Induced Damage.

- D. Asphalt Institute MS-2: Mix Design Methods for Asphalt Concrete.
- E. ASTM D140: Standard Practice for Sampling Bituminous Materials.
- F. ASTM D979: Standard Practice for Sampling Bituminous Paving Mixtures.
- G. ASTM C1097: Standard Specification for Hydrated Lime for Use in Asphalt Cement or Bituminous Pavements.
- H. ASTM D1188: Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens.
- I. ASTM D1559: Standard Test Method for Resistance of Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.
- J. ASTM D2041: Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
- K. ASTM D2726: Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
- L. ASTM D2950: Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Method.
- M. ASTM D3665: Standard Practice for Random Sampling of Construction Materials.
- N. ASTM D4125: Standard Test Method for Asphalt Content of Bituminous Mixtures by the Nuclear Method.
- O. ASTM D5361: Standard Practice for Sampling Compacted Bituminous Mixtures for Laboratory Testing.
- P. ASTM D5444: Standard Test Method for Mechanical Size Analysis of Extracted Aggregate.
- Q. ASTM D6307: Standard Test Method for Asphalt Content of Hot-Mix Asphalt by Ignition Method.

SUBMITTALS

A. Mix design shall be submitted to the ENGINEER for approval. The job-mix formula (JMF) with the allowable tolerances shall be within the master range specified. The job-mix formula for each mixture shall establish a single percentage of aggregate passing each required sieve size and a single mixing temperature. Mix designs shall be updated on an annual basis by mix verification tests performed by an independent testing laboratory. Mix verification tests shall include a laboratory batched verification point at optimal oil content and aggregate blend of the previously approved mix design. The mix verification will be approved if:

1. Do not furnish mix with virgin aggregate fractions that exceed the wide band limits or the tolerance ranges from the target JMF, in accordance with the following table:

Passing #4 and Larger Sieves	$\pm 5\%$
Passing #8 Sieve	$\pm 4\%$
Passing #30 Sieve	$\pm 3\%$
Passing #200 Sieve	$\pm 2\%$

2. The maximum theoretical unit weight must be within two (2) pounds per cubic foot of the previously approved mix design.

Should a change in material be made, a new job-mix formula shall be approved before the new material is used. When unsatisfactory results or other conditions make it necessary, ENGINEER may approve a new job-mix formula.

- B. Mixing plant scales shall be checked as often as deemed necessary by the ENGINEER to assure their continued accuracy. CONTRACTOR shall have on hand not less than ten (10) fifty (50) pound weights for checking of the scales.
- C. Mix designs shall be submitted for review to the ENGINEER a minimum of fourteen (14) days prior to anticipated use in the work.
- D. During production for CITY roadways with 500 tons or greater daily, the following shall be submitted to the CITY Construction Division on a daily basis:
 1. Gradation Verification

2. Copy of asphalt heat chart.
 3. Copy of total day's production quantities for the mix.
 4. Records of tank stabs and asphaltic concrete manifests throughout production period for CITY mix.
 5. Lime weights and manifests shall be provided.
 6. Manifests for liquid anti-strip shall be provided.
- E. During production for CITY roadways with less than five hundred (500) tons daily, excluding patching, a gradation and asphalt binder content by tank stabs shall be submitted to the ENGINEER.

1.05 DEFINITIONS

- A. Plant mix pavement is considered a surface course in all cases.
- B. Plant mix bituminous base is considered a subsurface course.

PART 2 PRODUCTS

2.01 MATERIALS

A. BITUMINOUS MATERIALS

1. The percentage of bituminous material to be added to the job-mix formula shall be designated by mix design.
2. The type and grade of bituminous material shall be PG 64-22 unless otherwise shown on the plans or as approved by the ENGINEER.
3. The bituminous material shall meet the applicable requirements of SECTION 02545, BITUMINOUS MATERIALS.

B. AGGREGATE MATERIALS

1. Aggregates shall meet the applicable requirements of SECTION 02190, AGGREGATES.
2. During crushing operations, the coarse and fine aggregates shall be stockpiled in separate piles in such manner that

they can later be combined to meet the required specifications.

3. Stockpiled material shall meet the requirements of SECTION 02190, AGGREGATES.
4. Natural filler, when required, shall be stockpiled separately. The plans may limit or prohibit the use of crusher rejects or material from the same source as the aggregate material.

C. COMMERCIAL ADDITIVES

1. The type of commercial additive to be used will either be designated on the plans, or when no specific type is designated, any of the commercial additives conforming to either of the following requirements may be used:
 - a. **HYDRATED LIME** - Hydrated lime shall conform to the requirements of ASTM C1097, except that not less than ninety-three (93) percent of the hydrated lime shall consist of calcium and magnesium oxides. A minimum of one and one-half (1.5) percent hydrated lime shall be used in all plant mix pavements. Hydrated lime and water shall be mixed with the aggregate prior to entering the dryer. Payment shall be subsidiary to the pavement and not by the ton. The rate of application shall be one and one-half (1.5) percent and must achieve a minimum Tensile Strength Retained (TSR) of 75%.
 - b. **LIQUID ANTI-STRIP AGENTS** - Liquid anti-strip agents may be used provided the anti-strip agent is thermally stable and compatible with the asphalt binder. The liquid anti-strip shall be applied at the rate required to achieve a minimum TSR of 80%.

D. COMPOSITION OF MIXTURES

1. The bituminous plant mix shall be composed of a mixture of aggregate, natural filler or commercial additive, if required, and bituminous material. The several aggregate fractions shall be sized, uniformly graded, and combined in such proportions that the resultant composite blend meets the job-mix formula. The suggested job mix formula may require adjustments due to variation in aggregate, gradation, or other actual field conditions encountered.

2. Do not furnish mix with virgin aggregate fractions that exceed the wide band limits or the tolerance ranges from the target JMF, in accordance with the following table:

Passing #4 and Larger Sieves	± 5%
Passing #8 Sieve	± 4%
Passing #30 Sieve	± 3%
Passing #200 Sieve	± 2%
Bituminous Material	± 0.25%
Mixing Temperature	± 20°F

- a. The physical properties of the mix design and plant mix product during production shall meet or fall within the following mixture properties:

Voids, Total Mix	3-5%
Voids in mineral aggregate	13% - 16%
Stability (lbs)	2000 Minimum (50 Blows) 2500 Minimum (75 Blows)
Flow, (0.01in.)	8-18
Tensile Strength Retained (AASHTO T283)	75 % Minimum w/ Lime Additive 80% Minimum w/Liquid Anti-Strip Agent
Film Thickness Aggregate/Lime	8-12 Microns
Moisture Content % Minimum	4.0

- b. Asphalt Binder Content will be determined on 500 tons or more by determining asphalt binder used as a percentage of plant mix produced. The binder's weight (mass) will be determined from delivery invoices and the quantity of material remaining in the storage tank at the end of a day's production. The calculation to determine content will include all material used during the day's production of plant mix, including asphalt binder and plant mix not incorporated into the project.
- c. If the oil content is between ± 0.25% and ± 0.5%, of the approved mix design, the plant will be shut

down and plant will be recalibrated before production is resumed. A letter will be sent to the project engineer explaining correction. If the oil content exceeds $\pm 0.5\%$ based on tank stabs on production tons of 500 tons or more, asphalt paving will be removed and replaced.

3. When a recycled plant mix is specified, use RAP for at least ten (10) percent of the total aggregate. The amount of RAP may be increased or decreased up to ten (10) percent (by weight of total aggregate) from the amount specified. Adjustment of the percent of RAP may result in an adjustment of the virgin aggregate gradation.
4. In general, the point of acceptance for the aggregate shall be after the material has passed through the gradation unit and prior to the addition of bituminous material. If this point of acceptance proves unsatisfactory, an alternate point of acceptance may be selected by ENGINEER.

PART 3 EXECUTION

3.01 PREPARATION

A. CONDITIONING OF EXISTING SURFACE

1. Irregular surfaces of existing pavements or bases shall be brought to uniform grade and cross section as directed.

B. PREPARATION OF BITUMINOUS MATERIAL

1. The bituminous material shall be heated to the specified temperature in a manner that will avoid local overheating and provide a continuous supply of the bituminous material to the mixer at a uniform temperature at all times and in conformance with SECTION 02545, BITUMINOUS MATERIALS.

C. PREPARATION OF AGGREGATE

1. The aggregates for the mixture shall be dried and heated to the required temperature. Flames used for drying and heating shall be properly adjusted to avoid damage to the aggregate or coating the aggregate with soot, oil, or other contaminants. Burner fuels may be specified by ENGINEER in the Special Provisions.

D. MIXING

1. After the required amounts of aggregate and bituminous material have been introduced into the mixer, the materials shall be mixed until a complete and uniform coating of the particles and a thorough distribution of the bituminous material throughout the aggregate is secured.
2. For hot mix bituminous pavement, the mixture shall be produced at the lowest possible temperature that will produce a workable mix within the application temperatures specified under SECTION 02545, BITUMINOUS MATERIALS. The bituminous material and aggregate shall be introduced into the mixer within the specified temperature range and shall be within 25°F of each other.

E. BITUMINOUS MIXING PLANT - GENERAL

1. Sufficient storage space shall be provided for each size of aggregate, and the different aggregate sizes shall be kept separated until they have been delivered to the cold elevator feeding the dryer.
2. Plants used for preparation of bituminous mixtures shall conform to all requirements under subsection 3.01(F) below. In addition, dryer-drum mixers shall conform to the requirements under subsection 3.01(H) herein.
3. Mixing plants shall be of sufficient capacity and coordinated to adequately handle the proposed bituminous construction.

F. REQUIREMENTS FOR ALL PLANTS

1. Scales shall be accurate to one-half (1/2) percent of the maximum load that may be required. Poises shall be designed to be secured in any position to prevent inadvertent change of position. CONTRACTOR may provide an approved automatic printer system which will print the weights of the material delivered, provided the system is used in conjunction with an approved automatic batching and mixing control system. Such weights shall be evidenced by a weigh ticket for each load.

2. Tanks for the storage of bituminous material shall be equipped to heat and hold the material at the required temperatures. The heating shall be accomplished by steam coils, electricity, or other approved means so that no flame shall be in contact with the tank. Provision shall be made for measuring and sampling storage tanks.
3. The plant shall be provided with accurate mechanical means for uniformly feeding the aggregate into the dryer so that uniform production and uniform temperature will be obtained.
4. The plant shall include a dryer or dryers which continuously agitate the aggregate during the heating and drying process. For cold-type bituminous mix, equipment for mechanical cooling of the dried aggregate to the temperature prescribed for cold mixtures shall be provided and shall be capable of supplying prepared material for the mixer to operate at full capacity.
5. The plant shall include storage bins of sufficient capacity to supply the mixer when it is operating at full capacity. Bins shall be arranged to assure separate and adequate storage of appropriate fractions of the mineral aggregates. Separate dry storage shall be provided for commercial additives when used, and the plant shall be equipped to feed such material into the mixer. Each bin shall be provided with overflow pipes of such size and at such location as to prevent backing up of material into other compartments or bins.
6. The plant shall be equipped with suitable sampling devices or facilities to insure representative samples. If ENGINEER is unable to obtain samples which represent the material being accepted for incorporation into the project, CONTRACTOR shall make necessary adjustments or revisions to the plant before any further mixing is done.
7. Satisfactory means, either by weighing, metering or tank stabs, shall be provided to obtain the proper amount of bituminous material in the mix. The accuracy of bituminous content measured either by weighing, metering or tank stabs, may be checked by computing the daily yield of total material being processed.
8. Thermometric Equipment:

- a. An armored thermometer of adequate range in temperature reading shall be fixed in the bituminous feed line at a suitable location near the charging valve at the mixer unit.
 - b. The plant shall also be equipped with an approved temperature recording device so placed at the discharge chute of the dryer as to register automatically or indicate the temperature of the heated aggregates or plant mix. The printed temperature recordings shall be furnished to ENGINEER after each day's run.
9. The bituminous mixture shall be weighed on approved scales. Such scales shall be inspected as often as ENGINEER deems necessary to assure their accuracy.

G. REQUIREMENTS FOR DRYER-DRUM MIXER

1. The plant shall be equipped to control aggregate gradation as described for cold feed control. The total cold aggregate feed shall be weighed continuously by an approved belt scale. When tested for accuracy, the weighing system shall register within $\pm 0.5\%$.
2. An automatic digital record of the dry aggregate and the asphalt shall be displayed, recorded and totaled in appropriate units of weight and time. A positive interlock shall be provided between the dry weight of the aggregate and the bituminous material. The flow of the bituminous material shall be adjusted to compensate for the changes in the dry weight of the aggregate.
3. The dryer-drum mixer shall be capable of drying and heating the aggregate to the moisture and temperature requirements. A uniform mixture of aggregates and bituminous material shall be produced. The plant shall have a temperature recording device at the discharge chute of the dryer.

H. REQUIREMENTS FOR ADDING HYDRATED LIME

1. Provide a mechanical mixing device that creates a uniform and homogeneous mixture with all aggregate particles coated with hydrated lime as approved by the ENGINEER.

2. Equip the mixing plant with facilities to weigh check samples and to calibrate gate openings and metering devices. Equip with weighing or metering devices (such as a vane feeder with a calibrated revolution counter) to determine the rate of hydrated lime introduced into the aggregate while the plant is in full operation. Do not use belt scales.
3. Use a spray bar or other approved method to wet the aggregate uniformly. Equip the plant with devices that meter the water and hydrated lime into the mixer. Interlock and synchronize the metering devices and feeders to maintain a constant rate of hydrated lime and water to the aggregate.
4. To control the daily quantity of hydrated lime added to the aggregate and to facilitate calibration of the metering devices, place the bulk storage container from which hydrated lime is metered on scales or equip with load cells to enable the accurate measurement of the remaining weight [mass] in the container at the end of each day. Do not use strain gages.
5. Use a pug mill with a mixing chamber to mix the hydrated lime and water with the aggregate. Keep the materials in the chamber until obtaining a uniform and homogeneous mixture of lime, water, and aggregate. Do not use devices that allow the materials to drop directly through the mixture paddles.
6. Locate the pug mill to allow inspection of the mixture during mixing and after discharge from the mixer. Make the belt from the pug mill to the dryer accessible for sampling. Provide a template of the belt for taking a sample to determine moisture content. Moisture shall be 4% minimum or as determined by ENGINEER.
7. Mix the hydrated lime and water with the aggregate before they enter the dryer.

3.02 APPLICATION

- A. The temperature of the mixture prior to lay down shall not be more than 25°F less than the mixing temperature.

- B. Plant mix wearing course shall be placed between the dates of April 15th and November 15th unless otherwise specified by ENGINEER.
- C. Bituminous plant mix shall not be placed on any wet pavement surface; when the atmospheric temperatures are less than those specified in the following table; or, when weather conditions otherwise prevent the proper handling or finishing of the bituminous mixtures:

COMPACTED THICKNESS	Minimum Ambient Temperature and Rising (°F)	
	SURFACE COURSE	SUBSURFACE COURSE
Less than 1"	60	55
1" - 2"	40	40
> 2"	40	35

- D. Spot leveling or the bottom lift of a leveling course may be placed at 50°F if additional courses are placed on the same contract.

E. HAULING EQUIPMENT

- 1. Trucks used for hauling bituminous mixtures shall have tight, clean, metal beds which have been thinly coated with a minimum amount of paraffin oil or other approved material to prevent the mixture from adhering to the beds. This material shall not be used in amounts which will contaminate the mixture.

F. SPREADING AND FINISHING

- 1. The mixture shall be laid upon an approved surface, spread, and struck off to the grade and elevation established. Bituminous pavers shall be used to distribute the mixture either over the entire width or over such partial width as may be practicable.
- 2. When the total compacted thickness of the mat is to be in excess of three (3) inches, it shall be placed in two (2) or more lifts. The compacted thickness of any one (1) lift in multiple-lift construction shall not exceed three (3) inches.
- 3. Except on tapers, narrow median areas, shoulders, and other such areas of irregular shape, limited length or restrictive width, or such other areas as directed, the paver

screed shall be controlled by the automatic screed control described under subsection 3.02(G) herein.

4. CONTRACTOR shall furnish, place, and maintain such materials, devices, and equipment as may be required to provide specified independent line and grade control references and other controls which may be required for proper execution of the work.
5. Line and grade control for use with automatic paver control systems shall be an independent control reference consisting of:
 - a. A tightly stretched wire or string line offset and paralleling true line for pavement edge and established grade for pavement surface; or
 - b. A floating beam of not less than twenty (20) feet in length attached to the paver and riding on previously placed base or pavement material. The beam shall be equipped with a floating string or other device that will actuate the automatic screed control in reference to the base on which it is riding. Unless otherwise permitted by ENGINEER, the first ribbon of the first course of pavement material shall be controlled by the independent control wire. Subsequent ribbons may be controlled by the beam reference system; or
 - c. Non-contact electronic sensors may be used.
6. The longitudinal joint in one (1) layer shall offset that in the layer immediately below, by at least six (6) inches. The longitudinal joints in the top lift need to coincide with the centerline and/or planned lane lines of the roadway unless otherwise shown in the plans or approved by the engineer.
7. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable, the mixture shall be spread, raked and luted by hand tools. For such areas the mixture shall be dumped, spread, and screeded to give the required compacted thickness.

G. BITUMINOUS PAVERS

1. Bituminous pavers shall be self-contained, power-propelled units, provided with an activated screed or strikeoff assembly, heated, and capable of spreading and finishing courses of bituminous plant mix material in lane widths applicable to the specified typical section and thickness shown on the plans. Pavers used for shoulders and similar construction shall be capable of spreading and finishing courses of bituminous plant mix material in widths shown on the plans.
2. The paver shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed.
3. The screed or strikeoff assembly shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.
4. Pavers shall be equipped with a paver control system which will automatically control the laying of the mixture to specified transverse slope and established longitudinal grade. The paver control system shall be automatically actuated from an independent line and grade control reference and through a system of mechanical sensors and sensor directed devices which shall maintain the paver screed at the proper transverse slope and at proper height to establish the top surface of the finally compacted mixture at specified slope and grade. In case of failure of the control system, the paver shall be operated by mechanical control only until the material under production at the time of breakdown is laid.
5. The paver shall be capable of being operated, when laying mixtures, at forward speeds consistent with satisfactory laying of the mixture.

H. ROLLERS

1. All rollers shall be in good condition, capable of reversing without backlash, and shall be operated at speeds slow enough to avoid displacement of the bituminous mixture. The number and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. The use of equipment which results in excessive crushing of the aggregate will not be

permitted.

2. The pneumatic-tired roller shall be self propelled with a total weight, including ballast, not greater than thirty (30) tons. The roller shall be constructed so contact pressure may be varied between forty (40) psi and ninety (90) psi. Each roller shall be equipped with not less than seven (7) wheels with tires of equal size and ply and having a smooth tread design. The wheels shall be staggered on the front and rear axles to provide complete coverage, have a system for uniformly moistening each wheel without an excess of water, and have close-fitting scrapers for each wheel. The tire pressures shall not vary by more than five (5) psi between individual tires from the designated pressure.

I. COMPACTION

1. Immediately after the bituminous mixture has been spread and struck off and the surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling. Rolling shall be continued while the mixture is in a workable condition until all roller marks are eliminated and, unless otherwise designated on the plans, until a minimum of the required density (see table below), as established by test results as determined by an approved laboratory, has been obtained. Samples shall be taken in accordance with ASTM D5361, or density shall be determined by the use of properly calibrated nuclear density gauge.

TABLE OF MINIMUM DENSITY REQUIREMENTS

New construction inside city right-of-way.	92% of theoretical maximum density as established by ASTM D2041.
Construction outside the city right-of-way (patching, parking lots).	94% of maximum density as established by ASTM D1559.
Patching inside city right-of-way.	94% of maximum density as established by ASTM D1559.
Overlays.	Density requirement shall be achieved when a determined number of passes of a steel wheel roller establishes the compaction of the mix no longer increases as determined by use of a

	nuclear density gauge.
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2. The number, weight, and type of rollers furnished shall be sufficient to obtain the required compaction without undue displacement, cracking, or shoving.
3. When the pavement is placed by machines in echelon or abutted against a previously placed lane, the longitudinal joint shall be rolled first, followed by the regular rolling procedure. On superelevated curves, the rolling shall begin at the low side and progress to the high side by overlapping of longitudinal trips parallel to the centerline.
4. Any displacement occurring as a result of the reversing of the direction of a roller, or from other causes, shall be corrected at once by the use of rakes and addition of fresh mixture when required. Care should be exercised in rolling not to displace the line and grade of the edges of the bituminous mixture.
5. To prevent adhesion of the mixture to the rollers, the wheels shall be kept properly moistened with water or water mixed with very small quantities of detergent or other approved material. Excess liquid shall not be permitted.
6. Along forms, curbs, headers, walls, and other places not accessible to the rollers, the mixture shall be thoroughly compacted with hot hand tampers, smoothing irons, or mechanical tampers. On depressed areas, a trench roller may be used, or cleated compression strips may be used under the roller to transmit compression to the depressed area.
7. Any mixture that becomes loose and broken, mixed with dirt, or is in any way defective shall be removed and replaced with fresh hot mixture, which shall be compacted to conform with the surrounding area. Any area showing an excess or deficiency of bituminous material shall be removed and replaced.

J. JOINTS

1. Placing of the bituminous paving shall be as continuous as possible. Rollers shall not pass over the unprotected end of a freshly laid mixture unless authorized by ENGINEER.

Transverse joints shall be formed by cutting back on the previous run to expose the full depth of the course. When directed by ENGINEER, a brush of bituminous material shall be used on contact surfaces of transverse joints just before additional mixture is placed against the previously rolled material.

3.03 PROTECTION

- A. During any delays or suspensions of work, as outlined in the Contract Documents, CONTRACTOR shall be responsible for maintaining the quality of all leveling courses until the placement of additional courses. Maintenance of leveling courses because of delays or suspension of work shall be done at CONTRACTOR's expense unless otherwise specified in the Contract Documents.

3.04 QUALITY CONTROL

- A. The surface shall be tested by ENGINEER using an approved a ten (10) foot straightedge provided by the CONTRACTOR at selected locations. The variation of the surface from the testing edge of the straightedge between any two (2) contacts with the surface shall at no point exceed one-quarter ($\frac{1}{4}$) inch. All humps or depressions exceeding the specified tolerance shall be corrected by removing defective work and replacing it with new material, or as directed.
- B. CONTRACTOR shall perform gradation verification testing every one thousand (1,000) tons of material produced. Particle size analysis sample to be taken at the hot mix plant from the cold feed belt.
- C. Minimum compaction of the mat shall be in accordance with the table indicated in Section 3.02.I.1 as established by ASTM D2041 or ASTM D6926 and D2726. Density shall be determined by coring in accordance with ASTM D5361 and compaction verified by ASTM D1188 or ASTM D2726. The rate of testing shall be every five hundred (500) tons or every three hundred (300) linear feet of street. The use of a nuclear density gauge, per ASTM D2950, is acceptable for quality control and acceptance. To use for quality control and acceptance, a nuclear density gauge must be correlated by coring and must be based on a minimum of seven (7) cores. Samples for determining maximum density shall be taken in accordance with ASTM D979. Testing will be paid by for the CONTRACTOR.
- D. Testing for moisture after pug mill shall be once per day when

producing for CITY roads.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Plant mix bituminous pavement shall be measured by the ton.
- B. Weigh tickets shall be issued for each load either by an automatic printer system as described under subsection 3.01(F) herein, or by a weighman. In the case of a nonautomatic plant, an inspector may be assigned to check the scales and metering devices during the batching process.
- C. No deduction shall be made for the weight of bituminous material in the mixture.
- D. When specified in the contract as pay items, the quantity of bituminous materials and commercial additive shall be the number of tons of each used in the accepted work.

4.02 BASIS OF PAYMENT

- A. All work performed and measured as prescribed above shall be paid for as provided in the respective sections for each type specified.
- B. Work prescribed in subsection 3.01(A) herein shall be paid for at the contract unit prices for the material used. Payment shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Plant Mix Bituminous Base	Ton or Sq. Yd.
Plant Mix Bituminous Pavement	Ton or Sq. Yd.
Plant Mix Wearing Course	Ton or Sq. Yd.
Leveling Course	Ton

END OF SECTION

SECTION 02513

EMULSIFIED ASPHALT SLURRY SEAL

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of general requirements that are applicable to all types of emulsified slurry seal surfacing. Deviations from these general requirements shall be indicated in the specific requirements.
- B. The slurry seal shall consist of a mixture of an approved asphalt, mineral aggregate, water and specified additives, proportioned, mixed and uniformly spread over a properly prepared surface as directed by the ENGINEER. The completed slurry seal shall leave a homogeneous mat, adhere firmly to the prepared surface, and have a friction-resistant surface texture throughout its service life.

1.02 RELATED WORK

- A. Section 01041 - Project Coordination.
- B. Section 01050 - Traffic Control.
- C. Section 02514 - Crack Sealing.
- D. Section 02545 - Bituminous Materials.

1.03 REFERENCES

- A. International Slurry Surfacing Association, Recommended Performance Guidelines for Emulsified Asphalt Slurry Seal, A105 (Revised) 2005.
- B. ASTM D977: Standard Specification for Emulsified Asphalt.
- C. ASTM D2397: Standard Specification for Cationic Emulsified Asphalt.
- D. ASTM D244: Standard Test Method for Emulsified Asphalt.
- E. ASTM D2419: Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

- F. ASTM C131: Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- G. ASTM C88: Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
- H. ASTM C117: Standard Test Method for Materials Finer than 75um (No. 200) Sieve in Mineral Aggregates by Washing.
- I. ASTM D75: Standard Practices for Sampling Aggregate.
- J. ASTM D242: Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
- K. ISSA TB-106: Measurement of Slurry Seal Consistency.
- L. ISSA TB-139: Test Method to Classify Emulsified Asphalt/Aggregate Mixture Systems by Modified Cohesion Tester Measurement of Set and Cure Characteristics.
- M. ISSA TB-109: Test Method for Measurement of Excess Asphalt in Bituminous Mixtures by use of a Loaded Wheel Tester and Sand Adhesion.
- N. ISSA TB-114: Wet Stripping Test for Cured Slurry Seal Mix.
- O. ISSA TB-100: Test Method for Wet Track Abrasion of Slurry Surfaces.
- P. ISSA TB-113: Trial Mix Procedure for Slurry Seal Design.

1.04 SUBMITTALS

- A. The CONTRACTOR shall submit a signed mix design covering the specific materials to be used on the project to the ENGINEER for approval. After the mix design has been approved, no substitution shall be permitted unless approved by the ENGINEER.
- B. Manufacturer's specifications, test data, MSDS, and other data required to prove compliance with the specified requirements.
- C. Manufacturer's recommended installation procedures which, when approved by ENGINEER, shall become the basis for accepting or rejecting actual installation procedures used in the work.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Emulsified asphalt shall conform to Grade CQS-1h as specified in ASTM D2397.
- B. Each load of emulsified asphalt shall be accompanied with a Certificate of Analysis/Compliance to assure that it is the same as that used in the mix design.

2.02 QUALITY TESTS

A.

	ASTM TEST METHOD	QUALITY	SPECIFICATION
TEST ON EMULSION	ASTM D244	Residue After Distillation	60% Minimum
TEST ON EMULSION RESIDUE	ASTM D2397	Penetration at 77°F	100-200

2.03 AGGREGATE

- A. The mineral aggregate used shall be the type and grade specified for the particular use of the slurry seal. The aggregate shall be manufactured crushed stone such as granite, slag, limestone, chat, or other high-quality aggregate, or combination thereof. To assure the material is totally crushed, one hundred (100) percent of the parent aggregate shall be larger than the largest stone in the gradation to be used.

B.

ASTM TEST NO.	QUALITY	SPECIFICATION
ASTM D2419	Sand Equivalent	45 Minimum
ASTM C88	Soundness	15% Maximum using Na ₂ SO ₄ or 25% Maximum using MgSO ₄
ASTM C131	Abrasion Resistance	35% Maximum

2.04

GRADING

- A. When tested in accordance to ASTM C136 and ASTM C117, the target (mix design) aggregate gradation (including the mineral filler) shall be within one (1) of the following bands.

SIEVE SIZE	TYPE I (% Passing)	TYPE II (% Passing)	TYPE III (% Passing)	STOCKPILE TOLERANCE (%)
3/8"	100	100	100	
# 4	100	90 - 100	70 - 90	± 5
# 8	90 - 100	65 - 90	45 - 70	± 5
# 16	65 - 90	45 - 70	28 - 50	± 5
# 30	40 - 65	30 - 50	19 - 34	± 5
# 50	25 - 42	18 - 30	12 - 25	± 4
# 100	15 - 30	10 - 21	7 - 18	± 3
# 200	10 - 20	5 - 15	5 - 15	± 2

- B. The job mix gradation shall be within the gradation band for the desired type. After the target gradation has been submitted then the percent passing each sieve shall not vary by more than the stockpile tolerance and still remain within the gradation band.
- C. The aggregate shall be accepted at the job location or stockpile. The stockpile shall be accepted based on five (5) gradation tests according to ASTM D75. If the average of the five (5) tests is within the gradation tolerances, the materials shall be accepted. If the tests show the material to be out of specification, the CONTRACTOR will be given the choice to either remove the material or blend other aggregates with the stockpile material to bring it into specifications. Materials used in blending must meet the quality test before blending and must be blended in a manner to produce a consistent gradation. This may require a new mix design.
- D. Screening shall be required at the stockpile if there are any problems created by having oversize materials in the mix. Care shall be taken to avoid contaminating the approved aggregate material with the existing material on which the stockpile is placed.

2.05

MINERAL FILLER

- A. Portland cement, hydrated lime, limestone dust, fly ash, or approved filler meeting the requirements of ASTM D242 shall be used if required by the mix design. They shall be considered as part of the dry aggregate.

2.06 WATER

- A. The water shall be free of harmful salts and contaminants.

2.07 ADDITIVES

- A. Additives may be used to accelerate or retard the break-set slurry seal or to improve the resulting finished surface. The use of additives in the slurry mix (or individual materials) shall be made initially in quantities predetermined by the mix design with the field adjustments, if required, after written approval by the ENGINEER.

2.08 MIX DESIGN

- A. The CONTRACTOR shall submit to the ENGINEER for approval a complete mix design prepared and certified by an approved laboratory. Compatibility of the aggregate, emulsion, mineral filler, and other additives shall be verified by the mix design. The mix design shall be made with the same aggregate gradation that the CONTRACTOR provided.

- B. Tests and values are as follows:

ISSA TEST NO.	DESCRIPTION	SPECIFICATION
ISSA TB-106	Slurry Seal Consistency	
ISSA TB-139	Wet Cohesion 30 Minutes Min. (Set)	12 Kg-cm minimum
	Wet Cohesion 60 Minutes Min.	20 Kg-cm minimum
ISSA TB-109	Excess Asphalt by LWT Sand Adhesion	50 g/sqft Max. (538 g/m Max.)
ISSA TB-114	Wet Stripping	Pass (90% Min.)
ISSA TB-100	Wet-Track Abrasion, One hour Soak	75 g/sqft (807 g/m)
ISSA TB-113	Mix Time*	Controllable to 180 Sec. minimum

*The mixing test and set-time test shall be performed at the highest temperatures expected during construction.

- C. The laboratory shall also report the quantitative effects of moisture content on the unit weight of the aggregate (bulking effect). The report must clearly show the proportions of aggregate, mineral filler (minimum and maximum), water (minimum and maximum), additive(s) (usage), and asphalt emulsion based on the dry weight of

the aggregate. All the component materials used in the mix design shall be representative of the materials proposed by the CONTRACTOR to be used on the project.

- D. The percentages of each individual material required shall be shown in the laboratory report. Adjustments may be required during construction, based on the field conditions. The ENGINEER shall give final approval for all such adjustments.
- E. The ENGINEER shall approve the mix design and all slurry seal materials and methods prior to use. The component materials shall be within the following limits:

COMPONENT MATERIALS	LIMITS
Residual Asphalt	Type I: 10 - 16% Type II: 7.5 - 13.5% Type III: 6.5 - 12% (Based on dry weight of aggregate)
Mineral Filler	0.5 - 2.0% (Based on dry weight of aggregate)
Additives	As needed
Water	As needed to achieve proper mix consistency (Total mix liquids should not exceed the loose aggregate voids. ISSA T106 should be used to check optimum liquids.)

2.09 RATE OF APPLICATION

- A. The slurry seal mixture shall be of proper consistency at all times so as to provide the application rate required by the surface condition. The average application rate, as measured by the ENGINEER, shall be in accordance with the following table:

AGGREGATE TYPE	LOCATION	SUGGESTED APPLICATION RATE
TYPE I	Parking Areas, Urban and Residential Streets, Airport Runways	8 - 12 lb/yd ²
TYPE II	Urban and Residential Streets, Airport Runways	10 - 18 lb/yd ²
TYPE III	Primary and Interstate Routes	15 - 20 lb/yd ²

- B. Suggested application rates are based upon the weight of dry aggregate in the mixture. Application rates are affected by the unit weight of the aggregate, the gradation of the aggregate, and the demand of the surface to which the slurry seal is being applied. ISSA Technical Bulletin 112 gives a method to determine expected application rates.

2.10 TOLERANCES

- A. Tolerances for individual materials as well as the slurry seal mixture are as follows:
 - 1. After the designed residual asphalt content is determined, a plus or minus one (1) percentage point variation shall be permitted.
 - 2. The percentage of aggregate passing each sieve shall be within stockpile tolerance range as stated.
 - 3. The percentage of aggregate passing shall not go from the high end to the low end of the specified range of any two (2) successive sieves.
 - 4. The slurry consistency shall not vary more than plus or minus two (2) inches from the job mix.
 - 5. The application rate shall not vary more than plus or minus two (2) pound per yard after formula field adjustments while remaining within the design application rate.

PART 3 EXECUTION

3.01 MIXING EQUIPMENT

- A. The material shall be mixed by a self propelled, slurry seal mixing machine of either truck mounted or continuous run design. Continuous run machines are those that are equipped to self-load materials while continuing to lay slurry seal. Either type of machine shall be able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, control setting additive, and water to a revolving mixer and to discharge the mixed product on a continuous-flow basis. The machine shall have sufficient capacity for aggregate, emulsified asphalt, mineral filler, control additive and water to maintain an adequate supply to the proportioning controls.

3.02 PROPORTIONING DEVICES

- A. Individual volume or weight controls for proportioning each material to be added to the mix shall be provided and properly marked.

3.03 SPREADING EQUIPMENT

- A. The mixture shall be spread uniformly by means of a conventional surfacing spreader box attached to the mixer and equipped to agitate and spread the material evenly throughout the box. A front seal shall be provided to insure no loss of the mixture at the road contact point. The rear seal shall act as final strike-off and shall be adjustable. The spreader box and rear strike-off shall be so designed and operated that a uniform consistency is achieved to produce a free flow of material to the rear strike-off. The spreader box shall have a suitable means provided to side shift the box to compensate for variations in the pavement geometry. A burlap drag or other approved screed may be attached to the rear of the spreader box to provide a uniform, highly textured mat.

3.04 CALIBRATION

- A. Each mixing unit to be used in performance of the work shall be calibrated in the presence of the ENGINEER prior to construction. Previous calibration documentation covering the exact materials to be used may be acceptable, provided they were made during the calendar year. The documentation shall include an individual calibration of each material at various settings, which can be related to the machine's metering devices. No machine shall be allowed to work on the project until the calibration has been completed and accepted.
- B. Test strips shall be made by each machine after calibration and prior to construction. Verification of rate of application shall be made. If this test fails then additional tests strips, at no cost to the OWNER, shall be required until each unit is authorized to work. Any unit failing to pass the tests after the third trial shall not be permitted to work on the project. Test strips must be accepted or rejected within twenty-four (24) hours after application.

3.05 WEATHER LIMITATIONS

- A. The slurry seal shall not be applied if either the pavement or air temperature is below 50°F and falling, but may be applied when both pavement and air temperatures are above 45°F and rising. No slurry seal shall be applied when there is danger that the finished product

will freeze before twenty-four (24) hours. No slurry seal shall be applied until pavement is completely dry. The mixture shall not be applied when weather conditions prolong opening to traffic beyond a reasonable time.

3.06 NOTIFICATION AND TRAFFIC CONTROL

- A. All homeowners and businesses affected by the paving shall be notified by the CONTRACTOR two (2) working days in advance of the surfacing. Suitable tow-away signs shall be posted twenty-four (24) hours prior to the surfacing. Should work not occur on the specified day, a new notification shall be distributed. The notification shall be in a form of written posting, stating the date that the surfacing will take place. Also, the CONTRACTOR shall provide a local phone number at which they can be contacted and shall be included on the written posting.
- B. Suitable methods shall be used by the CONTRACTOR to protect the slurry seal from damage from all types of vehicular traffic. Refer to SECTION 01050, TRAFFIC CONTROL, for additional traffic control requirements.
- C. Opening to traffic does not constitute acceptance of the work. Slight tire marks may be evident in sharp-turning areas and will be considered normal as long as there is no rutting.

3.07 SURFACE PREPARATION

- A. Immediately prior to applying the slurry seal, the surface shall be cleared of all loose material, oil spots, vegetation, and other objectionable material. All methods of cleaning shall be approved by the ENGINEER prior to starting. If water is used, cracks shall be dried thoroughly prior to crack sealing or application of slurry seal. Manholes, valve boxes, drop inlets and other service entrances shall be protected from the slurry seal by a suitable method. The ENGINEER shall approve the surface preparation prior to surfacing.

3.08 TACK COAT

- A. Tack coat is not required unless directed by the ENGINEER. If required, the tack coat should consist of one (1) part emulsified asphalt to three (3) parts water. The emulsified asphalt shall be the same as used in the mix. The distributor shall be capable of applying the dilution at a rate of five-hundredths (0.05) to one-tenth (0.10) gal/yd². The tack coat shall be allowed to cure before application of the slurry seal.

3.09 APPLICATION

- A. The slurry seal shall be of the desired consistency upon leaving the mixer. A sufficient amount of material shall be carried in all parts of the spreader at all times so that a complete coverage is obtained. Overloading the spreader shall be avoided.
- B. No lumping, bailing, or unmixed aggregate shall be permitted.
- C. No streaks, such as those caused by oversized aggregate, shall be left in the finished surface. If excess oversize develops, the job shall be stopped until the CONTRACTOR proves to the ENGINEER that the situation has been corrected. It may be required to screen the aggregate prior to loading into the units being used for the lay down operation.

3.10 JOINTS

- A. No excess buildup, uncovered areas, or unsightly appearance shall be permitted on longitudinal or transverse joints. The CONTRACTOR shall provide suitable width-spreading equipment to produce a minimum number of longitudinal joints throughout the project. Longitudinal joints shall be placed on lane lines. Half passes and odd-width passes shall be used only in minimum amounts. If half passes are used, they shall not be the last pass of any paved area. A maximum of six (6) inches shall be allowed for overlap of longitudinal lane line joints.

3.11 MIX STABILITY

- A. The slurry seal shall possess sufficient stability so that premature breaking of the material in the spreader box does not occur. The mixture shall be homogeneous during and following mixing and spreading. It shall be free of excess water and emulsion and free of segregation of the emulsion and aggregate fines from the coarser aggregate. Spraying of additional water into the spreader box shall not be permitted.

3.12 HANDWORK

- A. Areas which cannot be reached with slurry seal machines shall be surfaced using hand squeegees to provide complete and uniform coverage. The area to be hand worked shall be lightly damped prior to mix placement and the slurry worked immediately.

3.13 LINES

- A. Straight lines shall be measured along curbs and shoulders. No run-off on these areas shall be permitted. Lines at intersections shall be kept straight to provide good appearance.

3.14 CLEANUP

- A. All areas, such as sidewalks, gutters, and valley gutters, shall have the slurry seal removed as specified by the ENGINEER. The CONTRACTOR shall remove any debris associated with the performance of the work on a daily basis.

3.15 QUALITY CONTROL

A. Inspection

- 1. The ENGINEER shall be on site or in communication with the CONTRACTOR at all times to insure compliance of specifications for the project.

B. Materials

- 1. An independent testing laboratory shall obtain samples of the aggregate and asphalt emulsion used in the project. Gradation and sand equivalent tests shall be run on the aggregate and residual asphalt content tests on the emulsion. Tests must fall within the mix design's tolerances. All tests shall be paid for by the CONTRACTOR. Testing shall be performed prior to commencement of the slurry seal operation.

C. Slurry Seal

- 1. Samples of the slurry seal shall be taken directly from the slurry unit(s). Consistency and residual content tests shall be performed and must be within the tolerances of the job mix design. All tests shall be paid for by the CONTRACTOR. Testing shall be performed every one hundred fifty thousand (150,000) square yards of application and fraction thereof.
- 2. The ENGINEER may use the recorders and measuring facilities of the slurry seal unit to determine application rates, asphalt emulsion content, mineral filler, and additive(s) content for an individual load.
- 3. It is the responsibility of the CONTRACTOR to check the

moisture content of the stockpile and to set the machine accordingly to account for aggregate bulking.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. The quantity of slurry seal laid shall be the number of square yards placed on existing pavements. The number of square yards shall be determined by the ENGINEER after the slurry seal has been placed and accepted.

4.02 BASIS OF PAYMENT

- A. Payment shall constitute full compensation for furnishing all materials, for preparation, mixing and applying these materials, and for all labor, equipment, tools, test design, cleanup and incidentals necessary to complete and warrant the job as specified.
- B. Payment shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Slurry Seal	Sq Yd

END OF SECTION

SECTION 02514

CRACK SEALING OF ASPHALT PAVEMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of preparation and the filling of cracks with hot-applied thermoplastic materials.

1.02 RELATED WORK

- A. Section 01050 - Traffic Control.
- B. Section 02545 - Bituminous Materials.

1.03 SUBMITTALS

- A. Manufacturer's specifications, test data, MSDS, and other data required to prove compliance with the specified requirements.
- B. Manufacturer's recommended installation procedures which, when approved by ENGINEER, shall become the basis for accepting or rejecting actual installation procedures used in the work.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 PREPARATION OF CRACKS TO BE SEALED

- A. All cracks greater than one-eighth ($\frac{1}{8}$) and less than one and one-half ($1\frac{1}{2}$) inch in width shall be blown out using oil-free compressed air, with a minimum one hundred-twenty (120) psi, to a maximum depth of no greater than two (2) inches.
- B. Cracks shall be air dried, dried by heat lance or propane burner if necessary.

3.02 REMOVAL OF VEGETATION FROM CRACKS

- A. Prior to the removal of vegetation in the cracks they may be sprayed with an herbicide approved by the CITY Director of Weed and Pest.

- B. Removal of vegetation from the cracks shall be done by either wire brush or propane burner.

3.03 SEALING OF CRACKS

- A. Material used for filling of cracks shall be approved by the ENGINEER prior to placement and shall be accompanied by the manufacturer's certification.
- B. Hot-applied thermoplastic material shall be heated to a temperature of 370-390°F in a standard asphalt kettle.
- C. Cracks shall be filled using a two (2) inch inside diameter hand wand.
- D. A "U" shape rubber squeegee shall be used to feather filler sealant on asphalt pavement to a thickness one-eighth ($\frac{1}{8}$) to one-quarter ($\frac{1}{4}$) inch and shall be at least three (3) inches and not to exceed five (5) inches on either side of the crack.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Measurement shall be made by the pound of material applied.

4.02 BASIS OF PAYMENT

- A. Payment shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Rubberized asphalt	Pound

END OF SECTION

SECTION 02515

ASPHALT PATCHING

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of requirements applicable to asphalt patching.

1.02 RELATED WORK

- A. Section 02190 - Aggregates.
- B. Section 02231 - Aggregate Subbase and Base Course.
- C. Section 02512 - Plant Mix Pavements.
- D. Section 02545 - Bituminous Materials.
- E. Section 02551 - Tack Coat.

1.03 SUBMITTALS

- A. All submittals shall conform to current specifications and shall be approved by the ENGINEER.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Asphalt mixes used for patching shall conform to the requirement of one-half ($\frac{1}{2}$) inch nominal maximum gradation for patches less than four (4) feet in width. Patches greater than four (4) feet in width shall conform to the requirements of three-quarter ($\frac{3}{4}$) inch nominal maximum gradation for a base and a one-half ($\frac{1}{2}$) inch nominal maximum gradation for the top lift.

PART 3 EXECUTION

3.01 PREPARATION

- A. Irregular surfaces of existing pavements or bases shall be brought to uniform grade and cross section as directed by ENGINEER.
- B. Grading 'W' base course shall be a minimum of six (6) inches compacted depth, or as approved by the ENGINEER, conforming to SECTION 02231, AGGREGATE SUBBASE AND BASE COURSE.
- C. All vertical and horizontal asphalt and concrete surfaces abutting the asphalt shall have a tack coat applied per SECTION 02551, TACK COAT.
- D. If the edge of the patch is four (4) feet or less from face of gutter, all asphalt to face of gutter shall be removed and replaced.
- E. All patching shall conform to Section 02512, PLANT MIX PAVEMENTS, except for lift thickness. Temperature requirement shall be 32° and rising and not on frozen base course.
- F. Existing pavements shall be removed to clean straight lines parallel and perpendicular to the flow of traffic. Patches shall not be constructed with angled sides or irregular shapes.
- G. Patches within patches are to be avoided. Where this can not be avoided, boundaries of the new patch shall match the existing patch.
- H. Where three or more patches are proposed within a seventy-five (75) foot long roadway section, the pavement between patches shall be milled and inlaid with new pavement over the entire work area. In cases where the existing pavement is in poor condition and may require an overlay within the next few years, this requirement may be waived by the ENGINEER.
- I. Transverse patch length shall extend across the full width of the travel lane. Minimum width for transverse patches shall be five (5) foot for residential; eight (8) foot for collectors and ten (10) foot for arterials.
- J. Edges of longitudinal patches on collectors and arterials shall not fall in existing wheel paths. The edges of patches parallel to the

direction of travel shall be limited to the boundaries of lanes or to the center of travel lanes.

- K. Patches shall have a smooth longitudinal grade consistent with the existing roadway. Patches shall also have a cross slope or cross section consistent with the design of the roadway.
- L. The width of patches shall be consistent to simplify future maintenance.

3.02

APPLICATION

- A. Patch depths shall be a minimum of 4", or match existing up to six (6) inches, on all streets designated as local streets and alleys. Patch depths on all streets designated as collectors and arterials shall be a minimum of 6" or match existing up to twelve (12) inches.
- B. The hot mix bituminous pavement shall be placed with a self-propelled paver if patching widths are greater than eight (8) feet. For patch widths greater than four (4) and up to eight (8) feet, the mixture shall be placed with either a self-propelled paver or a box spreader. For patch widths less than four (4) feet in width or where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture shall be spread, raked, and luted by hand tools. The use of tampers shall not be allowed for compaction effort on asphalt. The use of plate type compactors shall only be permitted in areas not accessible to a roller.
- C. In order to obtain a good bond between existing and new asphalt pavements, all areas where the existing pavement is cut for the installation of an appurtenance or structure the Contractor shall saw cut the full depth of the existing asphalt pavement a minimum of twelve inches (12") (300mm) beyond the excavation. This entire edge will be properly coated with tack oil prior to the installation of the new asphalt pavement. The new pavement section will be applied in two (2) lifts. In addition, the edge of the old asphalt pavement shall be milled down to the level of the first lift of the new pavement section or a minimum of one and one-half (1½") (37.5mm) from the surface. The milling shall extend at least twelve (12") inches beyond the saw cut. The milled surface shall be thoroughly cleaned and have tack oil applied to it and coated to cover the entire edge before applying the second lift. The second lift will then be applied overlapping the milled surface and the new first lift of the new pavement. If the second lift cannot be applied

immediately after compaction of the first, the first lift shall have tack applied to its surface before the application of the second.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Asphalt patching shall be measured by the square yard or by the ton, complete in place.

4.02 BASIS OF PAYMENT

- A. Payment shall constitute full compensation for all material, excavation, base course fill, tack coat, asphalt, milling, equipment, tools and labor, and for performance of all work and incidentals necessary to complete this item.
- B. Pay shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Asphalt Patching 4"	Sq. Yd.
Asphalt Patching Exceeding 4"	Ton / Sq Yd

END OF SECTION

SECTION 02545

BITUMINOUS MATERIALS

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of general requirements applicable to all types of bases or pavements that require the application of bituminous materials by spray or mix. Deviations from these general requirements shall be indicated in the specific requirements for each type.

1.02 RELATED WORK

- A. Section 02512 - Plant Mix Pavements.
- B. Section 02515 - Asphalt Patching.
- C. Section 02551 - Tack Coat.
- D. Section 02552 - Seal Coat.

1.03 REFERENCES

- A. AASHTO M81: Cut-Back Asphalt (Rapid Curing Type).
- B. AASHTO M82: Cut-Back Asphalt (Medium Curing Type).
- C. AASHTO M140: Emulsified Asphalt.
- D. AASHTO M208: Cationic Emulsified Asphalt.
- E. AASHTO M226: Table 1, Viscosity Graded Asphalt Cement.
- F. AASHTO T40: Sampling Bituminous Materials.

1.04 SUBMITTALS

- A. Bituminous material may be conditionally accepted at the source based on test reports furnished by CONTRACTOR for each forty (40) tons or ten thousand (10,000) gallons loaded.

- B. A sample of each load of asphaltic materials is to be obtained at the time of conveyance loading, and the certificate of compliance, together with this sample, shall be surrendered to ENGINEER on the project. Sampling shall be accomplished using methods described and outlined in AASHTO T40.
- C. Tank trucks delivering bituminous material to the project shall be equipped with a sampling cock on the discharge pipe.
- D. Bituminous materials used on the project which do not meet the specification requirements for the type and grade specified may, at the direction of ENGINEER:
 - 1. Be rejected and CONTRACTOR required to remove and replace all materials affected by the out-of-specification material at his expense; or
 - 2. Be accepted and left in place and the contract price of the bituminous material deducted, or be accepted at a reduced unit price as directed by ENGINEER.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Bituminous materials shall meet all applicable requirements. No materials or products other than those designated in this section shall be added to bituminous material without the written approval of the ENGINEER.

2.02 ASPHALT CEMENTS

- A. The grades shown on the plans shall conform to the specifications of AASHTO M226, Table 1, with the following modifications:

TEST	PG 58-28	PG 64-22
Penetration, 77°F 100g, 5 sec (min.)	60	35

- B. The spot test shall be negative for all grades when tested with naphtha xylene solvent using 15% xylene.
- C. The letter “F” following the bituminous material type designation shall require a satisfactory antistripping agent be added to the material at the refinery.

2.03 LIQUID CUTBACK ASPHALTS

- A. Liquid cutback asphalts shall conform to manufacturer's recommendations and the requirements of AASHTO M81 and AASHTO M82. The spot test shall be negative for all grades when tested with naphtha xylene solvent using 15% xylene. The Saybolt-Furol viscosity alternate shall not apply.

2.04 EMULSIFIED ASPHALTS

- A. Emulsified asphalts shall conform to the following requirements:
 - 1. Emulsified Asphalt (Anionic) AASHTO M140.
 - 2. Emulsified Asphalt (Cationic) AASHTO M208.
- B. The designation "H" added to any grade of emulsified asphalt requires the residue from distillation to have a penetration from forty (40) to ninety (90).
- C. The following exceptions apply to grade CMS-2 only:
 - 1. Viscosity: Saybolt-Furol at 122°F, 50 seconds minimum to 500 seconds maximum.
 - 2. Distillation: percentage of residue is 60 minimum.
 - 3. Distillation: Oil Distillate, by volume of emulsion - to be determined by independent laboratory from produced materials, not to exceed 20%.

PART 3 EXECUTION

3.01 PREPARATION

- A. The water used for the dilution shall be free of sediment and other deleterious matter.

3.02 APPLICATION

- A. The rate of emulsified asphalt used for fog seal or tack shown in the Contract Documents, is the rate of emulsified asphalt as received from the refinery.

- B. Both the dilution water and the emulsion shall be heated to approximately 110°F prior to mixing, and this approximate temperature shall be maintained during the application. Dilution shall be made by introducing the water into the emulsified asphalt.
- C. Bituminous materials for the various types of applications shall be loaded and applied within the temperatures indicated in the following table:

TYPE and GRADE of MATERIAL	APPLICATION - SPRAY (°F)	MIXING TEMPERATURE (°F)
RT 1,2 & 3	60 - 130	60 - 130
RT 5 & 6	85 - 150	85 - 150
RT 7, 8, & 9	150 - 225	150 - 225
RT 10, 11, & 12	175 - 250	175 - 250
RT 70	100 - 180	90 - 140
250	160 - 220	140 - 175
800	175 - 250	170 - 210
3000	220 - 275	200 - 240
MC 30	120 - 200	95 - 140
70	120 - 200	95 - 140
250	160 - 220	140 - 200
3000	200 - 290	200 - 250
SC 70	120 - 200	95 - 145
250	160 - 220	140 - 200
800	175 - 250	175 - 210
3000	200 - 290	200 - 250

Notes:

All Emulsions shall be 50-140°F.

All Penetration Grades shall be 350°F max. and mixing temperature shall be as required to achieve viscosity of 75-150 seconds Saybolt-Furol

- D. The maximum loading temperature for asphalt cements shall be 350°F.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for items under this section.

4.02 BASIS OF PAYMENT

- A. No separate payment shall be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 02551

TACK COAT

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of preparing and treating an existing bituminous or concrete surface with bituminous material in accordance with these specifications and in reasonably close conformity with the lines shown on the plans or established by the ENGINEER.

1.02 RELATED WORK

- A. Section 02512 - Plant Mix Pavements.
- B. Section 02545 - Bituminous Pavements.

1.03 REFERENCES

- A. AASHTO M140: Emulsified Asphalt.
- B. AASHTO M208: Cationic Emulsified Asphalt.
- C. AASHTO M226: Table 1, Viscosity-Graded Asphalt Cement.
- D. AASHTO M81: Cut-Back Asphalt (Rapid Curing Type).
- E. AASHTO M82: Cut-Back Asphalt (Medium Curing Type).
- F. AASHTO T40: Sampling of Bituminous Materials.

1.04 SUBMITTALS

- A. All submittals shall conform to current specifications and shall be approved by the ENGINEER.
- B. All submittals shall include manufacturer's specifications, test data, MSDS, and other data required to prove compliance with the specified requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. The type of bituminous material shall be specified in the contract, and the grade shall be designated by ENGINEER emulsions shall be SS-1, SS1h, CSS-1 or CSS-1h.
- B. The bituminous material shall meet the applicable requirements of SECTION 02545, BITUMINOUS MATERIALS.

PART 3 EXECUTION

3.01 PREPARATION

- A. The existing surface shall be patched and cleaned and shall be free of irregularities to provide a reasonably smooth and uniform surface to receive the treatment. Unstable corrugated areas shall be removed and replaced with suitable patching materials. Payment for the patching shall be made at the contract unit price for the various items used unless a reconditioning item is included in the contract. All asphalt edges which are adjacent to new pavement shall be cleaned to permit the adhesion of bituminous materials.

3.02. EQUIPMENT

- A. The CONTRACTOR shall provide equipment for heating and applying the bituminous material.

3.03 APPLICATION

- A. APPLICATION OF BITUMINOUS MATERIAL
 - 1. The bituminous material shall be uniformly applied to all prepared surfaces.
 - 2. The tack coat shall be applied in such manner as to offer the least inconvenience to traffic and to permit one-way traffic without pickup or tracking of the bituminous material.
 - 3. Tack coat shall not be applied during wet or cold weather, after sunset, or to a wet surface. The quantity, rate of application and areas to be treated shall be approved prior to application. Application temperatures shall be in accordance with SECTION 02545, BITUMINOUS

MATERIALS.

4. Tack coat shall be applied to all vertical and horizontal asphalt surfaces abutting the asphalt.
5. Tack coat shall be applied between all asphalt lifts, except when top lift is put on bottom lift on same day.
6. Tack coat shall be applied within 24 hours of when paving operations occur or as approved by the ENGINEER.
7. Within 24 hours of when paving operations occur, excessive dust and mud that would cause non-adhesion of the toplift shall require brooming and reapplication of a light tack coat.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for items under this section.

4.02 BASIS OF PAYMENT

- A. No separate payment shall be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 02552

SEAL COAT

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of an application of bituminous material followed by an application of cover coat material in accordance with these specifications and in reasonably close conformity with the lines shown on the plans or established by the ENGINEER.

1.02 RELATED WORK

- A. Section 02190 - Aggregates.
- B. Section 02511 - Road Mix Bituminous Pavements.
- C. Section 02512 - Plant Mix Pavements.
- D. Section 02545 - Bituminous Materials.

1.03 REFERENCES

- A. AASHTO M140: Emulsified Asphalt.
- B. AASHTO M208: Cationic Emulsified Asphalt.
- C. AASHTO M226: Table 1, Viscosity-Graded Asphalt Cement.
- D. AASHTO M81: Cut-Back Asphalt (Rapid Curing Type).
- E. AASHTO M82: Cut-Back Asphalt (Medium Curing Type).
- F. AASHTO T40: Sampling of Bituminous Materials.

1.04 DEFINITIONS

- A. Plain seal shall consist of the application of bituminous material and a sand cover coat, where required.

PART 2 PRODUCTS

2.01 MATERIALS

A. BITUMINOUS MATERIAL

1. The type of bituminous material shall be specified in the contract, and the grade shall be approved by ENGINEER.
2. The bituminous material shall meet the applicable requirements of SECTION 02545, BITUMINOUS MATERIALS.

B. COVER COAT MATERIAL

1. Cover coat material shall meet the requirements of SECTION 02190, AGGREGATES, for the type specified. The material shall be accepted based on periodic samples taken at the latest practicable point prior to incorporation into the work.
2. Stockpiled material shall meet the requirements of SECTION 02190, AGGREGATES.

PART 3 EXECUTION

3.01 PREPARATION

- A. Seal coating operations shall not be started until the surface is thoroughly compacted.
- B. Bituminous material shall not be spread until the surface has been cleaned as required and the section to be sealed has been approved by the ENGINEER.

3.02 APPLICATION

A. WEATHER LIMITATIONS

1. Seal coat shall be applied only when the surface on which the material is to be applied is dry and when the atmospheric temperature is 40°F and rising.
2. Plain seal shall be applied when the surface is dry and the weather conditions are suitable for the proper application of the bituminous material specified.

B. EQUIPMENT

1. Equipment for heating and applying bituminous material.
2. A rotary power broom.
3. A self-propelled pneumatic-tired roller, the gross load of which shall be adjustable to apply two hundred (200) to three hundred-fifty (350) pounds of rolling width as directed. Tire pressure or contact pressure may be specified for pneumatic-tired rollers. Pneumatic-tired rollers shall be operated at a maximum speed of five (5) miles per hour.
4. A self-propelled aggregate spreader of approved design supported by at least four (4) wheels equipped with pneumatic tires on two (2) axles. The aggregate spreader shall be equipped with a means of applying the larger cover coat material to the surface ahead of the smaller cover coat material and with positive controls so that the required amount of material will be deposited uniformly over the full width of the bituminous material. Other types of aggregate spreaders may be used provided they accomplish equivalent results and are approved by the ENGINEER.

C. BITUMINOUS MATERIALS

1. Bituminous material shall be applied by means of a pressure distributor in a uniform, continuous spread over the section to be treated and within the temperature range specified. The quantity of bituminous material to be used per square yard shall be as directed. If the texture of the surface is such that bituminous material penetrates too rapidly, a preliminary application of from five-hundredths (0.05) to one-tenth (0.10) gallon per square yard of surface may be required.
2. A strip of building paper, at least three (3) feet in width and with a length equal to that of the spray bar of the distributor plus one (1) foot shall be used at the beginning of each spread. If the cutoff is not positive, the use of paper may be required at the end of each spread. The paper shall be removed and disposed of in a satisfactory manner.
3. The distributor shall be moving forward at proper application speed at the time the spray bar is opened. Any skipped areas or deficiencies shall be corrected. Junctions

of spreads shall be carefully made to assure a smooth riding surface.

4. The spreads of bituminous material shall not be more than six (6) inches wider than the width covered by the cover coat material from the spreading device. Under no circumstances shall operations proceed in such manner that bituminous material will be allowed to chill, set up, dry, or otherwise impair retention of the cover coat.
5. The distributor, when not spreading, shall be parked so that the spray bar or mechanism will not drip bituminous materials on any surface.

D. COVER COAT MATERIAL

1. Immediately following the application of the bituminous material, cover coat material shall be spread in quantities as designated. Spreading shall be accomplished in such a manner that the tires of the trucks or aggregate spreader at no time contact the uncovered and newly applied bituminous material.
2. The cover coat material shall be moistened with water when required to eliminate or reduce the dust coating of the aggregate. Moistening shall be done the day before the use of aggregates.
3. Immediately after the cover coat material is spread, any deficient areas shall be covered by additional material. Pneumatic-tire rolling shall begin immediately and shall be continued until three (3) complete coverages are obtained. Pneumatic-tire rolling shall be completed the same day the bituminous material and cover coat materials are applied.
4. After the application of the cover coat material, the surface where specified, shall be lightly broomed or otherwise maintained as directed for a period of four (4) days, or as directed by the ENGINEER. Maintenance of the surface shall include the distribution of cover coat material over the surface to absorb any free bituminous material and cover any area deficient in cover coat materials. The maintenance shall be conducted so as not to displace embedded materials. Excess material shall be swept from the entire surface by means of rotary brooms.

3.03 PROTECTION

- A. Areas where bituminous materials would be picked up, or the seal otherwise damaged by traffic, shall be covered by a protective coat of sand. When confined to small areas, the sand coat may be applied by hand spreading and smoothed by sweeping.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Bituminous and cover coat material shall be measured by the ton.

4.02 BASIS OF PAYMENT

- A. The accepted quantities of seal coat shall be paid for at the contract price per ton for bituminous material and per ton for cover coat material complete in place including haul. Payment shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Asphalt Cement	Ton
Liquid Asphalt (Seal)	Ton
Emulsified Asphalt (Seal)	Ton
Cover Coat Material	Ton

END OF SECTION

SECTION 02553

BITUMINOUS SURFACE TREATMENT

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of the construction of a single or multiple course bituminous surface treatment in accordance with these specifications and in reasonably close conformity with the lines shown on the plans or as established by ENGINEER.
- B. The bituminous surface treatment may consist of the application of one (1) or more seal coats or may consist of a prime coat followed by one (1) or more seal coats as specified in the Contract Documents.

1.02 RELATED WORK

- A. Section 02190 - Aggregates.
- B. Section 02545 - Bituminous Materials.
- C. Section 02550 - Prime Coat.
- D. Section 02552 - Seal Coat.

1.03 REFERENCES

- A. AASHTO M140: Emulsified Asphalt.
- B. AASHTO M208: Cationic Emulsified Asphalt.
- C. AASHTO M226: Table 1, Viscosity-Graded Asphalt Cement.
- D. AASHTO M81: Cut-Back Asphalt (Rapid Curing Type).
- E. AASHTO M82: Cut-Back Asphalt (Medium Curing Type).
- F. AASHTO T40: Sampling of Bituminous Materials.

PART 2 PRODUCTS

2.01 MATERIALS

A. BITUMINOUS MATERIAL

1. The types of bituminous material shall be specified in the Contract Documents. The grade shall be designated by ENGINEER.
2. The bituminous material shall meet the applicable requirements of SECTION 02545, BITUMINOUS MATERIALS.

B. AGGREGATES

1. Aggregates and blotter material shall meet the requirements of SECTION 02190, AGGREGATES, for the sizes specified. The material shall be accepted based on periodic samples taken at the latest practicable point prior to incorporation into the work.
2. Stockpiled material shall meet the requirements of SECTION 02190, AGGREGATES.

PART 3 EXECUTION

3.01 PREPARATION

- A. See requirements of related sections.

3.02 APPLICATION

A. PRIME COAT

1. The prime coat, when specified, shall be applied in accordance with the requirements of SECTION 02550, PRIME COAT.
2. A curing period of three (3) days is required between the application of the prime coat and the next application of bituminous material unless otherwise provided for in the Contract Documents or as approved by the ENGINEER.

B. SEAL COAT

1. Each seal coat shall be applied in accordance with SECTION 02552, SEAL COAT. If successive seal coats are to be applied, the previous seal coat shall be maintained and permitted to cure for a period of three (3) days unless otherwise provided for in the Contract Documents or as approved by the ENGINEER.

3.03 PROTECTION

- A. During the period between the application of the prime coat and the seal coat, the primed surface shall be kept in repair. All holes, ravels, and areas deficient shall be patched and repaired with bituminous treated materials, by penetration methods or other approved procedures.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Bituminous material, cover coat material and blotter material shall be measured by the ton.

4.02 BASIS OF PAYMENT

- A. The accepted quantities of bituminous surface treatment shall be paid for at the contract unit price per ton for bituminous material complete in place. No payment for haul of blotter material shall be made. Payment shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Liquid Asphalt (Bit. Surf. Trtmt.)	Ton
Emulsified Asphalt (Bit. Surf. Trtmt.)	Ton
Liquid Asphalt (Prime)	Ton
Cover Coat Material	Ton
Blotter Material	Ton

END OF SECTION

SECTION 02570

ADJUSTING STREET FIXTURES

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of locating and adjusting to grade existing manholes, cleanouts, inlets, water valve boxes, services, fire hydrants, and all other existing street fixtures.

1.02 RELATED WORK

- A. Section 01330 - Survey Monuments and Control Points.
- B. Section 02512 - Plant Mix Pavements.
- C. Section 02515 - Asphalt Patching.
- D. Section 02645 - Fire Hydrants.
- E. Section 02665 - Water Distribution and Transmission Systems.
- F. Section 02700 - Sanitary Sewer Systems.
- G. Section 02725 - Storm Drains and Culverts.

PART 2 PRODUCTS

2.01 MATERIAL

- A. All material such as concrete brick and mortar shall meet specifications as required in the section on the particular material involved, or if the material is not covered in these specifications, the material used for adjusting shall be equal and comparable to that in the existing structure. If extensions for water valve boxes or services and fire hydrants are required beyond the length found to exist, they shall be comparable to that in the existing structure.

PART 3 EXECUTION

3.01 METHOD OF CONSTRUCTION

- A. All existing manholes, inlets, cleanouts and water valve boxes or services shall be brought to grade by either lowering or raising as required in accordance with the details shown on the plans. Where lowering of manholes, cleanouts or inlets is required, care shall be used in removing the top portion of the masonry or pipe. Before the ring and cover is replaced, the top of the masonry on the manhole, cleanout, or inlet must be true to line and grade.
- B. Water valve boxes and services shall be excavated and exposed so as to readily determine whether height adjustment can be made without substituting a longer section. Water valve boxes and services shall be adjusted laterally so the valve stem can be operated by the extension. Water services shall be adjusted by raising or lowering the curb key stop or extension box.
- C. All street fixtures shall be lowered prior to the start of asphalt milling operations. All fixtures shall then be raised to grade following asphalt installation.
- D. All street fixtures shall be adjusted to final grade before the seal coat is applied. Preliminary adjustment may be required to allow placing of base courses and paving over the manholes, cleanout or water valve.
- E. Backfill shall be in conformance with SECTION 02210, EXCAVATION, EMBANKMENT, AND COMPACTION of these specifications. There may be adjustments required in the horizontal location of some existing fire hydrants. At the time of construction staking, any hydrants which require horizontal adjustment shall be located by the CONTRACTOR and the adjusted location shall be staked by the CONTRACTOR as shown on the plans.
- F. There may be minor adjustments required as dimensioned on the plans in the height of some existing fire hydrants to insure that they are at a reasonable height behind the back of curb. At the time of construction staking, any hydrants which require vertical adjustment shall be located by the CONTRACTOR and the adjusted height shall be staked by the CONTRACTOR.
- G. Before final acceptance, all street fixtures shall be cleaned and fire hydrants shall be operational.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Adjustment of existing street fixtures shall be measured by the number of facilities adjusted, complete in place.
- B. Location adjustment for existing fire hydrants shall be measured by the number of existing fire hydrants adjusted horizontally, complete in place.
- C. Vertical adjustment for existing fire hydrants shall be measured by the number of existing fire hydrants adjusted vertically, complete in place.
- D. No separate payment will be made for “New” street fixtures placed as part of the project. Payment for adjustment of “new” street fixtures is included in the installation of said street fixture.

4.02 BASIS OF PAYMENT

- A. Payment shall be made at the contract unit price bid for each item multiplied by the respective number of units adjusted.
- B. Payment shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Adjust Survey Monument	Per Each
Adjust Sewer Manholes	Per Each
Adjust Sewer Cleanouts	Per Each
Adjust Storm Drain Inlets	Per Each
Adjust Water Valve Boxes	Per Each
Adjust Water Services	Per Each
Horizontally Adjust Fire Hydrant	Per Each
Vertically Adjust Fire Hydrant	Per Each

- C. Payment shall constitute full compensation for all materials, excavation, backfill, compaction, cleaning, labor, tools and incidentals necessary to complete each item.

END OF SECTION

SECTION 02645

FIRE HYDRANT ASSEMBLY

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of installation of fire hydrants together with related appurtenances, complete.

1.02 REFERENCES

- A. AWWA C-502: Standard for Dry Barrel Fire Hydrants.
- B. ASTM A242: Standard Specification for High-Strength, Low-Alloy Structural Steel.
- C. Standard Drawing 02645-01

PART 2 PRODUCTS

2.01 MATERIALS

A. DRY-BARREL FIRE HYDRANTS

1. Fire hydrants shall conform to standard for dry barrel fire hydrants, AWWA C-502, and modifications herein specified.
2. Fire hydrants shall have a six (6) inch gate valve at the main connected with a swivel-tee. The fire hydrant shall have a six (6) inch mechanical joint inlet, with a five and one-quarter (5- $\frac{1}{4}$) inch valve opening; the operating nut and caps shall have a one and one-half (1- $\frac{1}{2}$) inch pentagon one and one-half (1- $\frac{1}{2}$) inch high; the fire hydrant shall open to the right (clockwise) with arrow cast into the top of the hydrant. The hydrant itself shall be a bury depth of six (6) feet to finished grade. (Refer to Standard Drawing No. 02645-01).
3. Type of fire hydrant - Mueller Super Centurion 250, ~~or a~~ Clow Medallion, or American AVK 2780 complying with AWWA C502, with a working pressure of 200 PSI or greater.

4. Size of fire hydrant - Six (6) foot bury depth, two (2) each - two and one-half (2-1/2) inch I.D. nozzles and one (1) each - four and one-half (4-1/2) inch I.D. nozzle.
5. Threads - National standard threads.
6. Color - Fire hydrant red.
7. Extensions are only to be used when the BOPU approves them, they shall be Mueller extensions for Mueller hydrants and Clow extensions for Clow hydrant, with a maximum extension length of eighteen (18) inches. The CONTRACTOR shall supply and be responsible for the installation of the extension.
8. Hydrants shall be of the "Compression" type with safety flange and safety stem coupling above the ground line so that they can be repaired without shutting off the water. Hydrants shall be of the dry top design with two (2) or more "O" rings sealing the water from the operating mechanism. The portion of the hydrants above the ground line shall be painted red. Hydrants shall be furnished for six (6) foot cover unless specified otherwise in the Special Provisions.
9. Fire hydrant barrel bolts and nuts, and shoe bolts and nuts, shall be a type 304 stainless steel. The mechanical joint fitting bolts and nuts shall be ASTM A242.

PART 3 EXECUTION

3.01 INSTALLATION

- A. All hydrants shall stand plumb (within one-thirty-seconds ($\frac{1}{32}$) inch per five (5) feet) with the pumper nozzle facing the street. Hydrant shall be set with the bury line set at finished grade. All parts of the fire hydrant that are below ground shall be double wrapped with polyethylene encasement. See Standard drawing 02665-02.
- B. Drainage shall be provided at the base of the hydrant by placing clean gravel under and around the base of the hydrant. Sufficient gravel shall be used to provide a minimum of one (1) foot on all sides from the base of the hydrant to the point at least six (6) inch above the drain opening. A single layer of eight (8) mil. plastic

shall be placed over drain rock to provide for separation between drain rock and backfill. Hydrant shall be braced against unexcavated earth at the end of the trench with concrete thrust block. The hydrant shall have a thrust block thirty-three (33) inches by thirty-nine (39) inches with a minimum length of thirty (30) inches. Hydrant installation shall be in accordance with BOPU Standard Drawing No. 02645-01. The hydrant shall be supported at the base by a concrete pad of 18"x18"x6" dimension.

PART 4 METHOD OF MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Measurement of fire hydrants assemblies shall be made by numerical count each.

4.02 BASIS OF PAYMENT

- A. Payment for fire hydrant assemblies shall be made at the Contract Unit Price bid each; which price shall include furnishing and installing the fire hydrant, swivel tee, gate valve, Valve Box Adaptor II, pipe and auxiliary gate valve box, all additional excavation, backfill, and special compaction required for the installation, thrust and anchor blocking, drain gravel, and all other work necessary or incidental for completion of the item.
- B. Payment shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Fire Hydrant	Each

END OF SECTION

SECTION 02665

WATER DISTRIBUTION AND TRANSMISSION SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of construction of water mains, including fittings, water valves, water services, water service piping, tapping the main, corporation stops, curb stops, and other appurtenances normally used for water supply and distribution systems, including furnishing and installing pipe, water valves, and fittings, construction of thrust blocking, testing, cleaning and disinfection of mains and other related work.

1.02 REFERENCES

- A. ASTM A242: Standard Specification for High-Strength, Low-Allow Structural Steel.
- B. AWWA C-104: Cement Mortar Lining for Ductile Iron Water Pipe and Fittings.
- C. ANSI/AWWA C-105/A21.5: Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.
- D. AWWA C-110 and AWWA C-153: Standard for Ductile-Iron and Gray-Iron Fittings, 3" through 48", for Water and Other Liquids.
- E. AWWA C-111: Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
- F. AWWA C-116/A21.16-09: Protective Fusion Bonded Epoxy Coating for the Interior and Exterior Surfaces of Ductile Iron and Gray Iron Fittings.
- G. AWWA C-151: Ductile Iron Pipe, Centrifugally Cast, for Water and Other Liquids.
- H. AWWA C-500: Gate Valves for Water and Sewerage Systems.
- I. AWWA C-504: Rubber-Seated Butterfly Valves.
- J. AWWA C-509: Resilient-Seated Gate Valves for Water and

Sewerage Systems.

- K. AWWA C-550: Protective Interior Coatings for Valves and Hydrants.
- L. AWWA C-600: Installation of Ductile Iron Water Mains and Their Appurtenances.
- M. AWWA C-651: Disinfecting Water Mains.
- N. AWWA C-900: PVC Pressure Pipe, 4" Through 12", for Water.

1.03 QUALITY ASSURANCE

- A. The CONTRACTOR shall be required to furnish certification by the manufacturer of the pipe to be furnished on this project, certifying that the pipe and fittings comply with applicable specifications. REQUIRED CERTIFICATION SHALL ACCOMPANY EACH DELIVERY OF MATERIAL.
- B. All pipe shall be clearly marked with type, class and/or thickness as applicable. Lettering shall be legible and permanent under normal conditions of handling and storage.
- C. The CONTRACTOR shall provide the BOPU with two (2) complete sets of submittals for all materials incorporated into the work. No materials shall be incorporated into the work until the BOPU or its designee has provided written approval within ten (10) calendar days of receipt of the related submittal.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All materials furnished and used shall be new and shall be less than two (2) years old since date of manufacture. No used material shall be allowed. All material used in water systems must be NSF approved.
- B. PIPE
 - 1. Pipe used in water main construction shall be in accordance with the following specifications:

C. DUCTILE IRON PIPE

1. Ductile iron pipe shall be no less than Class 52 and shall conform to the provisions of AWWA C-151.
2. Pipe joints shall be mechanical joint or “Push-On” joints conforming to AWWA C-111.
3. The interior of the pipe shall have a cement mortar lining conforming to the requirements of AWWA C-104. The outside surface of pipe designed for underground service shall receive a bituminous coating approximately one (1) mil thick.
4. All ductile iron pipe installed shall be double wrapped with polyethylene encased and shall meet the requirements of AWWA C-105/A21.5-88. Fire hydrant fittings, valves and valve boxes, shall be double wrapped. See Standard Drawing 02665-02.

D. POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

1. PVC pipe for the water mains shall meet the requirements of AWWA C-900, made to ductile iron O.D.’s for “Push-On” joints.
2. PVC pressure pipe shall meet all requirements and specifications as set forth in Attachment A, Standards and Specifications for PVC pressure pipe, as the same may be hereafter amended, attached hereto and incorporated by this reference as though fully set forth herein.

E. CASING PIPE

1. The casing pipe used for either water lines, sanitary sewer lines, or storm sewer lines shall be C-900 PVC DR-25 water pipe for twelve (12) inches and smaller and C-905 DR-41 water pipe for twelve (12) inches and larger, with a minimum inside diameter to accommodate the carrier pipe. Casing chalks shall be used on the carrier pipe, spaced according to manufacturer’s recommendations and the ends of the casing pipe properly sealed. (Refer to Standard Drawing No. 02665-01).

F. FITTINGS AND COUPLINGS

1. Fittings used for water mains shall be ductile iron Class 250 conforming to AWWA C-110 or AWWA C-153, Gray-iron and Ductile Irons fittings for Water and Other Liquids. Joints for Ductile Iron and PVC pipe shall be mechanical joint or Push-On joints conforming to AWWA C-111. The interior and exterior surfaces of the fitting shall have an epoxy coating in accordance with AWWA C-116. Couplings for making connections to existing pipelines shall be ductile iron solid sleeves.
2. ASTM A242, bolts and nuts shall be used for all fittings installed.
3. Acceptable products include: EBAA Iron Mega-Lug series 1100, 1100SD for twelve (12) inches and smaller on DIP, and series 2000 PV, 2000SV for twelve (12) inches and smaller on C-900 PVC. Star Grip Mega Lug 3000 for twelve (12) inch and smaller DIP and Star Grip Mega Lug 4000 for twelve (12) inch and smaller PVC and Tyler Union Tuff Grip TLD Series for DIP and Tuff Grip Series TLP for PVC.

G. AIR RELIEF VALVES, BLOW OFFS, FLUSHING HYDRANTS

1. These shall be of the same material as shown on the plans and shall meet pressure and flow requirements equal to or exceeding the main installation or as required by the manufacturer, and shall be pre-approved by the BOPU.

H. BUTTERFLY VALVES

1. Butterfly valves for use in the water distribution system shall be Class 150 rubber seated, tight closing butterfly valves conforming to AWWA C-504. Butterfly valves shall be furnished with mechanical joint ends and lubricated screw type operators designed for underground service. ASTM A242, bolts and nuts shall be used for valve installation.
2. Rubber valves seats shall be replaceable without disassembling the valve and shall not be interrupted by the shafting. Rubber seats may be retained on the disc edge by stainless steel clamping in lieu of bonding to the valve body. Shaft packing shall be of the self-adjusting permanent type.

3. Operators for underground service shall be permanently lubricated screw-type operators, totally enclosed and of watertight construction. Overload protection shall be incorporated into the operator allowing the application of four hundred-fifty (450) foot-pounds input torque at full-open and full-closed positions without damage to the operator or valve. A two (2) inch square wrench nut and valve box shall be provided for operating the valve. Valves shall open clockwise and shall have an arrow imprinted into the operating nut showing the direction for opening the valve.
4. Certification of performance, leakage and hydrostatic tests as described in Section 13 of AWWA C-504 shall be furnished when the shipment arrives. Valves shall be the product of a manufacturer having a minimum of five (5) years experience in the manufacture of water works and distribution valves. Butterfly valves shall be a Clow, M&H, Pratt, or Mueller.
5. Rubber seated butterfly valves' interior parts and surfaces shall be coated in accordance with AWWA C-550.
6. Butterfly valves shall be used for applications sixteen (16) inches and larger.

I. RESILIENT SEATED GATE VALVES

1. All gate valves supplied for the Cheyenne system shall be Resilient Seated Gate Valves and shall be ductile iron body with non-rising stems with design, construction, and pressure rating conforming to AWWA C-509, standard for Resilient Seated Gate Valves with modifications specified herein.
2. Waterway shall be smooth and shall have no depressions or cavities in seat area where foreign material can lodge and prevent closure or sealing.
3. Stem seals shall be double "O" ring seals designed so that the seal above the stem collar can be replaced with the valve under pressure in full open position.
4. Resilient seated gate valves for underground installation shall have two (2) inch square wrench nut for key operation. All valves shall open clockwise and shall have

an arrow imprinted into the operating nut showing the direction for opening the valve.

5. The resilient seated gate valve's interior parts and surfaces shall be coated in accordance with AWWA C-550.
6. All gate valves supplied for use in the Cheyenne system (for sizes three (3) inch through twelve (12) inch shall be manufactured by Clow, Mueller, M&H, American Flow Control Model AFC-2500, U.S. Pipe Metroseal 250 or American AVK series 65. ASTM A242, bolts and nuts shall be supplied and used for the installation.
7. The resilient seated gate valves shall have resilient seated wedges and shall have a working pressure rating of no less than two hundred (200) psi.
8. Bonnet, stuffing box and wrench nut, bolts and nuts shall be type 304 stainless steel.

J. VALVE BOXES

1. Valve boxes shall be cast iron, five and one-quarter (5-1/4) inch diameter I.D., adjustable valve boxes. Valve boxes shall be of the adjustable type and of sufficient length for the pipe bury. The cast iron cover of the valve box shall have the word "Water" stamped thereon. All valve boxes shall be as manufactured by Tyler or D&L Products, Starr, Castings, Inc. or an approved equal. The valve box shall be installed with a Valve Box Adaptor II, as manufactured by Adaptor Inc., or approved equal, placed on top of the valve.

- K. All other valves such as, but not limited to, PRV's air relief, check valves and backflow preventers shall be approved by the BOPU prior to their use and shall be as shown on the plans.

L. WATER SERVICE LINES

1. Pipe used in water services line construction (two (2) inch in diameter or less) shall be copper, and shall conform to the following specifications:
 - a. Copper Service Pipe shall be Type K soft, conforming to Federal Specification WW-T-799 or ASST, B88-62.

2. The service line shall be a continuous piece (no splices) from the corporation stop to the curb stop, or as otherwise approved by the BOPU.

M. CORPORATION STOPS

1. Corporation stops for PVC and DIP mains shall be brass with CC threads and a flared fitting and shall be equal in quality to Mueller B-25000, B-25008, or A.Y. McDonald 4701B or 4701BQ or Ford F-B600, FB-1000Q. All corporation stops installed on ductile iron water mains shall be installed with an insulator coupling.

N. SERVICE UNIONS

1. Mueller, A.Y. McDonald, & Ford flared and compression connections may be used for repairs to service lines, and for the construction of service lines exceeding the length of a standard roll of copper.

O. SERVICE LINE TAPPING SADDLES

1. Service Saddles for Ductile Iron Pipe:
 - a. Tapping saddles for one and one-half (1-½) and two (2) inch service shall have double strap, brass/bronze saddle or epoxy coated ductile iron saddle, neoprene gasket with CC corporation threads:
 - 1) Ford style 202B.
 - 2) A.Y. McDonald style 3825.
 - 3) Smith Blair style 313.
2. Service Saddles for C-900 PVC Pipe:
 - a. Tapping saddles for three-quarter (¾) to two (2) inch service shall have doubled stainless steel straps, epoxy coated saddle, neoprene gasket with CC corporation threads.
 - 1) Ford style FCD202.
 - 2) Smith Blair style 317.

3) A.Y. McDonald style 4855A

P. CURB STOPS

1. Curb stops shall be one-quarter ($\frac{1}{4}$) turn bronze ball-valve type as manufactured by A.Y. McDonald, or Mueller or Ford. Curb stops shall be set on a concrete support block and shall be located one (1) foot outside of the property line. The three-quarter ($\frac{3}{4}$) to two (2) inch curb stops shall have compression fitting and shall equal a Mueller B-25209, A. Y. McDonald 6100T, or a Ford B44-333Q. Adequate and appropriate stop boxes such as McDonald 5601, or approved equal, shall be installed with the curb stop.

Q. METERS AND PITS (See Standard Drawings)

1. All water meters shall be provided by the BOPU.
2. It is preferred that all meters one and one half ($1\frac{1}{2}$) inch and less be installed in a building.
3. When meters pits are used, the pit shall be 24" x 48" with an aluminum double lid cover for meters one (1) inch and smaller. Meter yokes shall be Ford L-Bar with drain. When the meter is one and one half ($1\frac{1}{2}$) inch or larger, the pit shall be a concrete vault with a twenty-four (24) inch cover. See Standard Drawing 02665-12.
4. When meters are placed in a pit or vault, the pit or vault shall be approved by the BOPU prior to installation.
5. If the meter is one and one-half ($1\frac{1}{2}$) or two (2) inch, see Standard Drawing No. 02665-17, and meters larger than two (2) inch, see Standard Drawing No. 02665-18.
6. In areas subject to vehicular traffic, the meter pit lid must be a traffic rated lid, see Standard Drawing No. 02665-12.
7. All meters two (2) inches or larger shall be installed in a pit or vault in accordance with Standard Drawing 02665-17.

R. BACKFLOW PREVENTERS

1. All new water services will have backflow preventers

installed as required by the International Plumbing Code, DEQ, Chapter 12, Section 14-i and the BOPU Rules & Regulations for backflow prevention. (Ref. Manual of Cross Connections and Control, 9th edition, University of Southern California.)

2. Backflow preventers for residences shall be installed inside the building to provide for proper operation of the device. When backflow devices, shut off valves, or pressure reducing valves are placed in a crawl space, these devices shall be no further than three (3) feet from the opening to the crawl space.
3. For three-quarter ($\frac{3}{4}$) and one (1) inch meter size, a Wilkins double check valve 950L (or equivalent) shall be installed.
4. A properly sized expansion tank, as specified by the manufacturer, shall be installed with the backflow preventer to provide a safety factor for expansion within the customer's water system caused by heated water in a confined system.
5. For services larger than three-quarter ($\frac{3}{4}$) inch diameter, the specified backflow prevention device shall be installed as required by the BOPU Rules and Regulations, and the International Plumbing Code for backflow prevention and State of Wyoming DEQ.
6. All exterior hose bibs, including exterior yard hydrants shall have a self draining vacuum breaker installed to protect the customer and the BOPU distribution system.
7. The hose bib vacuum breaker shall be the Arrowhead Model 59ABP (or equivalent). This backflow preventing device is designed specifically for use on frost-proof wall hydrants and buried yard hydrants, and provides freeze protection and health protection from potentially contaminated water. Designed with a break-a-way set screw to prevent vandalism. Rough brass finish. Meets ASSA Standards 1019 and 1011 and is listed with IAPMO individually boxed. Made in the USA.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. GENERAL

1. Pipe shall be installed in accordance with these specifications for installing the type of pipe used. The CONTRACTOR shall provide all tools and equipment including any special tools designed for installing each particular type of pipe used.
2. Service pipe shall be of the size or sizes designated in the plans.

B. DEWATERING OF TRENCH

1. Where free standing water is encountered in the trench, it shall be completely dewatered in compliance with WYPDES and WDEQ during pipe laying operations to keep the trench bottom dry at all times and so maintained until the ends of the pipe are sealed and the trench is completely backfilled and all other necessary provisions are made to prevent floating of the pipe.

C. RESPONSIBILITY FOR MATERIAL

1. The CONTRACTOR shall be responsible for all material furnished by him and shall replace at his own expense all such material found defective in manufacture or damaged. This shall include the furnishing of all materials and labor required for the placement of installed material discovered damaged or defective prior to the final acceptance of the work, or during the guarantee period.
2. The CONTRACTOR shall be responsible for the safe and proper storage of material furnished by him or to him and accepted by him, and intended for the work, until it has been incorporated in the completed project. The interior of all pipe and other accessories shall be kept free from dirt and foreign matter at all times.

D. HANDLING OF PIPE

1. All pipe furnished by the CONTRACTOR shall be

delivered and distributed at the site by the CONTRACTOR. Pipe, fittings, specials, valves and accessories shall be loaded and unloaded by lifting with hoists to avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe shall not be skidded or rolled against pipe already on the ground.

2. Pipe shall be so handled that the coating and lining will not be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by the CONTRACTOR at his expense in a manner satisfactory to BOPU, or the material will be rejected for use.

E. LAYING OF PIPE

1. Before installation, the pipe and pipe coating shall be inspected for defects. Any damage to pipe coatings shall be repaired as recommended by the pipe manufacturer before laying the pipe. If a satisfactory repair can not be found, the pipe will be marked and removed from the site.
2. All pipe shall be laid and maintained to the required lines and grades with fittings and valves at the required locations. All water mains shall be buried no less than five and one-half (5.5) feet and no more than seven (7.0) feet below final finished grade.
3. Grade and alignment on ungraded streets will be given from hubs set parallel to the line of the pipe, and on graded streets, the grade and alignment shall be taken from established points on the existing curbs or sidewalks, when directed by the ENGINEER. Trenches for the pipe shall be opened in accordance with the lines and grades given or to the standard depth of cover provided on the plans. The survey staking shall consist of line and grade stakes adequate to keep the pipeline to the plan lines and grade. CONTRACTOR shall transfer lines and grades to the pipe from marks set by a professional surveyor or from existing concrete curbs or sidewalks as an incidental part of his work. Streets, alleys, and/or easements shall be cut to final subgrade elevation before the construction of the water or sewer is to begin.
4. Wherever obstructions not shown on the plans are encountered, during the progress of the work and interfere to such an extent that an alteration in the plan is required,

ENGINEER shall be contacted to change the plans and order and deviation from the line and grade or arrange with the owners of the structures for the removal, relocation, and reconstruction of the obstructions. The BOPU shall approve all such changes before they are made.

5. Water Mains shall be installed along the north and west sides of the street, at least ten (10) feet away from the sewer main, or at a different location if preapproved by the BOPU.
6. All pipe, fittings, and valves shall be carefully lowered into the trench piece by piece by means of a derrick, slings or other suitable tools or equipment, in such a manner as to prevent damage to pipe materials and protective coatings and linings. Under no circumstances shall materials be dropped or dumped into the trench.
7. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. During laying operations, no debris, tools, clothing or other materials shall be placed in the pipe. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug.
8. Long radius curves, either horizontal or vertical, may be laid with standard pipe by deflections at the joints. If the pipe is shown curved on the plans and no special fittings are shown, CONTRACTOR can assume that the curves can be made by deflection of the joints with standard lengths of pipe. If shorter lengths are required, the plan will indicate maximum lengths that can be used.
9. Where field conditions require deflection or curves not anticipated by the plans, ENGINEER (with pre-approval from the BOPU) will determine the methods to be used.
10. Maximum deflections at pipe joints for various types of pipe shall not exceed the applicable material and joint specifications of AWWA nor shall they exceed the recommendations of the pipe manufacturer. When rubber gasketed pipe is laid on a curve, the pipe shall be jointed in a straight alignment and then deflected to the curved alignment. Trenches shall be made wide on curves for this purpose. Refer to Attachment "A", Standards and Specifications for PVC Pressure Pipe for additional

requirements.

11. Reaction or thrust blocking shall be applied at all tees, plugs, caps and at bends deflecting eleven and one-quarter (11-¼) degrees or more, or movement shall be prevented by attaching suitable metal rods or straps as approved by ENGINEER and the BOPU. Reaction blocking shall be concrete having a compressive strength of not less than four thousand (4,000) pounds per square inch at twenty-eight (28) days. Blocking shall be placed between solid ground and the fitting to be anchored; the area of bearing on the pipe and on the ground shall be as shown on Standard Drawing No. 02665-03. The blocking shall be so placed that the pipe and fitting joints will be accessible for repair. Minimum of eight (8) mil polywrap shall be used between the concrete and the pipe or fitting.
12. Thrust blocks shall not be placed under stress until they have cured for a minimum of five (5) days. If pre-approved, fast curing additives are added, the minimum curing time shall be three (3) days. The thrust block shall be prevented from freezing during curing.
13. The cutting of pipe for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or coating and so as to leave a smooth end at right angles to the axis of the pipe. The flame cutting of pipe by means of an oxyacetylene torch shall not be allowed.
14. Tracer Wire shall be a #10 THHN blue plastic coated solid copper wire or Copperhead #12 AWG HS-CCS blue HDPE 30 mil INSULATION coated wire run continuously. The tracer wire shall be fastened securely to the top of the pipe with a two (2) inch wide vinyl plastic electrical tape seven (7) mil. All splices shall be made with a (3m R/Y connector), capable of handling three (3) #10 wires or equal. At every fire hydrant location a Mini Glen Four test station or BOPU approved equal shall be installed one (1) foot in front of the fire hydrant (not within the sidewalk), connected to the pipe tracer wire. When tracer wire is run up the valve box at the end and beginning of the project; run the tracer wire up the outside of the valve box and drill a hole six (6) inches below the top of the valve box lid and coil eighteen (18) inches of wire in the valve box top. See Standard Drawing 02665-22.

15. DEWATERING

- a. Where ground water is encountered in excavation, it shall be removed to avoid interfering with pipe laying and other construction operations.
- b. Discharge from dewatering operations shall be per WDEQ and WYPDES requirements and approval and directed to approved natural drainages or storm sewers as appropriate.

16. TRENCH DIMENSIONS

- a. Trench dimensions shall be as specified below:
 - 1) Trench width from the trench bottom to a point one (1) foot above the top of the pipe shall be no less than the outside diameter of the pipe plus twelve (12) inches, and not more than twenty-four (24) inches plus the pipe outside diameter. The width of the trench from the bottom of the trench of the existing ground surface shall be adequate to allow proper compactive effort along both sides of the pipe.
 - a) Depth of Trench. Trench depth shall be as required for the invert grade or pipe bury shown on the plans. In all cases the depth of the water main shall be between five and one-half (5.5) and seven (7.0) feet. Care shall be taken not to excavate below the required depths.
 - b) When soft or unstable material or rock is encountered at the subgrade which will not uniformly support the pipe, such material will not uniformly support the pipe, such material shall be excavated to additional depth as necessary and backfilled with Type 2 Bedding material.

- 2) Trench Bottom.
 - a) The bottom of the trenches shall be accurately graded to the line and grade shown on the plans. Bedding material shall provide uniform bearing and support for each additional section of the pipe at every point along its entire length. Bell holes and depressions for joints shall be dug after the trench has been graded, and shall be only of such length, depth, and width as required for properly making the particular type joint. Over excavation shall be backfilled and compacted with Type 2 bedding material at the CONTRACTOR's expense.

17. TIME OF OPEN TRENCHES

- a. The CONTRACTOR shall be required to conduct his work so that trenches will remain open a minimum possible time. Trenches shall not be left open during times of freezing weather.
- b. No trench excavations shall begin until approved compaction equipment is at the site where the excavation is to take place. All backfilling and compacting shall be completed in all trenching and structural excavations within a maximum distance of two hundred (200) feet behind the end of newly installed pipe and the maximum distance between the newly installed pipe and the excavator shall be two hundred (200) feet. For each work group consisting of trench excavator, a pipe laying crew, and a backfilling and compacting crew, the maximum allowable open ditch at any time shall be four hundred (400) feet.
- c. Certain conditions may necessitate the closing of certain sections of trench prior to daily, weekend or holiday shutdown.

F. SEPARATION OF WATER MAINS AND SEWERS

1. Parallel Installation

- a. Normal Conditions - Water mains shall be laid at least ten (10) feet horizontally from any sanitary sewer, storm sewer, or manhole. The distance shall be measured as the clear or edge-to-edge distance.
- b. Unusual conditions - When local conditions prevents horizontal separation of ten (10) feet, a water main may be laid closer to a sanitary sewer, storm sewer, or manhole, provided that:
 - 1) The bottom of the water main is at least eighteen (18) inches above the top of the sanitary or storm sewer; or where eighteen (18) inches vertical separation as noted above cannot be obtained, the sewer shall be:
 - a) Constructed of materials and with joints that are equivalent to water main standards of construction and tested for water tightness; or
 - b) Either the water main or the sewer main shall be placed in a separate casing pipe. The casing pipe shall be C-900 PVC-DR-25 water pipe for twelve (12) inches and smaller and C-905 DR-41 water pipe for twelve (12) inches and larger.

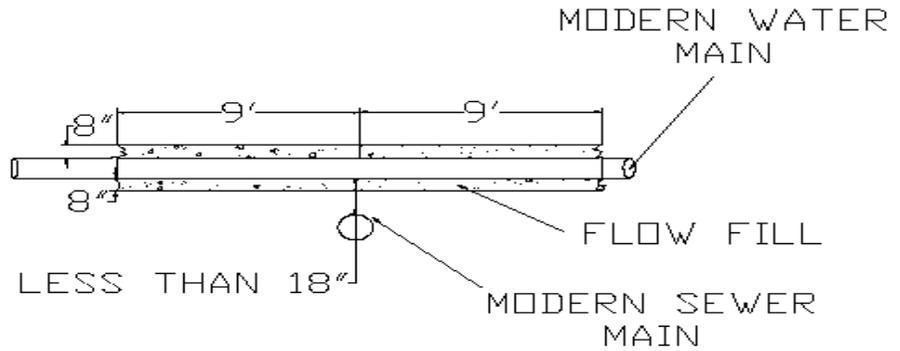
2. Crossing

- a. Normal conditions - Water mains crossing sanitary sewers, sanitary sewer service lines, or storm sewer shall be laid above to provide a vertical separation of at least eighteen (18) inches. The distance shall be measured from the top of the sewer pipe to the bottom of the water pipe.
- b. Unusual conditions - When local conditions prevent a vertical separation of at least eighteen (18) inches as noted above, the following construction shall be

used:

- 1) Definitions:
 - a) Modern water main materials - DIP, C-900 water pipe with rubber gaskets.
 - b) Non-modern water main materials - lead joint cast iron pipe.
 - c) Modern sewer main materials - PVC rubber gasket pipe, glued pipe is not acceptable.
 - d) Non-modern sewer main materials - VCP grouted pipe, concrete grouted pipe.
 - e) Flow fill - see SECTION 02225, TRENCH BACKFILL for construction standards for mixes.
- 2) Fire hydrants must be at least ten (10) feet away from storm drains, storm drain inlets, sanitary sewers and sanitary sewer appurtenances at all times.
- 3) Water mains and sanitary sewer main crossings:
 - a) When constructing a modern water main and it crosses over an existing modern sewer main and the pipes are less than eighteen (18) vertical inches of each other:
 - (1) Center a full joint of water main over sewer main.
 - (2) Flow fill the water main a distance of nine (9) feet each side of the sewer main.

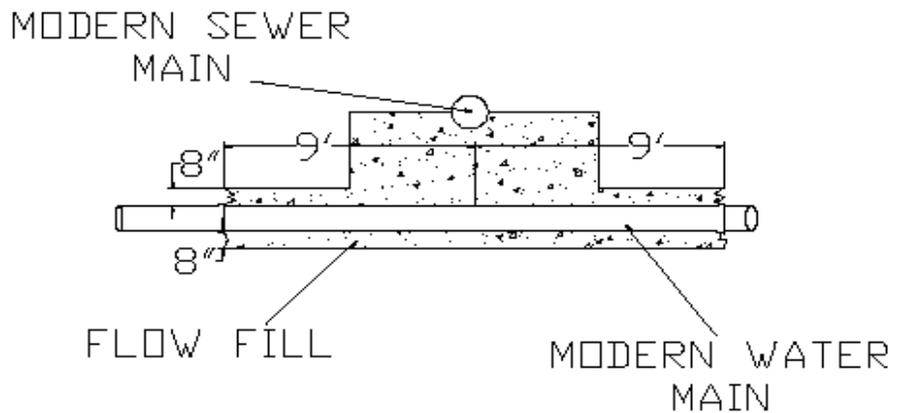
figure a



b) When constructing a modern water main that crosses under a modern sewer main or when constructing a modern sewer main that crosses over a modern water main:

- (1) When constructing a modern water main; flow fill the water main that goes under the sewer main nine (9) feet each side of the sewer main, also encasing the modern sewer main where it crosses the excavation for the new water line.

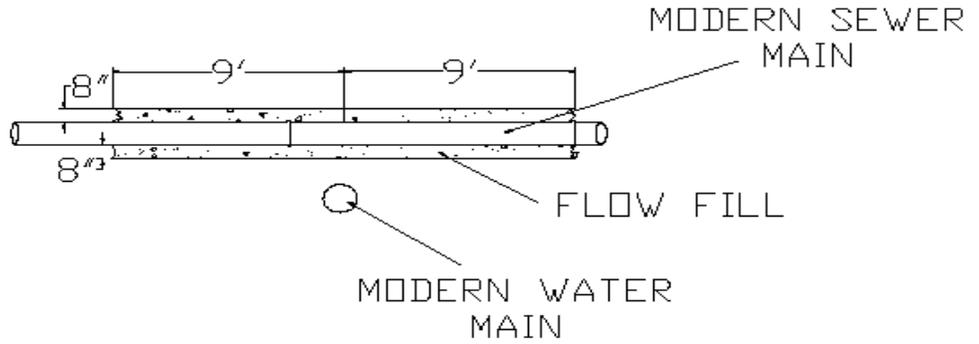
figure b-1



- (2) When constructing a modern sewer main; flow fill the

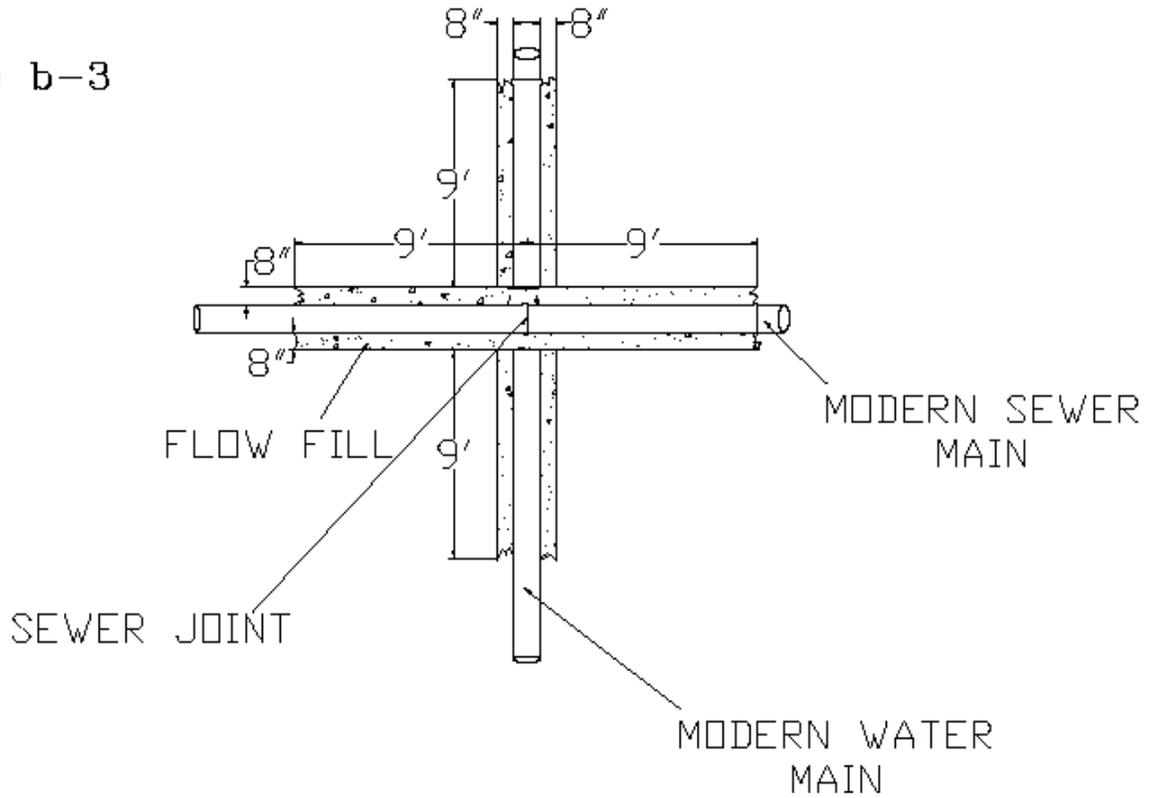
sewer main that goes over the water main nine (9) feet each side of the water main.

figure b-2



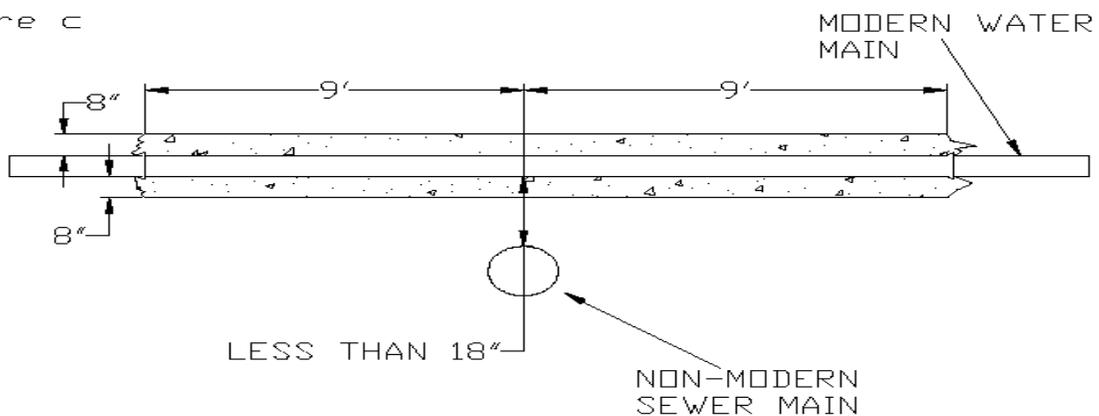
- (3) If a modern sewer main joint is directly over the water main then flow fill both mains nine (9) feet in all directions.

figure b-3



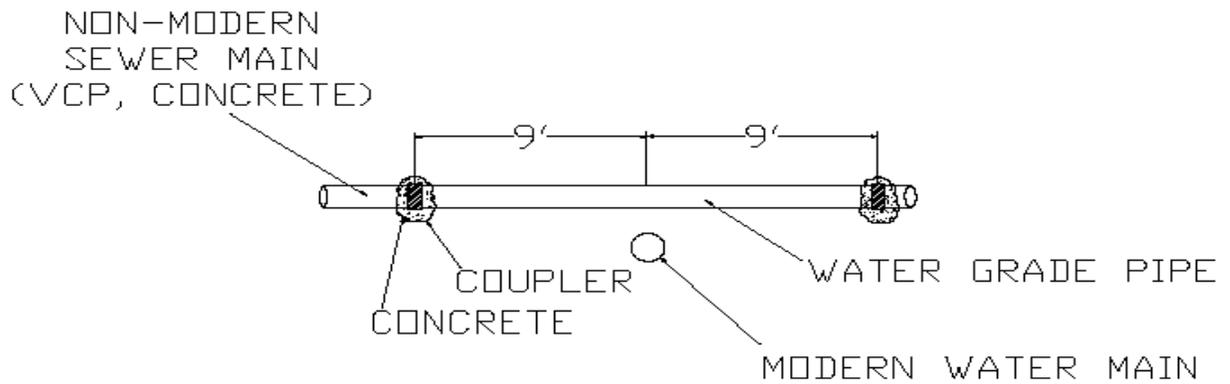
- c) When constructing a modern water main that crosses over a non-modern sewer main (VCP, Concrete) and has less than eighteen (18) vertical inches of separation between mains:
- (1) Center a full joint of water main over sewer main.
 - (2) Flow fill the modern water main a distance of nine (9) feet each side of the non-modern sewer main.

figure c



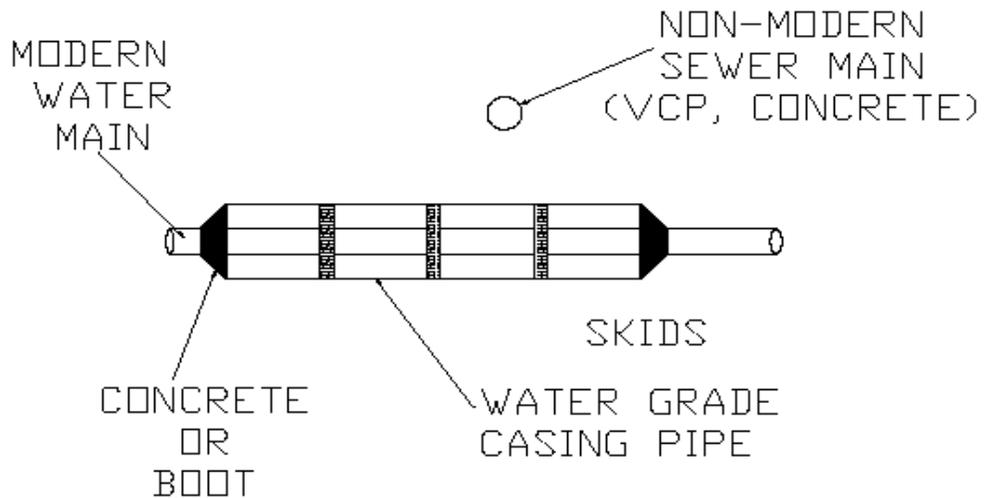
- d) When constructing a modern water main that crosses under a non-modern sewer main (VCP, Concrete):
- (1) Replace the non modern sewer main with water grade pipe (DR-25 C-900 or greater, encasing the couplers in concrete) nine (9) feet each side of the water main.

figure d-1



- (2) Encase the water main pipe nine (9) feet each side of the sewer with a water grade, casing pipe (using skids, boots, etc.).

figure d-2



- 4) Water mains and storm sewer main crossings:
 - a) When constructing a water main that crosses under a storm sewer lateral or collection box the main is flow filled nine (9) feet each side of the box or storm sewer lateral.

- b) When constructing a storm sewer lateral or collection box over a water main, the lateral or collection box is encased with flow fill nine (9) feet on each side of the water main.
- c) When constructing a water main that crosses under a forty-eight (48) inch or larger storm sewer; encase the water main using skids, boots, and appropriate water grade casing pipe.
- d) When constructing a water main that crosses under a forty-seven (47) inch and smaller storm sewer; flow fill the water main nine (9) feet each side of the forty-seven (47) inch or smaller storm sewer pipe up to the haunch of the storm sewer, maintaining a minimum eighteen (18) inch separation.
- e) When constructing a forty-seven (47) inch and smaller storm sewer that crosses over an existing water main; flow fill the storm sewer nine (9) feet each side of the water main, maintaining a minimum eighteen (18) inch separation:
 - (1) If separation between the mains is less than eighteen (18) inches, then two (2) inches of Dow Chemical Company Styrofoam 60 High Load 60 (HL) meeting ASTM D1621, ASTM C272, ASTM C177 or ASTM C518 or equal must be placed between the two (2) pipes in addition to the flow fill.

3.02 SETTING VALVES AND VALVE BOXES

- A. All valves and valves boxes shall be double wrapped with polyethelene wrap, see Standard Drawing 02665-02.

- B. Gate valves shall be set and jointed to the pipe in the manner specified for pipe laying and jointing. Valves shall be set with operating nut vertical. Valve boxes shall be centered and plumb over the operating nut by use of a Valve Box Adaptor II, as manufactured by Adaptor Inc., or approved equal, and shall be set so that no shock or stress will be transmitted to the valve.
- C. Special care needs to be taken when installing Butterfly Valves onto pressure Class 200 PVC water pipe (ANSI-AWWA C-900). It is advisable to take the following precautionary steps to assure proper valve performance:
 - 1. Cut the pipe that is to connect to the valve in a clean, straight and square manner, preventing spurs and ridges that might interfere with the operation of the valve.
 - 2. It is prudent on Class 200 PVC water pipe to bevel the inside edge slightly (removing approximately one-quarter (1/4) inch of the insider corner).
 - 3. Tighten all bolts on the follower ring and restraining gland uniformly to prevent egging.
 - 4. Test the valve operation after installation to assure proper operation before backfilling.
- D. Valve boxes shall be centered and plumb over the valve operating nut by use of a Valve Box Adaptor II, as manufactured by Adaptor Inc., or approved equal. Tops of valve boxes shall be set flush with the ground surface or street surfacing unless otherwise approved by the BOPU. The valve box shall have a twenty-four (24) inch square concrete collar at the top. During construction of the water main and prior to the work to pave the street, the valve boxes shall be set to a grade that is three (3) inches below the top of the final base elevation. The valve boxes shall be raised to finished grade within thirty (30) days of completion of paving. No Certificate of Occupancy shall be issued for area until all valve boxes have been permanently raised to the surface.

3.03

SERVICE CONNECTIONS

A. GENERAL

- 1. Once the required tap permits are obtained from the BOPU, the CONTRACTOR shall provide all work materials and

materials for the complete service line installation, including trench excavations and backfill; making sure the water main taps for taps two (2) inch and smaller; finishing and installing the corporation stop with insulator coupler, curb stop and box, service clamp where necessary, and service line with fittings as required to make the connection to the stops. The service line adjacent to the water main shall be bent slightly into a figure "S" to avoid a rigid connection. All services shall have a minimum of five (5) feet of cover. The service line shall be installed at right angles to the main, unless otherwise approved by the BOPU.

2. CONTRACTOR shall furnish and install the service pipe from the main to the property line with a curb stop and extension service box installed at the property line.
3. Installation of water service lines shall be in accordance with the Standard Drawings.

B. SEPARATIONS BETWEEN WATER AND SEWER SERVICES

1. The service connection shall be installed such that a minimum horizontal separation, measured center to center, of ten (10) feet is maintained, or as specified elsewhere in this section.

C. TAPPING

1. Actual tapping of the water mains for three-quarter ($\frac{3}{4}$) to two (2) inch sizes shall be made by the CONTRACTOR. The CONTRACTOR shall be licensed by the CITY and shall have been certified by BOPU. Certification is subject to renewal every twenty-four (24) months. The certified person must be on the job site during all tapping operations. Taps three (3) inch and larger will be installed by the BOPU after all required tap permits are obtained. All taps must be inspected before backfill.
2. Water taps must be a minimum of twenty-four (24) inches apart and they must be staggered.
3. Tapping directly into the barrel of PVC and AC pipe shall be done using a service saddle. Refer to Attachment "A" Standards and Specification for PVC pressure pipe and additional requirements.

4. Tap permits must be obtained from the BOPU before any taps can be installed.
5. Tapping Procedures (three-quarter ($\frac{3}{4}$) and one (1) inch sizes):
 - a. To perform the preferred method of tapping polyethylene encased Ductile Iron Pipe; wrap two (2) or three (3) layers of polyethylene compatible adhesive tape completely around the pipe to cover the area where the tapping machine and chain will be mounted.
 - b. Mount the tapping machine on the pipe area covered by the polyethylene tape. Then mark the tape and install the corporation stop directly through the tape and polyethylene.
 - c. After making the direct service connection, inspect the entire circumferential area for damage and make any necessary repairs to the pipe or poly wrap.

3.04 VALVE THRUST BLOCKS

- A. Valves requiring thrust blocks shall be installed in accordance with and as detailed on the Standard Drawing 02665-03 and 02665-04.

3.05 PIPE JOINTING

A. RUBBER GASKET "PUSH-ON" JOINTS

1. Jointing of pipe and fittings with a rubber gasket "push-on" joint shall be as recommended by the manufacturer. The rubber gasket and gasket seat inside the bell shall be wiped clean with a cloth. A thin film of lubricant (NSF approved for drinking water), furnished with the pipe, shall be applied to the inside surface of the gasket. The plain end of the adjoining pipe shall be wiped clean and inserted into the bell a sufficient distance to make contact with the gasket. The plain end shall then be forced "home" by the use of a crow bar, fork tool, or jack assembly.

B. MECHANICAL JOINTS

1. The inside of the bell and the outside of the spigot of the

mechanical joint fittings shall be brushed thoroughly with a wire brush to remove all loose rust or other foreign material just prior to assembly. The cleaned surfaces shall be brushed with an NSF approved lubricant just prior to slipping the gasket over the spigot end and into the bell.

2. The spigot end of the pipe or fitting shall be accurately centered in the bell before jointing is begun. After the gasket is in place, the gland shall be brought up toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the socket. Bolts shall be partially tightened alternately around the socket maintaining approximately equal tension until the final tension is reached.
3. The normal range of bolt torques to be applied to the cast iron bolts in the joints shall be as follows:

Bolt Size (in)	Range of Torque (ft. lb)
5/8	40 - 60
3/4	60 - 90
1	70 - 100
1-1/4	90 - 120

* The type of bolts and nuts shall be ASTM A242.

The above torque loads may be applied with torque measuring or indicating wrenches, or they may be applied using regular socket wrenches, and checked to torque wrenches.

4. If effective sealing is not attained at the maximum torque indicated above, the joint shall be disassembled and reassembled after thorough cleaning. Over stressing of bolts to compensate for poor installation practice shall not be permitted.

C. CONNECTIONS TO WATER MAINS

1. All three-quarter ($\frac{3}{4}$) to two (2) inch connections to water mains in use shall be made by CONTRACTOR, once tap permits are obtained. CONTRACTOR shall furnish all materials required. He shall make all necessary excavations and he shall perform all necessary backfilling.

2. Where the connection of new work to old requires interruption of service, CONTRACTOR shall give twenty-four (24) hours advance written notice to the customers affected. The BOPU, ENGINEER, and CONTRACTOR shall mutually agree upon a date for connections which will allow ample time to assemble labor and materials, and to notify all customers affected. When service is interrupted for more than four (4) hours, the CONTRACTOR shall provide temporary service.
3. Once the OWNER/CONTRACTOR obtains all tap permits, the BOPU will make all taps which are three (3) inch and larger. The CONTRACTOR shall make all necessary excavations, perform all backfill and perform any other necessary work.

3.06 CHANGES TO APPROVED PLANS

- A. The design engineer is required to obtain DEQ and BOPU approval for all field changes to the approved construction plans prior to the field change being made. Except for minor field changes, which require BOPU approval only. The BOPU inspector shall make the decision as to what constitutes a minor field change.

3.07 INSPECTION SCHEDULING

A. WATER AND SEWER TAPS

1. The CONTRACTOR shall make appointments with the BOPU utility inspectors one (1) working day in advance for the inspection of water and sewer taps.

B. GENERAL INSPECTIONS

1. The CONTRACTOR shall make appointments with the BOPU utility inspectors in advance for general inspections such as, but not limited to, thrust blocks, fire hydrants, valves, and bedding. The CONTRACTOR shall make appointments with the BOPU utility inspectors one (1) working day in advance for inspections.

C. PRECONSTRUCTION MEETINGS AND SYSTEM TESTING

1. The CONTRACTOR shall make arrangements with the BOPU utility inspectors two (2) working days in advance for preconstruction meetings and system testing.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. WATER MAINS

1. Measurement of water mains shall be made in lineal feet along the centerline of pipe through all valves, fittings, and appurtenances.

B. FITTINGS

1. Measurement of water main fittings will be by numerical count of the various types and sizes listed in the bid item list of the Proposal.

C. WATER VALVES

1. Measurement of water valves shall be made by numerical count of the sizes and types of valves listed in the bid item list of the Proposal.

D. THRUST BLOCKS

1. These are subsidiary.

E. WATER SERVICE LINES

1. This item shall be measured by numerical count of water services of the various sizes listed in the bid item list of the Proposal.
2. No measurement and payment shall be made for trench excavation and backfill for water service lines and the cost of this work shall be included in the bid price for service lines.

4.02 BASIS OF PAYMENT

A. WATER MAIN

1. Payment for water main shall be made at the contract unit price per lineal foot of the various sizes called for, which price shall include excavation, pumping and dewatering of trench, backfill, furnishings and installing pipe; furnishing and placing bedding and polywrap; cleaning, testing and

disinfecting the water main and all other work necessary or incidental for completion of the item.

B. FITTINGS

1. Payment for fittings shall be made at the contract unit price for each fitting, which price shall include furnishing and installing the valve and valve box, all additional excavating work, backfill and thrust block, and special compaction required for the installation and all other work necessary for completion of the item.

C. WATER VALVES

1. Payment for water valves shall be made at the contract unit price each; which price shall include furnishing and installing the valve and the valve box, Valve Box Adaptor II, all additional excavations, backfill and anchor block, and special compaction required for the installation, and all other work necessary or incidental for completion of the item. Payment includes final adjustment of valve box and concrete collar.

D. THRUST BLOCKS

1. No separate payment shall be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.

E. WATER SERVICE LINES

1. Payment for water service connections shall be made at the contract unit price per each, which price shall include tapping the main, installation of two (2) to four (4) feet of new service line and installing a union to the existing service line. The existing service line and curb stop are not to be otherwise disturbed unless directed by the OWNER.
2. Payment for these items shall be full compensation for providing all materials, tools, labor and equipment necessary to complete the item and all incidental work related thereto, whether specifically mentioned herein or not.

END OF SECTION

SECTION 02667

COLD WATER METERS

(⁵/₈" through 12")

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of specifications of cold water meters together with related appurtenances complete.
- B. This specification is for cold water meters used in the residential, commercial, and industrial areas of the Cheyenne service but, does not apply to special applications such as well fields, dams, pump stations and treatment plants.

1.02 REFERENCES

- A. AWWA C700-90: Cold-Water Meters-Displacement Type, Bronze Main Case.
- B. AWWA C701-88: Cold-Water Meters-Turbine Type, For Customer Service.
- C. AWWA C702-86: Cold-Water Meters-Compound Type.
- D. AWWA C706-86: Direct-Reading Remote-Registration System for Cold-Water Meters.
- E. AWWA C707-82: Encoder-Type Remote-Registration Systems for Cold Water Meters.

1.03 ORDERING WATER METERS

- A. When ordering water meters under these specifications the following must be clarified by the person placing order:
 - 1. The meter size.
 - 2. For one and one-half (1-½) and two (2) inch meters, the nutating disc or the inline turbine must be specified.

3. For two (2) through twelve (12) inch meters, specify if compound meter is desired.

PART 2 PRODUCTS

2.01 SPECIFICATIONS FOR COLD WATER NUTATING DISC METERS ($\frac{5}{8}$ "x $\frac{3}{4}$ " through 1- $\frac{1}{4}$ ")

A. GENERAL

1. All meters shall consist of a bronze maincase with the serial number stamped on the maincase.
2. Only displacement meters of the flat nutating disc type will be accepted. The size, capacity, accuracy, and meter lengths shall be as specified in AWWA Standard C700, latest revision. The maximum number of disc nutations is not to exceed those specified in AWWA C700 latest revision.

B. METER MAINCASE

1. Maincases shall be the removable bottom cap type with the bottom cap secured by a minimum of four (4) bolts on five-eighths ($\frac{5}{8}$) and ($\frac{3}{4}$) inch sizes and six (6) bolts on the one (1) inch size. Bottom caps shall be interchangeable, size for size, between frost-protected cast iron or non frost-protected bronze models. Both cast iron and bronze bottom caps will be installed with gaskets and liners.
2. Frost-protected meters shall have a cast iron bottom cap. Non-frost-protected meters shall have bronze bottom caps. The cross section of the bottom shall break clean when subjected to freezing pressure of six hundred (600) to eight hundred-fifty (850) psi.
3. All maincase bolts shall be of stainless steel to prevent corrosion. Bottom cap bolt lugs shall be enclosed in the maincase and shall not have externally exposed, threaded through holes.

C. REGISTER

1. The register shall be of the straight reading sealed magnetic through the meter cover, and shall contain six (6) numeral wheels. Registers must be roll sealed and oil sealed. All direct reading register lenses shall be flat, of high strength, and

impact resistant glass or polymer to prevent breakage.

2. The register shall have the size, model and date of manufacture stamped on dial face. The dial shall be of the center sweep pointer type and shall contain one hundred (100) equally divided graduations at its periphery.
3. The register must contain a low flow indicator with a 1:1 disc nutating ratio to provide leak detection. Register boxes shall be synthetic or bronze. All meters must be adaptable to encoder type registers without interruption of the customer's service.
4. Registers shall be secured to the maincase by means of a plastic tamper proof seal to allow for in-line service replacement. Seal screws are not accepted.
5. All registers shall read in U.S. Gallons.

D. MEASURING CHAMBER

1. The measuring chamber shall be of a two (2) piece snap-joint type. The chamber shall be made of non-hydrolyzing synthetic polymer, shall be smoothly and accurately machined and shall contain a removable molded diaphragm of the same material as that of the chamber. No screws shall be used to secure the chamber together.
2. The control block shall be the same material as the measuring chamber and be mounted on the chamber top to provide sand ring protection. The control box assembly shall be removable to facilitate repairing and allow for a greater disc socket wear surface for increase longevity. Control block assemblies shall be designed as not to allow any magnetic slippage.
3. The measuring chamber outlet port shall be sealed to the maincase outlet port by means of an "O" ring gasket.
4. The chamber is a nutating disc type, the flat nutating disc shall be one (1) piece construction molded of a non-hydrolyzing synthetic polymer and shall contain a stainless steel spindle. The nutating disc shall be equipped with a synthetic polymer thrust roller located within the disc slot. The roller head shall roll on the buttressed track provided by the diaphragm in the measuring chamber near the chambers outport.

E. PERFORMANCE

1. Registers must be guaranteed for at least ten (10) years. All meters will be guaranteed for one (1) year on material and workmanship.
2. To ensure accuracy, each meter must be accompanied by a factory test tag certifying the accuracy.

F. STRAINERS

1. All meters shall contain removable polypropylene plastic strainer screens. The strainer shall be located near the inlet maincase port before the measuring chamber and the control block assembly.

G. SYSTEMS GUARANTEE

1. All meters shall be guaranteed adaptable to the Neptune ARB Encoder, Unigun Electronic Meter Reading Systems, or Hand Held Programmer Model PRG-100.

2.02 SPECIFICATIONS FOR COLD WATER NUTATING DISC METERS
(1-½" and 2")

A. GENERAL

1. All meters shall consist of a bronze maincase with the serial number stamped on the maincase.
2. Only displacement meters of the flat nutating disc type will be accepted.
3. The size, capacity, accuracy, and meter lengths shall be as specified in AWWA Standard C700, latest revision. The maximum number of disc nutations is not to exceed those specified in AWWA C700 latest revision.

B. METER MAINCASE

1. All one and one-half (1-½) and two (2) inch meters shall have a split design secured by bronze or stainless steel bolts.

C. REGISTER

1. The register shall be of the straight reading sealed magnetic coupled through the meter cover, and shall contain six (6) numeral wheels. Registers must be sealed and oil filled. All direct reading register lenses shall be flat, of high strength, and impact resistant glass or polymer to prevent breakage.
2. The dial shall be of the center pointer type and shall contain one hundred (100) equally divided graduations at its periphery. The register must contain a low flow indicator to provide leak detection. Register boxes shall be synthetic polymer or bronze.
3. All meters must be adaptable to a digital encoder register without interruption of the customer's service for the purpose of pit, remote or central meter reading.
4. The register shall be secured to the maincase by means of a plastic tamper-proof seal pin to allow for in-line service replacement. Seal screws not accepted.
5. All registers shall have the size, model, and date of manufacture stamped on the dial plate.
6. All registers shall read in U.S. Gallons.

D. MEASURING CHAMBER

1. The measuring chamber shall be of a two (2) piece snap joint type. The chamber shall be made of non-hydrolyzing synthetic polymer, shall be smoothly and accurately machined and shall contain a removable molded diaphragm of the same material as that of the chamber. No screws shall be used to secure the chamber together.
2. The control block shall be the same material as the measuring chamber and be mounted on the chamber top to provide sand ring protection. The control block assembly shall be removable to facilitate repairing. Control block assemblies shall be designed as not to allow any magnetic slippage.
3. The measuring chamber outlet port shall be sealed to the maincase outlet port by means of an "O" Ring gasket.

4. The chamber is a nutating disc type, the flat nutating disc shall be three (3) piece construction molded of a non-hydrolyzing hard rubber and shall contain a stainless steel spindle. The nutating disc shall be equipped with a synthetic polymer thrust roller with a stainless steel shaft located within the disc slot. The roller head shall roll on the buttressed track provided by the diaphragm in the measuring chamber.

E. STRAINER

1. All meters shall contain removable polypropylene plastic strainer screens. The strainer shall be located near the inlet maincase port, before the measuring chamber and control block assembly.

F. PERFORMANCE

1. Registers must be guaranteed for at least ten (10) years. All meters will be guaranteed for one (1) year on material and workmanship.
2. To ensure accuracy, each meter must be accompanied by a factory test tag certifying the accuracy.

G. SYSTEMS GUARANTEE

1. All meters shall be guaranteed adaptable to the Neptune ARB Encoder, Unigun Electronic Meter Reading Systems, or Hand Held Programmer Model PRG-100.

2.03 SPECIFICATIONS FOR COLD WATER CLASS 2 INLINE TURBINE METERS (1-½" and 2")

A. GENERAL

1. All maincases shall be solid bronze, oval flange, with meter serial number imprinted on the meter maincase. The size, capacity, accuracy and meter lengths shall be as specified in AWWA C701 latest revision.

B. REGISTER

1. The register shall be of the straight reading sealed magnetic coupled through the meter cover, and shall contain six (6) numeral wheels. Registers must be sealed and oil filled. All direct reading register lenses shall be flat, of high strength, and impact resistant glass or polymer to prevent breakage.

2. The dial shall be of the center pointer type and shall contain one hundred (100) equally divided graduations at its periphery. The register must contain a low flow indicator to provide leak detection. Register boxes shall be synthetic polymer or bronze.
3. All meters must be adaptable to a digital encoder register without interruption of the customer's service for the purpose of pit, remote or central meter reading.
4. The register shall be secured to the maincase by means of a plastic tamper-proof seal pin to allow for in-line service replacement. Seal screws not accepted.
5. All registers shall have the size, model, and date of manufacture stamped on the dial plate.
6. All registers shall read in U.S. Gallons.

C. MEASURING CHAMBER

1. The Turbine measuring chamber shall be self-contained unit attached to the cover for easy removal. The Turbine rotor spindle shall be stainless steel. The bearings shall be graphite or ryton-coated graphite.

D. INTERMEDIATE GEAR TRAIN

1. The intermediate gear train shall be directly-coupled to the turbine rotor spindle and magnetically coupled to the register through the meter cover. The gear train shall be enclosed in the turbine rotor outlet and shall be capillary sealed. All moving parts of the gear train shall be made of a self-lubricating polymer or stainless steel for operation in water.

E. PERFORMANCE

1. Registers shall be guaranteed for at least ten (10) years. All meters shall be guaranteed for one (1) year on material and workmanship. To ensure accuracy, each meter shall be accompanied by a factory test tag certifying the accuracy.

F. SYSTEMS GUARANTEE

1. All meters shall be guaranteed adaptable to the Neptune ARB Encoder, Unigun Electronic Meter Reading Systems, or Hand Held Programmer Model PRG-100.

SPECIFICATIONS FOR COLD WATER METERS MAGNETIC
TURBINE (Type 3" through 12")

A. GENERAL

1. All maincases shall be solid bronze, round flange, with meter serial number imprinted on the meter maincase. The size, capacity, accuracy and meter lengths shall be as specified in AWWA C701 latest revision.

B. REGISTER

1. The register shall be of the straight reading sealed magnetic coupled through the meter cover, and shall contain six (6) numeral wheels. Registers must be sealed and oil filled. All direct reading register lenses shall be flat, of high strength, and impact resistant glass or polymer to prevent breakage.
2. The dial shall be of the center pointer type and shall contain one hundred (100) equally divided graduations at its periphery. The register must contain a low flow indicator to provide leak detection. Register boxes shall be synthetic polymer or bronze.
3. All meters shall be adaptable to a digital encoder register without interruption of the customer's service for the purpose of pit, remote or central meter reading.
4. The register shall be secured to the maincase by means of a plastic tamper-proof seal pin to allow for in-line service replacement. Seal screws not accepted.
5. All registers shall have the size, model, and date of manufacture stamped on the dial plate.
6. All registers shall read in U.S. Gallons.

C. MEASURING CHAMBER

1. The turbine measuring chamber shall be self-contained unit attached to the cover for easy removal. The turbine rotor spindle shall be stainless steel. The bearings shall be graphite or ryton-coated graphite.

D. INTERMEDIATE GEAR TRAIN

1. The intermediate gear train shall be directly-coupled to the turbine rotor spindle and magnetically coupled to the register through the meter cover. The gear train shall be enclosed in the turbine rotor outlet and shall be capillary sealed. All moving parts of the gear train shall be made of a self-lubricating polymer or stainless steel for operation in water.

E. PERFORMANCE

1. Registers shall be guaranteed for at least ten (10) years. All meters shall be guaranteed for one (1) year on material and workmanship.
2. To ensure accuracy, each meter shall be accompanied by a factory test tag certifying the accuracy.

F. SYSTEMS GUARANTEE

1. All meters shall be guaranteed adaptable to the Neptune ARB Encoder, Unigun Electronic Meter Reading Systems, or Hand Held Programmer Model PRG-100.

2.05 SPECIFICATIONS FOR COLD WATER METERS COMPOUND TYPE (2" through 10")

A. GENERAL

1. All maincases shall be solid bronze, round flange, with meter serial number imprinted on the meter maincase. The size, capacity, accuracy and meter lengths shall be as specified in AWWA C702 latest revision.

B. TYPE

1. Compound meters shall consist of a combination of an AWWA Class 2 turbine meter for measuring high rates of flow and anutating disc type positive displacement meter for measuring low rates of flow enclosed in a single maincase. An automatic valve shall direct flows through the disc meter at low flow rates and through the turbine meter at high flow rates. At high flow rates, the automatic valve shall also serve to restrict the flow through the disc meter to minimize wear.

C. OPERATING CHARACTERISTICS

1. Refer to Table 1 of the AWWA C702, latest revisions.

D. SIZE

1. Refer to Table 2 of the AWWA C702, latest revisions.

E. CASE AND COVER

1. The maincase and cover shall be cast of water works bronze containing not less than seventy-five (75) percent copper. The size, model, and arrows indicating direction of flow shall be cast in raised characters on the maincase or cover. The cover shall contain a stainless steel calibration vane for the purpose of calibrating the turbine measuring element while the meter is in line and under pressure. The calibration vane shall contain no gear reduction. A test plug shall be located in the maincase or the cover for the purpose of field testing the meter.

F. EXTERNAL BOLTS

1. Casing bolts shall be made of stainless steel.

G. CONNECTIONS

1. Maincases shall be flange. Two (2) inch meters shall be oval flange and three (3) through ten (10) inch sizes shall be round flange per Table 4, AWWA C702 latest revisions.

H. REGISTERS

1. The register shall be of the straight reading sealed magnetic coupled through the meter cover, and shall contain six (6) numeral wheels. Registers must be sealed and oil filled. All direct reading register lenses shall be flat, of high strength, and impact resistant glass or polymer to prevent breakage.
2. The dial shall be of the center pointer type and shall contain one hundred (100) equally divided graduations at its periphery. The register must contain a low flow indicator to provide leak detection. Register boxes shall be synthetic polymer or bronze.
3. All meters must be adaptable to a digital encoder register without interruption of the customer's service for the purpose of pit, remote or central meter reading. The register

shall be secured to the maincase by means of a plastic tamper-proof seal pin to allow for in-line service replacement. Seal screws not accepted.

4. All registers shall have the size, model, and date of manufacture stamped on the dial plate.
5. All registers shall read in U.S. Gallons.

I. MEASURING CHAMBERS

1. The measuring chamber shall be a self contained unit, attached to the cover for easy removal.
2. The nutating disc chamber shall be a self contained unit mounted on the cover, and easily removable from cover, and conform to AWWA C700.
3. The intermediate gear train shall be directly coupled from the turbine spindle and magnetically coupled to the register through the meter cover. The gear train shall be enclosed in the turbine rotor outlet and shall be capillary sealed. All moving parts of the gear train shall be made of a self lubricating polymer or stainless steel for operations in water.

J. AUTOMATIC VALVE

1. The automatic valve shall be spring loaded, poppet type. All valve parts shall be made of water works bronze, stainless steel, or suitable polymer with a replaceable semi hard EPDM rubber seat. Only the cover must be removed to gain access to the valve for inspection or service.
2. The change over rate shall meet minimum standard of AWWA C702, Table 3, latest revision.

K. STRAINER

1. A strainer shall be provided for the disc meter. It shall be easily removable and have an effective straining area of at least double the disc meter inlet.

L. PERFORMANCE

1. Registers shall be guaranteed for at least ten (10) years. All meters shall be guaranteed for one (1) year on material and workmanship.
2. To ensure accuracy, each meter shall be accompanied by a factory test tag certifying the accuracy.

M. SYSTEMS GUARANTEE

1. All meters shall be guaranteed adaptable to the Neptune ARB Encoder, Unigun Electronic Meter Reading Systems, or Hand Held Programmer Model PRG-100.

2.06 SPECIFICATIONS (GENERAL) FOR COLD WATER METER STRAINERS

A. GENERAL

1. This specification covers one hundred-fifty (150) psi working pressure plate type strainers for use with cold water meters of two (2) inch through twelve (12) inch pipe in size. The strainer is to be mounted directly on the inlet side of the meter to prevent objects such as stones or pebbles greater than three-sixteenth ($\frac{3}{16}$) inch diameter from entering or damaging the meter.
2. The strainer shall be designed for minimum weight and pressure loss.
3. The strainer screen shall be made of perforated 18-8 stainless steel plate and be shaped for maximum rigidity against forces exerted by the flow stream.
4. The effective straining area shall be at least double that of the meter maincase inlet area.
5. The two (2) inch strainer shall be furnished with elliptical two bolt flange connections. Strainers three (3) inch and larger shall be furnished with round flange connections. Bolt circle, bolt holes diameters, and flange dimensions shall be in compliance with the meter connection specifications contained in ANSI/AWWA C701, and C702 latest revisions.

6. The strainer bodies and covers in sizes two (2) through six (6) inch shall be made of cast bronze. Bodies and covers for eight (8) inch through twelve (12) inch strainers shall be cast iron. The manufacturer's name, strainer pipe size, and direction of flow (if required) shall be cast in raised letters and shall be clearly visible.
7. Cover bolts shall be made of stainless steel.
8. Strainer cover castings shall be equipped with a vent screw to remove trapped air at installation.
9. Strainer screens shall be accessible and removable from the top of the strainer case.

B. PERFORMANCE

1. All strainers shall be guaranteed for one (1) year on material and workmanship.

2.07 SPECIFICATIONS FOR AN AUTOMATED ENCODER BASED METER READING SYSTEM

A. GENERAL

1. These specifications cover a self contained encoder register metering system designed to obtain remote simultaneous water meter registration directly from the register odometer. The metering information shall be obtained through a remotely located receptacle using a compatible data capture system.

B. SYSTEM COMPONENTS

The above system shall be configured as follows:

1. Encoder meter register - Direct mounting, digitally encoded data stream. Batteries or pulses are not allowed.
2. Remotely mounted receptacle - Providing a communication link for the transmission of information from the register.
3. Data acquisition equipment with which the above components can be interrogated. Such equipment shall be configured in two (2) types:

- a. A device that captures information and displays it visually to confirm system installation and wiring test.
 - b. A device that is preprogrammed with route information and is capable of storing collected data in solid state memory. The device shall also electronically transfer the data into the utility billing computer.
4. All systems must be adaptable to interrogation and encoding to the Neptune ARB Encoder, Unigun Electronic Meter Reading Systems, or Hand Held Programmer Model PRG-100.

END OF SECTION

SECTION 02670

HYDROSTATIC TESTING

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of testing of water main and related appurtenances.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 OBSERVATION

- A. All hydrostatic testing of all water mains shall be under the full-time observation of and shall meet the approval of the BOPU.

3.02 HYDROSTATIC TESTING OF WATER MAINS

- A. PVC, ductile and cast iron pipe (Refer to Appendix "A" Standards and Specifications for PVC Pressure Pipe for additional information).

1. PRESSURE TEST:

All newly laid pipe or any valved section hereof shall be subjected to a hydrostatic pressure of two hundred (200) psi. Hydrostatic testing shall include all service line connections from the point of connection to the curb stop. All necessary labor, tools, materials and equipment shall be provided by the CONTRACTOR as approved by the BOPU.

a. Test Pressure Restrictions - Test pressures shall:

- (1) Not be less than one and one-quarter (1.25) times the working pressure at the highest point along the test section.
- (2) Not exceed pipe or thrust restraint design pressures.
- (3) Be of at least two (2) hour duration.

- (4) Not vary by more than five (5) psi.
- (5) Not exceed the rated pressure of the valves or hydrants when the pressure boundary of the test section includes closed gate valves or hydrants.

b. Pressurization

- 1) Each valved section of pipe shall be filled with water at a rate not exceeding a water velocity of one (1) foot per second. The specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the BOPU.

c. Air Removal

- 1) Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the CONTRACTOR shall install corporation stops at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation stops shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation stops shall be removed and plugged, or left in place at the discretion of the BOPU.

d. Examination

- 1) All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, or hydrants that are discovered following the pressure test shall be repaired or replaced with sound material and the test shall be repeated until it is satisfactory to the BOPU.

2. LEAKAGE TEST:

A leakage test shall be conducted concurrently with the pressure test.

a. Leakage Defined

- 1) Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within five (5) psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

b. Allowable Leakage

- 1) Pipe installation will not be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD \sqrt{P}}{133,200}$$

in which L is the allowable leakage, in gallons per hour; S is the length of pipeline tested, in feet D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test, in pounds per square inch gauge.

NOTE: Refer to Attachment "A" Standards and Specifications for PVC Pipe, for testing criteria.

3. LEAKAGE TEST FAILURE:

When the leakage test fails to pass the allowable limits, the CONTRACTOR shall make all necessary system repairs and schedule a retest.

3.03 DEQ DISCHARGE PERMIT

- A. As required by DEQ Regulations, the DEVELOPER/CONTRACTOR must file a NOI (Notice of Intent) and obtain a permit before discharging superchlorinated water or water from hydrostatic testing.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for items under this section.

4.02 BASIS OF PAYMENT

- A. No separate payment shall be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 02675

DISINFECTION

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of essential procedures for disinfecting new and repaired water mains.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 OBSERVATION

- A. All disinfection methods, processes, applications, and testing shall be performed under the observation of and with the approval of the BOPU.

3.02 DISINFECTING WATER MAINS

- A. BASIC PROCEDURE:
 - 1. Prevent contaminating materials from entering the water mains during construction or repair and remove by flushing materials that may have entered the water main.
 - 2. Disinfect any residual contamination that may remain.
 - 3. Determine the bacteriologic quality by laboratory test after disinfection.
- B. PREVENTATIVE MEASURES DURING CONSTRUCTION
 - 1. KEEPING PIPE CLEAN AND DRY
 - a. Precautions shall be taken to protect pipe interiors, fittings, and valves against contamination. Pipe delivered for construction shall be strung so as to minimize entrance of foreign material. When pipelaying is not in progress, as for example, at the close of the day's work, all openings in the pipeline shall be closed by watertight plugs. Joints of all pipe

in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.

Note: Delay in placement of delivered pipe invites contamination. The more closely the rate of delivery is correlated to the rate of pipelaying, the less the potential for contamination.

- b. If dirt, that in the opinion of the OWNER's engineer or job superintendent, will not be removed by the flushing operation (Item D, PRELIMINARY FLUSHING) enters the pipe, the interior of the pipe shall be cleaned and swabbed as necessary, with a five (5) percent hypochlorite disinfecting solution.

2. PACKING MATERIAL AND JOINTS

- a. No contaminated material or any material capable of supporting prolific growth of micro-organisms shall be used for sealing joints. Packing material shall be handled in such a manner as to avoid contamination.
- b. The lubricant used in the installation of sealing gaskets shall be NFS approved for use in potable water. It shall be delivered to the job in enclosed containers and shall be kept clean.

C. PRELIMINARY FLUSHING

- 1. The main shall be flushed prior to disinfection, except when the tablet method is used (Item E, METHODS OF CHLORINE APPLICATION, Paragraph (3)). The sites and velocities of flushing shall be as specified in the supplemental specifications.

Note 1: The flushing velocity shall not be less than two and one-half (2.5) ft/sec. The rate of flow required to produce this velocity in various diameters is shown in Table 2. No site for flushing should be chosen unless it has been determined that drainage is adequate at that site and at all points downstream. The CONTRACTOR shall be liable for downstream damages.

Note 2: Flushing is no substitute for preventive measures taken before and during pipelaying (Item B, PREVENTIVE MEASURES DURING CONSTRUCTION). Certain contaminants, especially in caked deposits, resist flushing at any velocity. Furthermore, with diameters of sixteen (16) inches or more, even the minimum flushing velocity of two and one-half (2.5) ft/sec is sometimes difficult to achieve.

TABLE 2

Required Openings to Flush Pipelines*
(40 psi Residual Pressure)

Hydrant Outlet Nozzles

Pipe Size (inches)	Flow Required to Produce 2.5 fps Velocity (gpm)	Orifice Size (inches)	Number	Size (inches)
4	100	$\frac{15}{16}$	1	2- $\frac{1}{2}$
6	220	1	1	2- $\frac{1}{2}$
8	390	1	1	2- $\frac{1}{2}$
10	610	2- $\frac{5}{16}$	1	2- $\frac{1}{2}$
12	880	2- $\frac{13}{16}$	1	2- $\frac{1}{2}$

* With forty (40) psi residual pressure, a two and one-half (2- $\frac{1}{2}$) inch hydrant outlet nozzle will discharge approximately one thousand (1,000) gpm and a four and one-half (4- $\frac{1}{2}$) inch hydrant nozzle will discharge approximately two thousand- five hundred (2,500) gpm.

D. FORM OF CHLORINE FOR DISINFECTION

1. The most common forms of chlorine used in the disinfecting solutions are liquid chlorine (gas at atmospheric pressure), calcium hypochlorite granules, sodium hypochlorite solutions, and calcium hypochlorite tablets. (Hot tub tablets are not allowed.)
2. Hypochlorite
 - a. Calcium Hypochlorite
 - 1) Calcium hypochlorite contains sixty-five (65) percent available chlorine by weight. It is either granular or tabular in form. The tablets, 6-8 to the ounce, are designed to dissolve slowly in water (Item E,

METHODS OF CHLORINE APPLICATION, Para. (3). Calcium hypochlorite is packaged in containers of various types and sizes ranging from small plastic bottles to one hundred (100) pound drums.

- 2) A chlorine-water solution is prepared by dissolving the granules in water in the proportion requisite for the desired concentration.

b. Application:

The hypochlorite solutions shall be applied to the water main with a gasoline or electrically-powered chemical feed pump designed for feeding chlorine solutions. For small applications the solutions may be fed with a hand pump, for example a hydraulic test pump. Feed lines shall be of such material and strength as to withstand safely the maximum pressures that may be checked for tightness before the hypochlorite solutions is applied to the main.

E. METHODS OF CHLORINE APPLICATION

1. Continuous Feed Method

- a. This method is suitable for general application.

- 1) Water from the existing distribution system or other approved sources of supply shall be made to flow at a constant, measured rate into the newly-laid pipeline. The water shall receive a dose of chlorine, also fed at a constant, measured rate. The two (2) rates shall be proportioned so that the chlorine concentration in the water in the pipe is maintained at a minimum of fifty (50) mg/l available chlorine. To assure that this concentration is maintained, the chlorine residual should be measured at regular intervals.

Note: In the absence of a meter, the rate may be determined either by placing a pilot gage at

the discharge or by measuring the time to fill a container of known volume.

2) Table 3 gives the amount of chlorine residual required for each one hundred (100) feet of pipe of various diameters. Solutions of one (1) percent chlorine may be prepared with sodium hypochlorite or calcium hypochlorite. The latter solution requires approximately one pound of calcium hypochlorite in eight and one-half (8.5) gallons of water.

b. During the application of the chlorine, valves shall be manipulated to prevent the treatment dosage from flowing back into the line supplying the water. Chlorine application shall not cease until the entire main is filled with the chlorine solution. The chlorinated water shall be retained in the main for at least twenty-four (24) hours, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this twenty-four (24) hour period, the treated water shall contain no less than three (3) mg/l chlorine throughout the length of the main.

TABLE 3

Chlorine Required to Produce 50 Mg/l Concentration
in 100 Feet of Pipe-by Diameter

Pipe Size (in.)	100 Percent Chlorine (lb.)	One Percent Chlorine Solutions (gal.)
4	0.027	0.33
6	0.061	0.73
8	0.108	1.30
10	0.170	2.04
12	0.240	2.88

2. Slug Method:

This method is suitable for use with mains of large diameter for which, because of the volumes of water involved, the continuous feed method is not practical.

- a. Water from the existing distribution system or other approved source of supply shall be made to flow at a constant, measured rate (Item E, METHODS OF CHLORINE APPLICATION, Paragraph (1), Note: into the newly-laid pipeline. The water shall receive a dose of chlorine, also fed at a constant, measured rate. The two (2) rates shall be proportioned so that the concentration in the water entering the pipeline is maintained at no less than three hundred (300) mg/l. The chlorine shall be applied continuously and for a sufficient period to develop a solid column or “slug” of chlorinated water that will, as it passes along the line, expose all interior surfaces to a concentration of at least three hundred (300) mg/l for at least three (3) hours. The application shall be checked at a tap near the upstream end of the line by chlorine residual measurements.
- b. As the chlorinated water flows past tees and crosses, related valves and hydrants shall be operated so as to disinfect appurtenances.

3. Tablet Method:

Tablet disinfection is best suited to short extensions (up to two thousand-five hundred (2,500) feet) and smaller diameter mains (up to twenty-four (24) inches). Because the preliminary flushing step must be eliminated, this method shall be used only when scrupulous cleanliness has been exercised. It shall not be used if trench water or foreign material has entered the main or if the water is below 5°C (41°F).

- a. Placement of Tablets
 - 1) Tablets are placed in each section of pipe and also in hydrants, hydrant branches, and other appurtenances. They shall be attached by an adhesive, except for the tablets placed in hydrants and in the joints between the pipe sections. All the tablets within the main must be at the top of the main. If the tablets are fastened before the pipe section is placed in the trench, their position should be marked on the section to assure that there will be no rotation. In placing tablets in

joints, they are either crushed and placed on the inside annular space, or, if the type of assembly does not permit, they are rubbed like chalk on the butt ends of the sections to coat them with calcium hypochlorite.

- 2) The adhesive shall be a food grade adhesive, such as Dow Corning 748 Noncorrosive Sealant, approved by the BOPU. There shall be no adhesive on the tablet except on the broad side next to the surface which the table is attached.

b. Filling and Contact

- 1) When installation has been completed, the main shall be filled with water at a velocity of more than one (1) foot/second. This water shall remain in the pipe for at least twenty-four (24) hours. The water must remain in the pipe for at least forty-eight (48) hours if the water temperature is below 41°F (5°C), maintaining no less than three (3) mg/l chlorine.
- 2) Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water.

TABLE 4

Number of Hypochlorite Tablets of 5-G
Required for Dose of 50 Mg/l*

Length of Section (ft.)	Diameter of Pipe (in.)					
	2	4	6	8	10	12
13 or less	1	1	2	2	3	5
18	1	1	2	3	5	6
20	1	1	2	3	5	7
30	1	2	3	5	7	10
40	1	2	4	6	9	14

* Based on 3-¾ g available chlorine per tablet.

F. FINAL FLUSHING

1. After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system, or less than one (1) mg/l. Points of discharge of heavily chlorinated water shall be shown on plans or designated in Special Provisions. Chlorine residual determination shall be made to ascertain that the heavily chlorinated water has been removed from the pipeline.

G. BACTERIOLOGIC TESTS

1. After final flushing, and before the water main is placed in service, a sample or samples shall be collected from the end of the line and tested for bacteriologic quality and shall show the absence of coliform organisms. If the number and frequency of samples is not prescribed by the public health authority having jurisdiction, at least one (1) sample shall be collected from chlorinated supplies where a chlorine residual is maintained throughout the new main. From unchlorinated supplies, at least one (1) sample shall be collected from chlorinated supplies where a chlorine residual is maintained throughout the new main.

Note: In the case of extremely long mains, it is desirable that samples be collected the length of the line as well as at its end. A sample shall be collected for every six hundred

(600) feet of water main disinfected.

2. Samples for bacteriologic analysis shall be collected in sterile bottles treated with sodium thiosulphate. No hose or fire hydrant shall be used in collection of samples. A suggested sampling tap consists of a standard corporation cock installed in the main with a copper tube gooseneck assembly. After samples have been collected, the gooseneck assembly may be removed and retained for future use.

H. REPETITION OF PROCEDURE

1. If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated until satisfactory samples have been obtained. The tablet method cannot be used in these subsequent disinfections. When the samples are satisfactory, the main may be placed in service.

I. PROCEDURE AFTER CUTTING INTO OR REPAIRING EXISTING MAINS:

The procedures outlined in this section apply primarily when mains are wholly or partially dewatered. Leaks or breaks that are repaired with clamping devices while the mains remain full of water under pressure present little danger of contamination and require no disinfection.

1. Trench "Treatment":

When an old line is opened, either by accident or by design, the excavation will likely be wet and badly contaminated from nearby sewers. Liberal quantities of hypochlorite applied to open trench areas will lessen the danger from such pollution. Tablets have the advantage in such a situation because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation.

2. Main Disinfection

- a. Swabbing and Flushing:

The following procedure is considered as a minimum that may be used.

b. Swabbing with Hypochlorite Solution:

The interior of all pipe and fittings used in making the repair (particularly couplings and tapping sleeves) shall be swabbed with a five (5) percent hypochlorite solution before they are installed.

c. Flushing:

Thorough flushing is the most practical means of removing contamination introduced during repairs. If valving and hydrant locations permit, flushing from both directions is recommended. Flushing shall be started as soon as the repairs are completed and continued until discolored water is eliminated.

d. Slug Method:

Where practicable, in addition to the procedures of Paragraph (b) SWABBING WITH HYPOCHLORITE SOLUTION, a section of main in which the break is located shall be isolated, all service connections shut off, and the section flushed and chlorinated as described in Item F, METHODS OF CHLORINE APPLICATION, Paragraph (2), SLUG METHOD, except that the dose may be increased to as much as five hundred (500) mg/l, and the contact time reduced to as little as one-half (½) hour. After chlorination, flushing shall be resumed and continue until discolored water is eliminated.

3. Sampling:

Bacteriologic samples shall be taken after repairs to provide a record by which the effectiveness of the procedures used can be determined. If the direction of flow is unknown, samples shall be taken on each side of the main break.

3.03 DEQ DISCHARGE PERMIT

A. As required by DEQ Regulations, the DEVELOPER/CONTRACTOR must file a NOI and obtain a permit before discharging superchlorinated water or water from hydrostatic testing.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for items under this section.

4.02 BASIS OF PAYMENT

- A. No separate measurement shall be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 02700

SANITARY SEWER SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of construction of sanitary sewer mains, including manholes, service lines, and other appurtenant structures, complete.

1.02 REFERENCES

- A. Where the reference is made to an ASTM, ANSI or AASHTO designation, it shall be the latest revision.

1.03 QUALITY ASSURANCE

- A. Sewer pipe and fittings furnished under this contract shall be as called out in the Contract Documents. Wye or tee branches shall be of the same material and design as the sewer pipe used.
- B. When required by BOPU, CONTRACTOR shall furnish certification by the manufacturer of the pipe to be furnished on this project, certifying that the pipe and fittings comply with the applicable specifications. Required certification shall accompany each delivery of material.
- C. All pipe shall be clearly marked with type, class and/or thickness as applicable. Lettering shall be legible and permanent under normal conditions of handling and storage.
- D. Type of joint, class, thickness designation, castings, lining, marking, testing etc., shall be as specified.
- E. The CONTRACTOR shall provide the BOPU with two complete sets of submittals for all materials incorporated into the work. No materials shall be incorporated into the work until the BOPU or its' designee has provided written approval within ten (10) calendar days of receipt of the related submittal.

PART 2 PRODUCTS

2.01 MATERIALS

A. All materials furnished and used shall be new and shall be less than two (2) years old since date of manufacture.

B. POLYVINYL CHLORIDE (PVC) PIPE

1. PVC Sewer Pipe shall be produced by a continuous extrusion process, employing a prime grade of unplasticized polyvinyl chloride. The grade used shall be highly resistant to hydrogen sulfide, sulfuric acid, gasoline, oil, detergents and other chemicals commonly found in sewage and industrial wastes. The material shall conform to the requirements of ASTM D1784, "Rigid Polyvinyl Chloride Compounds." The pipe shall have self-extinguishing flammability characteristics.

2. Pipe and fittings shall conform to ASTM D3034, "Standard Specification for Polyvinyl Chloride Sewer Pipe and Fittings," or ASTM F679 for sizes over fifteen (15) inches in diameter. PVC pipe shall have a minimum Standard Dimension Ratio (SDR) of 35. (SDR=Diameter divided by thickness).

3. Nominal laying lengths shall be not less than twelve and one-half (12.5) feet, except shorter lengths may be used adjacent to manholes or other appurtenances. Each length of pipe shall be marked with size, SDR, "Sewer Pipe" and Code Number.

4. PIPE JOINTING

a. Each length of pipe shall be provided with a bell designed so that a watertight joint will be obtained when jointing the bell and spigot with a rubber ring.

b. The rubber gasket joint for PVC pipe and fittings shall consist of a rubber gasket which is compressed between the outer surface of the spigot and the inner surface of a retaining groove in the bell. The joint shall be completely sealed by the gasket so that the assembly will remain watertight under all conditions of service, including movements resulting from expansion, contraction, settlement

and deformation of the pipe. The rubber ring joint assembly shall be made in strict accordance with the manufacturer's recommendations.

c. When couplings are used for the repair of existing sewer mains (up to twelve (12) inches in diameter) they shall be Mission Flex-seal ARC sewer repair couplings or equal. Methods for repairing sewers larger than twelve (12) inches in diameter need written BOPU approval.

5. Wye fittings for connecting service lines shall be of the same material, construction and joint design as the main sewer pipe.

C. CONCRETE PIPE (Only allowed for sanitary sewers 18" and larger)

1. Concrete sewer pipe shall conform to ASTM C76, except as noted hereafter. The reinforced concrete sewer pipe shall be manufactured in accordance with the Class I, II, III, IV, or V strength requirements as specified in ASTM C76 and as required in the detailed plans and technical specifications for the project.

2. The maximum absorption allowed shall be eight (8) percent as stated in the above ASTM Specification. For pipe sizes smaller than twelve (12) inch in diameter the proportion of portland cement in the concrete mixture shall not be less than six and one-half (6.5) U.S. standard bags (94 pounds) per cubic yard of concrete, and the water cement ratio shall not exceed six (6) gallons per sack of cement.

3. The referenced ASTM Specifications list permissible variations in pipe dimensions. They shall be strictly adhered to, and the uniformity of barrel thickness shall be such that a constant flow area without projections exists across joints.

4. Wye or tee fittings for connecting service lines shall be of the same material, construction and joint design as the main sewer pipe.

5. Joints for concrete pipe shall be made using flexible watertight, rubber-type gaskets conforming to ASTM C443.

6. The pipe supplier shall furnish ENGINEER with certified test results from an independent testing laboratory on the following: (1) crushing strength using the three (3) edge bearing method, (2) absorption, and (3) hydrostatic performance. Test results shall be furnished for each pipe size supplied for this project and the number of tests performed shall be in accordance with ASTM Specification C14 and/or C76, or a minimum of two (2) percent of the number of pipe supplied, whichever is greater. Cost of these tests shall be borne by the pipe supplier and/or CONTRACTOR.
7. Concrete pipe products shall be manufactured with ASTM C150 Type 1 (low alkali) cement and fifteen (15) percent of the cement shall be replaced with one and one-half (1.5) pounds of ASTM C618 Class F fly ash substituted for each pound of cement being replaced. (The fly ash shall not exceed a four (4) percent loss on ignition.) Also, limestone aggregates shall not be used in the manufacture of these concrete products.
8. The “Lifetime” liquid for “Lifetime-SL” crystals may be used to control alkali-silica reactivity in concrete as an alternative to the use of fly ash.

Lifetime (Liquid): (As manufactured by FMC):

To control alkali-silica reactivity (ASR) in concrete, add 0.72 gallons of Lifetime per yard for every pound of sodium equivalent supplied by the cement, then subtract the number of gallons of Lifetime from the mix water. For example, for a mix containing six hundred (600) lbs of cement per cubic yard of concrete, with a sodium equivalent of one (1) percent, use 4.32 gallons of Lifetime per yard of concrete (six (6) pounds of sodium equivalent). For the same cement loading of six hundred (600) lbs., if the sodium equivalent was one-half (0.5) percent, then use 2.16 gallons of Lifetime per yard of cement.

Please note that the CONTRACTOR should not use Lifetime in doses lower than required for a sodium equivalent of 0.6% (i.e. no less than 0.4 gallons per sack of cement). Because some of the Lifetime is consumed in cement hydration, lower doses could fail to provide adequate ASR protection.

Lifetime-SL (Crystals): (As manufactured by FMC)

To control alkali-silica reactivity (ASR) in concrete, add the same weight of Lifetime SL per yard as the sodium equivalent supplied by the cement. For example, if there were six hundred (600) lbs of cement per cubic yard of concrete, and the sodium equivalent of the cement was one (1) percent, then use 6 lbs. of Lifetime-SL per yard of concrete. For the same cement loading of six hundred (600) lbs., if the sodium equivalent was one-half (0.5) percent then use three (3) pounds of Lifetime-SL per yard of cement.

Please note that the CONTRACTOR should not use Lifetime-SL in doses lower than required for a sodium equivalent of 0.6% (i.e. no less than 0.6 pounds per sack of cement). Because some of the Lifetime-SL is consumed in cement hydration, lower doses could fail to provide adequate ASR protection.

D. DUCTILE IRON PIPE

(Only allowed for sanitary sewers upon prior written approval by the BOPU.)

1. Ductile iron pipe shall conform in all aspects to the latest revisions of ASTM A746.
2. Wye or tee fittings for connecting service lines shall be of the same material, construction and joint design as the main sewer pipe or a method approved by BOPU.
3. All field joints shall meet the manufacturer's requirement for the brand of pipe being used.

E. CASING PIPE

1. The casing pipe used for either water lines, sanitary sewer lines, or storm sewer lines shall be (C-900 PVC DR-25 water pipe for twelve (12) inch and smaller C-905 DR-41 water pipe for twelve (12) inch and larger), with a minimum inside diameter to accommodate the carrier pipe. Casing chalks shall be used on the carrier pipe, spaced according to manufacturer's recommendations and the ends of the casing pipe properly sealed. (Refer to Standard

Drawing No. 02665-01)

2. Acceptance of the pipe at point of delivery will not relieve the CONTRACTOR of full responsibility for any defects in material or workmanship of the completed pipeline.
3. Casing ends shall be sealed with Cascade Model CCES or Power Seal casing end seals.
4. The carrier pipe shall be centered within the casing by use of casing caulks (Power Seal 4810 or Cascade Casing Spacers) and shall be sized to prevent the pipe from moving or shifting.

F. MANHOLES

1. Manholes shall be constructed of precast concrete rings with frames and covers and steps in accordance with details shown on Standard Drawings.
2. Lifting holes shall not protrude through the manhole wall. One (1) full inch of concrete must remain between the deepest point of the lifting hole and the wall of the manhole.
3. All manholes shall be designed to withstand AASHTO HS-20 loading.
4. Concrete manhole products shall be manufactured with ASTM C50 Type 1 (low alkali) cement and fifteen (15) percent of the cement shall be replaced with one and one-half (1.5) pounds of ASTM C618 Class-F fly ash substituted for each pound of cement being replaced. (The fly ash shall not exceed a four (4) percent loss on ignition.) Also, limestone aggregates shall not be used in the manufacture of these concrete products.
5. The "Lifetime" liquid for "Lifetime-SL" crystals may be used to control alkali-silica reactivity in concrete as an alternative to the use of fly ash.

Lifetime (liquid): (As Manufactured by FMC):

To control alkali-silica reactivity (ASR) on concrete, add 0.72 gallons of Lifetime per yard for every pound of sodium equivalent supplied by the cement, then subtract the number of gallons of

Lifetime from the mix water. For example, for a mix containing six hundred (600) pounds of cement per cubic yard of concrete, with sodium equivalent of one (1) percent, use 4.32 gallons of Lifetime per yard of concrete (six (6) pounds of sodium equivalent x 0.72 gallons of Lifetime/pound of sodium equivalent). For the same cement loading of six hundred (600) pounds., if the sodium equivalent was one-half (0.5) percent, then use 2.16 gallons of Lifetime per yard of cement.

Please note that you should not use Lifetime in doses lower than required for a sodium equivalent of 0.6% (i.e. no less than 0.4 gallons per sack of cement). Because some of the Lifetime is consumed in cement hydration, lower doses could fail to provide adequate ASR protections.

Lifetime-SL (Crystals): (As Manufactured by FMC):

To control alkali-silica reactivity (ASR) in concrete, add the same weight of Lifetime-SL per yard as the sodium equivalent supplied by the cement. For example, if there six hundred (600) pounds of cement per cubic yard of concrete, and the sodium equivalent of the cement per cubic yard of concrete, and the sodium equivalent of the cement was one (1) percent, then use six (6) pounds of Lifetime-SL per yard of concrete. For the same cement loading of six hundred (600) pounds if the sodium equivalent was one-half (0.5) percent, then use three (3) pound of Lifetime-SL per yard of cement.

Please note that you should not use Lifetime-SL in doses lower than required for a sodium equivalent of 0.6% (i.e. no less than 0.6 pounds per sack of cement). Because some of the Lifetime-SL is consumed in cement hydration, lower doses could fail to provide adequate ASR protection.

G. RINGS AND COVERS

1. Rings and covers shall be East Jordan Iron Works (EJIW) #330-4, ring with flush mount cover, or equal. Covers shall be the non-ventilated type.
2. The covers shall be of the bolt down type if the manhole is outside of a paved street or alley.

H. PRECAST CONCRETE RINGS

1. Adjusting rings may be used for adjusting the manhole top

elevation to coincide with existing ground elevations, except the total height of adjusting rings used per manhole shall not exceed six (6) inches in new construction. Adjusting rings shall be reinforced with the same percentage of steel as the riser and top.

2. Precast Concrete rings for manholes shall conform to ASTM C478, "Precast Reinforced Concrete Manhole Risers and Tops".
3. These concrete products shall be manufactured with ASTM C150 Type 1 (low alkali) cement and fifteen (15) percent of the cement shall be replaced with one and one-half (1.5) pounds of ASTM C618 Class F fly ash substituted for each pound of cement being replaced. (The fly ash shall not exceed a four (4) percent loss on ignition.) Also, limestone aggregates shall not be used in the manufacture of these concrete products.

I. STEPS

1. Non-corrosive steps of rubber encased steel, shall be used. Steps shall withstand vertical loads of four hundred (400) pounds and pull-out resistance of one thousand (1,000) pounds.

J. CONCRETE BASE

1. Concrete bases shall be precast or poured in the field on undisturbed earth. Poured in place bases will only be allowed when existing manhole is being replaced and only with BOPU prior approval, see Standard Drawing 02700-06.
2. Whether precast or poured in place manhole base, all troughs must be coated with a Type 3 Epoxy, a minimum of 4 (four) hours prior to being placed into service. In addition all grout installed in or around the trough shall also be Type 3 Epoxy coated a minimum of 4 (four) hours prior to being placed into service. The Type 3 Epoxy shall not be applied to the trough until all grouting in and around the trough has been installed.
3. Concrete bases shall be manufactured with ASTM C150 Type 1 (low alkali) cement and fifteen (15) percent of the cement shall be replaced with one and one-half (1.5)

pounds of ASTM C618 Class F fly ash substituted for each pound of cement being replaced. (The fly ash shall not exceed a four (4) percent loss on ignition.) Also, limestone aggregates shall not be used in the manufacture of these concrete products.

4. The “Lifetime” liquid for “Lifetime-SL” crystals may be used to control alkali-silica reactivity in concrete as an alternative to the use of fly ash.

Lifetime (Liquid): (As Manufactured by FMC):

To control alkali-silica reactivity (ASR) in concrete, add 0.72 gallons of Lifetime per yard for every pound of sodium equivalent supplied by the cement, then subtract the number of gallons of Lifetime from the mix water. For example, for a mix containing six hundred (600) pounds of cement per cubic yard of concrete, with a sodium equivalent of one (1) percent, use 4.32 gallons of Lifetime per yard of concrete (six (6) pounds of sodium equivalent x 0.72 gallons of Lifetime/pound of sodium equivalent). For the same cement loading of six hundred (600) pounds, if the sodium equivalent was one-half (0.5) percent, then use 2.16 gallons of Lifetime per yard of cement.

Please note that you should not use Lifetime in doses lower than required for a sodium equivalent of 0.6% (i.e. no less than 0.4 gallons per sack of cement). Because some of the Lifetime is consumed in cement hydration, lower doses could fail to provide adequate ASR protection.

Lifetime-SL (Crystals): (As Manufactured by FMC):

To control alkali-silica reactivity (ASR) in concrete, add the same weight of Lifetime SL per yard as the sodium equivalent supplied by the cement. For example, if there were six hundred (600) pounds of cement per cubic yard of concrete, and the sodium equivalent of the cement was one (1) percent, then use six (6) pounds of Lifetime-SL per yard of concrete. For the same cement loading of six hundred (600) pounds, if the sodium equivalent was one-half (0.5) percent then use three (3) pounds. of Lifetime SL per yard of cement.

Please note that you should not use Lifetime-SL in doses lower than required for a sodium equivalent of 0.6% (i.e.

no less than 0.6 pounds per sack of cement). Because some of the Lifetime-SL is consumed in cement hydration, lower doses could fail to provide adequate ASR protection.

K. GRAVITY SEWER SERVICE MATERIALS

1. Type of joint, class, thickness designation, castings, lining, marking, testing, etc., shall be the same as the sewer main.

PART 3 EXECUTION

3.01 PIPE INSTALLATION

A. RESPONSIBILITY FOR MATERIAL

1. CONTRACTOR shall be responsible for all material furnished by him and shall replace at his own expense all such material found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include furnishing all material and labor required for the replacement of installed material discovered defective prior to final acceptance of the work or during the guarantee period.
2. CONTRACTOR shall be responsible for the safe storage of material intended for the work until it has been incorporated in the completed project.

B. HANDLING OF PIPE

1. All pipe furnished by CONTRACTOR shall be delivered and distributed at the site by CONTRACTOR. Pipe, fittings and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.
2. In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. The interior of all pipe and other accessories shall be kept free from dirt and foreign matter at all times.
3. Pipe shall be handled so that no coating or lining will be damaged. If, however, any part of the coating or lining is

damaged, the repair shall be made by CONTRACTOR at his expense in a manner satisfactory to the BOPU.

C. LAYING PIPE

1. All pipe shall be laid and maintained to the required lines and grades with fittings, tees and manholes at the required locations.
2. CONTRACTOR shall use good workmanship. All pipe shall be properly jointed home, using wood cushion and protective devices in accordance with manufacturer's recommendations.
3. Proper tools and equipment satisfactory to ENGINEER shall be used by CONTRACTOR for the safe and convenient prosecution of the work. All pipe and fittings shall be carefully lowered into the trench in such a manner as to prevent damage to pipe materials and protective coatings and linings. Under no circumstances shall materials be dropped or dumped into the trench.
4. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being installed. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a plug or other means approved by ENGINEER. CONTRACTOR shall clean and remove all sand, gravel, concrete and cement grout that has entered the lines in the process of construction.
5. If the CONTRACTOR's activity results in gravel, mud or other debris getting into existing sewer mains, the CONTRACTOR shall be responsible for the cleaning of the existing sewer mains.
6. The bottom of the trench shall be shaped to fit the bottom quadrant of the pipe, with holes for couplings just large enough to permit their assembly.
7. Preparation of Trench Bottom: The trench bottom should be constructed to provide a firm, stable, and uniform support for the full length of the pipe. Bell holes should be provided at each joint to permit proper assembly and pipe support. Any part of the trench bottom excavated below grade should be backfilled to grade and should be compacted as required to provide firm pipe support. When

an unstable subgrade condition is encountered that could provide inadequate pipe support, additional trench depth should be excavated and refilled with suitable foundation material. Ledge rock, boulders, and large stones should be removed to provide six (6) inch of soil cushion on all sides of the pipe and accessories.

D. JOINTS

1. The spigot and bell ends of the pipe and couplings shall be thoroughly cleaned before joint assembly. Jointing of the pipe shall be in strict accordance with the recommendations of the manufacturer of the pipe and fittings. The correct position of the rubber gaskets and proper assembly of the pipe shall be checked by means of a feeler gauge prior to backfilling of the trench. On larger diameter pipe, which will provide room for workmen inside, all joints shall be visually inspected and gauged inside for proper position of the gasket and joint gap tolerances.
2. The sewers shall be installed within one-quarter ($\frac{1}{4}$) inch for grade and shall not be off more than two (2) inches for alignment. ENGINEER shall specify joint deflection tolerance where acceptable.
3. Pipe entering manholes with precast bases shall be grouted inside and outside to assure a watertight seal.

E. TOLERANCES

1. Each segments of sewer main (manhole to manhole) shall be installed within plus or minus one-quarter ($\frac{1}{4}$) inch for planned grade and shall not be off more than plus or minus two (2) inches for planned alignment.

F. SEPARATION OF WATER MAINS AND SEWERS

1. PARALLEL INSTALLATION

- a. Normal conditions - Sanitary sewer mains and manholes shall be laid at least ten (10) feet horizontally from any water main whenever possible. The distance shall be measured edge-to-edge.
- b. Unusual conditions - When local conditions prevent

a horizontal separation of ten (10) feet as noted above, a sewer main may be laid closer to a water main, provided that:

- 1) The top of the sewer main is at least eighteen (18) inches below the bottom of the water main.
- 2) Where eighteen (18) inches vertical separation as noted above cannot be obtained, the sewer main shall be:
 - (a) Constructed of materials and with joints that are equivalent to water main standards of construction, and tested to assure water tightness prior to backfilling.
 - (b) Placed in a separate casing pipe. The casing pipe shall be C-900 PVC DR 25 water pipe.

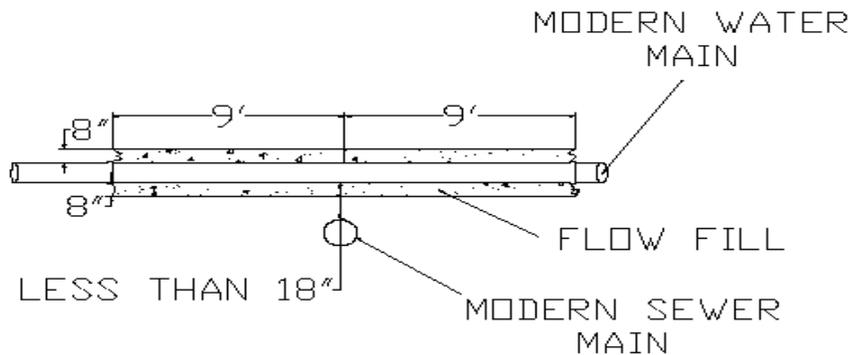
2. CROSSING

- a. Normal conditions - Sewers crossing water mains shall be laid below the water mains to provide a vertical separation of at least eighteen (18) inches, whenever possible. The distance shall be measured between the bottom of the water main and the top of the sewer.
- b. Definitions:
 - 1) Modern water main materials - DIP, C-900 water pipe with rubber gaskets.
 - 2) Non-modern water main materials - lead joint cast iron pipe.
 - 3) Modern sewer main materials - PVC rubber gasket pipe, glued pipe is not acceptable.
 - 4) Non-modern sewer main materials - VCP grouted pipe, concrete grouted pipe.
 - 5) Flow fill - see SECTION 02225, TRENCH

BACKFILL for construction standards for mixes.

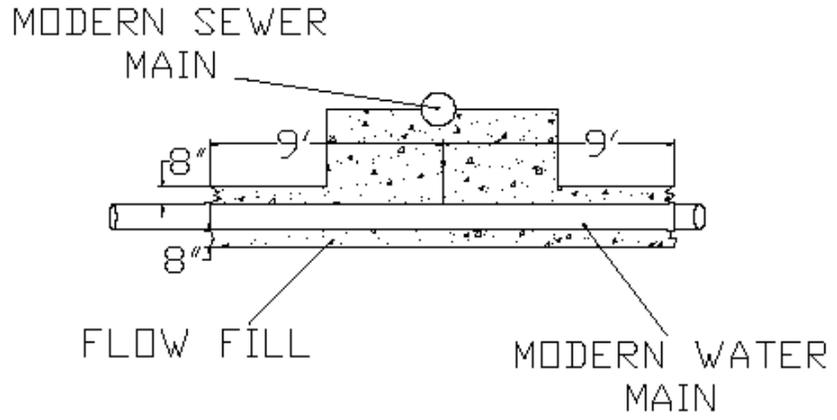
- c. Fire hydrants must be at least ten (10) feet away from storm drains, storm drain inlets, sanitary sewers & sanitary sewer appurtenances at all times.
- d. Water mains and sanitary sewer main crossings:
 - 1) When constructing a modern water main and it crosses over an existing modern sewer main and the pipes are less than eighteen (18) vertical inches of each other:
 - (a) Center a full joint of water main over sewer main.
 - (b) Flow fill the water main a distance of nine (9) feet each side of the sewer main.

figure 1



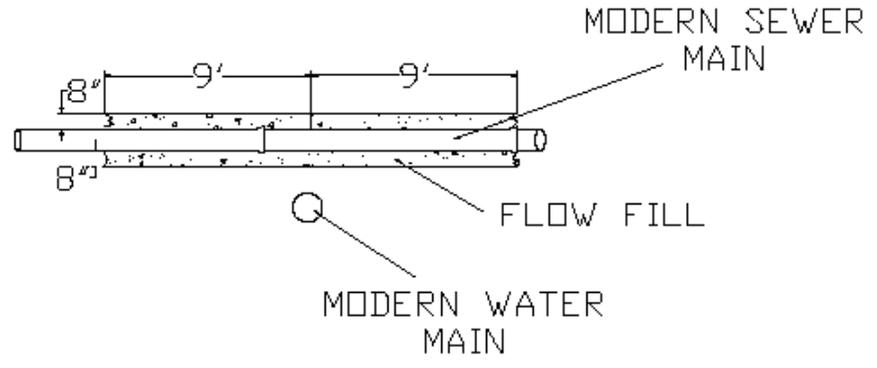
- 2) When constructing a modern water main that crosses under a modern sewer main or when constructing a modern sewer that crosses over a modern water main:
 - (a) When constructing a modern water main; flow fill the water main that goes under the sewer main nine (9) feet each side of the sewer main, also encasing the modern sewer main where it crosses the excavation for the new water line.

figure 2-a



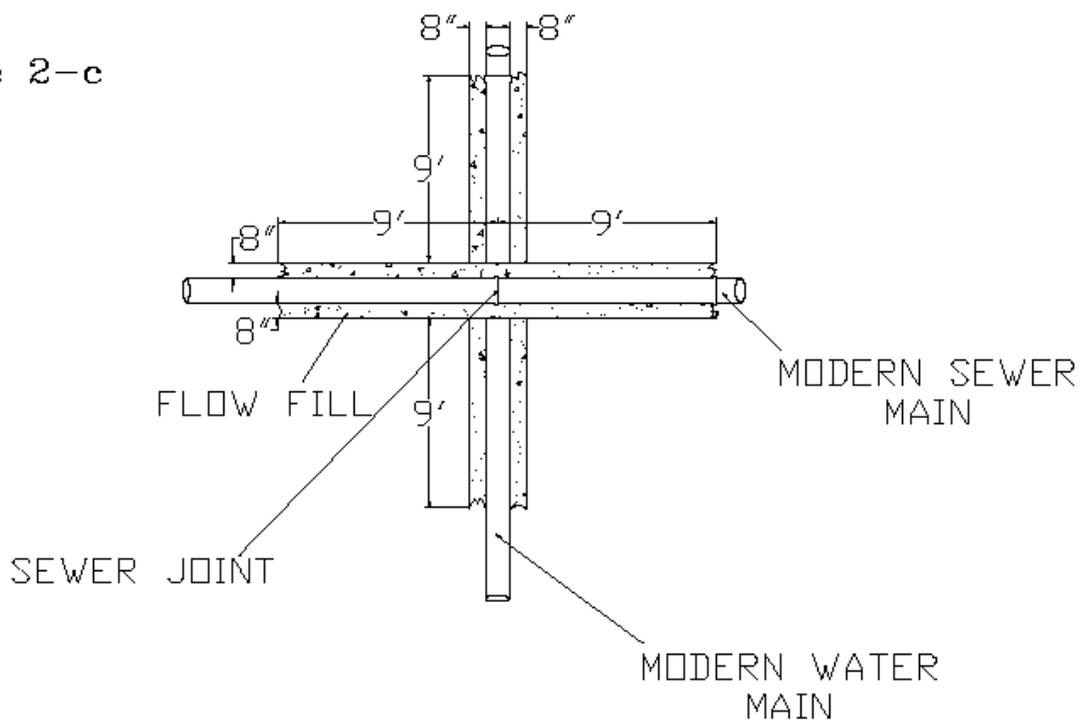
(b) When constructing a modern sewer; flow fill the sewer main that goes over the water main nine (9) feet each side of the water main.

figure 2-b



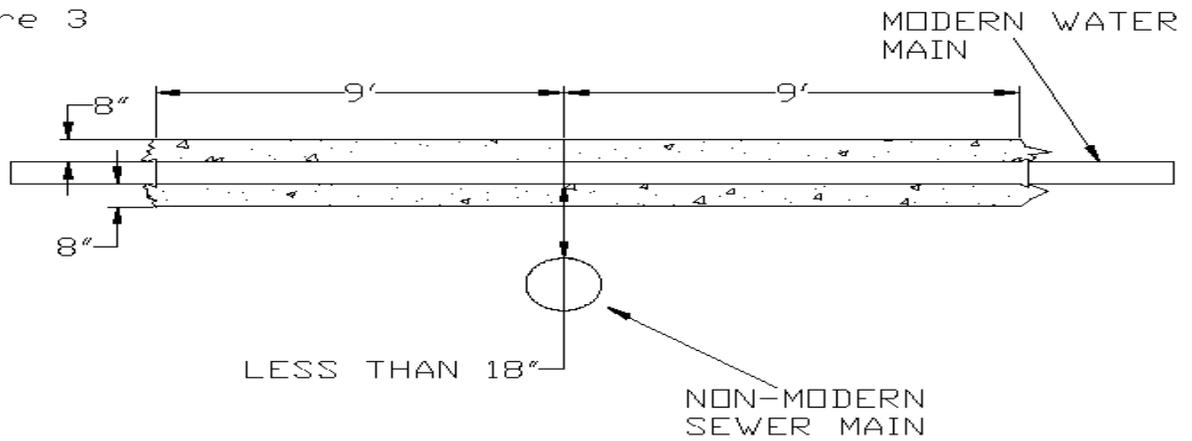
(c) If a modern sewer main joint is directly over the water main then flow fill both mains nine (9) feet in all directions.

figure 2-c



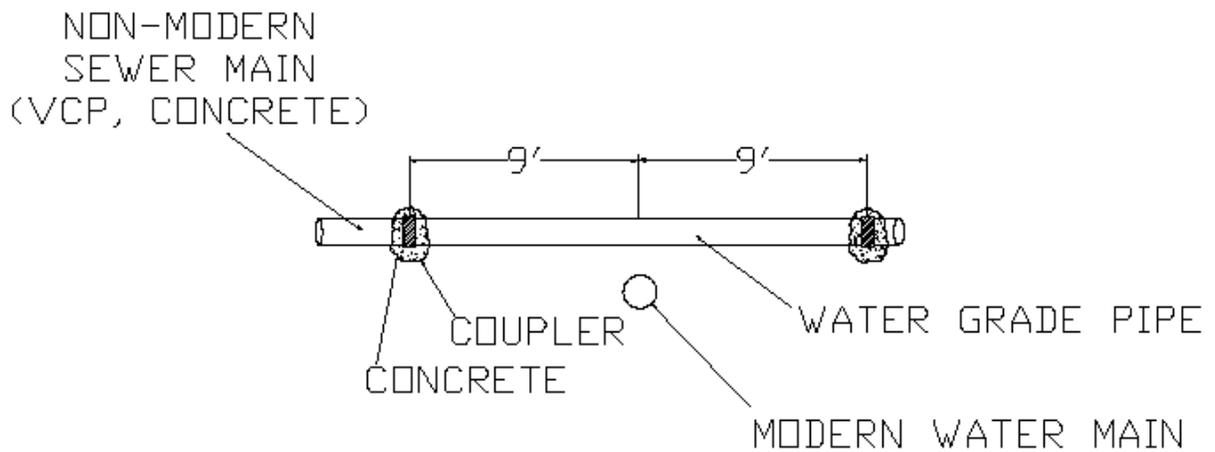
- 3) When constructing a modern water main that crosses over a non-modern sewer main (VCP, Concrete) and is less than eighteen (18) vertical inches of separation between the main:
 - (a) Center a full joint of water main over sewer main.
 - (b) Flow fill the modern water main a distance of nine (9) feet each side of the non-modern sewer main.

Figure 3



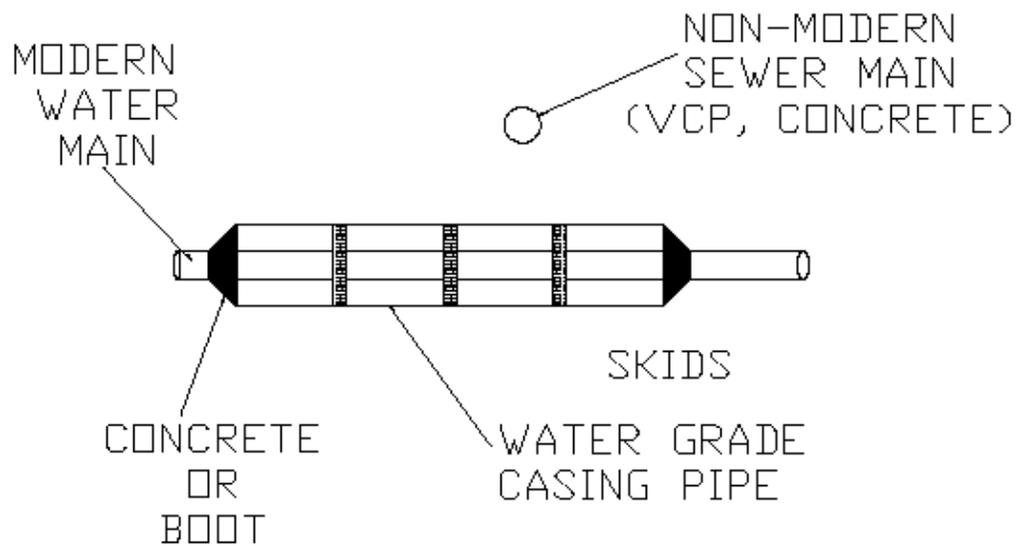
- 4) When constructing a modern water main that crosses under a non-modern sewer main (VCP, Concrete):
 - (a) Replace the non-modern sewer main with water grade pipe (DR-25 C-900 or greater, encasing the couplers in concrete) nine (9) feet each side of the water main.

figure 4-a



- (b) Encase the water main pipe nine (9) feet each side of the sewer with a water grade, casing pipe (using skids, boots, etc.).

figure 4-b



- 5) Water mains and storm sewer main crossings:
 - (a) When constructing a water main that crosses under a storm sewer lateral or collection box the main is flow

filled nine (9) feet each side of the box or storm sewer lateral.

- (b) When constructing a storm sewer lateral or collection box over a water main, the lateral or collection box is encased with flow fill nine (9) feet each side of the water main.
- (c) When constructing a water main that crosses under a forty-eight (48) inch or larger storm sewer; encase the water main using skids, boots, and appropriate water grade casing pipe.
- (d) When constructing a water main that crosses under a forty-seven (47) inch and smaller storm sewer; flow fill the water main nine (9) feet each side of the forty-seven (47) inch or smaller storm sewer pipe up to the haunch of the storm sewer, maintaining a minimum eighteen (18) inch separation.
- (e) When constructing a forty-seven (47) inch and smaller storm sewer that crosses over an existing water main; flow fill the storm sewer nine (9) feet each side of the water main, maintaining a minimum eighteen (18) inch separation:
 - (1) If separation between the mains is less than eighteen (18) inches, then two (2) inches of Dow Chemical Company Styrofoam 60 High Load (HL) meeting ASTM D1621, ASTM C272, ASTM C177 or ASTM C518 or equal must be placed between the two (2) pipes in addition to the flow fill.

- A. Manholes shall be constructed to the general dimensions shown. Invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction or flow shall be made with a smooth curve with as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels may be formed directly in the concrete of the manhole base or may be half-pipe laid in concrete. The floor of the manhole outside the channel shall be smooth and shall slope toward the channel not less than one (1) inch per foot, no more than two (2) inches per foot.
- B. Free drop inside the manhole shall not exceed one and one-half (1-½) feet measured from the invert of the inlet pipe to the invert of the outlet pipe. Where the drop exceeds one and one-half (1-½) feet, drop manholes shall be constructed as shown on the typical manhole detail.
- C. All connections between wall sections or between sewer pipe and manhole walls shall be joined with Conseal or “Kent Seal” manufactured by K.T. Snyder Company, or approved equal, in such a manner as to make the manhole watertight. Manhole construction shall be not greater than one manhole distance behind sewer construction, unless otherwise allowed by BOPU.
- D. MANHOLES SHALL BE SIZED ACCORDINGLY

Manhole Diameter (ft)	Pipe Diameter (in) or	Depth (ft)
Four ft	8 - 12 in	Less 15 ft
Five ft	15 - 21 in	15 - 20 ft
Six ft	24 in	Greater than 20 feet needs BOPU approval

- * Manhole depths over twenty (20) feet need a landing at the midpoint as per OSHA regulations.
- E. ACCESS TO MANHOLES
 - 1. Paved or gravel road access shall be provided to all manholes that are to be owned and maintained by the BOPU, which are on sewer mains that are twelve (12) inch in diameter or smaller.
- F. When a manhole is in anticipated or actual groundwater conditions, a water proofing coating must be applied to the outside

of the manhole and base.

- G. Compaction around manholes shall conform to the specifications and standards set forth in SECTION 02225, TRENCH BACKFILL.
- H. Manholes shall be set flush with the ground surface or street surfacing unless otherwise approved by the BOPU. The manholes shall be raised to finished grade within thirty (30) days of completion of paving. No Certificate of Occupancy shall be issued for area until all manholes have been permanently raised to the surface.

3.03 SERVICE LINE INSTALLATION

A. GENERAL

1. Service lines shall be constructed in accordance with Standard Drawings. The service line shall be installed to the property line. The end of the service line shall be plugged with an approved stopper or plug. Grouting of plugs shall not be permitted.
2. Wye fittings shall be installed in the mainline sewer for connection of service lines. Wye fittings shall be of the same material and design and of the same specifications of the sewer main pipe. Jointing of service pipe to wye or tee branches of main line pipe other than PVC, shall be accomplished with special joint adapters manufactured specifically for jointing the two different types of pipe. Saddle wye fittings shall not be used in new construction, but shall be used, with BOPU approval, to tap existing mains.
3. The main sewer line may be extended up to ten (10) feet beyond the end manhole (in cul-de-sacs and other specially approved situations) to receive service laterals. The end of the line shall be capped with a large concrete thrust block.
4. Preparation of Trench Bottom: The trench bottom should be constructed to provide a firm, stable, and uniform support for the full length of the pipe. Bell holes should be provided at each joint to permit proper assembly and pipe support. Any part of the trench bottom excavated below grade should be backfilled to grade and should be compacted as required to provide firm pipe support. When

an unstable sub-grade condition is encountered that could provide inadequate pipe support, additional trench depth should be excavated and refilled with suitable foundation material. Ledge rock, boulders, and large stones should be removed to provide six (6) inch of soil cushion on all sides of the pipe and accessories.

B. CROSSING

1. Normal Conditions - Sanitary sewer service lines crossing water mains shall be laid to provide a vertical separation of at least eighteen (18) inches whenever possible. The distance shall be measured from the top of the lower pipe to the bottom of the upper pipe.
2. Unusual conditions - When local conditions prevent a vertical separation of at least eighteen (18) inches as noted above, the sanitary sewer service line shall be placed in a separate casing pipe, said casing pipe shall extend a minimum of nine (9) feet each side of center of the crossing.

C. END PIPE MARKER

1. The end of newly installed sewer service lines shall be marked by CONTRACTOR at the property line by a post five (5) feet long buried in the ground a distance of three (3) feet, in addition to a one-half (½) inch diameter reinforcing bar, eighteen (18) inch in length, buried vertically two (2) inches below the ground surface.

3.04 TESTING

A. LIGHT TEST

1. After the trench has been backfilled and compacted to final subgrade, a light test shall be made between manholes to check alignment and grade for displacement of pipe. The completed pipeline shall be such that a true circle of light can be seen from one (1) manhole to the next. If alignment or grade is other than specified and displacement of pipe is found, CONTRACTOR shall remedy such defects at his own expense.

B. T.V. INSPECTION

1. The OWNER or BOPU, requires all sanitary sewers to be inspected by the use of a television camera before final acceptance. The costs incurred in making the initial inspection shall be borne by the OWNER/DEVELOPER/CONTRACTOR.
2. If a problem with the work is discovered, the OWNER/DEVELOPER/CONTRACTOR shall be required to correct the defective work.
3. OWNER/DEVELOPER/CONTRACTOR shall bear all costs incurred in correcting any deficiencies found during television inspection, including the cost of any additional television inspection that may be required by the OWNER or BOPU to verify the correction of said deficiency.
4. BOPU inspection staff must be present during the video inspection process and shall receive a copy of the completed videotape, CD-R disk, and data sheets showing all appurtenances related to the main being videoed.
5. OWNER/DEVELOPER/CONTRACTOR shall be responsible for all cost incurred in any television inspection performed solely for the benefit of the OWNER/DEVELOPER/CONTRACTOR.

C. LEAKAGE TEST

1. New sewer line shall not be finally accepted until leakage tests have been made to assure ENGINEER that pipe laying and jointing are satisfactory. When a pipe section fails to pass a test, the CONTRACTOR shall make all necessary repairs and schedule a retest.
 - a. Water Test
 - 1) Hydrostatic testing of sewer mains is not allowed as an acceptable test method.
 - b. Air Test
 - 1) The CONTRACTOR shall utilize low pressure air as a means of testing the sewer mains. The test procedure shall be as described in the UNI-BELL publication UNI-6-90, recommend practice for low

pressure air testing of installed sewer pipe.

- c. Plug both ends of the pipe under test with airtight plugs and brace adequately to prevent slippage and blowout. One (1) plug shall have an inlet tap or other provision for connecting an air hose.
 - d. The air supply hose, connected between the air compressor and the plug, shall have a throttling valve, an air bleed valve, and a high pressure shut-off valve for control. The low pressure side of the throttling valve shall have a tee for a monitoring pressure gauge, protected by a gauge cock. This cock is kept closed except when the pressure loss is being timed.
 - e. If the pipeline is submerged under groundwater, the back pressure, caused by the water head, is measured and added to the standard test pressures to compensate for the groundwater effect on the air test.
 - f. Air shall be applied slowly to the pipeline until the pressure reaches manufacturer's recommendations. The air supply shall then be throttled so that the internal pressure is maintained at the pressure and for the time duration as recommended by the manufacturer. During this time the plugs shall be checked with soap solution to detect any plug leakage.
 - g. When the pressure reaches the manufacturer's recommended pressure, a stop watch is started and the time recorded for the pressure to drop. Should the time of the pressure drop be less than the allowable specified time, the CONTRACTOR shall make the necessary leakage repairs and repeat the air test.
 - h. This does not preclude the fact that obvious and concentrated leaks, such as open joints, pinched gaskets, cracked barrels or bell, etc., shall not be allowed. The CONTRACTOR shall make repairs as necessary at his own expense.
2. Manholes shall be checked for leakage by means of air/vac

testing as per ASTM C1244.

D. DEFLECTION TESTING

1. After the pipe has been laid and backfilled to final subgrade, all flexible pipe systems shall be tested for deflection in the presence of the BOPU. This test shall consist of pulling a mandrel (Go-No Go Device) through the pipe. The maximum deflection allowable shall not exceed seven and one-half (7-½) percent of the pipe's internal diameter for final inspection. The CONTRACTOR shall conduct the test and shall furnish all necessary test equipment and labor. All pipe sections failing the test shall be removed and replaced at the CONTRACTOR's expense.

E. NUMBER OF TESTS

1. A sufficient number of leakage tests shall be performed to assure the BOPU that materials and workmanship are acceptable. Defective joints shall be repaired only by use of approved jointing material which is flexible when set and that has a permanent bond to the pipe. Pipe having cracked or broken barrels shall be replaced. The length of sewer main tested per test shall not exceed three hundred-fifty (350) feet.

F. MATERIALS AND EQUIPMENT FOR TESTING

1. All labor, equipment and materials (including water) necessary for making the tests of sewer lines shall be furnished by the CONTRACTOR.

- G. All tests shall be made after backfill is completed, all mains, and manholes are cleaned of any debris from construction. The CONTRACTOR shall dispose of debris collected from the cleaning process in a proper manner. The CONTRACTOR shall be responsible for finding and repairing all breaks and leaks revealed by the tests.

3.05 CHANGES TO APPROVED PLANS

- A. The ENGINEER shall obtain DEQ and BOPU approval for all field changes made to the approved construction plans prior to the field changes being made, except for minor field changes which require BOPU approval only. (The BOPU inspector shall make the call as to what is a minor field change.)

3.06 INSPECTION SCHEDULING

A. SEWER TAPS

1. The CONTRACTOR shall make appointments with the BOPU utility inspectors twenty-four (24) hours in advance for the inspection of water and sewer taps.

B. GENERAL INSPECTIONS

1. The CONTRACTOR shall make appointments with the BOPU chief utility inspector one (1) working day in advance for general inspections such as but not limited to manholes, wye's and bedding.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

A. SEWER MAIN

1. Measurement of sewer mains shall be made in lineal feet of the various sizes and classes, along the centerline of pipe from center to center of manhole.

B. MANHOLES

1. Measurement of each manhole for payment shall be made by the numerical count of each manhole constructed.

C. SERVICE LINES

1. Measurement shall be by numerical count each.

4.02 BASIS OF PAYMENT

A. SEWER MAIN

1. Payment for sewer main shall be made at the contract unit price bid per lineal foot of the various sizes and classes called for, which price shall include furnishing and installing pipe; furnishing and placing pipe bedding; trench excavation; backfill; pumping and dewatering of trench; specials required for connection to manholes; testing and all other work necessary or incidental for completion of the

item.

B. MANHOLES

1. Payment for furnishing and installing a manhole complete, shall be made at the contract unit price bid each for manholes. Such payment shall include base; manhole sections; steps; cast iron ring and cover; joint sealer; bedding; excavation; backfill; pumping and dewatering of trench; and all other incidentals required to complete the item. Payment includes final adjustment to grade and concrete collar.

C. SERVICE LINES

1. Payment for furnishing and installing sewer services shall include the tee or wye; trench excavation; bedding; backfill; labor; materials; tools; and other necessary things as may be required to complete the item of work in accordance with the drawings and specifications.

END OF SECTION

SECTION 02725

STORM DRAINS AND CULVERTS

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of construction of drainage culverts and storm drains, including pipe manholes, inlets and other appurtenant structures, complete. All precast items shall be manufactured in a plant certified by the National Precast Concrete Association. Construction may include surface preparation; trench excavation; shoring; dewatering; lay, align and join pipe; installation of appurtenances; bedding and backfilling; surface restoration; and other related work. Construction of storm water systems shall adhere to the requirement of the Federal Clean Water Act of 1972 and the Wyoming Pollutant Discharge Elimination System (WYPDES) Municipal and Construction Site Permits.

1.02 RELATED WORK

- A. Section 02220 Trench Excavation
- B. Section 02225 - Trench Backfill.
- C. Section 02665 - Water Distribution and Transmission Systems.
- D. Section 02700 - Sanitary Sewer.

1.03 REFERENCES

- A. Where reference is made to an ASTM, ANSI or AASHTO designation, it shall be the latest revision at the time of call for Bids, except as noted on the plans.

1.04 SUBMITTALS

- A. All submittals shall include manufacturer's specifications, test data, MSDS, and other data required to prove compliance with the specified requirements.
- B. Details of fittings and specials shall be furnished for approval by engineer.

- C. Manufacturer's recommended installation procedures which, when approved by ENGINEER, shall become the basis for accepting or rejecting actual installation procedures used in the work.

1.05 QUALITY ASSURANCE

A. WPDES PERMIT

- 1. Quality control inspection shall be made by the ENGINEER with regard to the WYPDES permit issued for the project.

B. CERTIFICATION BY MANUFACTURER

- 1. CONTRACTOR shall furnish certification by the manufacturers of the pipe and appurtenant structures to be furnished on a project, certifying that the pipe and appurtenant structures comply with the applicable specifications, when required by ENGINEER. Required certification shall accompany each delivery of material.
- 2. All pipe and appurtenant structures shall be clearly marked with type, class and/or, thickness as applicable. Lettering shall be legible and permanent under normal conditions of handling and storage.
- 3. Type of joint, class, thickness designation, casting, lining, marking, testing, etc., shall be specified.

PART 2 PRODUCTS

2.01 MATERIALS

A. STORM DRAIN AND CULVERT PIPING

- 1. All storm drain and culvert piping shall be as called out in the Contract Documents and shall be in accordance with materials and testing as specified in this section. Pipe sizes and strength classifications shall be as shown on the approved plans. All storm drain pipes shall be twelve (12) inches or larger.

B. CONCRETE PIPE

- 1. Pipe for storm drains and culverts shall be reinforced concrete pipe conforming to ASTM C76, non-reinforced

concrete pipe conforming to ASTM C14 or elliptical pipe conforming to ASTM C507. Joints for concrete pipe shall be rubber gasket type conforming to ASTM C443 or as otherwise specified by ENGINEER. All concrete pipe in the right-of-way shall be reinforced.

C. OTHER PIPE

1. C-900 or C-905 pipe may be used as laterals from inlets or waterline crossings when approved by the ENGINEER. Pipe and gaskets shall conform to ASTM D1784 and ASTM F477.
2. Other pipe materials, suitable for the applications, may be specified, with prior approval by the ENGINEER.

D. MANHOLES

1. Manholes shall be constructed of precast concrete materials fabricated in accordance with ASTM C478 and sealed with ring and covers in accordance with details shown on the Standard Drawings. They shall have smooth inverts across the main pipe. All pipes shall have rubber seals or be grouted flush with manhole.

E. RINGS AND COVERS

1. Rings and covers shall be in accordance with OWNER's standards. Covers shall be twenty-four (24) inch minimum, non-ventilated type unless called out otherwise on the plans. All storm sewer covers shall have "STORM" on the cover. Locking covers may be required as per the ENGINEER.

F. PRECAST CONCRETE RINGS

1. Adjusting rings shall be used for adjusting the manhole top elevation to coincide with existing final elevations, except the total height of adjusting rings used per manhole shall not exceed six (6) inches in new construction. Adjusting rings shall be reinforced with the same percentage of steel as the riser and top, and shall be sealed and supplied with nonslip lugs or bonded with sealant or other approved method.

2. Precast concrete rings for manholes shall conform to ASTM C478.

G. STEPS

1. Steps are required. Steps shall be cast into the manhole wall at the time the manhole is cast.
2. Non-corrosive steps of rubber encased steel, aluminum, or nylon shall be used. Steps shall withstand vertical loads of four hundred (400) pounds and pull-out resistance of one thousand (1,000) pounds. Steps shall not be more than eighteen (18) inches apart or begin more than twenty-eight (28) inches below final grade. Steps shall align with manhole and subsequent sections of manhole.

H. CONCRETE BASE

1. Concrete bases shall be precast or poured in the field on undisturbed earth. Concrete shall conform to SECTION 03304, PORTLAND CEMENT CONCRETE.

I. INLETS AND CATCH BASINS

1. Inlet frames and grates shall be standard cast iron frames and grates of the design shown on the Standard Drawings. (See Standard Drawings No. 02725-01, 02725-02, 02725-03.)

J. SIDEWALK CHASE

1. Sidewalk chases shall conform to Standard Drawing No. 02725-04.

K. FLARED END SECTION, HEADWALL AND TRASH GUARD

1. Open pipe sections with diameters less than forty-eight (48") inches or greater shall require flared end sections with joint fasteners, or headwalls and wingwalls.
2. Open pipe sections with diameters forty-eight (48) inches or greater shall require headwalls, with railings as appropriate.
3. Lockable steel trash guards that can be opened for maintenance are required on the upstream end of pipe

sections with diameters less than forty-eight (48) inches, with a length greater than one hundred (100) feet or includes bends. Trash guards or grating is prohibited on the downstream end of pipe sections unless approved by the ENGINEER.

L. FLEXIBLE COUPLERS

1. Flexible couplers shall be Fernco Series 1000 with two (2) Series 300 stainless steel clamps or approved equal.

M RESPONSIBILITY FOR MATERIAL

1. CONTRACTOR shall be responsible for all material furnished by him and shall replace at his own expense all such material found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include furnishing all material and labor required for the replacement of installed material discovered defective prior to final acceptance of the work or during the guarantee period.
2. CONTRACTOR shall be responsible for the safe storage of material intended for the work until it has been incorporated in the completed project.
3. All gaskets shall be stored in a cool place, preferably less than seventy degrees Fahrenheit (70°F). In no case shall gaskets be stored in the open or exposed to the direct rays of the sun.

PART 3 EXECUTION

3.01 PIPE INSTALLATION

A. HANDLING OF PIPE

1. All pipe furnished by CONTRACTOR shall be delivered and distributed at the site by CONTRACTOR. Pipe, fittings and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground. Pipe shall be approved by the ENGINEER prior to incorporation into the project.

2. In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. The interior of all pipe and other accessories shall be kept free from dirt and foreign matter at all times.
3. Pipe and appurtenant structures shall be handled so that no coating or lining will be damaged. If any part of the coating or lining is damaged, the repair shall be made by CONTRACTOR at his expense in a manner satisfactory to ENGINEER.

B. LAYING PIPE

1. Pipe trench shall conform to current OSHA regulations, City Standard Drawing 02220-01 and be backfilled to the standards of the CITY. Pipe shall be laid from outfall up.
2. All pipe shall be laid on six (6) inches of bedding material in accordance to SECTION 02225, TRENCH BACKFILL.
3. All pipe shall be laid and maintained to the required lines and grades with fittings, tees and manholes at the required locations. Electronic grade and alignment control equipment may be used when laying pipe.
4. All pipe and fittings shall be carefully lowered into the trench in such a manner as to prevent damage to pipe materials, joints, protective coatings and linings. Under no circumstances shall materials be dropped or dumped into the trench.
5. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being installed. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a plug or other means approved by ENGINEER. CONTRACTOR shall clean and remove all sand, gravel, concrete and cement grout that has entered the lines in the process of construction. All connection pipes shall be trimmed flush with main pipe wall.
6. The CONTRACTOR shall call the CITY Construction Division for inspection of all pipe prior to backfilling two (2) working days in advance.

7. The trench shall be backfilled with cement slurry when any portion of the pipe has less than eighteen (18) inches of cover, to top of finish grade. The pipe shall be slurried with City Mix #3 to the top of subgrade, otherwise backfill shall conform to SECTION 02225, TRENCH BACKFILL.
8. Pipe with lifting holes shall be installed such that the lifting holes shall be in the crown of the pipe. All lifting holes shall be properly grouted with cement mortar immediately after the pipe is installed and prior to commencement of backfill.
9. Pipe with lifting anchors shall be installed such that the lifting anchors are in the crown of the pipe. All lifting anchors recesses in the wall of the pipe at the lifting anchors need not be grouted.

C. TOLERANCES

1. The sewers shall be installed within one-half ($\frac{1}{2}$) inch from grade and shall not be off more than two (2) inches for alignment. No deviation from grade shall cause a depression in the sewer invert that could retain fluids or solids.
2. The rate of departure from or return to the established grade or alignment shall be not more than one (1) inch in ten (10) feet unless approved by ENGINEER.

D. STORM SEWERS CROSSING WATER MAINS AND SANITARY SEWERS

1. See SECTION 02700, SANITARY SEWER. Use of casing pipe or water class pipe may be required.

3.02 MANHOLE INSTALLATION

- A. Manholes shall be constructed to the general dimensions shown. Invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels may be formed directly in the concrete of the manhole base or may be half-pipe laid in concrete. The floor of the manhole outside the channel shall be smooth and shall slope

toward the channel not less than one (1) inch per foot, nor more than two (2) inches per foot.

- B. All connections between wall sections or between sewer pipe and manhole walls shall be joined with a watertight seal. All pipes shall be trimmed within three (3) inches of manhole walls, except bottom pipe if it is laid straight through. The joint between PVC pipe and manhole wall shall be sealed with a non shrink grout per section 03600, Grout.
- C. Manhole construction shall be not greater than one (1) manhole distance behind the sewer main construction, unless approved by ENGINEER.

3.03 INLETS AND CATCH BASINS

- A. Inlets and catch basins shall be constructed as shown on the plans for the type designated. The frame shall be installed seventeen-hundredths (0.17) foot below the existing flow line.
- B. Inlet structures shall be constructed to the line, cross section and dimensions shown. Concrete and reinforcing steel shall conform to SECTION 03304, PORTLAND CEMENT CONCRETE. Inlet structures may be precast or cast-in-place. All pipes shall be trimmed within three (3) inches of inlet/catch basin walls.
- C. Ferncos shall be used when connecting existing pipe to new pipe. Flowlines shall meet on new pipe and on repairs. When grouting is required, a non-shrinking grout per SECTION 03600, GROUT shall be utilized. Repairs may use C-900 or C-905 pipe or as approved by the ENGINEER.

3.04 TESTING

- A. LIGHT TEST (18" and Smaller)
 - 1. After the trench has been completely backfilled, compacted and passed all testing, a light test shall be made between manholes to check alignment and grade for displacement of pipe. The completed pipeline shall be such that a true circle of light can be seen from one manhole to the next. If alignment or grade is other than specified and displacement of pipe is found, CONTRACTOR shall remedy such defects at his own expense.
- B. LEAKAGE TEST

1. Unless specified by the ENGINEER, a leakage test shall not be required. However, this does not preclude the fact that leaks shall not be allowed.

C. CAMERA INSPECTION

1. The CITY requires all storm sewers to be inspected by the use of a television camera before final acceptance. The costs incurred in making the initial inspection shall be borne by the CONTRACTOR.
2. If a problem with the work is discovered, the CONTRACTOR shall be required to correct the defective work.
3. CONTRACTOR shall bear all costs incurred in correcting any deficiencies found during television inspection, including the cost of any additional television inspection that may be required by the CITY to verify the correction of said deficiency.
4. CITY inspection staff must be present during the video inspection process and shall receive a copy of the completed videotape, CD-R disk, and data sheets showing all appurtenances related to the main being videoed.

D. DEFLECTION TESTING

1. Maximum installed deflection of flexible pipe shall be five (5 %) percent of mean internal diameter.
2. At the ENGINEER's discretion, CONTRACTOR shall test flexible pipe after backfill has been in place a minimum of thirty (30) days. Deflection is defined per ASTM D2321.
 - a. CONTRACTOR shall provide rigid ball or mandrel deflection testing equipment and labor.
 - b. Pipe exceeding deflection limits, as defined in ASTM D2321, shall be replaced or re-compacted at CONTRACTOR's expense.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Measurement of storm drain pipe shall be made in lineal feet of the various sizes and classes along the centerline of pipe from center to center of manholes, or center of inlet to center of manhole.
- B. Measurement of culvert piping shall be made in lineal feet of the various sizes and classes, along the centerline of pipe for the length of pipe installed.
- C. Manholes will be measured by the complete unit including ring and cover. Manhole depth will be measured from top of cover to manhole invert at the center. Measured depth and pay depth of manholes shall conform to the following:

MEASURED DEPTH	Pay Depth
0 to 5 Feet	5 feet
Greater than 5 feet to 10 feet	10 feet
Greater than 10 feet to 15 feet	15 feet
Greater Than 15 feet	20 feet

Structure excavation and backfill for manholes will not be measured and paid for separately, but shall be included in the work.

- D. Storm drain inlets shall be measured by the number of drain inlets installed, complete in place. This includes a combination inlet/manhole.
- E. Flared end sections shall be measured by each item by diameter, pipe type, and with trash guard.
- F. Sidewalk chase shall be measured by square foot of the lid.

4.02 BASIS OF PAYMENT

- ~~A.~~ The following items shall constitute pay items for the work covered under this section of the specifications. Payment for these items shall be full compensation for providing all materials, tools, labor and equipment necessary to complete the item and all incidental work related thereto, whether specifically mentioned herein or not.

- A. PIPE

1. Payment for storm drain pipe shall be made at the contract unit price bid per lineal foot of the various sizes and classes called for, which price shall include furnishing and installing pipe; furnishing and placing Type 1 pipe bedding; specials required for connection to manholes and inlets; backfill and compaction testing and all other work necessary or incidental for completion of the item.
2. Payment for culvert piping shall be made at the contract unit price per lineal foot, which price shall include furnishing and installing pipe, furnishing and placing Type I pipe bedding; backfill and compaction; including any specials and all other work necessary or incidental for completion of the item. Flared end sections (including trash racks) shall be paid for at unit price bid per each.
3. Flared End Section payment shall be made under:

Flared End section, Size	EACH
Flared End section, Size with Trash Guard	EACH

B. MANHOLES

1. Payment for furnishing and installing a manhole complete shall be made at the contract unit price for each of the pay items listed below that appear in the bid schedule.. Such payment shall include base, concrete invert, manhole sections, steps, lid, cast iron ring and cover, joint sealer, connecting devices, backfill and compaction, testing and all other incidentals required to complete the item.
2. Payment shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Four Foot Diameter Manhole, 5 foot depth	EACH
Four Foot Diameter Manhole, 10 foot depth	EACH
Four Foot diameter Manhole, 15 foot depth	EACH
Five foot Diameter Manhole, 5 foot depth	EACH
Five Foot Diameter Manhole, 10 foot depth	EACH
Five Foot Diameter Manhole 15 foot depth	EACH

- C. Storm drain inlets and catch basins shall be paid by the number of drain inlets measured, complete in place, at the contract unit price bid for the various types of inlets listed in the Contract Documents,

which price and payment shall constitute full compensation for furnishing and installing all materials required (including frames and grates), for all backfill, compaction, labor, tools and incidentals necessary to complete the item.

D. Sidewalk Chase payment shall be made under:

Sidewalk Chase	SqFt
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END OF SECTION

SECTION 02805

INSTALLATION, RELOCATION OR REPLACEMENT OF STREET SIGNS, UTILITY POSTS AND MAILBOXES

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of the installation, removal and/or relocation of street signs, traffic control signs, utility poles, street lights and mailboxes.
- B. Location of street signs and private mailboxes “to be removed”, are approximate only. The survey for curb or sidewalk alignment as a part of actual construction shall be the determining factor as to which of these facilities are to be moved or removed by the CONTRACTOR or others.

1.02 SUBMITTALS

- A. All submittals shall include manufacturer’s specifications, test data, MSDS, and other data required to prove compliance with the specified requirements.
- B. Manufacturer’s recommended installation procedures which, when approved by ENGINEER, shall become the basis for accepting or rejecting actual installation procedures used in the work.

PART 2 PRODUCTS

2.01 SIGN MATERIAL AND DESIGN

- A. All signs shall be fabricated in accordance with SECTION 02806, SIZE, FABRICATION, MATERIAL, AND DESIGN OF NEW TRAFFIC SIGNS.
- B. All signs installed shall have the month and year of installation marked in an indelible fashion on the back of the sign.

2.02 POST DESIGN

- A. All posts shall be square with galvanized finish and have three-eighths ($\frac{3}{8}$) or seven-sixteenths ($\frac{7}{16}$) inch holes on all sides on one (1) inch spacing to the center of the hole.

B. Size:

1. One and three-quarters (1-³/₄) inch pole for parking signs two (2) square feet or less and Type I streets signs.
2. Two (2) inch post for signs nine (9) square feet or less including Type II street signs. Signs larger than nine (9) square feet may require two (2) posts or a larger post as directed by the CITY Traffic Engineer.
3. Signs forty-eight (48) inches wide or more may require two (2) posts as directed by the CITY Traffic Engineer.
4. The CITY Traffic Engineer may approve other posts under special circumstances.

2.03 SIGN HARDWARE

- A. All signs including street signs shall be attached directly to the pole using three-eighths (³/₈) inch zinc coated hex head bolts and nylon self-locking nuts (9 Ny-loc or approved equal). Flat washers shall be used under the head of the bolt (1ea.) and under the nut (1ea.).
- B. Signs forty-eight (48) inches or wider may require backing made of angle iron or other support system (Signfix Support System by Band-it-Idex, Inc. or approved equal).

2.04 SIGN PLACEMENT

- A. Sign placement and mounting height shall be in accordance with the latest version of the MUTCD unless otherwise specified by the CITY Traffic Engineer.
- B. Street sign placement shall be under the direction of the CITY Traffic Engineer.

2.05 POLE EMBEDMENT

- A. Poles shall be directly embedded into the earth or existing concrete surface a minimum of two and one-half (2-¹/₂) feet. The use of concrete around the embedded portion of the pole shall not be used unless approved by the CITY Traffic Engineer. Telescoping galvanized square tubing with anchor base ground support may be used in lieu of direct embedment.

- B. For poles placed in a new concrete surface (sidewalk) or where the roadway design is thirty-five (35) mph or greater, the V-lock Socket System manufactured by Foresight Products, Inc., (or approved equal) shall be used as a pole support. The CITY Traffic Engineer may approve other methods of pole embedment or support.

PART 3 EXECUTION

3.01 CONSTRUCTION METHODS

- A. The ENGINEER's decision to move or relocate street or traffic control signs shall be based on the location of the sign with respect to curb line, sidewalk line and the staked grading limits.
- B. Signs within the staked grading limits whose existing location (both vertically and horizontally) conform to final plan location within a six (6) inch tolerance will not be relocated. If no street signs exist then new ones shall be installed.
- C. Signs within the staked grading limits whose existing location does not conform to final plan location tolerance above shall be relocated. Signs outside the staked grading limit shall also be relocated to conform to final plan location.
- D. The preservation of the street, stop and other traffic control and direction signs that are to remain in place shall be the responsibility of the CONTRACTOR while the job is under construction. Should any of the signs need to be moved for the CONTRACTOR's convenience, they shall be removed by the CONTRACTOR, either temporarily reinstalled or stored, and permanently reinstalled when construction of curb and gutter is completed. The CONTRACTOR shall be held liable for any damage to these signs caused by neglect on his part and no extra compensation shall be allowed for preserving, removing or replacing stop and other traffic control and direction signs designated to remain in place, but rather this work shall be considered as included in the contract unit prices for the various items of the contract.
- E. Street, stop and other traffic control and direction signs designated to be relocated shall be removed and reinstalled in the locations shown on the plans or designated by the ENGINEER. The cost of removing, temporarily reinstalling, storing, and permanently reinstalling these signs, shall be compensated for at the unit price bid for relocating such signs.

F. The following procedures shall be followed in removing and relocating both signs removed by the CONTRACTOR for his convenience, and signs designated by the ENGINEER for relocation:

1. After it has been determined which signs shall be relocated at project expense, and which signs the CONTRACTOR shall remove and replace for his convenience, the ENGINEER shall be notified in writing which street, stop and traffic direction signs are to be removed and reinstalled.
2. Upon receiving the CONTRACTOR's notification, a representative of the OWNER shall inspect the signs with the CONTRACTOR to determine the condition of the signs. Signs which require repair shall be delivered by the CONTRACTOR to the OWNER. Signs not requiring repair shall be removed and reinstalled as specified below. Signs delivered to the OWNER shall be repaired and ready for pickup within forty-eight (48) hours, unless new street signs are required to be ordered from the factory or other arrangements have been made with the CONTRACTOR.
3. Where stop signs and traffic direction or control signs are removed, the CONTRACTOR shall place a properly flared barricade in the center of the street and temporarily install a similar stop sign or traffic direction sign on the barricade. This temporary sign shall remain in place until the CONTRACTOR permanently reinstalls the stop or traffic control signs.
4. Street signs may be installed temporarily upon approval by the ENGINEER.
5. Signs not required or used for temporary installation shall be stored.
6. All stop, traffic direction, street signs or control signs shall be reinstalled in the permanent location shown on the plans or designated by the ENGINEER within five (5) working days after necessary work has been completed. Signs which have been damaged after removal shall be replaced with new signs at the CONTRACTOR's expense.

G. All signs shall conform to the latest edition of the MUTCD.

- H. CONTRACTOR shall be responsible for determining post length in conformance with installation guidance in MUTCD. Post length shall include embedment, clearance height and sign height.
- I. Failure of the CONTRACTOR to permanently reinstall signs within a forty-eight (48) hour period after written notice shall result in the OWNER reinstalling the sign, and withholding the cost of the work from the CONTRACTOR's estimate.
- J. Private mailboxes within the staked grading limits generally are not shown on the plans. Mailboxes within the staked grading limits designated for relocation by the ENGINEER shall be removed by the CONTRACTOR and temporarily installed outside, but immediately adjacent to the construction limits. Mailboxes shall be reinstalled in accordance with U.S. Post Office regulations. Coordination with the local United States Post Office shall be required.
- K. It shall be the CONTRACTOR's responsibility to coordinate the removal or relocation of utility poles (power, street lights, telephone poles, etc.) with the utility owner. (Owner may initiate.)

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Street, stop and traffic control or direction signs designated for relocation shall be measured by the number of street, stop, and traffic control or direction signs relocated. If new post are requested by the ENGINEER they shall be measured in accordance with 4.01.D.
- B. Private mailboxes designated for relocation shall be measured by the number of mailboxes relocated.
- C. For new sign fabrication and installation, measurement shall be made for each square foot of sign installed. The square foot of sign measurement shall include both eight-hundredths (0.08) and one-tenth (0.10) inch thick aluminum panels.
- D. Posts shall be measured by the lineal foot. The linear foot of post measurement shall include all sizes of post, sign hardware, V-Locks, and backing for a complete installation.

4.02 BASIS OF PAYMENT

- A. Payment shall be for each square foot of sign complete in place and linear foot of post complete in place, and shall constitute full compensation for all materials, installation, equipment, tools, and labor for the performance of all work and incidentals necessary to complete the work item. Payment shall be for each existing sign and each existing private mailbox removed and reset and shall constitute full compensation for all materials, installation, equipment, tools, and labor for the performance of all work and incidentals necessary to complete the work item.
- B. Payment shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Remove and Reset Existing Sign	EA
Sign Panels	SF
Sign Posts	LF
Remove and Reset Existing Private Mailbox	EA

END OF SECTION

SECTION 02806

SIZE, FABRICATION, MATERIAL AND DESIGN OF NEW TRAFFIC SIGNS

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of fabricating and supplying new traffic control signs.

1.02 SUBMITTALS

- A. All submittals shall include manufacturer's specifications, test data, MSDS, and other data required to prove compliance with the specified requirements.
- B. Manufacturer's recommended installation procedures which, when approved by ENGINEER, shall become the basis for accepting or rejecting actual installation procedures used in the work.

PART 2 PRODUCTS

2.01 SHEETING MATERIAL

- A. The following types of signs shall be fabricated with ASTM D4956 Type I material. In addition, there is to be a seven (7) year guarantee covering reflectivity, fading, and workmanship.
 - 1. Regulatory signs:
 - a. R7 series.
 - b. R8 series.
- B. The following types of signs shall be fabricated with ASTM D4956 Type IX or XI material. In addition, there shall be a fifteen (15) year guarantee covering reflectivity, fading, and workmanship.
 - 1. All except as listed in 2.01(A).
 - 2. School signs:

- a. S1-1 fluorescent yellow-green.
- b. S4-3 & top of S5-1 fluorescent yellow-green.
- c. W16 series placards associated with S1-1's fluorescent yellow-green.

2.02 SIZE

A. All signs shall be fabricated and supplied in accordance with the following standards or as required by the ENGINEER:

1. Regulatory signs:

- a. Roadways with three (3) lanes or less: conventional per the MUTCD.
- b. Roadways with four (4) lanes or more: expressway per the MUTCD.

2. Warning signs:

- a. Roadways with three (3) lanes or less: conventional per the MUTCD.
- b. Roadways with four (4) lanes or more: expressway per the MUTCD.

3. School signs:

a. S1-1:

- 1) Thirty (30) inches on roadways with three (3) lanes or less.
- 2) Thirty-six (36) inches on roadways with four (4) lanes or more.

4. All other school signs:

- a. Roadways with three (3) lanes or less: conventional per the MUTCD.
- b. Roadways with four (4) lanes or more: oversized per the MUTCD.

2.03 BACKING MATERIAL

- A. Sign panels smaller than six and one-half (6.5) square feet shall be made of eight-hundredths (0.08) inch thick alodized aluminum. Sign panels six and one-half (6.5) square feet or larger shall be made of one-tenths (0.10) inch thick alodized aluminum unless the CITY Traffic Engineer specifies a different panel thickness.

PART 3 EXECUTION

3.01 DESIGN

- A. All signs shall be fabricated in accordance with the latest editions of Standard Highway Signs and Markings (SHSM) and the MUTCD. All signs shall be fabricated using the latest edition of Standard Alphabets for Traffic Control Devices as prepared by the Federal Highway Administration.
- B. Design of signs not included in Standard Highway Signs shall be approved by the CITY Traffic Engineer prior to fabrication. No payment shall be made for improperly fabricated signs.
- C. Street name signs shall be designated, fabricated, and installed in accordance with the following standards:
 - 1. Type I street signs:
 - a. Single faced on eight-hundredths (0.08) inch alodized aluminum.
 - b. Sign blade six (6) inches high with length as required (twenty-four (24) inches minimum).
 - c. ASTM D4956 Type IX or XI retroreflective green background with ASTM D4956 Type IX or XI retroreflective white legend.
 - d. Primary copy four (4) inch series "C" upper and lower case lettering (N, S, E, or W designation and street name or number).
 - e. Suffix copy four (4) inch series "C" upper and lower case lettering (St, Av or Ave, etc.).
 - f. Margins: Per City Standard Drawing 02806-01.

- 1) Primary copy one (1) inch top and bottom.
 - 2) Suffix copy one (1) inch top and bottom.
 - 3) Left and right one and one-half (1-½) inches minimum.
- g. Mounting height seven (7) feet from bottom of lowest sign to ground.
- h. Direct bolted to pole.
- i. No border.
- j. To be used at the intersection of two (2) local streets only.

2. Type II street signs:

- a. Single faced on eight-hundredths (0.08) inch anodized aluminum.
- b. Sign blade nine (9) inches high with length as required (twenty-four (24) inches minimum).
- c. ASTM D4956 Type IX or XI retroreflective green background with ASTM D4956 Type IX or XI retroreflective white legend.
- d. Primary copy six (6) inch series “C” upper and lower case lettering (N, S, E, or W designation and street name or number).
- e. Suffix copy six (6) inch series “C” upper and lower case lettering (St, Ave, Blvd, etc.).
- f. Margins: Per City Standard Drawing 02806-01
 - 1) Primary copy one and one-half (1-½) inches top and one and one-half (1-½) inches bottom.
 - 2) Suffix copy one and one-half (1-½) inches top and one and one-half (1-½) inches bottom.

- 3) Left and right two (2) inches minimum.
 - g. Mounting height seven (7) feet or above stop/yield sign.
 - h. Direct bolted to pole.
 - i. No border.
 - j. To be used at intersections of collectors and arterials with posted speed of forty (40) MPH or less, or two lane road any speed.
3. Type III street signs:
- a. Single faced on eight-hundredths (0.08) inch anodized aluminum.
 - b. Sign blade twelve (12) inches high with length as required (twenty-four (24) inches minimum).
 - c. ASTM D4956 Type IX or XI retroreflective green background with ASTM D4956 Type IX or XI retroreflective white legend and borders.
 - d. Primary copy eight (8) inch series "C" and lower case lettering (N, S, E, or W designation and street name or number).
 - e. Suffix copy eight (8) inch series "C" upper and lower case lettering (St, Ave, Blvd, etc.).
 - f. Margins: Per City Standard Drawing 02806-02.
 - 1) Primary copy two (2) inches top and two (2) inches bottom.
 - 2) Suffix copy two (2) inches top and two (2) inches bottom.
 - 3) Left and right two (2) inches minimum.
 - g. Mounting height seven (7) feet or above stop/yield sign.
 - h. Direct bolted to pole. Signs wider than forty-eight

(48) inches wide shall have the ends pop riveted or bolted together.

- i. Border three-eighths ($\frac{3}{8}$) inch without margin.
- j. To be used at intersections of collectors and arterials with posted speed of more than forty (40) MPH.

4. Type IV street signs:

- a. Single faced on ten-hundredths (0.10) inch alodized aluminum.
- b. Sign size: Per City Standard Drawing 02806-03.
- c. ASTM D4956 Type IX or XI retroreflective green background with ASTM D4956 Type IX or XI retroreflective white legend and borders.
- d. Minimum primary copy twelve (12) inch series "C" upper & nine (9) inch series "C" lower case lettering.
- e. Other copy four (4) inch series "C".
- f. Margins: Per City Standard Drawing 02806-03.
- g. Borders: minimum one-half ($\frac{1}{2}$) inch.
- h. Mounting:
 - 1) Sign shall be mounted on traffic signal arm and/or traffic signal pole.
 - 2) Sign shall be mounted using Astro-Brac or other approved mounting device.
- i. Block numbers to be the number of the block (typically, but not always, in hundreds) of the block being entered by a vehicle traveling straight on the roadway the sign faces. Block numbers should be approved by the CITY Traffic Engineering Department prior to sign fabrication.

5. Standard abbreviations shall be used as follows:

- a. Avenue: Av or Ave
 - b. Boulevard: Blvd
 - c. Circle: Cir
 - d. Court: Ct
 - e. Drive: Dr
 - f. Highway: Hwy
 - g. Lane: Ln
 - h. Loop: Loop or Lp
 - i. Parkway: Pkwy
 - j. Place: Pl
 - k. Road: Rd
 - l. Street: St
 - m. Trail: Trl
 - n. Way: Way
 - o. East: E
 - p. North: N
 - q. South: S
 - r. West: W
6. Street name signs for numbered streets and avenues shall be signed with the cardinal direction (E or W typically), street number in Arabic numerals with appropriate suffix (e.g. 6th), and standard abbreviation per 3.01(C) (5). For example, East 6th Street should be signed as “E 6th St”.

PART 4

METHOD OF MEASUREMENT

4.01 METHOD OF MEASUREMENT

- A. For new sign fabrication, measurement shall be made for each square foot of sign.
 - 1. The square foot of sign measurement shall include both eight-hundredths (0.08) inch and one-tenths (0.10) inch thick aluminum panels.
- B. For new sign installations, payment for fabrication shall be subsidiary to installation.

4.02 BASIS OF PAYMENT

- A. Payment shall be for each square foot of sign, and shall constitute full compensation for all materials, equipment, tools, and labor for the performance of all work and incidentals necessary to complete the work item.
- B. Payment shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Sign Panel	Sq. Ft.

END OF SECTION

SECTION 02895

ENGINEERING FABRIC

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of materials and work associated with providing engineering fabric for drainage and filtration, erosion control, separation and stabilization, embankment, and retaining wall reinforcement, and asphalt paving. The fabrics covered in this section shall be woven or non-woven fabric consisting only of long chain polymeric filaments or yarns such as polyethylene, polyester, polyamide, or polyvinilidene-chloride formed into a stable network such that the filaments or yarns retain their relative positions to each other.

1.02 SUBMITTALS

- A. Submit for approval the name of fabric, manufacturer's specifications, test data, installation procedures, MSDS, and handling and storage procedures prior to incorporation into the work.
- B. Manufacturer's recommended installation procedures which, when approved by ENGINEER, shall become the basis for accepting or rejecting actual installation procedures used in the work.

1.03 QUALITY ASSURANCE

- A. Deliver, handle, and store materials in accordance with manufacturer's instructions. All test methods shall be in accordance with latest ASTM procedures.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Drainage and filtration fabric shall be continuous filament non-woven needle punched engineering fabric and meet the minimum performance and strength requirements listed in Table No. 1 during its service life.
- B. Paving fabric shall meet the minimum performance and strength requirements listed in Table No. 1 during its service life.

- C. Separation and stabilization erosion control fabric shall meet the minimum performance and strength requirements listed in Table No. 1 during its service life.

TABLE NO. 1					
GEOTEXTILE SPECIFICATIONS		Fabric Requirements (Minimum Roll Averages)			
Fabric Property	Test Method	Drainage & Filtration	Erosion Control	Separation & Stabilization	Paving

PERFORMANCE CRITERIA DURING SERVICE LIFE

* Equivalent or Apparent	CW 002215				
** Water Permeability k,cm/sec	ASTM D4491				
Retention Efficiency, %	VTM 51-79				
Asphalt Retention	ASTM D4595				0.2
Melting Point, F					300

STRENGTH REQUIREMENTS

Wide Width Strip Tensile	ASTM D4595	40	65	90	
Strength, lbs/in	-3				
Elongation at Failure, %	ASTM D4594	20	20	20	50
Burst Strength, psi	ASTM D3786	130	210	290	
Trapezoid Tear Strength, lbs.	ASTM D4533	25	40	50	
Puncture Strength, lbs.	ASTM 751	25	50	75	
Seam Strength, lbs/in	ASTM D4595	40	65	65	
Grab Strength					80

ENVIRONMENTAL REQUIREMENTS

Mildew, rot resistance %	AATCC 30	100	100	100	
Insect rodent resistance %	AATCC 24	100	100	100	
Ultraviolet resistance % strength retention	ASTM D4355	-5	90	-5	

Notes:

- | | |
|---|--|
| * Piping Resistance | A (Soil Retention - all applications)
EOS No fabric \geq 30 sieve
($<$ 50% soil passing #200 sieve) |
| ** Water Permeability
Critical/Severe Applications - k fabric \geq 10 k soil
Normal Applications - k fabric \geq k soil | B EOS No fabric \geq 50 sieve |

PART 3 EXECUTION

3.01 PACKAGING AND ON SITE STORAGE

- A. Engineering fabric shall be uniformly rolled onto a cardboard core, and shall be wrapped in plastic to protect the material from moisture and damage during shipment. Protective wrapping shall be left on the fabric until installation. The product must not be allowed to get wet prior to installation to prevent weakening of the cardboard core. Rolls shall be externally tagged for easy field identification. External tagging shall include the following:
 - 1. Name of Manufacturer.
 - 2. Product type.
 - 3. Product grade.
 - 4. Lot number.
 - 5. Physical dimensions.

3.02 INSTALLATION

- A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with work of other sections.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Engineering fabric shall be measured by the square yard excluding overlaps and seam allowances.

4.02 BASIS OF PAYMENT

- A. Engineering fabric shall be paid for at bid schedule unit prices in place. Price quoted for fabric shall include all installation charges for placing fabric as shown on plans. CONTRACTOR shall be responsible for any damage that occurs to the fabric during installation and shall replace the damaged fabric at no additional cost to the OWNER.

B. Payment shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Engineering Fabric	Sq. Yd.

END OF SECTION

SECTION 02900

LANDSCAPING

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of requirements for providing topsoil, lawns, trees, shrubs, soil amendments, fertilizer, seeding, mulching, and any other landscaping item.

1.02 SUBMITTALS

- A. Submit for approval product and maintenance data, manufacturer's specifications, manufacturer's recommended installation procedures, test data, MSDS, and verification of seed mixture breakdown.
- B. Manufacturer's recommended installation procedures which, when approved by ENGINEER, shall become the basis for accepting or rejecting actual installation procedures used in the work.

1.03 QUALITY ASSURANCE

- A. Trees and shrubs shall be nursery-grown, with botanical and common names of plants true to the approved names given and shall meet the requirements of American Standard for Nursery Stock adopted by the American Association of Nurserymen. Plants shall be sound, healthy, vigorous, symmetrically proportioned, well-branched, densely foliated when in leaf, free of diseases and insect pests, eggs, larvae, and have well-developed root systems. All materials shall be subject to inspection and approval by the ENGINEER.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver fertilizer in unopened containers bearing the manufacturer's statement of analysis.
- B. Adequately protect root balls at all times from sun, drying winds and frost. Do not prune plants prior to delivery. If balled and burlapped plants are not installed immediately upon delivery, set on the ground and protect well with moist soil or wet mulch.

- C. Deliver, store and handle other materials in accordance with manufacturer's instructions.

1.05 WARRANTY

- A. Warrant trees and shrubs for a period of one (1) year after final acceptance, against defects including death and unsatisfactory growth, except for defects resulting from OWNER's neglect, abuse by others, or natural phenomena. Replace unsatisfactory plant material at end of warranty period. One (1) replacement is required if necessary.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Topsoil: Obtain from local source(s) having similar soil characteristics to that at the site. Obtain from well-drained site(s) where topsoil occurs in a depth of not less than four (4) inches. Do not obtain from bogs or marshes. Topsoil shall be fertile, friable, natural loam, reasonably free of subsoil, clay lumps, brush, weeds, litter, rots, stumps, stones larger than two (2) inches in any dimension, or any material which would inhibit the germination of seeds or the growth of the cover crop. Topsoil shall have an organic amendment of five (5) cubic feet to one (1) cubic yard of topsoil.
- B. Lawns, seed: New crop seed mixture, composed principally of common Kentucky Bluegrass, or as approved. Other acceptable varieties include Merion, Baron, and Fylking.
- C. Lawns, sod: Vigorous, viable, strongly rooted sod, not dormant or less than two (2) years old, free of weeds and undesirable native grasses, insect infestations and fungus, and machine cut to a pad thickness of one (1) inch or greater. Sod shall be composed principally of Kentucky Bluegrass (*Poa pratensis*), testing 99.9% pure, or as approved. Other acceptable varieties include Tall Fescue and Brome.
- D. Trees and shrubs: See schedule on approved plans.
- E. Soil amendments: Organic matter such as pine needles, leaf mold, or peat.
 - 1. Shredded peat moss shall be commercial grade of either sphagnum moss, reed, or sedge peat, taken from fresh water

site, free of lumps, roots and stones, with texture and pH range suitable for intended use.

2. Well-rotted and shredded manure.
 3. Triple super phosphate.
- F. Fertilizer: Commercial grade of neutral character, with some elements derived from organic sources.
1. Lawns: Farm-type, such as 18-46-0, applied at five (5) pounds per one thousand (1000) square feet of lawn area, or 16-20-0, at seven (7) pounds per one thousand (1000) square foot. Provide nitrogen in a form that will be available to lawns during initial growth period. Established lawns shall not receive more than one and one-half (1-½) pounds of soluble nitrogen per one thousand (1000) square feet, applied four (4) times annually.
 2. Trees and shrubs: Not less than five (5) percent total nitrogen, ten (10) percent available phosphoric acid, and five (5) percent soluble potash.
 3. Dryland seeding: Not less than a 2:1:1 ratio of nitrogen, phosphorous and potassium.
- G. Dryland seed mix shall be of the following mix and guaranteed 95% pure live seed.

Texoka Buffalo Grass	3%
Annual Rye Grass	20%
Critana Wheatgrass	3%
Blue Grama	10%
Butte Side Oats Grama	10%
Fairway Crested Wheatgrass	44%
Western Wheatgrass	10%

Application rate shall be thirty (30) pounds/acre.

- H. Mulch
1. Trees and shrubs: Well-aged fibrous or shredded bark, old sawdust, pine needles, or leaf mold.
 2. Dryland seeding: Certified weed free small grain straw or native hay.

3. Pigmented wood cellulose fibers or paper pulp for hydraulic seeding. Mulch shall form a blotter-like ground cover with moisture absorption and percolation properties, and the ability to cover and hold the seed in contact with the topsoil, yet not inhibit the penetration of seedlings through it.

PART 3 EXECUTION

3.01 INSTALLATION

A. Topsoil:

1. Spread topsoil to a uniform depth of six (6) inches over all areas scheduled to receive lawns. Fertilize proposed lawns at rate specified herein. Fine grade areas to a firm even surface, free from lumps or stones. Installation of sod may be done immediately after fine grading, provided the bed is in good condition and not muddy or hard. If it is hard, scarify to a friable condition again.

B. Lawns, seed:

1. If soils are predominantly clayey or sandy, peat moss or manure shall be spread uniformly at a rate of three (3) cubic yards per one thousand (1000) square feet, and worked into the soil.
2. Apply super phosphate at a rate of ten (10) pounds per one thousand (1000) square feet.
3. Apply seed, at rate of two (2) pounds per one thousand (1000) square feet, using a drop (band) type spreader. Divide seed into two (2) halves and distribute one (1) half in the north-south direction, and the other half from east to west.
4. Rake seed into the soil and commence light watering, at least four times per day for two (2) weeks, or until seed germinates.

C. Lawns, sod:

1. Lay sod perpendicular to the direction of the slope and in a manner permitting butt joints to alternate. Fit sod pieces tightly together so that no joint is visible and tamp sod

firmly and evenly by hand.

2. Roll sod with a one hundred-fifty (150) pound roller to level and seal seams. After rolling, water sod until water soaks through into topsoil to a depth of not more than three (3) inches.
3. Water, weed and replace sod, if required, until final acceptance. Erect and maintain temporary protection devices where deemed necessary.
4. Mow sod at least twice before final acceptance. At the time of the first mowing, set mower blades to produce two (2-½) inches mowed height.

D. Trees and shrubs:

1. Mark planting area for tree and shrub pits that is five (5) times the diameter of the root ball. Do not proceed with planting until the bed and pit locations are approved by the ENGINEER.
2. Loosen soil with rototiller or shovels to a depth of twelve (12) inches. Add organic matter, distributed uniformly within planting bed.
3. In the center of the prepared area, excavate a shallow hole for the root ball, so that it sits on solid subsoil. Apply fertilizer directly to bottom of pit.
4. Set plant in center of pit, plumb and straight, and at such a level that, after settlement, the top of the root collar is even with adjacent finished grade. Remove burlap, ropes, and all wire. Gently pack soil around plant and lightly water, to promote further soil consolidation.
5. Apply two (2) inch thick layer of mulch.
6. Prune each plant with clean, sharp tools to remove suckers, and broken, badly bruised or dead branches. Wrap tree trunks with TUBEX, or equivalent translucent material.
7. Guy trees with two (2) wires anchored securely to steel posts, directly opposite each other, not less than five (5) feet from the trunk. Protect the tree from direct contact with the wires. Remove posts and wires after one (1) year.

8. Commence watering and maintenance of plantings until final acceptance.
9. Correct defective work as soon as it becomes apparent and as weather and season permit.

E. Seeding:

1. Broadcasting shall not be allowed.
2. Prior to seeding, areas that have become muddy or hard shall be scarified to a depth of four (4) inches, and left in a friable condition. Fertilize at a rate of forty (40) pounds of available nitrogen per acre.
3. Drills shall be set for uniform rows with spacing not to exceed eight (8) inches, and depth for the type of seed being drilled.
4. Spread mulch uniformly over the seeded area at a rate of two (2) tons per acre. Anchor mulch in the soil with a smooth or serrated coulter disc.
5. For hydraulic seeding and mulching, use equipment designed for such work. Seed and water shall be uniformly applied to the areas scheduled to be seeded. Fertilizer, water and approximately one (1) ton per acre of hydraulic mulch shall be homogeneously mixed and uniformly applied to seeded areas.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Measurement shall not become necessary if landscaping is bid as lump sum.
- B. If unit prices are called for in the Bid Schedule, measurement of each item shall be made as the number of units used or installed.

4.02 BASIS OF PAYMENT

- A. Unless otherwise called out in the Contract Documents, payment for landscaping shall be lump sum.

- B. When unit prices are called for in the Bid Schedule, payment shall be made at unit prices for each of the various items multiplied by the number of units installed or incorporated in the work.

END OF SECTION

SECTION 02915

UNIT PAVERS

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of clay brick pavers set in sand bed over concrete slurry with sand joints.

1.02 RELATED WORK

- A. Section 03304 - Portland Cement Concrete.

1.03 SUBMITTALS

- A. Submit the following:
 - 1. Product data, manufacturer's specifications, MSDS, and test data for the clay brick pavers.
 - 2. Samples for verification purposes in full-size units in sets for each color and texture and pattern showing full range of variations expected in these characteristics. Submit samples of the following colors: red, brown.
- B. Single-source responsibility: Obtain each color, type and variety of unit pavers, joint materials, and setting materials from a single source with resources to provide products and materials of consistent quality in appearance and physical properties without delaying progress of the work.
- C. Manufacturer's recommended installation procedures which, when approved by ENGINEER, shall become the basis for accepting or rejecting actual installation procedures used in the work.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Protect unit pavers and aggregate during storage and construction against wetting by rain, snow, or ground water and against spoilage or contamination from earth or other materials.

1.05 PROJECT CONDITIONS

- A. Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing at the CONTRACTOR's expense.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
 - 1. Clay Brick Pavers.
 - 2. Belden Brick Company.
 - 3. Boral Bricks, Inc.
 - 4. Endicott Clay Products Company.
 - 5. Glen-Gery Corporation.
 - 6. Hastings Pavement Company, Inc.

2.02 COLORS AND TEXTURES

- A. Provide materials and products that result in colors and textures of exposed unit paver surfaces and joints complying with OWNER's selections from manufacturer's full range of colors and textures specified.

2.03 UNIT PAVERS

- A. Clay Brick Pavers: Paving brick; solid (uncored), unfrosted brick of sizes indicated, complying with ASTM C902, Weather Class SX, Application PX, with an average compressive strength of fifteen thousand (15,000) psi, an average absorption rate of four (4) percent, a maximum saturation coefficient of 0.85, and a modulus of rupture of one thousand-five hundred (1,500) psi.
 - 1. 3-¹³/₁₆" x 7-⁵/₈" x 2-¹/₄" min. thick paver.
 - 2. Dimensional Tolerances: Manufacture unit to standard

dimensions indicated with deviations in any direction not exceeding plus or minus one-sixteenth ($1/16$) inch.

3. Texture: Natural.

2.04 SETTING MATERIALS

- A. Sand Leveling Course: Fine, sharp, nonplastic aggregate complying with ASTM C33.
- B. Sand for Joints: Fine, sharp, masonry sand with one hundred (100) percent passing the No. 16 sieve and no more than ten (10) percent passing the No. 200 sieve.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine surfaces indicated to receive paving, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of unit pavers. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Proof roll prepared subgrade surface to check for unstable areas and areas requiring additional compaction. Do not proceed with installation of slurry base until deficient subgrades have been corrected.

3.03 INSTALLATION

- A. Do not use unit pavers with chips, cracks, voids, discoloration, and other defects that might be visible or cause staining in finished work.
- B. Cut unit pavers with motor-driver masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide patterns indicated and to fit adjoining work neatly. Work shall be planned to allow use of full units without cutting where possible. Hammer cutting shall not be acceptable.
- C. Lay pavers in patterns and directions as shown on the approved plans.
- D. Lay pavers with hand-tight joints or with joints as shown on the approved plans.

- E. Do not exceed one-sixteenth ($\frac{1}{16}$) inch unit-to-unit offset from flush (lippage) and a tolerance of one-eighth ($\frac{1}{8}$) inch in two (2) feet and one-quarter ($\frac{1}{4}$) inch in ten (10) feet from level to slope as indicated, for finished surface of paving.

3.04

PAVER APPLICATION

- A. Compact soil subgrade uniformly to a minimum of ninety-five (95) percent of maximum dry density per ASTM D698.
- B. Insure that concrete slurry with a minimum of two-thousand (2000) psi strength is installed and that the level and finish of slurry is acceptable before proceeding.
- C. Place sand for leveling course and screed to a minimum thickness of three-quarter ($\frac{3}{4}$) inch, taking care that moisture content remains constant and the density is loose and constant until pavers are set and compacted.
- D. Set pavers hand tight against each other and against concrete walks, retaining walls, or edge restraint. Use string lines to keep straight lines where necessary. Select units at random to properly blend color and texture variations. Fill gaps between units that exceed three-sixteenths ($\frac{3}{16}$) inch with pieces cut to fit from full-size unit pavers.
- E. Vibrate pavers into leveling course with a low amplitude plate vibrator capable of a 3,500 to 5,000 pound compaction force. Perform at least three (3) passes across paving with vibrator.
 - 1. Vibrate under the following conditions:
 - a. After edge pavers are installed and there is a completed surface or before surface is exposed to rain.
 - b. Before ending each day's work, fully compact installed pavers within three (3) feet of the laying face. Cover the open layers with non-staining plastic sheets overlapped four (4) feet on each side of laying face to protect it from rain.
- F. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Brush and vibrate sand until joints are completely filled, then remove surplus sand.

- G. Do not allow traffic on installed pavers until sand has been vibrated into joints.
- H. Repeat joint filling process thirty (30) days later.

3.05 REPAIR, POINTING, CLEANING AND PROTECTION

- A. Remove and replace unit pavers which are loose, chipped, broken, stained, or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment to eliminate evidence of replacement.
- B. Provide final protection and maintain conditions in a manner acceptable to installer, which ensures unit paver work being without damage or deterioration at time of final acceptance.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Unit pavers shall be measured by the square foot.

4.02 BASIS OF PAYMENT

- A. Basis of payment shall include paver, sand setting bed, sand joint filler and grouting of pavers as indicated on approved plans, and all materials and labor to complete the installation.
- B. Payment shall be made at the contract unit bid price multiplied by the number of square feet placed and accepted.

<u>Pay Item</u>	<u>Pay Unit</u>
Pavers	Sq. Ft.

END OF SECTION

SECTION 02920

TREE GRATES

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of furnishing and installing tree grates and frames.

1.02 SUBMITTALS

- A. Submit to the ENGINEER for approval manufacturer's specifications, test data, MSDS, and other data required to prove compliance with the specified requirements.
- B. Manufacturer's recommended installation procedures which, when approved by ENGINEER, shall become the basis for accepting or rejecting actual installation procedures used in the work.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Handle and store materials to prevent damage.

PART 2 PRODUCTS

2.01 TREE GRATE AND FRAME

- A. Tree grates and frames shall be Neenah Foundry Model #R-8708 180 Square or approved equivalent. Tree grates shall have factory applied paint finish consisting of at least two (2) coats of Lo-lustre black enamel paint.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install per manufacturer's specifications at locations as shown on the approved plans and as approved by the ENGINEER.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Tree grates and frames shall be measured by each unit.
- B. Concrete curb around frames shall be considered subsidiary to the frame and shall not be measured separately.

4.02 BASIS OF PAYMENT

- A. Basis of payment shall be made at the contract unit bid price multiplied by the number of units installed.
- B. Payment shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Tree Grate & Frame	Each
Tree Frame w/o Grate	Each

END OF SECTION

SECTION 03100

CONCRETE FORMWORK

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of formwork for cast-in-place concrete, openings in formwork for other affected work, form accessories, and stripping formwork.

1.02 RELATED WORK

- A. Section 03251 - Expansion and Contraction Joints.
- B. Section 03345 - Concrete Finishing.
- C. Section 03370 - Concrete Curing.

1.03 SUBMITTALS

- A. Shop Drawings: Submit fabrication and erection drawings of forms for specific finished concrete surfaces as indicated. Show general construction of forms, jointing, special joints or reveals, location and pattern of form tie placement, and other items affecting exposed concrete.
- B. Form Release Agent: Where concrete surfaces are scheduled to receive special finishes or applied coverings, which may be affected by agent, submit manufacturer's instructions for use of agent.

1.04 QUALITY ASSURANCE

- A. Design, Engineering and construction of formwork shall be the CONTRACTOR's responsibility.
- B. Comply with all pertinent provisions of ACI 347.
- C. Provide at least one (1) person who shall be present at all times during the work of this section and who shall be thoroughly familiar with the type of materials being installed, the reference standards, and the requirements of this work.

- D. Design Forms:
 - 1. With sufficient strength to maintain finished tolerances indicated in SECTION 03345, CONCRETE FINISHING, to support loads, pressures, and allowable stresses as outlined in ACI 347.
 - 2. To permit easy removal and for required finishes.
- E. Product Handling
 - 1. Take all means necessary to protect formwork materials before, during, and after installation and to protect the installed work of other trades. In the event of damage, immediately make all repairs and replacements necessary to the approval of the ENGINEER and at no additional cost to the OWNER.

1.05 DEFINITIONS

- A. Shoring: The activity to support formwork.
- B. Reshoring: The activity to reduce the amount of formwork supporting concrete elements. As concrete sets and strength increases, less need for formwork occurs gradually until concrete becomes free standing.

1.06 REFERENCES

- A. ACI 347: Recommended Practice for Concrete Formwork.

1.07 JOB CONDITIONS

- A. For reference purposes, establish and maintain sufficient control points and benchmarks to check tolerances as specified in ACI 117-06. Maintain in an undisturbed condition until final acceptance of work.
- B. Regardless of tolerances specified, allow no portion of work to extend beyond legal boundaries.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Construct formwork for concrete concealed from view with plywood, sawn boards of sound grade or steel forms as approved by the ENGINEER.
- B. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without excessive and objectionable bow or deflection.
- C. Do not use material with raised grain, patches, or other defects which will impair texture of concrete surface.
- D. All forms shall be full face.

2.02 FORMWORK ACCESSORIES

- A. Form ties and spreaders
 - 1. Provide factory-fabricated, removable or snap off metal form ties designed to prevent form deflection and to prevent spalling concrete surfaces upon removal.
 - 2. Form ties shall be of the removable end, permanently embedded body type, and shall have sufficient strength and rigidity to support and maintain the form in proper position and alignment without the use of auxiliary spreaders. Cones shall be provided on the outer ends of each tie, and the permanently embedded portion shall be at least one (1) inch back from the concrete face. Form ties for liquid-bearing walls shall be provided with water stop washers located on the permanently embedded portions of the ties at the approximate center of the wall. Permanently embedded portions of form ties without threaded ends shall be constructed so that the removable ends are readily broken off without damage to the concrete. Through-wall tapered removable ties will not be acceptable in liquid-containing structures. The type of form ties used shall be acceptable to the Engineer. Form ties in exposed surfaces shall be uniformly spaced and aligned in horizontal and vertical rows.

3. Wire ties shall be permitted where surfaces on either side of a formed member will not be exposed to view or painted. Projecting ends of wire ties shall be cut off flush with the concrete surfaces. Job fabricated ties shall not be acceptable.
- B. Premolded Expansion Joint Filler
1. Unless indicated otherwise, provide Type F1 in accordance with SECTION 03251, EXPANSION AND CONTRACTION JOINTS.
- C. Form Release Agent
1. Provide commercial formulation form release agent compounds that will not bond with, stain, nor adversely affect concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.
 2. Surplus oil on forms and form oil on reinforcing steel and construction joints shall be removed before concrete is placed.
- D. Fillets for Chamfered Corners
1. Provide wood strips $\frac{3}{4}$ "x $\frac{3}{4}$ " size; of the maximum possible length.

2.03 DESIGN OF FORMWORK

- A. General
1. Design, erect, support, brace, and maintain formwork so that it will safely support vertical and lateral loads that might be applied until such loads can be supported by the concrete structure.
 2. Carry vertical and lateral loads to ground by formwork system and in-place construction that has attained adequate strength for that purpose.
 3. Construct formwork so that concrete members and structures are of correct size, shape, alignment elevation, and position.

4. Design forms and false work to include assumed values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperatures, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.
5. Support form facing materials by structural members spaced sufficiently close to prevent objectionable deflection.
6. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities, and within allowable tolerances.
7. Provide formwork sufficiently tight to minimize leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.

PART 3 EXECUTION

3.01 SUB-SURFACE CONDITIONS

- A. Examine the substrata and conditions under which work of this section is to be performed and correct unsatisfactory conditions which would prevent proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 FORM CONSTRUCTION

- A. Construct forms complying with ACI 347, to the sizes, shapes, lines, and dimensions shown within the tolerances as specified in ACI 117-06, and as required to obtain accurate alignment, location, grade, level, and plumb work in finished structures.
- B. Provide for openings, offsets, keyways, recesses, moldings, reglets, chamfers, blocking, screed, bulkheads, anchorages, inserts, and other features required. Use selected materials to obtain required finishes.
- C. Forms for openings and construction which accommodates installation by other trades whose materials and products must be fabricated before the opportunity exists to verify the measurements of adjacent construction which affects such installations, shall be

accurately sized and located as dimensioned on the plans. In the event that deviation from the plan dimensions results in problems in the field, the CONTRACTOR shall be responsible for resolution of the conditions as approved by the ENGINEER without additional expense to the OWNER.

- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.
- E. Provide openings in concrete formwork to accommodate work of other trades. Verify size and location of openings, recesses, and chases with the trade requiring such items. Accurately place and securely support items to be built into forms.
- F. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before concrete is placed.

3.03 FORM COATINGS

- A. Coat form contact surfaces with form-coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come into contact with surfaces which will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.

3.04 INSTALLATION OF EMBEDDED ITEMS

- A. Set and build into the work anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of the items to be attached thereto.
- B. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support types of screeds required.

3.05 REMOVAL OF FORMS

- A. Forms shall be removed in a manner to insure complete safety of the structure. Forms shall not be removed until concrete has

sufficient strength to safely carry its own weight and the loads upon it. Due to weather conditions or for other reasons, the forms shall remain in place for longer periods than stated above when directed by the ENGINEER.

- B. Do not pry against face of concrete. Use only wooden wedges.
- C. When repair of surface defects or finishing is required at an early age, remove forms as soon as concrete has hardened sufficiently to resist damage from removal operations.
- D. Where no reshoring is planned, leave forms and shoring used to support weight of concrete in beams, slabs, and other concrete members in place until concrete has attained its specified strength.
- E. Where reshoring is planned, supporting formwork may be removed when concrete has reached seventy (70) percent of specified strength provided reshoring is installed immediately.

3.06

RESHORING

- A. When reshoring is permitted or required, plan operations in advance and obtain approval from the ENGINEER.
- B. During reshoring, do not subject concrete in beam, slab, column, or any other structural member to combined dead and construction loads and live loads in excess of loads permitted for developed concrete strength at time of reshoring.
- C. Place reshores as soon as practical after stripping operations are complete, but in no case later than the end of working day on which stripping occurs.
- D. Tighten reshores to carry required loads without overstressing.
- E. Leave reshores in place until the concrete being supported has reached its specified strength.
- F. For floors supporting shores under newly placed concrete, level original supporting shore or reshore.
 - 1. Reshoring system shall have a capacity to resist anticipated loads in all cases equal to at least one-half ($\frac{1}{2}$) the capacity of the shoring system.
 - 2. Locate reshores directly under a shore.

- G. Design, engineering, and construction of shoring and reshoring is the responsibility of the CONTRACTOR.

3.07 REMOVAL STRENGTH

- A. When removal of formwork or reshoring is based on concrete reaching a specified strength, it shall be assumed that concrete has reached this strength when either of the following conditions have been met:
 - 1. When test cylinders, field cured along with the concrete they represent, have reached the specified strength; or
 - 2. When concrete has been cured in accordance with provisions of SECTION 03370, CONCRETE CURING, for the same length of time as the site-cured cylinders which reached specified strength. Determine the length of time the concrete has been cured in the structure by cumulative number of days or fractions thereof, not necessarily consecutive, during which the air temperature is above 50°F and concrete has been damp or sealed from evaporation and loss of moisture.

3.08 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated, or otherwise damaged form facing material shall not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork. When forms are re-used for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets.

3.09 FIELD QUALITY CONTROL

- A. Before commencing a placement, verify connections, form alignment, ties, inserts, and shoring are placed and secure.
- B. Observe formwork continuously while concrete is being placed to verify that the forms are plumb and there are no deviations from desired elevation, alignment, or camber.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for items under this section.

4.02 BASIS OF PAYMENT

- A. No separate payment shall be made for items under this section. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of reinforcing steel bars, wire fabric, or rod mats for cast-in-place concrete, support chairs, bolsters, bar supports, and spacers for supporting reinforcement, and fiber reinforced concrete.

1.02 RELATED WORK

- A. Section 03304 - Portland Cement Concrete.

1.03 REFERENCES

- A. AASHTO M254: Corrosion-Resistant Coated Dowel Bars.
- B. ACI 301: Specifications for Structural Concrete for Buildings.
- C. ACI 315: Details and Detailing of Concrete for Buildings.
- D. ASTM A82: Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
- E. ASTM A185: Standard Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement.
- F. ASTM A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- G. ASTM A706: Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
- H. AWS D1.1: Structural Welding Code Steel.
- I. AWS D1.4: Structural Welding Code Reinforcing Steel.
- J. CRSI Document: Manual of Standard Practice.

1.04

SUBMITTALS

- A. Submit mill test certificates of supplied concrete reinforcement indicating physical and chemical analysis.
- B. Welder's certification.
- C. Shop drawings.
 - 1. Indicate sizes, spacings, locations, and quantities of reinforcing steel, wire fabric, bending and cutting schedules, splicing, stirrup spacing, supporting, and spacing devices.
- D. Fiber Reinforced Concrete
 - 1. Submit one (1) copy of clearly marked manufacturer's printed product data, indicating proposed fibrous concrete reinforcement materials. Printed data shall state one and one-half (1.5) pounds of fiber to be added to each cubic yard of each type of concrete.
 - 2. Submit one (1) copy of a manufacturer's printed batching and mixing instructions.

1.05

PRODUCT HANDLING

- A. Deliver reinforcement to the job site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.
- B. Take all means necessary to protect reinforcement materials before, during, and after installation and to protect the installed work of other trades. Store all reinforcement materials in a manner to prevent excessive rusting and fouling with grease, dirt, and other bond-breaking coatings. Take all necessary precautions to maintain identification after bundles are broken. In the event of damage or errors, immediately make all repairs or replacements necessary and at no additional cost to the OWNER.

PART 2 PRODUCTS

2.01 CONCRETE REINFORCEMENT MATERIALS

- A. Reinforcing steel shall be in accordance with ASTM A615 deformed bars, grade, and type as indicated, including supplementary requirements S1, either uncoated or as indicated. When no grade is indicated, use 60 ksi yield grade steel. Use ASTM A706 steel if welding is indicated or allowed.
- B. Welded steel wire fabric shall be in accordance with ASTM A185 plain type; in flat sheets or coiled rolls either uncoated or as indicated.
- C. Stirrup steel shall be in accordance with ASTM A82.
- D. Plain dowel bars for expansion joints shall be in accordance with ASTM A615, 60 ksi yield grade steel.
 - 1. Epoxy coated in roadway pavements.
 - 2. Provide metal dowel cap at one (1) end of dowel to permit longitudinal movement of dowel within concrete section. Caps shall have one (1) end closed.
 - 3. Provide for movement equal to joint width plus one-half (½) inch.
 - 4. For load transfer bars, paint with one (1) coat of paint conforming to AASHTO M254 and coat one-half (½) with grease.
- E. Fibrous Concrete Reinforcement Material
 - 1. 100% virgin polypropylene, fibrillated fibers containing no reprocessed olefin materials and specifically manufactured to an optimum gradation for use as concrete secondary reinforcement or as approved by the ENGINEER. Volume per cubic yard shall equal a minimum of 0.1% (one and one-half (1.5) pounds).

2. Physical Characteristics:
 - a) Specific gravity: 0.91.
 - b) Tensile strength: 50 to 110 ksi.
 - c) Fiber length: graded per manufacturer; or, as specified by project engineer and approved by the ENGINEER.
3. Fibrous concrete reinforcement materials provided in this section shall produce concrete conforming to the requirements for each type and class of concrete required, as indicated on the plans and tested in accordance with ASTM C94 and ASTM C1116.

2.02 ACCESSORY MATERIALS

- A. Minimum sixteen (16) gage steel tie wire shall be plain, cold drawn and shall comply with ASTM A82.
- B. Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place:
 1. Use wire bar type supports complying with CRSI recommendations unless otherwise indicated. Do not use wood, brick, and other unacceptable materials.
 2. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
 3. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with either hot-dip galvanized or plastic protected legs.

2.03 FABRICATION

- A. Fabricate reinforcement in accordance with ACI 315 providing for the concrete cover specified in SECTION 03304, PORTLAND CEMENT CONCRETE.
- B. Locate reinforcing splices not indicated on drawings at points of minimum stress. Indicate location of splices on shop drawings.
- C. Weld reinforcing bars in accordance with AWS D1.4.

- D. Reinforcement with any of the following defects shall not be permitted in the work:
 - 1. Bar lengths, depths, and bends exceeding specified fabrication tolerances as specified in ACI 117-06.
 - 2. Bends or kinks not indicated on plans or final shop drawings.
 - 3. Bars with reduced cross-section due to excessive rusting or other cause.

PART 3 EXECUTION

3.01 PLACING

- A. All reinforcement shall be free of loose mill scale, loose or thick rust, dirt, paint, oil or grease.
- B. Place all reinforcement according to the tolerances outlined in ACI 117-06. Tie bars together at all intersections.
- C. Maintain the distance from vertical forms and between layers of reinforcement by means of prefabricated chairs, ties, hangers, or other approved devices. Placing and fastening of reinforcement in each section of the work must be approved before concrete is placed.
- D. Overlap sheets of metal mesh one (1) square plus six (6) inches (to maintain a uniform strength.) Securely fasten at the ends, edges, and supports to maintain clearances.

3.02 SPLICING

- A. Furnish all reinforcement in the full lengths indicated unless otherwise permitted. Splicing of bars, except where indicated shall not be permitted without written approval. Stagger splices where possible.
- B. Unless indicated otherwise, overlap reinforcing bars a minimum of thirty (30) diameters to make the splice. In lapped splices, place the bars and wire to maintain the minimum distance for clear spacing to the surface of the concrete.

- C. Do not use lap splices on bars greater in diameter than No. 11 unless approved.
- D. Weld reinforcing steel only if indicated. Weld in conformance to AWS D1.4.
- E. Do not bend reinforcement after embedding in hardened concrete.
- F. Do not permit reinforcement or other embedded metal items bonded to the concrete to extend continuously through any expansion joint except dowels in floors bonded on only one (1) side of joints.

3.03 PLACING EMBEDDED ITEMS

- A. Place all sleeves, inserts, anchors, and embedded items prior to concrete placement. Temporarily fill voids in embedded items to prevent entry of concrete.
- B. Give all trades whose work is related to the concrete section ample notice and opportunity to introduce or finish embedded items before concrete placement.

3.04 CONSTRUCTION METHODS FOR FIBER REINFORCED CONCRETE

- A. Add fibrous concrete reinforcement to concrete materials at the time concrete is batched in amounts in accordance with approved submittals for each type of concrete required.
- B. Mix batched concrete in strict accord with fibrous concrete reinforcement manufacturer's instructions and recommendations for uniform and complete dispersion.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. The cost of the fibrous concrete reinforcing shall be included as a part of the appropriate item in which it is being used. There shall be no separate measurement for this item.
- B. Reinforcing steel shall be measured by the pound, based on the theoretical number of pounds, excluding splice bars to replace test samples, complete in place as shown on plans or placed as ordered.

- C. The quantities of materials furnished and placed shall be based upon the calculated weights of the reinforcing steel actually placed in accordance with these specifications. No deductions shall be made for any bends except for hooks. The length of the bar to be added to out-to-out dimensions of hooked bars shall be shown on the plans. The weights calculated shall be based upon the following table:

SIZE	WEIGHT/LF in lbs.
# 3	0.376
# 4	0.668
# 5	1.043
# 6	1.502
# 7	2.044
# 8	2.67
# 9	3.4
# 10	4.303
# 11	5.313
# 14	7.65
# 16	13.6

- D. The weights estimated for spiral spacers shall be based on three-quarters ($\frac{3}{4}$) pound per linear foot. The weight of the spiral shall be computed using the core diameter shown on the plans. Wire mesh, when included as a pay item, shall be based on the weights shown on the plans for the type of mesh designated.

4.02 BASIS OF PAYMENT

- A. The accepted quantities of reinforcing steel shall be paid for at the contract unit price per pound complete in place. No allowance shall be made for clips, wires, or other material used for fastening reinforcement in place.
- B. Payment shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Reinforcing Steel	Lb.

END OF SECTION

SECTION 03251

EXPANSION AND CONTRACTION JOINTS

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of joints and joint sealants in horizontal traffic surfaces for cast-in-place concrete sidewalks, curb, gutter, and pavement slabs.

1.02 SUBMITTALS

- A. Manufacturer's certification that product was manufactured, tested, and supplied in accordance with source quality control requirements specified herein, together with a report of the test results and the date each test was completed.
- B. Manufacturer's instruction for joint preparation, type of cleaning, and installation.
- C. Manufacturer's product data and samples for each joint sealant product required.
- D. Material Safety Data Sheets.

1.03 REFERENCES

- A. ASTM C920: Standard Specification for Elastomeric Joint Sealants.
- B. ASTM D545: Standard Methods of Testing Preformed Expansion Joint Filler for Concrete Construction (Non-extruding and Resilient Types).
- C. ASTM D994: Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
- D. ASTM D1056: Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
- E. ASTM D6690: Standard Specification for Joint and Crack Sealants, Hot-applied, for Concrete and Asphalt Pavements.

- F. ASTM D5329: Standard Test Methods for Sealants and Fillers, Hot-applied, for Joints and Cracks in Asphaltic and Portland Cement Concrete pavements.
- G. ASTM D1751: Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- H. ASTM D1752: Standard Specification for Preformed Sponge Rubber, Cork, and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- I. ASTM D2240: Standard Test Method for Rubber Property-Durometer Hardness.
- J. ASTM D2628: Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
- K. ASTM D3406: Standard Specification for Joint Sealant, Hot-Applied, Elastomeric-Type, for Portland Cement Concrete Pavements.
- L. ASTM D3569: Standard Specification for Joint Sealant, Hot-applied, Elastomeric, Jet-Fuel-Resistant Type for Portland Cement Concrete Pavements.
- M. ASTM D3542: Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Bridges.
- N. ASTM D3581: Standard Specification for Joint Sealant, Hot-Poured, Jet-Fuel-Resistant-Type, for Portland Cement Concrete and Tar-Concrete Pavements.
- O. ASTM D5893: Standard Specification for Cold-applied, Single Component Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.
- P. FS SS-S-200: Sealants, Joint, Two Component, Jet-Blast Resistant, Cold-Applied, for Portland Cement Concrete Pavement.

1.04

QUALITY ASSURANCE

- A. Obtain joint sealing materials from a single manufacturer for each different product required.

- 1.05 DELIVERY, STORAGE, AND HANDLING
- A. Deliver materials to site in original unopened containers or bundles with labels identifying manufacturer, product name and designation color, expiration period for use, pot life, cure time, and mixing instructions for multi-component materials.
 - B. Store and handle materials in compliance with manufacturer's recommendations to prevent deterioration; or damage due to moisture, high or low temperatures, contaminants, or other causes.

- 1.06 SYSTEM PERFORMANCES
- A. Pavement joints include longitudinal and transverse expansion joints, contraction joints, construction joints, and crack control joints.
 - B. Provide joint sealants that maintain watertight and airtight continuous seals.

PART 2 PRODUCTS

- 2.01 GENERAL
- A. Provide joint filler, sealant backings, sealants, and other related materials that are compatible with one another and with joint substrates under conditions of service and application as demonstrated by sealant manufacturer based on testing and field experience.

- 2.02 JOINT VOID - FORMER
- A. Plastic with a water stop.
 - B. One-quarter ($\frac{1}{4}$) depth of concrete structural section or as otherwise specified.

- 2.03 JOINT FILLER - SHEET TYPE
- A. F1 Joint Filler: Bituminous (asphalt or tar) mastic in accordance with ASTM D994; formed and encased between two (2) layers of bituminous saturated felt or two (2) layers of glass-fiber felt.
 - B. F2 Joint Filler: Cane or other cellulosic fiber in accordance with ASTM D1751; saturated with asphalt.

- C. F3 Joint Filler: Granulated cork in accordance with ASTM D1751; in an asphalt binder; encased between two (2) layers of asphalt saturated felt or two (2) layers of glass-fiber belt.
- D. F4 Joint Filler: Sponge rubber fully compressible in accordance with ASTM C1752; with resiliency recovery rate of ninety (90) percent minimum.
- E. F5 Joint Filler: Cork in accordance with ASTM C1752; impregnated and bound with asphalt; compressible with resiliency recovery rate of ninety (90) percent if not compressed more than fifty (50) percent of original thickness.
- F. F6 Joint Filler: Plastic foam (for cold-applied sealants only) preformed, compressible, resilient, non-waxing, non-extruding strips of flexible, non-gassing plastic foam; non-absorbent to water and gas; thirty (30) lb/ft³ density maximum; and of size and shape to control sealant depth and performance.

2.04 JOINT FILLER - BACKER ROD AND TAPE TYPE

- A. Elastomeric Tube (Backer Rod) shall be Neoprene, butyl, EPDM, or silicone complying with ASTM D1056, non-absorbent to water and gas, capable of remaining resilient at temperatures down to -26°F. Provide product with low compression set and of size and shape to provide a secondary seal, and to control sealant depth.
- B. Self-adhesive polyethylene bond breaker tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to joint filler materials or joint surfaces at back or bottom of joint.

2.05 JOINT SEALANT - GENERAL

- A. Color of exposed joint sealant as indicated on plans, or if not, as selected from manufacturer's standard colors.

2.06 JOINT SEALANT - HOT-APPLIED

- A. HAS1 Sealant: Resilient and adhesive compound type in accordance with ASTM D3405; for portland cement concrete or asphalt concrete pavements.
- B. HAS2 Sealant: Thermoplastic type in accordance with ASTM D3581; jet-fuel resistant without rubber unless indicated otherwise.

- C. HAS3 Sealant: Elastic type in accordance with ASTM D6690.
- D. HAS4 Sealant: Elastomeric type in accordance with ASTM D3406; one component, for portland cement concrete pavements.
- E. HAS5 Sealant: Elastomeric type in accordance with ASTM D3569; one component, jet-fuel resistant, for portland cement concrete pavements.

2.07 JOINT SEALANT - COLD-APPLIED

- A. All cold-applied joint sealants shall be self-leveling in horizontal surfaces.
- B. CAS1 Sealant: Elastomeric type in accordance with ASTM C920; Chemically curing, for vehicular or pedestrian use, and types of construction other than highway and airfield pavements and bridges and joint substrates indicated; Types S or M; Grade P or NS; Class 25; Use T, NT, M and O.
 - 1. Self leveling.
 - 2. Shore A Hardness: 40 ± 5 ASTM D2240.
 - 3. Final cure: Four (4) days maximum.
 - 4. Service range: -10 to 150°F.
- C. CAS2 Sealant: Mastic type in accordance with ASTM D5893 for joints having a minimum width of one-half (1/2) inch. The following joint sealers or their approved equal that conform to ASTM D5893 are approved for use in the CITY:
 - 1. Crafc0 RoadSaver Silicone SL
 - 2. Dow Corning 890-SL Self-Leveling Silicone Joint Sealant
 - 3. Or approved equal.
- D. CAS3 Sealant: Coal-tar modified urethane type in accordance with FS SS-S-200; one part, jet fuel resistant; Type H.
- E. CAS4 Sealant: Elastomeric preformed polychloroprene type with lubricant adhesive and indicated movement ratio.
 - 1. For concrete pavement seal: ASTM D2628.

2. For concrete bridge seals: ASTM D3542.

2.08 SOURCE QUALITY CONTROL

- A. Preformed Expansion Joint Fillers: Non-extruding and resilient types; ASTM D545.
- B. Hot-Applied Joint Sealants:
 1. Elastic type used in concrete pavements, bridges, other structures: ASTM D5329.
 2. Bituminous type for hydraulic and asphaltic concrete pavements: ASTM D5329.
 3. Elastomeric type of hydraulic concrete pavements: ASTM D5329 and ASTM D3569.
- C. Jet-Fuel-Resistant Joint Sealant: Hot-applied: ASTM D5329 and ASTM D3569.
- D. Cold-Applied Mastic Joint Sealant: In accordance with ASTM D5893.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not proceed with installation of joint sealants under unfavorable weather conditions.
- B. Install elastomeric sealants when temperature is stable in temperature range recommended by manufacturer for installation.
- C. Do not proceed with installation of joint sealers until contaminants capable of interfering with their adhesion are removed from joint substrates.

3.02 PREPARATION

- A. Clean, prepare, and size joints in accordance with manufacturer's instructions. Remove any loose materials and other foreign matter which might impair adhesion of sealant.

- B. Verify that joint shaping materials and release tapes are compatible with sealant.
- C. Examine joint dimensions and size materials to achieve required width to depth ratio.
- D. Adjust joint depths to allow sealants to perform properly.
- E. Remove moisture on substrate.
- F. Install bond breaker tape where needed or required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.

3.03 JOINTS - GENERAL

- A. Construct all joints as follows:
 - 1. At right angles to top surface of placement.
 - 2. Straight unless indicated otherwise.
 - 3. Before uncontrolled shrinkage cracking takes place.
 - 4. To prevent concrete edge slump.

3.04 EXPANSION JOINTS

- A. Expansion joints shall be in location as shown on plans or as approved by the ENGINEER. Joints in exterior concrete work shall be placed where shown on the Standard Drawings. Sidewalk and curb or curb and gutter shall have expansion joint placed a maximum of one hundred (100) feet on center.
- B. Premolded filler strips shall extend full depth of slab plus one (1) inch into the grade.
- C. Isolation joints shall be used in all areas where slabs abut rigid structures and all other appurtenances. Joint material shall be placed on levels called for and in conformance with ACI 117-06.
- D. In no case shall the reinforcing or other fixed metal items embedded or bonded into concrete be run continuous through expansion joint.
- E. Finish at joints shall be neatly finished with an edging tool

providing a slightly rounded edge on each side of the joint filler material.

- F. All expansion joints shall be sealed.

3.05 CONSTRUCTION JOINTS

- A. Construction joints shall be placed in flat slabs ten (10) foot on center or as approved by the ENGINEER.
- B. The preformed metal keyway joints shall be set to obtain accurate alignment, grades, level and plumb in the work and shall be furnished the full depth of the slab.
- C. Where a joint is made to a previously placed concrete section, care should be taken to remove all laitance prior to new placement of concrete.
- D. The CONTRACTOR may elect to place concrete on both sides of a construction joint or placing through the joint. When this method is employed, a temporary backer such as a two inch by four inch (2"x 4") shall be provided to stiffen and hold the preformed metal joint in alignment ahead of the work and shall be removed as the work progresses.

3.06 CONTROL JOINTS

- A. Tooled Joint
 - 1. Tooled joints shall be formed by scoring the slab one-quarter ($\frac{1}{4}$) depth with a steel trowel along a straight edge in locations as shown on the Standard Drawings or if not shown, not to exceed ten (10) foot on centers.
 - 2. The joint shall be finished using a joint tool guided by a straight edge leaving a slightly rounded edge on each side of the joint.
- B. Sawn Joints
 - 1. Sawn joints shall be sawn into interior concrete floors as indicated on the plans and at CONTRACTOR's option in place of preformed metal keys.
 - 2. Joints shall be sawn with a water-cooled diamond bladed power saw or with an early entry saw designed to cut depth

and width as shown on plans.

3. Saw cutting shall occur within twelve (12) hours after placement of concrete. The line of the saw shall be straight, true to line, and square.
4. Pourable joint sealant shall be poured into all sawn joints. Installation shall be in strict accordance with manufacturer's specifications which shall include preparation, priming, etc.

3.07 JOINT SEALING

A. Surface Preparation

1. Remove oil, grease, wax, form-release-agents, curing compounds, bitumens, laitance, and old chalking material by sandblast or water blast as recommended by manufacturer of sealant. Maximum sand blast angle, twenty-five (25) degrees plus or minus five (5) degrees as measured from a vertical plane.
2. Clean and dry with air blast. Do not contaminate air blast with oils or lubricants.
3. Remove frost and moisture in concrete joint substrates before commencing sealing.

B. Installation

1. Ensure that sealants are installed in uniform, continuous ribbons without gaps or air pockets, with complete bonding of joint surfaces on opposite sides.
2. Except as otherwise indicated, fill sealant reservoir to one-quarter ($\frac{1}{4}$) inch below the surface.
3. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove so that joint will not trap moisture and dirt.

- C. Saw cut joints if necessary to provide the required sealant thickness and depth. Install sealant to depths indicated or, if not indicated, as recommended by sealant manufacturer and within the following general limitations measured at center (thin) section of bead:

1. For sidewalks, pavements, and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to seventy-five (75) percent of joint width, but neither more than five-eighths ($\frac{5}{8}$) inch deep nor less than three-eighths ($\frac{3}{8}$) inch deep.
 2. For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to fifty (50) percent of joint width, but neither more than one-half ($\frac{1}{2}$) inch deep nor less than one-quarter ($\frac{1}{4}$) inch deep.
 3. For joints sealed with non-elastomeric sealants and caulking compounds, fill joints to a depth in range of seventy-five (75) percent to one hundred twenty-five (125) percent of joint width.
- D. Do not allow poured sealant compound to overflow or spill onto adjoining surfaces or to migrate into voids of adjoining surfaces. Clean adjoining surfaces to eliminate evidence of spillage.
- E. Do not overheat hot-applied sealants.
- F. Unless indicated otherwise, recess exposed edges of gasket and exposed joint fillers slightly behind adjoining surfaces so compressed units will not protrude from joints.

3.08 CURE AND PROTECTION

- A. Cure sealants and caulking compounds in accordance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability.
- B. Follow procedures required for cure and protection of joint sealants during construction period so they will be without deterioration or damage (other than normal wear and weathering) at time of Final Acceptance.

3.09 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses. Use methods and cleaning materials approved by manufacturer of joint sealant and of products in which joints occur.

- B. Remove protective coating and oil from metals with solvent recommended by the sealant manufacturer.

3.10 PROTECTION

- A. Protect joint sealant during and after curing period from contact with contaminating substances or from damage resulting from deterioration or damage at time of Final Acceptance.
- B. If damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealant immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work at no additional cost to OWNER.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for items under this section.

4.02 BASIS OF PAYMENT

- A. No separate payment shall be made for items under this section. Full compensation shall be included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 03304

PORTLAND CEMENT CONCRETE

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of portland cement concrete material and mix design requirements.

1.02 RELATED WORK

- A. Section 01330 - Survey Monuments and Control Points.
- B. Section 02570 - Adjusting Street Fixtures.
- C. Section 03100 - Concrete Formwork.
- D. Section 03200 - Concrete Reinforcement.
- E. Section 03251 - Expansion and Contraction Joints.
- F. Section 03305 - Concrete Quality Control.
- G. Section 03310 - Concrete Work.
- H. Section 03320 - Portland Cement Concrete Pavement.
- I. Section 03330 - Concrete Curbs and Combined Curbs and Gutters.
- J. Section 03340 - Concrete Sidewalks, Driveways Approaches, Curb Turn Fillets, Valley Gutters, and Miscellaneous New Concrete Construction.

1.03 DEFINITIONS

- A. Average Strength (f_{cr}): The required average strength for thirty (30) consecutive strength tests which statistically assures no more than the permissible proportions of tests will fall below specified strength.
- B. Specified Strength (f'_c): The indicated strength.

1.04

REFERENCES

- A. ACI 211.1: Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
- B. ACI 211.2: Standard Practice for Selecting Proportions for Structural Lightweight Concrete.
- C. ACI 211.3: Standard Practice for Selecting Proportions for Non-Slump Concrete.
- D. ACI 214: Recommended Practice for Evaluation of Strength Test Results of Concrete. F.ACI 301: Specifications for Structural Concrete for Buildings.
- E. ASTM C33: Standard Specification for Concrete Aggregates.
- F. ASTM C88: Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
- G. ASTM C94: Standard Specification for Ready-Mix Concrete.
- H. ASTM C150: Standard Specification for Portland Cement.
- I. ASTM C260: Standard Specification for Air-Entraining Admixtures for Concrete.
- J. ASTM C289: Standard Test Method for Potential Reactivity of Aggregates (Chemical Method).
- K. ASTM C494: Standard Specification for Chemical Admixtures for Concrete.
- L. ASTM C618: Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for use in Concrete.
- M. ASTM C 227: Standard Test Method of Potential Alkali Reactivity of Aggregate (Mortar Bar Method).

1.05

SUBMITTALS

- A. Submit annual mix designs or each proposed mix design fourteen (14) days prior to use in the work. An annual mix design shall be submitted for the ENGINEER's approval prior to April 15th. Indicate whether mixes have been designed for pumping. Include in the report the following information:

1. Water-cementitious ratio.
 2. Proportion of materials in the mix.
 3. Source and type of cement.
 4. Analysis of water to be used unless potable.
 5. Type and name of admixtures applied. Indicate when accelerating or retarding admixtures are to be used and the resulting change in placement times.
 6. Slump, air content, and temperature of samples.
 7. Unit weight of fresh and dry lightweight concrete.
 8. Submit one (1) copy of a certificate prepared by the concrete supplier stating that the approved fibrous concrete reinforcement materials at the rate of one and one-half (1.5) pounds per cubic yard were added to each batch of concrete delivered to the project site
- B. Concrete Quality Charts. Comply with ACI 214 and ACI 301, and submit the following:
1. Specified strength (f'_c).
 2. Required average strength (f_{cr}).
 3. Compressive strength versus date of sample.
- C. Optional design mix:
1. At the CONTRACTOR's option, he may elect to provide a concrete mix that has been previously designed (not more than eleven (11) months prior), tested, and used and which provides the quality required by these specifications.
 2. If the CONTRACTOR exercises this option, he shall submit to the ENGINEER for his approval all pertinent data, including test results to substantiate the design mix requested to be furnished.
- D. Submit an aggregate test report for each aggregate source.
1. Date of test analysis.

2. Sieve analysis.
3. Organic impurities.
4. Sodium sulfate soundness test.
5. Reactivity of aggregate.
6. Complete identification of aggregate source of supply.

1.06

QUALITY ASSURANCE

- A. The amount by which the average strength (f_{cr}) of a concrete mix exceeds the specified compressive strength (f'_c) shall be based upon no more than one (1) in one hundred (100) random individual strength tests falling more than five hundred (500) psi below the specific strength.
- B. Proportion the materials in accordance with ACI 211.1, 211.2, or 211.3 as applicable to produce concrete with the appropriate strength for the item being placed.
 1. Entrained air content shall be 6% \pm 1.5%.
 2. Slump shall be one (1) to four (4) inches; unless using a super-plasticizer, then slump may be a maximum of eight (8) inches.
 3. Water/cementitious ratio shall not exceed 0.45.
 4. Seven (7) day strength test shall be a minimum of sixty-seven (67) percent of total specified strength.
- C. All concrete within the CITY right-of-way shall be a minimum of 4500 psi concrete with fiber reinforcement unless otherwise shown on the Standard Drawings or indicated in these specifications.
- D. Do not change material sources, type of cement, air-entraining agent, water reducing agent, other admixtures, or aggregate without ENGINEER's approval.
- E. In proportioning materials for mixing, use scales certified in accordance with Wyoming State Law. Do not use volume measurement except for water and liquid admixtures.
- F. Do not change the quantity of cement per cubic yard from

approved mix design without written approval of ENGINEER.

- G. Use of admixture will not relax hot or cold weather placement requirements.
- H. Ready-mixed concrete to be in accordance with Alternate No. 3 of ASTM C94 and requirements in this section.
- I. Control Testing of Concrete: In accordance with SECTION 03305, CONCRETE QUALITY CONTROL.
- J. Hand mix a maximum of one-half (0.5) cubic yard only on watertight platform. Mix cement and aggregate prior to adding water ensuring all stones are thoroughly covered with mortar and mixture is of uniform color and consistency.
- K. Do not allow products to contact the aggregate.
- L. Heat mixing water to 150°F maximum. Heat aggregates uniformly.
- M. Do not mix cement with water and aggregate at a mix temperature greater than 100°F.

1.07 PRODUCT STORAGE AND HANDLING

- A. Store bagged and bulk cement in weatherproof enclosures to exclude moisture and contaminants.
- B. Stockpile aggregate to avoid segregation and prevent contamination.
- C. Avoid contamination, evaporation, or damage to admixtures. Protect liquid admixtures from freezing.

PART 2 PRODUCTS

2.01 CEMENT

- A. ASTM C150, Type II or low alkali Type III for precast items. Type I in above grade structure if approved, or as recommended by soils engineer.
- B. Do not use air entraining cement.

2.02

WATER

- A. Clean and potable.
- B. Comply with ACI 211.1.

2.03

AGGREGATES - GENERAL

- A. Gravel, crushed slag, crushed stone, or other inert materials, composed of hard, strong, durable particles free of injurious coatings.
- B. The materials passing the No. 200 sieve shall not exceed one and three-quarters (1.75) percent by weight in the combined coarse and fine aggregate.
- C. Determine alkali-silica reactivity of each source of both fine and coarse aggregates in accordance with ASTM C1260. When expansion exceeds 0.10%, remedial measures may include selecting a cement type with low alkali content, using non-reactive aggregates from another source, replacing a percentage of cement with certain pozzolans or using a chemical admixture such as a lithium compound, or some combination of these. Mix designs along with test results of the ASTM C1260 shall be submitted to the ENGINEER showing which remedial measures you are using for approval two (2) weeks prior to placement of any concrete item. Test shall be at least once per year by an independent lab qualified to do so.

2.04

COARSE AGGREGATE

- A. Graded in accordance with ASTM C33, as indicated in the following table.

MASTER GRADING BAND LIMITS FOR COARSE AGGREGATES				
	COARSE AGGREGATE (% Passing by Weight)			
Sieve Sizes	Grade 57		Grade 67	
(in)	Min	Max	Min	Max
2	-	-	-	-
1-1/2	100	-	-	-
1	95	100	100	-
3/4	-	-	90	100
1/2	25	60	-	-
3/8	-	-	20	55
# 4	0	10	0	10
# 8	0	5	0	5

B. Gradation limits of the following table may be changed if, in the judgment of the ENGINEER, workability and methods of consolidation are such that concrete can be placed without honeycomb or voids, and the maximum aggregate size does not exceed the following requirements:

1. One-fifth ($\frac{1}{5}$) of narrowest dimension between forms.
2. One-third ($\frac{1}{3}$) of depth of slabs.
3. Three-quarters ($\frac{3}{4}$) of minimum clear spacing between reinforcing bars.

C. Deleterious Substances: (Maximum percentage by weight.)

1. Soft Fragments: 2.0%.
2. Coal and Lignite: 0.3%.
3. Clay Lumps: 0.3%.
4. Other Deleterious Substances: 2.0%.

2.05

FINE AGGREGATE

- A. Sieve Analysis: Graded in accordance with ASTM C33, as follows:

MASTER GRADING BAND LIMITS FOR FINE AGGREGATES		
	FINE AGGREGATE (% Passing by Weight)	
Sieve Sizes (in)	Min	Max
3/8	100	-
# 4	95	100
# 16	45	80
# 50	10	30
# 100	2	10

- B. Deleterious Substances: (Maximum percentage by weight.)
1. Coal and Lignite: 0.3%.
 2. Clay Lumps: 0.5%.
 3. Other Deleterious Substances: 2.0%.

2.06

ADMIXTURES

- A. Air Entrainment: ASTM C260.
- B. Water Reducing and Set Retarding Agents: ASTM C494.
1. Type A: Set water reducing.
 2. Type B: Set retarding.
 3. Type C: Set accelerating.
 4. Type D: Water reducing and set retarding.
 5. Type E: Water reducing and set accelerating.
 6. Type F: High range water reducing (super plasticizer). *
 7. Type G: High range water reducing and set retarding. *

* The relative durability factor of water reducing admixtures shall not be less than eighty (80), and the chlorides content (as C1-) shall not exceed one (1) percent by weight of the admixtures.

- C. Calcium Chloride: None allowed.
- D. Pozzolan (Fly Ash) conforming to the requirements of ASTM C618, Class F, is allowed as a portland cement replacing agent under the following conditions:
 - 1. The maximum percentage of portland cement replacement is twenty-six (26) percent.
 - 2. The ratio of replacement by weight of pozzolan to cement shall be 1.25 to 1.0.
 - 3. The minimum cement content shall be used in the design formulas before replacement is made.
 - 4. Loss of ignition of pozzolan is less than three (3) percent, and the water requirement does not exceed one hundred (100) percent.
 - 5. All other requirements of this section still apply.
 - 6. Mix designs including trial batches are required for each aggregate source and for each concrete class.
- E. Reinforced Concrete
 - 1. All concrete in right-of-way shall be fiber reinforced unless otherwise shown on the Standard Drawings or indicated in these specifications.
 - 2. All reinforced concrete shall conform to SECTION 03200, CONCRETE REINFORCEMENT.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for items under this section.

4.02

BASIS OF PAYMENT

- A. No separate payment shall be made for items under this section. Full compensation shall be included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 03305

CONCRETE QUALITY CONTROL

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of testing requirements for CONTRACTOR's quality control of portland cement concrete mixtures and re-testing potential defective concrete.

1.02 RELATED WORK

- A. Section 01340 - Submittals.
- B. Section 02225 - Trench Backfill.
- C. Section 02570 - Adjusting Street Fixtures.
- D. Section 02665 - Water Distribution and Transmission Systems.
- E. Section 02700 - Sanitary Sewer Systems.
- F. Section 02725 - Storm Drains and Culverts.
- G. Section 02915 - Unit Pavers.
- H. Section 03304 - Portland Cement Concrete.
- I. Section 03310 - Concrete Work.
- J. Section 03320 - Portland Cement Concrete Pavement.
- K. Section 03330 - Concrete Curbs and Combined Curb and Gutter.
- L. Section 03340 - Concrete Sidewalks, Driveway Approaches, Curb Turn Fillets, Valley Gutters and Miscellaneous New Concrete Construction.

1.03 SUBMITTALS

- A. All field and laboratory control test reports.
- B. Material certificates.

1.04

REFERENCES

- A. ACI 318: Building Code Requirements for Reinforced Concrete.
- B. ASTM C31: Standard Practice for Making and Curing Concrete Test Specimens in the Field.
- C. ASTM C39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- D. ASTM C42: Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- E. ASTM C78: Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
- F. ASTM C 38: Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
- G. ASTM C172: Standard Method of Sampling Freshly Mixed Concrete.
- H. ASTM C173: Standard Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method.
- I. ASTM C231: Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
- J. ASTM C567: Standard Test Method for Unit Weight of Structural Lightweight Concrete.
- K. ASTM D4832: Standard Test Method for Preparation and Testing of Controlled Low-Strength Material (CLSM) Test Cylinders.
- L. Wyoming Department of Transportation Standard Specifications for Road and Bridge Construction

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 REQUIREMENTS

- A. All testing shall be performed by an ACI certified technician employed by an independent testing laboratory.

TESTING COMPRESSION STRENGTH

- A. Secure composite samples in accordance with ASTM C172.
- B. Casting:
 - 1. Cast and cure four (4) concrete cylinders in accordance with ASTM C31, three (3) for testing and one (1) for a spare. Determine unit weight, slump, air content, and temperature of concrete casting.
 - 2. For controlled low-strength material (CLSM) cast concrete cylinders in accordance with ASTM D4832. Cast and cure three (3) cylinders, two (2) for testing and one (1) as a spare.
- C. Testing: Perform compression tests on samples in accordance with ASTM C39.
 - 1. Tests shall be performed on all single placements of twenty (20) cubic yards or more and every accumulative fifty (50) cubic yards throughout the project.
 - 2. Two (2) specimens shall be tested at twenty-eight (28) days for acceptance, one (1) shall be tested at seven (7) days or as directed by the ENGINEER for information. The acceptance test results shall be the average of the strengths of the two (2) specimens tested at twenty-eight (28) days. If one (1) specimen in a test manifests evidence of improper sampling, molding or testing, it shall be discarded and the spare specimen shall be tested and averaged as one (1) of the two (2) constituting the twenty-eight (28) day test.
 - 3. For CLSM, test one (1) cylinder at three (3) days and the remainder at twenty-eight (28) days. If any one (1) cylinder in a twenty-eight (28)-day test shows definite evidence, other than low strength, of improper sampling, molding, handling, curing, or testing, discard. The average strength of the remaining cylinders shall be considered the test result.

3.03

ADDITIONAL TESTING

- A. Slump Test: ASTM C231.
- B. Air Test:
 - 1. Normal weight concrete air content per ASTM C231.
 - 2. Light weight concrete air content per ASTM C173.
- C. Unit Weight:
 - 1. Normal weight concrete per ASTM C138.
 - 2. Light weight concrete per ASTM C567.

3.04

RE-TESTING POTENTIALLY DEFECTIVE CONCRETE

- A. If a concrete test result is below specification and the work is considered potentially deficient:
 - 1. A request to ENGINEER for re-testing must be made within thirty-five (35) days from time of placement if CONTRACTOR desires re-test.
 - 2. No coring or re-testing shall be done after forty (40) days have elapsed from the time of placement.
 - 3. Only one (1) re-test shall be allowed for a test subplot.
 - 4. The costs associated with re-testing shall be in accordance with SECTION 01041, PROJECT COORDINATION.
- B. Obtain and test cores in accordance with ASTM C42. Secure a minimum of three (3) cores from each subplot considered potentially deficient. Test locations shall be selected by the ENGINEER.
- C. If concrete in work will be dry under service condition, air dry cores for seven (7) days before tests. Unless otherwise specified, use air temperature 60 to 80°F and relative humidity less than sixty (60) percent.
- D. If concrete in work under service conditions will be more than superficially wet, test cores after moisture conditioning (liquid or vapor water cure).

- E. If one (1) or more cores show evidence of having been damaged before testing, provide replacement.
- F. Evaluate cores in accordance with ACI 318.
- G. If core tests are inconclusive or impractical to obtain, or if structural analysis does not confirm the safety of the work, load test may be required and evaluated in accordance with ACI 318.
- H. Fill core holes with non-shrink, low slump concrete mortar. Coat sides of holes with an approved concrete epoxy resin adhesive. Match color and texture of surrounding concrete.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for items under this section.

4.02 BASIS OF PAYMENT

- A. No separate payment shall be made for items under this section. Full compensation shall be included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 03310

CONCRETE WORK

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of concrete placement operations for cast-in-place slabs on grade, slabs on fill, structural building frame, and other concrete components.

1.02 RELATED WORK

- A. Section 01330 - Survey Monuments and Control Points.
- B. Section 02570 - Adjusting Street Fixtures.
- C. Section 03100 - Concrete Formwork.
- D. Section 03200 - Concrete Reinforcement.
- E. Section 03251 - Expansion and Contraction Joints.
- F. Section 03305 - Concrete Quality Control.
- G. Section 03310 - Concrete Work.
- H. Section 03320 - Portland Cement Concrete Pavement.
- I. Section 03330 - Concrete Curbs and Combined Curbs and Gutters.
- J. Section 03340 - Concrete Sidewalks, Driveways Approaches, Curb Turn Fillets, Valley Gutters, and Miscellaneous New Concrete Construction.
- K. Section 03370 - Concrete Curing and Sealing.

1.03 SUBMITTALS

- A. Quality control test reports and material certificates in accordance with SECTION 03305, CONCRETE QUALITY CONTROL.

- B. Record of placed concrete:
1. Record date.
 2. Location of pour.
 3. Quantity.
 4. Air temperature.
 5. CONTRACTOR's quality control test samples taken.
- C. Product name, type, MSDS, and chemical analysis of the following as applicable:
1. Curing compound.
 2. Sealing compound.
 3. Chemical hardener.
 4. Bonding compound.
- D. Submit a batch delivery ticket for each batch delivered to site. Each ticket shall include:
1. Projected slump.
 2. Date.
 3. Producer and plant.
 4. Job and location.
 5. Name of CONTRACTOR.
 6. Serial number of ticket.
 7. Truck number and time batched.
 8. Volume of concrete.
 9. Reading of revolution counter at first addition of water on site.
 11. Amount of cement.

12. Total water content (W/C ratio).
13. Water added to concrete and receiver's signature.
14. Admixture types and amounts.
15. Maximum size of aggregate.
16. Separate weights of fine and coarse aggregate.
17. Indication that all ingredients are as previously certified or approved.
18. Weight and type of fibrous reinforcement.

1.04 QUALITY ASSURANCE

- A. Concrete work which fails to meet one (1) or more of the following requirements and which cannot be brought into compliance shall be rejected. ENGINEER shall determine appropriate modifications or payment adjustments to be made.
 1. Concrete exposed to public view with defects which adversely affect appearance of specified finish.
 2. Strength of concrete fails to comply with any of the following requirements:
 - a. The average of two (2) twenty-eight (28) day compressive or flexural strength samples made from the same batch of concrete falls below the acceptance level.
 - b. Reinforcing steel size, quantity, strength, position, damage, or arrangement at variance with requirements.
 - c. Concrete which differs from required dimensions or location in such a manner as to reduce its strength or load carrying capacity.
 - d. Method of curing is not as specified.

- e. Inadequate protection of concrete from extremes of temperature during the early stages of hardening and strength development.
 - f. Mechanical injury, construction fires, accidents, or premature removal of formwork likely to result in deficient strength development.
 - g. Workmanship likely to result in deficient strength.
- 3. Finishing which fails to comply with SECTION 03345, CONCRETE FINISHING, requirement.
 - 4. Material Sources: Failure to comply with SECTION 03305, CONCRETE QUALITY CONTROL.

1.05 REFERENCES

- A. ACI 301: Specifications for Structural Concrete for Buildings.
- B. ACI 305: Hot Weather Concreting.
- C. ACI 306: Cold Weather Concreting.
- D. ACI 309: Standard Practice for Consolidation of Concrete.
- E. ASTM C881: Specification for Epoxy-Resin-Based Bonding Systems for Concrete.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Concrete: strength as indicated, material in accordance with SECTION 03304, PORTLAND CEMENT CONCRETE.
- B. Bonding Compound: Polyvinyl acetate base or acrylic base, non-rewettable type.
- C. Vapor Barrier: ten (10) mil thick, clear, polyethylene sheet. Type recommended for below grade application and shall be free from pin holes, tears, scars, and other defects.
- D. Forms: In accordance with SECTION 03100, CONCRETE FORMWORK.

- E. Reinforcement: In accordance with SECTION 03200, CONCRETE REINFORCEMENT.
- F. Coverings, Sealants and Curing Compound: In accordance with SECTION 03370, CONCRETE CURING AND SEALING.
- G. Non-shrink Grout: Adhesives epoxy, in accordance with SECTION 03600, GROUT.

PART 3 EXECUTION

3.01 PREPARATION

- A. Verify that anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, held securely, and will not impede placing concrete.
- B. Do not allow construction loads to exceed member capacity.
- C. Prepare previously placed concrete by cleaning with steel brush and applying bonding compound. Apply bonding compound in accordance with manufacturer's instructions.
- D. At locations where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels, and epoxy in dowels with an epoxy that adheres to ASTM C881.

3.02 DELIVERY

- A. All concrete trucks shall be equipped with an automatic chute closure. Chute closure assembly shall prevent concrete from spilling during transit.
- B. Do not discharge concrete if its slump is greater or less than permissible slump.
- C. After the introduction of mixing water to the cement and aggregates at the batch plant, discharge concrete from truck mixer within the following:
 - 1. Mix shall not exceed ninety (90) minutes.
 - 2. Mix temperature shall not exceed 90°F.

D. Tempering

1. When concrete arrives at site with slump below specified, water may be added if the maximum approved water/cementitious material ratio and the maximum slump is not exceeded, provided that:
 - a. The approved mix design has allowed for on-site addition of water.
 - b. The amount of water added at the site is accurately measured to plus or minus one (1) gallon of the desired added amount.
 - c. That water addition is followed by three (3) minutes of mixing at mixing speed prior to discharge.
2. Do not add water after concrete discharge from the mixer commences.

E. Maintain mixed concrete temperature at times of placement between 50°F and 90°F.

F. Super-plasticizer

1. Pre-measure and add high range water reducing agent in accordance with manufacturer's instructions.
2. Do not deliver to site unless batch delivery ticket displays water/cementitious ratio prior to super-plasticizer addition.
3. Tempering with super-plasticizer after expiration of allowable delivery times is prohibited.

G. Wash out of concrete trucks and equipment shall comply with current WDEQ requirements. Proposed wash out locations within the right-of-way shall be approved by the ENGINEER.

3.03

INSPECTION

A. All concrete work shall have a grade and form inspection prior to placement performed by the ENGINEER. Inspections shall be scheduled a minimum of one (1) working day in advance by calling 307-637-6265.

CONCRETE PLACEMENT

- A. Notify ENGINEER minimum two (2) working days prior to commencement of concrete placement operations.
- B. Place concrete in accordance with ACI 301.
- C. Hot Weather Placement:
 - 1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
 - 2. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90°F. Mixing water may be chilled or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.
 - 3. Cover reinforcing steel with water-soaked burlap if it becomes too hot so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
 - 4. Wet forms and grade thoroughly before placing concrete.
 - 5. Evaporation retardant shall be approved by the ENGINEER on a pour by pour basis. This is to be used per manufacturer's recommendations. This is not to be used as a finishing agent.
- D. Cold Weather Placement
 - 1. Protect concrete from physical damage or reduced strength caused by frost, freezing, or low temperatures, in compliance with ACI 306 and as herein specified.
 - 2. If necessary to place concrete when ambient air temperature is below 40°F or expected to fall below 40°F during cure period, placement shall be approved by the ENGINEER. Work shall be placed and protected in accordance with Table 7.3.3 of ACI 306 until concrete has reached 3,500 psi as evidenced by cylinders field cured in accordance with ASTM C31. ENGINEER may require protection plan in writing.

3. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen material.
 4. Do not use calcium chloride, salt and other material containing antifreeze agents, or chemical accelerators, unless otherwise accepted in writing by the ENGINEER.
- E. Do not disturb reinforcement, inserts, embedded parts, and formed joints.
- F. Do not break or interrupt successive pours such that cold joints occur.
- G. Honeycomb in concrete shall be patched unless area exceeds 20% of face of individual stone or 1-inch in depth. Areas exceeding 20% of face and 1-inch depth shall be removed and replaced at CONTRACTOR's expense. Embedded debris shall be considered as defective work and shall be removed and replaced.

3.05 JOINTS AND JOINT SEALING

- A. Expansion and contraction joints, in accordance with SECTION 03251, EXPANSION AND CONTRACTION JOINTS.

3.06 CONSOLIDATION

- A. In accordance with ACI 309.
- B. Keep spare vibrator available during concrete placement operations.

3.07 FINISHING

- A. As defined in ACI 301.
- B. Do not add water to concrete surface (i.e.: sprinkle) without written approval from the ENGINEER.
- C. Slab finishing tolerance shall be in accordance with SECTION 03345, CONCRETE FINISHING.
- D. Finishes shall be in accordance with SECTION 03345, CONCRETE FINISHING. When type of finish is not indicated, use following finishes as applicable:

1. Sidewalks, garage floors, and ramps: Broom finish.
2. Exterior concrete pavement: Broom finish.
3. Exterior platforms, steps, and landings, exterior and interior pedestrian ramps, not covered by other finish materials: Non-slip finish.
4. Surfaces intended to receive bonded applied cementitious applications: Scratched finish.
5. Surfaces intended to receive roofing, except future floors, waterproofing membranes, and roof surfaces which are future floors or sand bed terrazzo: Floated finish.
6. Floors and roof surfaces intended as walking surfaces or to receive floor coverings: Toweled finish.
7. Unpainted concrete surfaces not exposed to public view: Rough as-cast form finish.
8. Unpainted concrete surfaces exposed to public view: Smooth as-cast form finish.
9. Concrete surfaces to receive paint or plaster: Grout cleaned finish.

3.08 CURING AND SEALING

- A. Cure and seal in accordance with SECTION 03370, CONCRETE CURING AND SEALING.

3.09 CONTROL TESTING

- A. Testing shall be in accordance with SECTION 03305, CONCRETE QUALITY CONTROL.

3.10 DEFECTIVE CONCRETE

- A. Modify or replace concrete not conforming to required levels, lines, details, and elevations.
- B. Structural analysis and additional testing may be required at no additional cost of OWNER when the strength of a structure is considered deficient.

- C. Patch imperfections in accordance with SECTION 03345, CONCRETE FINISHING.

3.11 PROTECTION AND REPAIRS

- A. After placement, immediately protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimum moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- C. When cracks occur within two (2) feet of expansion or construction joints, remove and replace. All remove and replace areas shall be from joint to joint. Random cracks which occur away from joints and, in the judgment of the ENGINEER, will not cause future maintenance problems may be routed and sealed. If not accepted, the slab shall be replaced at the CONTRACTOR's expense to the satisfaction of the ENGINEER.

3.12 OPENING TO TRAFFIC

- A. Concrete shall reach eighty (80%) percent of 28 day strength prior to opening to traffic.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for items under this section.

4.02 BASIS OF PAYMENT

- A. No separate payment shall be made for items under this section. Full compensation shall be included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 03320

PORTLAND CEMENT CONCRETE PAVEMENT

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of constructing a pavement composed of air-entrained portland cement concrete on a prepared subgrade or base course in accordance with these specifications and in reasonably close conformity with the lines, grades, thicknesses, and typical cross sections shown on the plans or designated by the ENGINEER. This section is primarily concerned with smaller types of concrete pavement construction reconstruction projects such as portland cement concrete intersections. This section shall be modified by one or more special provisions for projects of a larger nature normally associated with new construction or "main line" paving.

1.02 SUBMITTALS

- A. All submittals shall conform to SECTION 03304, PORTLAND CEMENT CONCRETE.
- B. All submittals shall be reviewed and approved by the ENGINEER prior to use.

1.03 RELATED WORK

- A. Section 02231 - Aggregate Subbase and Base Courses.
- B. Section 03200 - Concrete Reinforcement.
- C. Section 03251 - Expansion and Contraction Joints.
- D. Section 03304 - Portland Cement Concrete.
- E. Section 03370 - Concrete Curing and Sealing.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Concrete: All materials shall conform with the following sections:
1. Section 03200 - Concrete Reinforcement.
 2. Section 03251 - Expansion and Contraction Joints.
 3. Section 03304 - Portland Cement Concrete.
 4. Section 03370 - Concrete Curing and Sealing..

PART 3 EXECUTION

3.01 PROPORTIONING CONCRETE MIX

- A. The concrete shall meet the following requirements:
1. Pavement shall be 4500 psi or higher.
 2. Design flexural strength as specified or shown on the approved plans.
 3. Water-cementitious material ratio shall not exceed 0.45.
 4. Fly ash may be substituted for portland cement up to a maximum of twenty-six (26) percent.
 5. The percentage of entrained air in the mix shall be 6% \pm 1.5%.
 6. Maximum slump of four (4) inches.
 7. All concrete in the right-of-way shall be fiber reinforced. Fibrous concrete reinforcement material shall be 100% virgin polypropylene fibers containing no reprocessed materials.
 - a. Volume = 1.5 pounds per cubic yard
 - b. Tensile strength = 50 to 110 ksi

- B. The mix proportions shall be based upon trial mixes conducted by an independent testing laboratory in accordance with ACI 211. The proportions shall be stated in terms of aggregates in a saturated, surface-dry condition, and the batch weights shall be adjusted to take into account the actual moisture content of the aggregates at time of use.
- C. The designated proportions shall govern during the progress of the work, except as provided below in paragraphs one (1) through three (3), inclusive.
 - 1. If it is found impossible to obtain concrete of the desired plasticity and workability with the proportions originally approved by the ENGINEER, he may approve changes in aggregate weights, provided that in no case shall the cement content originally designated be changed except as provided below.
 - 2. If it is found impossible to produce concrete having the required consistency without exceeding the maximum allowable water-cementitious ratio specified, the cement content shall be increased or admixtures added as approved by the ENGINEER so that the maximum water-cementitious ratio shall not be exceeded.
 - 3. No change in the sources or character of the materials shall be made without due notice to the ENGINEER, and no new materials shall be used until approved by the ENGINEER and he has approved new proportions based upon independent laboratory tests and trial mixes.

3.02 EQUIPMENT

- A. The batching plant shall include bins, weighing hoppers, and scales for the fine aggregate and for each size of coarse aggregate. If cement is used in bulk; a bin, hopper, and separate scale for cement shall be included. The weighing hopper shall be properly sealed and vented to preclude dusting operation.
 - 1. Bins with adequate separate compartments for fine aggregate and for each size of coarse aggregate shall be provided in the batching plant.

2. The scales for weighing aggregates and cement shall be of either the beam type or the spring less-dial type. They shall be accurate within one-half ($\frac{1}{2}$) percent throughout the range of use. When beam-type scales are used, provisions such as a “telltale” dial shall be made for indicating to the operator that the required load in the weighing hopper is being approached. A device on weighing beams shall indicate critical position clearly. Poises shall be designed to be secured in any position and to prevent inadvertent change. The weigh beam and “telltale” device shall be in full view of the operator while the hopper is charged, and he shall have convenient access to all controls. Weighing may be accomplished using electronic load cells and computer controls. Scales shall be tested as often as the ENGINEER may deem necessary to assure their continued accuracy. The CONTRACTOR shall have on hand not less than ten (10), fifty (50) pound weights for frequent testing of all scales.
- B. Concrete may be mixed at the site of construction or at a central point, or wholly or in part in truck mixers. Each mixer shall have attached in a prominent place a manufacturer’s plate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.
1. Central plant mixers shall be capable of combining the aggregates, cement, and water into a thoroughly mixed and uniform mass within the specified mixing period, and of discharging and distributing the mixture without segregation on the prepared grade. The mixer shall be equipped with an approved timing device which will automatically lock the discharge lever when the drum has been charged and release it at the end of the mixing period. The mixers shall be cleaned at suitable intervals. The pickup and throw-over blades in the drum or drums shall be repaired or replaced when they are worn down one (1) inch or more. The CONTRACTOR shall: (1) have available at the job site a copy of the manufacturer’s design, showing dimensions and arrangements of blades in reference to original height and depth; or (2) provide permanent marks on blade to show points of one (1) inch wear from new condition. Drilled holes of one-quarter ($\frac{1}{4}$) inch diameter near each end and at the midpoint of each blade are recommended.

2. Truck Mixers and Truck Agitators
 - a. Truck mixers used for mixing and hauling concrete, and truck agitators used for hauling central mixed concrete shall conform to the requirements of ASTM C94.
 - b. All concrete trucks shall be equipped with an automatic chute closure. Chute closure assembly shall prevent concrete from spilling during transit.
 3. Non-agitator Trucks - Bodies of non-agitating hauling equipment for concrete shall be smooth, mortar-tight, metal containers and shall be capable of discharging the concrete at a satisfactory controlled rate without segregation. The concrete shall be discharged from the bottom of the container. If discharge of concrete is accomplished by tilting the body, the surface of the load shall be retarded by a suitable baffle. Covers shall be provided when needed for protection.
- C. The finishing machine shall be of ample weight and power for proper finishing of the concrete. The finishing machine shall be designed and operated to strike off, screed and consolidate the concrete. Screed and float adjustments of these machines shall be checked at the start of each day's paving. Machines that cause displacement of side forms or frequent delays due to mechanical failure shall be replaced. When the finishing machines ride the edge of previously constructed slabs, provisions shall be made to protect the surface of these slabs.
- D. Vibrators, for full width vibration of concrete paving slabs, may be either the surface pan type or the internal type with either immersed tube or multiple spuds.
1. Vibrators may be attached to the spreader or the finishing machine, or may be mounted on a separate carriage.
 2. Vibrators shall not come in contact with the joint, load transfer devices, subgrade, or side forms.

3. The frequency of the surface vibrators shall not be less than three thousand-five hundred (3,500) impulses per minute, and the frequency of the internal type shall not be less than five thousand (5,000) impulses per minute for tube vibrators and not less than seven thousand (7,000) impulses per minute for spud vibrators. When spud-type internal vibrators, either hand-operated or attached to spreaders or finishing machines, are used adjacent to forms, they shall have a frequency of not less than three thousand-five hundred (3,500) impulses per minute.
- E. The CONTRACTOR shall provide sawing equipment adequate in number of units and power to complete the sawing with a water-cooled diamond edge saw blade or early entry saws at the required rate. The CONTRACTOR shall provide adequate artificial lighting facilities for night sawing. All of this equipment shall be at the job site both before and continuously during concrete placement. A backup saw shall be on site.
- F. Straight side forms shall be made of a metal having a thickness of not less than seven-thirty seconds ($\frac{7}{32}$) inch and shall be furnished in sections not less than ten (10) feet in length.
1. Forms shall have a depth at least equal to the prescribed edge thickness of the concrete, without horizontal joint, and a base width equal to not less than the depth of the forms.
 2. Flexible or curved forms of proper radius shall be used for curves of one hundred (100) feet radius or less. Flexible or curved forms shall be of a design acceptable to the ENGINEER.
 3. Forms shall be provided with adequate devices for secure setting so that when in place they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment.
 4. Flange braces shall extend outward on the base not less than two-thirds ($\frac{2}{3}$) the height of the form.
 5. Forms with battered top surfaces, and/or bent, twisted, or broken forms shall be removed from the work. Repaired forms shall not be used unless inspected and approved by the ENGINEER.

6. Built up forms shall not be used except where the total area of pavement of any specified thickness on the project is less than two thousand (2,000) square yards.
7. The top face of the form shall not vary from a true plane more than one-quarter ($\frac{1}{4}$) inch in ten (10) feet, and the upstanding leg shall not vary more than one-quarter ($\frac{1}{4}$) inch.
8. The forms shall contain provisions for locking the ends of abutting form sections together tightly and securing pins.

3.03

CONDITIONING OF SUBGRADE OR BASE COURSE

- A. The subgrade or base course shall be brought to proper cross section. Low areas may be filled with subgrade or base course material and compacted to the specified density, or filled with concrete integral with the pavement. The finished grade shall be maintained in a smooth and compacted condition until the pavement is placed.
- B. The subgrade or base course shall be uniformly moist when the concrete is placed. If it subsequently becomes too dry, the subgrade or base course shall be sprinkled, but the method of sprinkling shall not be such as to form mud or pools of water.
- C. The moisture content of the material at the time of compaction shall be within plus two (2) and minus four (4) percentage points of optimum.
- D. If the required compacted depth of subbase course exceeds six (6) inches, the course shall be constructed in two (2) or more layers of approximately equal thickness. The maximum compacted thickness of any one (1) layer shall not exceed six (6) inches. When vibrating or other approved types of special compacting equipment are used, the depth of a single layer of the course may be increased upon approval by ENGINEER.
- E. Each layer shall be compacted to a minimum of ninety-five (95) percent of maximum dry density as determined in accordance with ASTM D698. Testing shall comply with ASTM D2922, D1556, or D5195. The surface of each layer shall be maintained during the compaction operations in such a manner that a uniform texture and surface is produced and the aggregates firmly keyed. Water shall be uniformly applied over the materials during compaction in the amount necessary for proper consolidation.

- F. Frequency of testing shall be every two hundred-fifty (250) feet horizontally and every twelve (12) inches vertically per lane.
- G. It shall be the responsibility of the CONTRACTOR to schedule and obtain compaction tests by an independent construction laboratory. The CONTRACTOR shall be responsible for providing copies of all tests results to the CITY's Construction Department. All tests shall be paid for by the CONTRACTOR.
- H. The road bed shall be tested for soft spots by proof rolling. The proof roll test shall be done after passing the in-place compaction tests. Copies of the passing compaction tests, including the proctor, shall be provided to the ENGINEER. Each succeeding pass of the proof roller over the roadbed shall be offset by no greater than four (4) tire widths. The proof roller shall be uniformly.
 - 1. The ENGINEER shall initial the permit after the successful completion of the proof roll test. A copy of the completed permit with the approved inspections shall be submitted with the "As Built" plans and specifications when the written notification for CITY Acceptance is requested.
 - 2. The proof roller shall be the weight of a fully loaded ten (10) yard dump truck (approx. 50,000 lbs or more on ten (10) wheels).
 - 3. Areas which exhibit movement, cracking, or deflection of the material shall be removed, replaced, and retested to ensure proper compaction.
- I. A string line test shall be done after a passing proof roll test. The CONTRACTOR shall place blue tops at centerline of the road every fifty (50) feet and at all grade breaks and crown transitions. If the roadway is greater than forty (40) feet from face of gutter to centerline, then the CONTRACTOR shall also place quarter blue tops. The blue tops shall be placed using a generally accepted industry standard as approved by the ENGINEER. String line tests shall be performed for all sections of the road profile complete (i.e.: subgrade, subbase, and base). Tolerances for string line shall be one-tenth (0.10) of a foot for subgrade, three-quarter ($\frac{3}{4}$) inch for subbase, and one-half ($\frac{1}{2}$) inch for base materials. If a string line test fails, the CONTRACTOR shall rework the area to compliance. Passing string line and proof roll tests are required prior to any placement of pavement.

- J. No additional compensation shall be paid to the CONTRACTOR for the required tests.
- K. Scheduling for the proof roll and string line tests shall be done a minimum of twenty-four (24) hours in advance with the ENGINEER.
- L. No concrete shall be placed on frozen ground.

3.04 SETTING FORMS

- A. The foundations under the forms shall be hard and true to grade so that the form, when set, will be firmly in contact for its whole length and at the specified grade. Any grade which at the form line is found below established grade shall be filled to grade and thoroughly compacted. Imperfections or variations above grade shall be corrected by tamping or by cutting, as necessary.
- B. Forms shall be set sufficiently in advance of the point where concrete is being placed.
 - 1. After the forms have been set to correct grade, the grade shall be thoroughly tamped, mechanically or by hand, at both the inside and outside edges of the base of the forms.
 - 2. Forms shall be staked into place with not less than three (3) pins for each ten (10) foot section. A pin shall be placed at each side of every joint.
 - 3. Form sections shall be tightly locked, free from play or movement in any direction. No excessive settlement or springing of forms under the finishing machine will be tolerated.
 - 4. Forms shall be cleaned and oiled prior to the placing of the concrete.
- C. The forms shall not deviate from true line by more than one-half ($\frac{1}{2}$) inch at any point. The alignment and grade elevation of the forms shall be checked and corrections shall be made by the CONTRACTOR immediately before the concrete is placed. When any form has been disturbed or any grade has become unstable, the form shall be reset and rechecked.
- D. In lieu of setting forms, the edge of a previously placed concrete gutter section may be used as a form.

HANDLING, MEASURING, AND BATCHING MATERIALS

- A. The batch plant site, layout, equipment, and provisions for transporting material shall be such as to assure a continuous supply of material to the work. Aggregates from different sources and of different gradings shall not be stockpiled together.
- B. Aggregates shall be handled from stockpiles or other sources to the batching plant in such a manner as to secure a uniform grading of the material. Aggregates that have become segregated or mixed with earth or foreign material shall not be used.
 - 1. All aggregates produced or handled by hydraulic methods, and washed aggregates, shall be stockpiled or binned for draining at least twelve (12) hours before being batched. In case the aggregates contain high or non-uniform moisture content, storage or stockpile periods in excess of twelve (12) hours may be required by the ENGINEER.
 - 2. Rail shipment requiring more than twelve (12) hours will be accepted as adequate binning only if the car bodies permit free drainage.
 - 3. The fine aggregate and each size of coarse aggregate shall be weighed into separate hoppers in the respective amounts set by the job mix.
- C. Cement shall be measured by the sack or by weight. Separate scales and hoppers shall be used for weighing the cement, with a device to indicate positively the complete discharge of the batch of cement into the mixer. Ninety-four (94) pounds of bulk cement shall be considered one (1) sack. Batches involving fractional sacks shall not be allowed, except when bulk cement is used.
- D. Fly ash shall be stored in a separate silo. If both cement and fly ash are used, they may be batched cumulatively provided portland cement is batched first.
- E. Methods and equipment for adding air-entraining agent or other admixtures into the batch, when required, shall be approved by the ENGINEER. All admixtures shall be measured into the mixer with an accuracy of plus or minus three (3) percent.

MIXING CONCRETE

- A. The concrete may be mixed at the site of the work, in a central-mix plant, or in truck mixers. The mixer shall be of an approved type and capacity.
- B. Ready-mix concrete shall be mixed and delivered in accordance with requirements of ASTM C94.
- C. When concrete is mixed in a central mixing plant, the mixing time shall not be less than recommended by the manufacturer unless tests can show the mix can be thoroughly mixed in less time. Mixing time shall be measured from the time all materials, except water, are in the drum. Transfer time in multiple drum mixers is included in mixing time.
 - 1. The contents of an individual mixer drum shall be completely removed before a succeeding batch is emptied therein.
 - 2. The mixer shall be operated at a drum speed as shown on the manufacturer's name plate on the approved mixer.
 - 3. The batch shall be so charged into the drum that a portion of the mixing water shall enter in advance of the cement and aggregates. The flow of water shall be uniform, and all water shall be in the drum by the end of the first fifteen (15) seconds of the mixing period. The throat of the drum shall be kept free of such accumulations as may restrict the free flow of materials into the drum.
- D. Any concrete mixed less than the specified time shall be discarded and disposed of by the CONTRACTOR at his expense.
- E. The volume of concrete mixed per batch shall not exceed the mixer's nominal capacity in cubic feet, as shown on the manufacturer's standard rating plate on the mixer.
- F. The time elapsing from the time batched until the concrete is deposited in place at the site of the work shall not exceed:
 - 1. Forty-five (45) minutes when the concrete is hauled in non-agitating trucks.
 - 2. Ninety (90) minutes when hauled in truck mixers or truck agitators.

- G. Retempering concrete by adding water or by other means shall not be permitted. When additional water is added to the batch materials and additional mixing performed to increase the slump to meet the specified requirements, the following conditions shall be met:
1. Water shall be measured through a water meter.
 2. Maximum allowable water-cementitious ratio shall not be exceeded.
 3. Maximum allowable slump shall not be exceeded.
 4. Maximum allowable mixing and agitating time (or drum revolutions) shall not be exceeded.
 5. Concrete is remixed for at least three (3) minutes.
 6. Concrete that does not meet the above provisions shall be rejected.
- H. No concrete shall be mixed, placed, or finished when the natural light is insufficient unless an adequate artificial lighting system is operated.
- I. If necessary to place concrete when ambient air temperature is below 40°F or expected to fall below 40°F during cure period, placement shall be approved by the ENGINEER. Work shall be placed and protected in accordance with Table 7.3.3 of ACI 306 until concrete has reached 3,500 psi as evidenced by cylinders field cured in accordance with ASTM C31. ENGINEER may require protection plan in writing.
- J. The temperature of the mixed concrete shall be not less than 50°F and not more than 90°F at the time of placing it in the forms.
1. The mixing water may be heated to no more than 150°F
 2. Aggregates may be heated by either steam or dry heat prior to being placed in the mixer. The apparatus used shall heat the mass uniformly and shall be so arranged as to preclude the possible occurrence of overheated areas which might injure the materials.

3.07

PLACING CONCRETE

- A. The concrete shall be deposited on the grade in such manner as to require as little rehandling as possible. Unless truck mixers, truck agitators, or non-agitating hauling equipment are equipped with means for discharge of concrete without segregation of the materials, the concrete shall be unloaded into an approved spreading device and mechanically spread on the grade in such a manner as to prevent segregation of the materials. Placing shall be continuous between transverse joints without the use of intermediate bulkheads. Necessary hand spreading shall be done with shovels, not rakes. Workmen shall not be allowed to walk in the freshly-mixed concrete with boots or shoes coated with earth or foreign substances.
- B. Where concrete is to be placed adjoining a previously constructed lane of pavement and mechanical equipment will be operated upon the existing lane of pavement, that lane shall have attained eighty (80) percent of design strength. If only finishing equipment is carried on the existing lane, paving in adjoining lanes may be permitted after three (3) days.
- C. Concrete shall be thoroughly consolidated against and along the faces of all forms and along the full length and on both sides of all joint assemblies, by means of vibrators inserted in the concrete. Vibrators shall not be permitted to come in contact with a joint assembly, the grade, or a side form. In no case shall the vibrator be operated longer than fifteen (15) seconds in any one (1) location.
- D. Concrete shall be deposited as near to expansion and contraction joints as possible without disturbing them, but shall not be dumped from the discharge bucket or hopper onto a joint assembly unless the hopper is well centered on the joint assembly.

3.08

TESTING

- A. The CONTRACTOR shall be responsible for all the testing. All testing shall be performed by an approved independent lab.
- B. The concrete shall be sampled and specimens made in accordance with the following:
 - 1. Slump: ASTM C143.
 - 2. Air Content: ASTM C231.

3. Unit Weight: ASTM C138.
 4. Strength (compressive): ASTM C39.
 5. Making and Curing Test Specimens in the Field: ASTM C31.
- C. Tests shall be performed on all single placements of twenty (20) cubic yards or more and every accumulative fifty (50) cubic yards throughout the project.
- D. All testing shall be performed by an ACI certified technician employed by an independent testing laboratory.

3.09

STRIKEOF OF CONCRETE AND PLACEMENT OF REINFORCEMENT

- A. Following the placing of the concrete, it shall be struck off to conform to the cross section shown on the plans and to an elevation such that when the concrete is properly consolidated and finished, the surface of the pavement shall be at the elevation shown on the plans.
- B. When reinforced concrete is placed in one (1) layer, the reinforcement shall be positioned in advance of concrete placement.
- C. All reinforcing steel shall be free from dirt, oil, paint, grease, mill scale, and loose or thick rust which would impair bond or the steel with the concrete.
- D. Bars shall be placed by approved mechanical equipment or rigidly secured by chairs or other approved supports to prevent displacement.
- E. Tie bars shall not be painted or coated with asphalt or other material, or enclosed in tubes or sleeves.
- F. Dowels, when used as load transfer devices, shall be held in position parallel to the surface and centerline of the slab by a metal device that is left in the pavement.
1. One-half ($\frac{1}{2}$) of each dowel shall be painted with one (1) coat of form release agent to prevent the concrete from binding to that portion of the dowel.

2. An approved metal dowel cap or sleeve shall be furnished for each dowel bar used with the expansion joints. The caps or sleeves shall fit the dowel bar tightly.
3. In lieu of using dowel assemblies at contraction joints, dowel bars may be placed in the full thickness of pavement by a mechanical device approved by the ENGINEER.

3.10 JOINTS

- A. Joints shall be constructed of the type and dimensions, and at the locations required by the plans or special provisions and conform to SECTION 03251, CONTRACTION AND EXPANSION JOINTS.
- B. Sawed joints shall be cut by means of concrete saws with water cooled diamond blades or early entry saws to the depth, width, and line shown on the plans.
 1. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit sawing. Joints shall be cut, whenever possible, with an early entry cut method. The depth of saw cut shall be one-quarter ($\frac{1}{4}$) the depth of the slab thickness with a one (1) inch minimum. All joints shall be sawed before uncontrolled shrinkage cracking takes place. If necessary, the sawing operations shall be carried on both during the day and night, regardless of weather conditions. Sawing shall be discontinued when a crack develops ahead of the saw. In general, all joints should be sawed in sequence. Where the saw cut was discontinued because of interference of a form, the saw cut must be completed when the form is stripped.
 2. Suitable guidelines or devices shall be used to assure cutting the joint as shown on the plans.
 3. The saw cut shall not vary by more than one-quarter ($\frac{1}{4}$) inch in ten (10) feet.
 4. When shown on the plans, a second shallower cut must be made to provide adequate space for joint sealer. This sawing may commence as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling or tearing.

- C. When approved by the ENGINEER, joints may be cut into the fresh concrete with a finishing tool. This tool must be capable of cutting to the depth specified.
1. Suitable guidelines or devices shall be used to assure cutting the joint as shown on the plans.
 2. The cut shall not vary by more than one-quarter ($\frac{1}{4}$) inch in ten (10) feet.
- D. Deformed steel tie bars of specified length, size, spacing, and material shall be placed perpendicular to the longitudinal joints when shown on the plans.
1. When adjacent lanes of pavement are constructed separately, steel side forms shall be used which will form a keyway along the construction joint or dowels shall be installed at the spacing and size shown on the drawings. Tie bars or load transfer bars may be installed through holes in the forms or approved two (2) piece connectors may be used.
 2. Longitudinal contraction joints shall consist of planes of weakness created by cutting grooves in the surface of the pavement and, when shown on the plans, shall include load transfer assemblies.
- E. Transverse expansion joints shall have the joint filler be continuous from form to form, shaped to the subgrade. Damaged or repaired joint filler shall not be used unless approved by the ENGINEER.
1. The expansion joint filler shall be held in a vertical position. An approved installing bar, or other device, shall be used if required to secure preformed expansion joint filler at the proper grade and alignment during placing and finishing of the concrete.
 2. Finished joints shall not deviate more than one-quarter ($\frac{1}{4}$) inch in ten (10) feet of the horizontal alignment from a straight line.
 3. If joint fillers are assembled in section, there shall be no offsets between adjacent units.

4. No plugs of concrete shall be permitted anywhere within the expansion space.
- F. Transverse contraction joints shall consist of planes of weakness created by cutting grooves in the surface of the pavement and, when shown on the plans, shall include load transfer assemblies.
- G. When directed by the ENGINEER, random cracks shall be routed or sawed and filled with joint sealer. Care shall be taken so that the depth of cut is uniform.
- H. Transverse formed contraction joints shall comply with the requirements of subsection 3.11(D) for the longitudinal formed joint.
- I. Transverse construction joints shall be constructed when there is an interruption of more than thirty (30) minutes in the concreting operations. No transverse joint shall be constructed within five (5) feet of an expansion joint, contraction joint, or plane of weakness. If sufficient concrete has not been mixed at the time of interruption to form a slab at least five (5) feet long, the excess concrete back to the preceding joint shall be removed and disposed of as directed.

3.11 FINAL STRIKEOFF, CONSOLIDATION, AND FINISHING

- A. The sequence of operations shall be the strike off and consolidation, floating and removal of laitance, straight edging, and final surface finish. Trowels and floats shall be wood or magnesium.
- B. First, the concrete shall be consolidated and struck off.
 1. Unless otherwise permitted for small areas or for short periods of time due to equipment failure, all pavement concrete shall be consolidated using vibrators for full width of paving slabs.
 2. Concrete adjacent to joints shall be mechanically vibrated, also under and around all load transfer devices, joint assembly units, and other features designed to extend into the pavement.
 3. After the concrete has been placed and vibrated adjacent to the joints as required, the finishing machine shall be brought forward, operating in a manner to avoid damage to or misalignment of joint devices.

- C. After the concrete has been struck off and consolidated, it shall be further smoothed, trued, and consolidated, by means of a longitudinal float, by the use of one of the following methods as specified or permitted.
1. Hand Method - The hand-operated longitudinal float shall be not less than twelve (12) feet in length and six (6) inches in width, properly stiffened to prevent flexibility and warping. The longitudinal float, operated from foot bridges resting on the side forms and spanning but not touching the concrete, shall be worked with a sawing motion, while held in a floating position parallel to the road centerline, and shall be passed gradually from one side of the pavement to the other. Movement ahead along the centerline of the pavement shall be in successive advances of not more than one-half ($\frac{1}{2}$) the length of the float. Any excess water or soupy material shall be wasted over the side forms of each pass.
 2. Mechanical Method - The mechanical longitudinal float shall be of a design approved by the ENGINEER and shall be in good working condition. The tracks from which the float operates shall be securely adjusted to the required crown. The float shall be accurately adjusted and coordinated with the adjustments of the transverse finishing machine so that a small amount of mortar is carried ahead of the float at all times. The forward speed shall be adjusted so that the float will lap the distance specified by the ENGINEER on each transverse trip. The float shall pass over each area of pavement at least two (2) times, but excessive operation over a given area shall not be permitted. Any excess water or soupy material shall be wasted over the side forms on each pass.
 3. Alternative Mechanical Method - As an alternative to item (2) above, the CONTRACTOR may use a machine composed of a cutting and smoothing float, or floats, suspended from and guided by a rigid frame. This frame shall be carried by four or more visible wheels riding on, and constantly in contact with, the side forms.
 4. If necessary, following one of the preceding methods of floating, long handled floats having blades not less than five (5) feet in length and six (6) inches in width may be used to smooth and fill in open-textured areas in the

pavement. Long handled floats shall not be used to float the entire surface of the pavement in lieu of, or supplementing, one of the preceding methods of floating. When strike off and consolidation is done by the hand method and the crown of the pavement will not permit the use of the longitudinal float, the surface shall be floated transversely by means of the long handled float. Care shall be taken not to work the crown out of the pavement during the operation. After floating, any excess water and laitance shall be removed from the surface of the pavement by a straightedge ten (10) feet or more in length. Successive drags shall be lapped one-half ($\frac{1}{2}$) of the length of the blade.

- D. After the floating has been completed and the excess water removed, but while the concrete is still plastic, the surface of the concrete shall be tested for trueness with a ten (10) foot straightedge. For this purpose the CONTRACTOR shall furnish and use an accurate ten (10) foot straightedge swung from handles three (3) feet longer than one-half ($\frac{1}{2}$) the width of the slab. The straightedge shall be held in contact with the surface in successive positions parallel to the road centerline and the whole area gone over from one side of the slab to the other, as necessary. Advance along the road shall be in successive stages of not more than one-half ($\frac{1}{2}$) the length of the straightedge. Any depressions found shall be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. High areas shall be cut down and refinished. Special attention shall be given to assure that the surface across joints meets the requirements for smoothness. Straightedge testing and surface corrections shall continue until the entire surface is found to be free from observable departures from the straightedge and the slab conforms to the required grade and cross section.
- E. The final finish shall be specified on the plans as to the type of surface texture. The following types of surface textures may be specified:

1. Type I - Transverse Tinning - The mainline finish shall be produced by mechanical equipment described as follows: The transverse grooving machine shall be either a vibrating roller or a comb equipped with steel tines. The machine shall be self-propelled and shall automatically lift the roller or tine comb at the end of the pavement. Hand grooving methods shall be permitted in a manner approved by the ENGINEER in those areas where the mechanical equipment cannot be used. This equipment shall have rectangular or circular shaped spring steel tines which are randomly spaced at one-half ($\frac{1}{2}$) to one (1) inch intervals from center to center. The grooves shall be made perpendicular to the center line of the pavement and the resulting transverse grooves shall be 0.090 to 0.125 inches wide and shall be one-eighth ($\frac{1}{8}$) to three-sixteenths ($\frac{3}{16}$) inch deep. Acceleration lanes, deceleration lanes, and irregular sections may be finished by methods other than mechanical, provided they produce a similar type of transverse groove.
2. Type II - Longitudinal Tinning - The mainline finish shall be produced by mechanical equipment described as follows: The longitudinal grooving machine shall be either a vibrating roller or a comb equipped with steel tines. The machine shall be self-propelled and shall automatically lift the roller or tine comb at the end of the pavement. Hand grooving methods will be permitted in a manner approved by the ENGINEER in those areas where the mechanical equipment cannot be used. This equipment shall have rectangular or circular shaped spring steel tines which are randomly spaced at one-half ($\frac{1}{2}$) to one (1) inch intervals from center to center. The grooves shall be made parallel to the center line of the pavement and the resulting longitudinal grooves shall be 0.090 to 0.125 inches wide and shall be one-eighth ($\frac{1}{8}$) to three-sixteenths ($\frac{3}{16}$) inch deep. The mechanical equipment shall be operated from a bridge when the pavement is sixteen (16) feet or more in width. Acceleration lanes, deceleration lanes, and irregular sections may be finished by methods other than mechanical, provided they produce a similar type of longitudinal groove.
3. Type III - Artificial Grass Drag - The pavement finish shall be produced by a nylon or artificial grass drag as approved by the ENGINEER. A uniform surface or gritty texture shall be produced by pulling the drag longitudinally. For a

pavement width of sixteen (16) feet or more in width, the drag shall be mounted on a bridge which travels on the forms. The drag shall be at least three (3) feet wide and in full contact with the full width of the pavement. Drags shall be maintained clean and free from encrusted mortar. Drags that cannot be cleaned shall be discarded and new ones substituted.

4. Type IV - Bristle Broom - The surface texture produced by a broom shall be applied when the water sheen has practically disappeared. The broom shall be drawn from the center to the edge of the pavement with adjacent strokes slightly overlapping. The brooming operation shall be so executed that the corrugations produced in the surface shall be uniform in appearance and shall have a minimum depth of one-sixteenth ($1/16$) inch and a maximum depth of one-eighth ($1/8$) inch. Brooming shall be completed before the concrete is in such condition that the surface will be torn or unduly roughened by the operation. The finished surface shall be free from rough and porous areas, irregularities and depressions resulting from improper handling of the broom. Mechanical brooming, in lieu of the manual brooming, will be permitted if satisfactory results can be obtained.
5. Type V - Belt Finish (Paving with Rigid Forms) - When straight edging is complete and the water sheen has practically disappeared and just before the concrete becomes nonplastic, the surface shall be belted with a two (2) ply canvas belt not less than eight (8) inches wide and at least three (3) feet longer than the pavement width. Hand belts shall have suitable handles to permit controlled, uniform manipulation. The belt shall be operated with short strokes transverse to the road centerline and with a rapid advance parallel to the centerline.
6. Type VI - Burlap Drag - The drag shall be a seamless strip of damp burlap or cotton fabric which shall produce a uniform surface of a gritty nature after dragging it longitudinally along the full width of pavement. For pavement sixteen (16) feet or more in width, the drag shall be mounted on a bridge which travels on the forms. The dimensions of the drag shall be such that a strip of burlap or fabric, at least three (3) feet wide, is in contact with the full width of pavement surface while the drag is used. Drags shall be maintained clean and free from encrusted mortar.

Drags that cannot be cleaned shall be discarded and new drags shall be substituted.

- F. After the final finish, but before the concrete has taken its initial set, the edges of the pavement along each side of each slab, and on each side of transverse expansion joints, formed joints, transverse construction joints, and emergency construction joints shall be worked with an approved tool and rounded to a radius of one-quarter ($\frac{1}{4}$) inch.
 - 1. A well defined and continuous radius shall be produced, and a smooth, dense mortar finish shall be obtained. The surface of the slab shall not be disturbed by tilting of the tool during use.
 - 2. At all joints, any tool marks appearing on the slab adjacent to the joints shall be eliminated by texturing the surface. The rounding of the corner of the slab shall not be disturbed when the surface is textured. All concrete on top of the joint filler shall be completely removed.
 - 3. All joints shall be tested with a straightedge before the concrete has set, and correction shall be made if one side of the joint is higher than the other or if an edge is higher or lower than the adjacent slabs.
- G. If the application of water to the surface is permitted, it shall be applied as a fog spray by means of approved spray equipment.
- H. Unless otherwise specified, hand finishing methods shall not be permitted except under the following conditions:
 - 1. In the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade when the breakdown occurs.
 - 2. Narrow widths or areas of irregular dimensions where operation of the mechanical equipment is impractical may be finished by hand methods.

3. Concrete, as soon as placed, shall be struck off and screeded. An approved portable screed shall be used. In operation the screed shall be moved forward on the forms with a combined longitudinal and transverse shearing motion, moving always in the direction in which the work is progressing and so manipulated that neither end is raised from the side forms during the striking off process. If necessary, this shall be repeated until the surface is of uniform texture, true to grade and cross section, and free from porous areas.
4. The screed for the surface shall be at least two (2) feet longer than the maximum width of the slab to be struck off. It shall be of approved design, sufficiently rigid to retain its shape, and shall be constructed either of metal or other suitable material shod with metal.
5. Consolidation shall be attained by the use of a suitable vibrator or other approved equipment.

3.12 SURFACE TEST

- A. As soon as the concrete has hardened sufficiently, the pavement surface shall be tested with a ten (10) foot straightedge provided by the CONTRACTOR and approved by the ENGINEER.
 1. Areas showing high spots of more than one-quarter ($\frac{1}{4}$) inch, but not exceeding one-half ($\frac{1}{2}$) in ten (10) feet shall be marked and immediately ground down with an approved grinding tool to an elevation where the area or spot will not show surface deviations in excess of one-quarter ($\frac{1}{4}$) inch when tested with a ten (10) foot straightedge. Grinders shall be of the stacked head, vertical blade type that will not polish or smooth the surface but will provide a coefficient of friction approximately equal to that of the unground pavement. Grinding grooves shall be kept parallel with the direction of travel. If grinding produces exposed aggregate, the section shall be subject to removal at the ENGINEER's discretion. Any removal and replacement done shall be at the CONTRACTOR's expense.

2. Where the departure from final grade survey exceeds minus one-quarter ($-\frac{1}{4}$) inch, the pavement shall be removed and replaced by and at the expense of the CONTRACTOR. Any area or section so removed shall not be less than five (5) feet in length and not less than the full width of the lane involved. When it is necessary to remove and replace a section of pavement, any remaining portion of the slab adjacent to the joint that is less than five (5) feet in length shall also be removed and replaced.

3.13

CURING

- A. Immediately after the finishing operations have been completed and as soon as marring of the concrete will not occur, the entire surface of the newly placed concrete shall be covered and cured in accordance with one of the following methods.
 1. Cotton or burlap mats - The surface of the pavement shall be entirely covered with mats. The mats used shall be of such length (or width) that as laid they will extend at least twice the thickness of the pavement beyond the edges of the slab. The mat shall be placed so that the entire surface and both edges of the slab are completely covered. Prior to being placed, the mats shall be saturated thoroughly with water. The mats shall be so placed and weighed down as to cause them to remain in intimate contact with the surface covered, and the covering shall be maintained fully wetted and in position for seventy-two (72) hours after the concrete has been placed, unless otherwise specified.
 2. Waterproof paper - The top surface and sides of the pavement shall be entirely covered with waterproofed paper. The units shall be lapped at least eighteen (18) inches. The paper shall be so placed and weighted down as to cause it to remain in intimate contact with the surface covered. The paper shall be of such dimensions that each unit as laid will extend beyond the edges of the slab at twice the thickness of the pavement or shall be of pavement width and two (2) foot strips of paper provided for the edges. If laid longitudinally, paper not manufactured in sizes which will provide this width shall be securely sewed or cemented together, the joints being securely sealed in such a manner that they do not open up or separate during the curing period. Unless otherwise specified, the covering shall be maintained in place for seventy-two (72) hours after the concrete has been placed. The surface of the

pavement shall be thoroughly wetted prior to the placing of the paper.

3. White pigmented impervious membrane - The entire surface of the pavement shall be sprayed uniformly with white pigmented curing compound immediately after the finishing of the surface and before the set of the concrete has taken place, or if the pavement is cured initially with burlap or cotton mats, the curing compound may be applied upon removal of the mats.
 - a. The curing compound shall not be applied during rainfall.
 - b. Curing compound shall be applied under pressure at the rate as specified by the manufacturer by mechanical sprayers. The spraying equipment shall be of the fully atomizing type equipped with a tank agitator. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. During the application the compound shall be stirred continuously by effective mechanical means. Hand spraying of odd widths or shapes and on concrete surfaces exposed by the removal of forms will be permitted. Curing compound shall be applied to the inside faces of joints to be sealed.
 - c. Should the film become damaged from any cause within the required curing period, the damaged portions shall be repaired immediately with additional compound.
 - d. Upon removal of side forms, the sides of the slabs exposed shall be protected immediately to provide a curing treatment equal to that provided for the surface.
4. White polyethylene sheeting - The top surface and sides of the pavement shall be entirely covered with polyethylene sheeting. The units used shall be lapped at least eighteen (18) inches. The sheeting shall be so placed and weighed down as to cause it to remain in intimate contact with the surface covered. The sheeting as prepared for use shall have such dimension that each unit as laid will extend beyond the edges of the slab at least twice the thickness of

the pavement. Unless otherwise specified, the covering shall be maintained in place for seventy-two (72) hours after the concrete has been placed.

- B. Failure to provide sufficient cover material of whatever kind the CONTRACTOR may elect to use, or lack of water to adequately take care of both curing and other requirements, shall be cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than one-half ($\frac{1}{2}$) hour between stages of curing or during the curing period.
- C. When concrete is being placed and the average daily temperature is below 40°F or the air temperature may be expected to drop below 35°F, a sufficient supply of straw, hay, grass, or other suitable blanketing material shall be spread over the pavement to a sufficient depth to prevent freezing of the concrete. The period of time such protection shall be maintained shall be not less than ten (10) days or until the concrete has reached full strength. The CONTRACTOR shall be responsible for the quality and strength of the concrete placed during cold weather, and any concrete injured by frost action shall be removed and replaced at the CONTRACTOR'S expense.

3.14 SEALANT

- A. All concrete shall be sealed in accordance with SECTION 03370, CONCRETE CURING AND SEALING.
- B. Apply the approved product to the designated surfaces in strict accordance with the manufacturer's recommended application procedures.
- C. Apply uniformly in continuous operation.
- D. Maintain continuity of coating and repair damage.
- E. Unless specified otherwise by manufacturer of sealing compound, do not use curing compound on surfaces which are to be covered with coating materials.

3.15 REMOVING FORMS

- A. Forms shall not be removed from freshly placed concrete until it has set for at least twelve (12) hours, except auxiliary forms used temporarily in widened areas.

- B. Forms shall be removed carefully so as to avoid damage to the pavement. After the forms have been removed, the sides of the slab shall be cured as outlined in one of the methods indicated above.
- C. Any honeycombed areas in excess of one (1) square foot shall be considered as defective work and shall be removed and replaced. Any area or section so removed shall not be less than five (5) feet in length and not less than full width of the lane involved. When it is necessary to remove and replace a section of pavement, any remaining portion of the slab adjacent to the joint that is less than five (5) feet in length shall also be removed and replaced.

3.16

SEALING JOINTS

- A. When joints are specified to be sealed on the plans, they shall be filled with joint-sealing material before the pavement is opened to traffic and as soon after completion of the curing period as is feasible.
- B. Just prior to sealing, each joint shall be thoroughly cleaned of all foreign material, including membrane curing compound, and the joint faces shall be clean and surface dry when the seal is applied.
- C. Material for seal shall be installed in accordance with the manufacturer's recommendations. A copy of the instructions shall be submitted to the ENGINEER for information.
- D. The sealing material shall be applied to each joint opening to conform to the details shown on the plans or as directed by the ENGINEER.
- E. The pouring shall be done in such a manner that the material will not be spilled on the exposed surfaces of the concrete. Any excess material on the surface of the concrete pavement shall be removed, and the pavement surface shall be cleaned. The use of sand or similar material as a cover for the seal shall not be permitted.
- F. Poured joint-sealing material shall not be placed when the air temperature in the shade is less than 50°F, unless approved by the ENGINEER.

3.17

PROTECTION OF PAVEMENT

- A. The CONTRACTOR shall protect the pavement and its appurtenances against both public traffic and traffic caused by his own employees and agents. This shall include watchmen to direct traffic and the erection and maintenance of warning signs and lights. He shall indicate the location and type of device or facility required to protect the work and provide adequately for traffic.
- B. In order that the concrete may be properly protected against the effects of rain before the concrete is sufficiently hardened, the CONTRACTOR shall be required to have available at all times materials for the protection of the edges and surface of the unhardened concrete. Such protection materials shall consist of standard metal forms or wood plank having a nominal thickness of not less than two (2) inches and a nominal width of not less than the thickness of the pavement at its edge for the protection of the pavement edges, and covering material such as burlap or cotton mats, curing paper, or plastic sheeting material for the protection of the surface of the pavement. When rain appears imminent, all paving operations shall stop and all available personnel shall begin placing forms against the side of the pavement and covering the surface of the unhardened concrete with the protective covering.
- C. Any damage to the pavement occurring prior to final acceptance shall be repaired or the pavement shall be replaced as directed by the ENGINEER.

3.18

OPENING TO TRAFFIC

- A. The ENGINEER shall decide when the pavement shall be opened to traffic.
- B. Prior to being opened to traffic, the pavement shall be cleaned. All positive control pavement markings shall be in place.

3.19

CONCRETE PAVEMENT - SLIPFORM METHOD

- A. After the grade or base has been placed and compacted to the required density per SECTION 02231, AGGREGATE SUBBASE AND BASE COURSE, the grade and areas which are to support the paving machine shall be cut to the proper elevation by means of an approved fine-grading machine.
 - 1. The fine-grading machine shall be of sufficient weight, and shall be either self-propelled or towed by sufficient power

to trim the compacted material without gouging or tearing the surface.

2. The machine shall have cutting edges or surface shavers controlled from an independent control reference wire by means of an automatic control device.
 3. To avoid excessive depths of cut the machine may accomplish the fine grading by means of successive passes with each pass controlled from the independent reference line through the automatic control.
 4. If the density of the base is disturbed by the grading operations, it shall be corrected by additional compaction before concrete is placed.
 5. Proof roll and string line tests shall be done in accordance to SECTION 02231, AGGREGATE SUBBASE AND BASE COURSE.
 6. The grade shall be constructed sufficiently in advance of the placing of the concrete. If any traffic is allowed to use the prepared grade, the grade shall be checked and corrected immediately ahead of the placing of the concrete.
- B. The concrete shall be placed with an approved SLIPFORM paver designed to spread, consolidate, screed, and float-finish the freshly placed concrete in one (1) complete pass of the machine in such manner that a minimum of hand finish will be necessary to provide a dense and homogenous pavement in conformance with the plans and specifications.
1. The machine shall vibrate the concrete for the full width and depth of the strip of pavement being placed. Such vibrations shall be accomplished with vibrating tubes or arms working in the concrete, or with a vibrating screed or pan operating on the surface of the concrete.
 2. The sliding forms shall be rigidly held together laterally to prevent spreading of the forms. The forms shall trail behind the paver for such a distance that no appreciable slumping of the concrete will occur.
 3. The concrete shall be held at a uniform consistency, having a slump of not more than two (2) inches.

4. The slip form paver shall be operated with as nearly a continuous forward movement as possible, and all operations of mixing, delivering, and spreading concrete shall be so coordinated as to provide uniform progress with stopping and starting of the paver held to a minimum. If, for any reason, it is necessary to stop the forward movement of the paver, the vibratory and tamping elements shall also be stopped immediately. No tractive force shall be applied to the machine, except that which is controlled from the machine.
- C. The surface smoothness and texture shall meet the requirements of this section.
- D. Curing shall be done in accordance with this section.
- E. All joints shall be constructed in accordance with this section.
- F. Flow test shall be done in accordance with this section.

3.20

TOLERANCE IN PAVEMENT THICKNESS

- A. The thickness of the pavement shall be determined by average caliper measurement of cores tested.
- B. For the purpose of establishing an adjusted unit price for pavement, a minimum of one (1) core per one thousand (1,000) square yards (SY) per lane or areas such as intersections, entrances, crossovers, ramps, etc., shall be considered as one unit and the thickness of each unit shall be determined separately. Small irregular unit areas may be included as part of another unit. At such point as the ENGINEER may select in each unit, one (1) core shall be taken for each one thousand (1,000) square yards of pavement, or fraction thereof, in the unit. Should any thickness deviation be found, additional cores may be taken to define the horizontal limits of the deviation.
- C. When the measurement of the core from a unit is not deficient more than one-half ($\frac{1}{2}$) inch from the plan thickness, full payment shall be made.

- D. When such measurement is deficient more than one-half ($\frac{1}{2}$) inch and not more than one (1) inch from the plan thickness, two (2) additional cores at intervals not less than three hundred (300) feet will be taken and used in the average thickness for that unit.
- E. When the measurement of any core is less than the plan thickness by more than one (1) inch, the actual thickness of the pavement in this area shall be determined by taking additional cores at not less than ten (10) foot intervals parallel to the centerline in each direction from the affected location until in each direction a core is found which is not deficient by more than one (1) inch. Areas found deficient in thickness by more than one (1) inch shall be evaluated by the ENGINEER. If in his judgment the deficient areas warrant removal, they shall be removed and replaced with concrete of the thickness shown on the plans at the CONTRACTOR'S expense. Exploratory cores for deficient thickness shall not be used in averages for adjusted unit prices.
- F. Fill core holes with non-shrink, low slump concrete mortar. Coat sides of holes with an approved concrete epoxy resin adhesive. Match color and texture of surrounding concrete.

3.21

REPAIR OF DEFECTIVE PAVEMENT SLABS AND SPALLS

- A. Random cracks which occur away from joints and, in the judgment of the ENGINEER, will not cause future maintenance problems may be routed and sealed. If not accepted, the slab shall be replaced at the CONTRACTOR'S expense.
- B. Spalls along joints shall be replaced by saw cutting at least one-half ($\frac{1}{2}$) inch outside the spalled area but no less than two (2) inches in total width. The area shall be removed a minimum of three (3) inches to solid concrete, then cleaned with compressed air sandblasting. The surface of the cavity shall be coated with an approved epoxy-resin binder, then filled with an approved non-shrink grout.
- C. Spalls shall be saw cut into a square or rectangular area and to the depth of the spall or a minimum of three (3) inches, which ever is greater. The excess concrete shall be removed. Material chosen to repair the spalled area shall be mixed and placed in accordance with the manufactures recommendation. Traffic control shall be left in place until the material has fully cured and set.

- D. Materials - Products that are acceptable are: “Five Star Structural Concrete”, “HD-50”, “PaveQuick”, or equal product that has been accepted by the ENGINEER.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. The quantity of pavement laid shall be the number of square yards of full depth pavement. The number of square yards shall be determined by the ENGINEER after construction of the pavement has been completed.

4.02 BASIS OF PAYMENT

- A. The quantity of accepted pavement shall be measured as above provided and shall be paid for at the contract unit price per square yard bid as called for in the proposal. This price shall constitute full compensation for furnishing and preparation of all materials, including all joints, joint filler, dowels, and reinforcing if required in the construction drawings or special provisions; placing, finishing, curing, and all labor, equipment, tools and incidentals necessary to complete these items.

- B. Payment shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Concrete Pavement	Sq. Yd.

- C. CONCRETE PAVEMENT DEFICIENCY:

1. Where the average thickness of pavement is deficient in thickness by more than one-quarter ($\frac{1}{4}$) inch, but not more than one (1) inch, payment shall be made at an adjusted price as specified in the table following Paragraph D.
2. When concrete pavement is suspected of being deficient, the investigation procedures of ACI 318.5.6.4, “Investigation of low-strength test results”, shall be followed.

- D. When thickness of pavement is deficient by more than one (1) inch and the judgment of the ENGINEER is that the area of such deficiency should not be removed and replaced, there shall be no payment for the area retained.

<u>Deficiency in Thickness as Determined by Cores</u> (inch)	<u>Proportional Part of Contract Price</u> (% allowed)
0 to 1/2	100
1/2 to 3/4	68
3/4 to 1	57
+ 1	50

END OF SECTION

SECTION 03330

CONCRETE CURBS AND COMBINED CURBS AND GUTTERS

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of air-entrained portland cement concrete curbs and combined curbs and gutters constructed in accordance with these specifications. This work shall be in reasonably close conformity with the lines and grades, thicknesses, and typical cross sections shown on the plans or established by the ENGINEER. See Standard Drawing No.03330-01.
- B. Concrete curbs and combined curbs and gutters shall be constructed to meet requirements of American Disabilities Act, Title II, when applicable.

1.02 SUBMITTALS

- A. All submittals shall meet the requirements in SECTION 03304, PORTLAND CEMENT CONCRETE.

1.03 RELATED WORK

- A. Section 03100 - Concrete Formwork.
- B. Section 03251 - Expansion and Contraction Joints.
- C. Section 03304 - Portland Cement Concrete.
- D. Section 03305 - Concrete Quality Control.
- E. Section 03310 - Concrete Work.
- F. Section 03345 - Concrete Finishing.
- G. Section 03370 - Concrete Curing and Sealing.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Air-entrained portland cement concrete shall conform to the requirements of SECTION 03304, PORTLAND CEMENT CONCRETE.
- B. Reinforcing steel shall conform to the requirements of SECTION 03200, CONCRETE REINFORCEMENT.
- C. Joint material shall conform to the requirements of SECTION 03251, EXPANSION AND CONTRACTION JOINTS.

PART 3 EXECUTION

3.01 GENERAL

- A. Curbs and curb and gutter shall be constructed at the locations shown on the plans and where directed by the ENGINEER and shall be in accordance with these specifications and Standard Drawings.

3.02 SUBGRADE AND BASE COURSE PREPARATION

- A. The subgrade shall be excavated or filled with suitable material to the required grades and lines.
- B. All soft, yielding, and otherwise unsuitable material shall be removed and replaced with suitable material. Filled sections shall be compacted and extend a minimum of one (1) foot outside the form lines.
- C. The subgrade and base shall be a minimum ninety-five (95) percent of maximum dry density as determined by ASTM D698. Subgrade and base shall be tested a minimum of every two hundred-fifty (250) linear feet or fraction thereof for new construction areas and every one hundred (100) linear feet or fraction thereof for remove and replace areas.
- D. When required on the plans, base course shall be installed to the required grade in accordance with SECTION 02231, AGGREGATE SUBBASE AND BASE COURSE to a minimum depth of six (6) inches or as approved by the ENGINEER.

CONCRETE PLACEMENT

- A. The concrete shall be placed either by a slipform/extrusion machine, by the formed method, or by a combination of these methods.
- B. Subgrade or base course shall be thoroughly dampened immediately prior to placement of concrete.
- C. The slipform/extrusion machine shall be so designed as to place, spread, consolidate, screed, and finish the concrete in one (1) complete pass in such a manner that a minimum of hand finishing will be necessary to provide a dense and homogeneous concrete section.
 - 1. The machine shall shape, vibrate, and/or extrude the concrete for the full width and depth of the concrete section being placed.
 - 2. It shall be operated with as nearly a continuous forward movement as possible. All operations of mixing, delivery, and spreading concrete shall be so coordinated as to provide uniform progress, with stopping and starting of the machine held to a minimum.
- C. The formed method shall consist of setting forms, placing concrete and finishing.
 - 1. Form material shall be straight and free from warp, having sufficient strength to resist the pressure of the concrete without displacement and sufficient tightness to prevent the leakage of mortar. Flexible or rigid forms of proper curvature may be used for curves having a radius of one hundred (100) feet or less. Division plates shall be metal.
 - 2. The front and back forms shall extend for the full depth of the concrete. All of the forms shall be braced and staked so that they remain in both horizontal and vertical alignment until their removal.
 - 3. They shall be cleaned and coated with an approved form-release agent before concrete is placed against them.
 - 4. The concrete shall be deposited into the forms without segregation and then it shall be tamped and spaded or mechanically vibrated for thorough consolidation.

5. Low roll or mountable curbs may be formed without the use of a face form by using a straightedge and template to form the curb face. When used, face forms shall be removed as soon as possible to permit finishing.
6. Front and back forms may be removed at such time as the concrete is sufficiently set that removal will not chip, spall or otherwise damage the concrete. When forms are removed before the expiration of the curing period, the edges of the concrete shall be protected with curing compound.
7. All excess concrete extruding from the forms or left by the slipform machine shall be removed without damaging the adjacent concrete.

3.04 FINISHING

- A. The surface of the concrete shall be finished true to the lines and grades shown on the plans.
- B. Concrete shall be worked until the coarse aggregate is forced down into the body of the concrete and no coarse aggregate is exposed. The surface shall then be floated to a smooth and uniform surface. Trowels and floats shall be wood or magnesium.
- C. When the concrete has hardened sufficiently the surface shall be given a broom finish. The strokes shall be lengthwise with adjacent strokes overlapped. Strokes shall be made without tearing the concrete. The broomed finish shall produce regular corrugations not over one-eighth ($\frac{1}{8}$) inch in depth.
- D. Concrete that is adjacent to forms and formed joints shall be edged with an edging tool to produce a one-quarter ($\frac{1}{4}$) inch radius.

3.05 JOINTING

- A. Transverse weakened-plane contraction joints shall be constructed at right angles to the curb line at intervals not exceeding ten (10) feet. Joint depth shall be a minimum of one-quarter ($\frac{1}{4}$) of the depth of the cross section of the concrete.
 1. Contraction joints may be sawed in all curb and gutter, hand formed, or made by one-eighth ($\frac{1}{8}$) inch thick templates in the formwork.

2. Sawing shall be done early after the concrete has set to prevent the formation of uncontrolled cracking.
 3. The joints may be hand formed by using a narrow or triangular jointing tool or a thin metal blade to impress a plane of weakness into the plastic concrete to the depth of one-quarter ($\frac{1}{4}$) of the cross section of the concrete.
 4. Where templates are used to make contraction joints, the plates shall be removed after the concrete has set and while the forms are still in place.
- B. Expansion joints shall be constructed at right angles to the curb line at immovable structures, at points of curvature for short-radius curves, at every one hundred (100) feet on center, and per the Standard Drawings.
1. Filler material for expansion joints shall be furnished in a single one-half ($\frac{1}{2}$) inch thick piece for the full depth and width of the joint plus a minimum of one (1) inch of the expansion joint shall be placed into the grade.
 2. Expansion joints in a slipformed curb or curb and gutter shall be constructed with an appropriate hand tool by raking or sawing through partially set concrete for the full depth and width of the section. The cut shall be only wide enough to permit a snug fit for the joint filler. After the filler is placed, open areas adjacent to the filler shall be filled with concrete and then troweled and edged.
 3. Alternately, an expansion joint may be installed by removing a short section of freshly extruded curb and gutter immediately, installing temporary holding forms, placing the expansion joint filler, and replacing and reconsolidating the concrete that was removed. Contaminated concrete shall be discarded.
- C. Construction joints may be either butt or expansion type joints.
- D. Curbs or combined curbs and gutters constructed adjacent to existing concrete shall have the same type of joints as in the existing concrete, with similar spacing; however, contraction joint spacing shall not exceed ten (10) feet.

3.06 PROTECTION

- A. The CONTRACTOR shall always have materials available to protect the surface of the plastic concrete against rain. These materials shall consist of waterproof paper or plastic sheeting. For slipform construction, materials such as wood planks or forms to protect the edges shall also be required.
- B. If necessary to place concrete when ambient air temperature is below 40°F or expected to fall below 40°F during cure period, placement shall be approved by the ENGINEER. Work shall be placed and protected in accordance with Table 7.3.3 of ACI 306 until concrete has reached 3500 psi as evidenced by cylinders field cured in accordance with ASTM C31. ENGINEER may require protection plan in writing.

3.07 CURING AND SEALING

- A. Curing shall be in accordance with SECTION 03370, CONCRETE CURING AND SEALING.

3.08 BACKFILLING

- A. After the concrete has set sufficiently, the spaces in front and back of curbs shall be backfilled with original material or as shown on the plans to the required elevations.
- B. The backfill material shall be thoroughly compacted to a density equal to that of adjacent materials.

3.09 TOLERANCES

- A. The work shall be performed in a manner which results in a curb and gutter constructed to specified line and grade, uniform in appearance and structurally sound.
- B. Honeycomb in concrete shall be patched unless area exceeds 20% of face or 1-inch in depth. Areas exceeding 20% of face or 1-inch depth shall be removed and exposed for inspection and approval by ENGINEER. Embedded debris shall be considered as defective work and shall be removed and replaced.
- C. Curb and gutter found with bulges, ridges, low spots in the gutter or other defects shall be removed and replaced at the CONTRACTOR's expense if the ENGINEER considers them to be irreparable.

- D. When checked with a ten foot (10) straightedge, grade shall not deviate more than one-quarter (1/4) inch, and alignment shall not vary more than one-quarter (1/4) inch.
- E. Final elevation shall not depart from plan elevation by more than one-half (1/2) inch.
- F. Any area or section removed shall not be less than ten (10) feet in length (joint to joint). Any removal and replacement done shall be at the CONTRACTOR's expense.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. This item shall be measured along the flow line of the curb by the linear feet of concrete curb and combined curb and gutter complete in place.

4.02 BASIS OF PAYMENT

- A. Payment shall constitute full compensation for all materials, curing of concrete, for all premolded mastic material for expansion joints, contraction joints, steel dowels and sleeves, and for the excavation and the placing and compaction of embankment under the curb, furnishing and placing of backfill and topsoil behind the curb, and for all equipment, tools and labor and for the performance of all work and incidentals necessary to complete the item.
- B. Payment shall be made at the contract unit price bid multiplied by the number of units (linear feet) completed in place.

<u>Pay Item</u>	<u>Pay Unit</u>
Curb	Linear Foot
Combined Curb and Gutter	Linear Foot

END OF SECTION

SECTION 03340

CONCRETE SIDEWALKS, DRIVEWAY APPROACHES, CURB TURN FILLETS, VALLEY GUTTERS AND MISCELLANEOUS NEW CONCRETE CONSTRUCTION

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of concrete sidewalk and driveway approaches, curb turn fillets, valley gutters, detectable warning plates, and other miscellaneous new concrete construction consisting of air-entrained portland cement concrete constructed in accordance with these specifications. This work shall be in reasonably close conformity with the lines and grades, thicknesses, and typical cross sections shown on the plans or established by the ENGINEER. See Standard Drawings series No. 03340.

1.02 SUBMITTALS

- A. All submittals shall conform to SECTION 03304, PORTLAND CEMENT CONCRETE.

1.03 RELATED WORK

- A. Section 03100 - Concrete Formwork.
- B. Section 03251 - Expansion and Contraction Joints.
- C. Section 03304 - Portland Cement Concrete.
- D. Section 03305 - Concrete Quality Control.
- E. Section 03310 - Concrete Work.
- F. Section 03345 - Concrete Finishing.
- G. Section 03370 - Concrete Curing and Sealing.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Air-entrained portland cement concrete shall conform to the requirements of SECTION 03304, PORTLAND CEMENT CONCRETE.
- B. Reinforcing steel shall conform to the requirements of SECTION 03200, CONCRETE REINFORCEMENT.
- C. Joint material shall conform to the requirements of SECTION 03251, EXPANSION AND CONTRACTION JOINTS.
- D. Detectable Warning Plates shall be East Jordon Iron Works 7005 series, natural finish 2' deep x width of ramp (7006 series on radius type), Neenah Foundry #4984, or approved equal.

PART 3 EXECUTION

3.01 GENERAL

- A. Sidewalks and driveway approaches, either new or replacement, valley gutters and curb turn fillets shall be constructed at the locations shown on the plans and where directed by the ENGINEER, and shall be in accordance with these specifications and Standard Drawings.
- B. Handicap ramps will be field located and formed by the CONTRACTOR and verified by the ENGINEER during construction and will be constructed in accordance with the specifications and current ADA standards. Ramps will be considered as incidental to the unit prices for curb and gutter, fillets and sidewalks.

3.02 SUBGRADE AND BASE COURSE PREPARATION

- A. The subgrade shall be excavated or filled with suitable material to the required grades and lines.
- B. All soft, yielding and otherwise unsuitable material shall be removed and replaced with suitable material. Filled sections shall be compacted and extended a minimum of one (1) foot outside the form lines.
- C. When required on the plans, base course shall be installed to the

required grade in accordance with SECTION 02231, AGGREGATE SUBBASE AND BASE COURSE to a minimum depth of six (6) inches or as approved by the ENGINEER. Sidewalks shall have a minimum of four (4) inches or as approved by the ENGINEER.

- D. The subgrade and base course shall be a minimum ninety-five (95) percent of maximum dry density as determined by ASTM D698. Testing shall be done on every driveway approach, curb turn fillet, and every 200 square foot of valley gutter. Sidewalk shall be tested a minimum of every two hundred-fifty (250) linear feet or fraction thereof for new construction and every one hundred (100) linear feet or fraction thereof for removal and replace areas.

3.03 ERECTING FORMS

- A. Forms, wood or steel, shall be staked securely in place, true to line and grade.
- B. Sufficient support shall be given to the form to prevent movement in any direction, resulting from the weight of the concrete or the concrete placement.
- C. Forms shall be clean and well oiled prior to setting in place.
- D. When set, the top of the form shall not depart from grade more than one-quarter ($\frac{1}{4}$) inch. The alignment shall not vary more than one-quarter ($\frac{1}{4}$) inch in ten (10) feet.
- E. Immediately prior to placing the concrete, forms shall be carefully inspected for proper grading, alignment and rigid construction. Adjustments and repairs as needed shall be completed before placing concrete.

3.04 PLACING AND FINISHING CONCRETE

- A. The subgrade or base course shall be properly compacted and brought to specified grade before placing concrete.
- B. The subgrade or base course shall be thoroughly dampened immediately prior to the placement of the concrete.
- C. Concrete shall be spaded and tamped thoroughly into the forms to provide a dense, compacted concrete free of rock pockets.
- D. The exposed surfaces shall be floated, finished and broomed.

Trowels and floats shall be wood or magnesium.

1. The surface of concrete shall be finished true to the lines and grades shown on the plans.
 2. Concrete shall be worked until the coarse aggregate is forced down into the body of the concrete and no coarse aggregate is exposed. The surface shall then be floated to a smooth and uniform surface. Trowels and floats shall be wood or magnesium.
 3. When the concrete has hardened sufficiently, the surface shall be given a broom finish. The strokes shall be square across the concrete from edge to edge with adjacent strokes overlapped. Strokes shall be made without tearing the concrete. The broomed finish shall produce regular corrugations not over one-eighth ($\frac{1}{8}$) inch in depth.
 4. Concrete that is adjacent to forms and formed joints shall be edged with an edging tool to produce a one-quarter ($\frac{1}{4}$) inch radius.
- E. The rate of concrete placement shall not exceed the rate at which the various placing and finishing operations can be performed in accordance with these specifications.
- F. All excess concrete extruding from the forms shall be removed without damaging the adjacent concrete.

3.05 STRIPPING FORMS

- A. Forms may be removed at such time as the concrete is sufficiently set that removal shall be without chipping or spalling.
1. When forms are removed before the expiration of the curing period, the edges of the concrete shall be protected with curing compound.
 2. All forms shall be cleaned, oiled and be examined for defects before they are used again.

3.06 PROTECTION

- A. The CONTRACTOR shall always have materials available to protect the surface of the plastic concrete against rain. These materials shall consist of waterproof paper or plastic sheeting.

- B. If necessary to place concrete when ambient air temperature is below 40°F or expected to fall below 40°F during cure period, placement shall be approved by the ENGINEER. Work shall be placed and protected in accordance with Table 7.3.3 of ACI 306 until concrete has reached 3500 psi as evidenced by cylinders field cured in accordance with ASTM C31. ENGINEER may require protection plan in writing.

3.07 CURING AND SEALING

- A. Curing and sealing shall be in accordance with SECTION 03370, CONCRETE CURING AND SEALING.

3.08 JOINTS

- A. Preformed expansion joints shall be installed at the locations shown in the standard drawings. For City standard sidewalks and Greenway sidewalks, expansion joints shall be placed at one-hundred (100) feet intervals and as shown on the standard drawings. A preformed joint material shall be installed full depth of placement plus one inch into grade across the entire width of sidewalk and sealed with a silicone sealant.
- B. Contraction joints shall be provided between expansion joints at the intervals of five (5) feet for City standard sidewalk and ten (10) feet intervals for Greenway sidewalk. All other contraction joint placement shall be per the Standard Drawings. Joints in new construction shall match joints in adjacent existing concrete.
- C. Contraction joints in CITY standard sidewalk may be saw cut or tooled. Contraction joints in Greenway sidewalk shall be saw cut.

3.09 BACKFILL

- A. In areas where lawns exist or as shown on the plans, the top four (4) inches of backfill bringing its level up to the top of the sidewalk or driveway shall be black loam or good topsoil which is suitable for the growth of lawns.
 - 1. It shall be placed out from the sidewalk or driveway a sufficient distance and in amount to replace turf or lawn removed during installation.

2. Backfill shall be completed by grading to match the existing lawn.
- B. Where lawns do not exist, the top four (4) inches of backfill shall be impervious dirt with no stones larger than two (2) inches in any dimension, and shall be placed to conform with the typical sections shown on the plans.
- C. Backfill shall be compacted to a density equal to the adjacent materials. It shall be leveled off to a neat and free draining surface.

3.10 TOLERANCES

- A. The work shall be performed in a manner which results in the item being constructed true to line and grade, uniform in appearance and structurally sound.
- B. Items found with bulges, ridges, low spots or other defects shall be removed and replaced at the CONTRACTOR's expense if the ENGINEER considers them to be irreparable. Items found that do not have a uniform finish, for example the broom finish does not produce regular corrugations, the corrugations are not parallel to the joint, and/or the corrugations are not continuous across the entire stone shall be removed and replaced at the CONTRACTOR's expense.
- C. When checked with a ten (10) foot straightedge provided by the CONTRACTOR and approved by the ENGINEER, grade shall not deviate by more than one-quarter ($\frac{1}{4}$) inch and alignment shall not vary by more than one-quarter ($\frac{1}{4}$) inch.
- D. Final elevation shall not depart from plan elevation by more than one-half ($\frac{1}{2}$) inch.
- E. Any area or section removed shall be joint to joint. Any removal and replacement done shall be at the CONTRACTOR's expense.
- F. CONTRACTOR is responsible for the concrete while it is curing. The CITY will not accept any concrete that has any type of surface damage, including, but not limited to: graffiti, footprints and bicycle tracks. The CITY will not accept a patch repair for such items. The CONTRACTOR will remove the entire stone, from joint to joint, and replace at CONTRACTOR's expense.
- G. Expansion joints found to have less than full depth and full width of placement shall be cut and expansion joint installed to the

ENGINEER's satisfaction. Any damage to stone will require replacement at the CONTRACTOR's expense.

3.11 DETECTABLE WARNING PLATES

- A. Use 2' wide plate x width of ramp for coverage according to ADA guidelines.
- B. Use radial plates when shown on the drawings
- B. Set cast iron Detectable Warning Plate into wet concrete in accordance with ADAAG Guidelines. Place plates 2" back from edge of ramp face.
- C. Tamp plate thoroughly with rubber mallet until concrete seeps through vent holes. Vent holes should be filled flush with concrete to ensure that no air pockets are left under the plate and that the lugs are completely encased in concrete for a strong bond.
- D. Clean excess concrete off of plate and finish concrete around the plate.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Curb turn fillets - This item shall be measured by the square foot, in plan view, of curb turn fillets constructed, complete in place. The following method of measurement shall be used: Find the length of each leg or straight edge and then apply the following formula: When leg · leg = x, and $(x \cdot \pi) \div 4 = y$, then $x - y =$ square foot of fillet. Curb shall be measured separately for payment.
- B. Concrete valley gutters - This item shall be measured by the square foot.
- C. New concrete sidewalk - This item shall be measured by the square foot.
- D. Detectable Warning Plates – This item shall be measured by each individual plate installed.
- E. Drive approaches – This item shall be measured by the square foot for either residential or commercial.

BASIS OF PAYMENT

- A. Curb turn fillets - Payment shall constitute full compensation for all material, excavation, backfill, curing of concrete, premolded mastic material, reinforcing steel, equipment, tools and labor and for the performance of all work and incidentals necessary to complete this item.
- B. Concrete valley gutters - Payment shall constitute full compensation for all material, excavation, backfill, curing of concrete, premolded mastic material, reinforcing steel, equipment, tools and labor and for the performance of all work and incidentals necessary to complete this item.
- C. New concrete sidewalk - Payment shall constitute full compensation for all material, excavation, backfill, curing of concrete, premolded mastic material, equipment, tools and labor and for the performance of all work and incidentals necessary to complete this item.
- D. Detectable Warning Plates - Payment shall constitute full compensation for all material, tools and labor, and for the performance of all work and incidentals necessary to complete this item.
- E. Drive Approaches - Payment shall constitute full compensation for all material, excavation, backfill, curing of concrete, premolded mastic material, equipment, tools and labor and for the performance of all work and incidentals necessary to complete this item.
- E. Payment shall be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Curb Turn Fillets	Sq.ft.
Concrete Valley Gutters	Sq.ft.
New Concrete Sidewalk	Sq.ft.
New Misc. Concrete	Sq.ft.
Drive Approach 6" or 8"	Sq.ft.
Detectable Warning Plates	EA

Payment shall be made at the contract unit bid price for each item multiplied by the number of units installed.

END OF SECTION

SECTION 03345

CONCRETE FINISHING

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of finishing interior and exterior concrete surfaces.

1.02 RELATED WORK

- A. Section 03200 - Portland Cement Concrete Pavement.
- B. Section 03305 - Concrete Quality Control.
- C. Section 03310 - Concrete Work.
- D. Section 03330 - Curbs and Combined Curb and Gutter.
- E. Section 03340 - Concrete Sidewalks, Driveway Approaches, Curb Turn Fillets, Valley Gutters, and Miscellaneous New Concrete Construction.
- F. Section 03370 - Concrete Curing and Sealing.
- G. Section 03600 - Grout.

1.03 SUBMITTALS

- A. All submittals shall include, but are not limited to, name, type, chemical analysis, manufacturer's specifications, test data, MSDS and manufacturer's recommended rate of application for liquid chemical hardener.
- B. Manufacturer's recommended installation procedures which, when approved by ENGINEER, shall become the basis for accepting or rejecting actual installation procedures used in the work.

1.04 REFERENCES

- A. ACI 303: Guide to Cast-in-Place Architectural Concrete Practice.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Mortar and grout shall be in accordance with SECTION 03600, GROUT.
- B. Dry shake shall be a blend of metallic or mineral aggregate with portland cement concrete in proportions recommended by manufacturer.
- C. If permitted or required, proprietary compounds may be used in lieu of or in addition to foregoing materials. Use such compounds in accordance with manufacturer's recommendations.
- D. Liquid-chemical hardener shall be a colorless, aqueous solution containing a blend of magnesium fluosilicate, zinc fluosilicate, and a wetting agent. Mixture contains not less than two (2) pounds fluosilicate per gallon and does not interfere with adhesives and bonding of finishes where such is indicated.

PART 3 EXECUTION

3.01 PREPARATION

- A. Examine the areas and conditions under which work of this section shall be performed.
- B. Correct conditions detrimental to timely and proper finishing.
- C. Do not proceed until unsatisfactory conditions are corrected.

3.02 FINISHING OF FORMED SURFACES

- A. General
 - 1. Allow concrete to cure not more than seventy-two (72) hours before commencing surface finish operations, unless approved otherwise.
 - 2. Revise the finishes as needed to secure approval.
- B. As-Cast Form Finish
 - 1. Rough: Patch defects, chip or rub off fins exceeding one-quarter (1/4) inch height.

2. Smooth: Patch tie holes and defects and remove fins completely.
 - a. When surface texture is impaired and form joints misaligned; grind, bush hammer, or correct affected concrete.
 - b. Slurry grout areas evidencing minor mortar leakage to match adjacent concrete.
 - c. Repair major mortar leakage as a defective area.
 - d. When workmanship is less than acceptable standard, provide one (1) of rubbed finishes at no additional cost to OWNER.

C. Rubbed Finish

1. Smooth Rubbed:
 - a. Remove forms and perform necessary patching as soon after placement as possible.
 - b. Finish newly hardened concrete no later than twenty-four (24) hours following form removal.
 - c. Wet surfaces and rub with carborundum brick or other abrasive until uniform color and texture are produced.
2. Grout Cleaned:
 - a. Undertake no cleaning operations until all contiguous surfaces are completed and accessible.
 - b. Wet surface of concrete sufficiently to prevent absorption of water from grout.
 - c. Apply grout uniformly.
 - d. Immediately after grouting, scrub surface with cork float or stone to coat surface and fill voids.
 - e. While grout is still plastic, remove excess grout by working surface with rubber float or sack.

f. After surface whitens from drying, rub vigorously with clean burlap.

g. Keep damp for at least thirty-six (36) hours after final rubbing.

3. Cork Floated:

a. Remove forms within two (2) to three (3) days of placement where possible.

b. Remove ties.

c. Remove all burrs and fins.

d. Dampen wall surface.

e. Apply mortar with firm rubber float or with trowel, filling all surface voids.

f. Compress mortar into voids.

g. If mortar surface dries too rapidly to permit proper compaction and finishing, apply a small amount of water with fog sprayer.

h. Produce final texture with cork float using a swirling motion.

D. Unformed Finish

1. After concrete is placed, strike smooth, tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces.

2. Float to texture which is reasonably consistent with formed surfaces.

E. Blasted Finish

1. Perform abrasive blasting within twenty-four (24) to seventy-two (72) hours after casting.

2. Coordinate with form work construction, concrete placement schedule, and form work removal to ensure that surfaces are blasted at the same age for uniform results.

3. Re-apply curing protection after blast finishing.

F. Architectural Finish

1. In accordance with ACI 303.
2. Tooled Finish:
 - a. Dress thoroughly cured concrete surface with electric, air, or hand tools to uniform texture, and give a bush hammered surface texture.
 - b. Remove sufficient mortar to exposed coarse aggregate in relief and to fracture coarse aggregate for tooled finish.

G. Patched Finish

1. Repair defective areas.
 - a. Remove honeycomb and defective concrete to sound concrete.
 - b. Make edges perpendicular to surface or slightly undercut.
 - c. Feathered edges are not permitted.
 - d. Dampen area to be patched and at least six (6) inches surrounding it to prevent absorption of patching mortar water.
 - e. Prepare bonding grout.
 - f. Mix to consistency of thick cream.
 - g. Brush into surface.
2. Unless indicated otherwise, after being cleaned and thoroughly dampened, fill tie holes solid with patching mortar.
3. Make any patches in concrete to closely match color and texture of surrounding surfaces. Determine mix formula for patching mortar by trial and obtain a good color match with concrete when both patch and concrete are cured and dry.

- a. Mix white and gray portland cement as required to match surrounding concrete to produce grout having consistency of thick paint.
 - b. Use a minimum amount of mixing water.
 - c. Mix patching mortar in advance and allow to stand without frequent manipulation, without addition of water, until it has reached stiffest placeable consistency.
 - d. After initial set, dress surfaces of patches manually to obtain same texture as surrounding surfaces.
4. After surface water has evaporated from patch area, brush bond coat into surface.
- a. When bond coat begins to lose water sheen, apply patching mortar.
 - b. Thoroughly consolidate mortar into place and strike-off to leave patch slightly higher than surrounding surface.
 - c. Leave undisturbed for at least one (1) hour before final finish.
 - d. Keep patched area damp for seventy-two (72) hours or apply curing compound.
 - e. Do not use metal tools in finishing an exposed patch.
5. Where as-cast finishes are indicated, total patched area may not exceed one (1) in five hundred (500) of as-cast surface. This is in addition to form tie patches, if ties are permitted to fall within as-cast areas.
6. In any finishing process which is intended to expose aggregate on surface, patched areas must show aggregate.
- a. Outer one (1) inch of patch shall contain same aggregates as surrounding concrete.
 - b. For aggregate transfer finish, patching mixture shall contain same selected colored aggregates.

- c. After curing, expose aggregates together with aggregates of adjoining surfaces by same process.

3.03

FINISHING SLABS

- A. For a broom and belt finish, after concrete has been consolidated, struck-off, and leveled, roughen surface transversely with stiff brushes, rakes, or burlap belt before final set.
- B. For a floated finish, after concrete has been consolidated, struck-off, and leveled, do not work further until ready for floating.
 - 1. Begin floating when water sheen has disappeared and surface has stiffness sufficient to permit operation.
 - 2. During or after first floating, check planeness of entire surface with a ten (10) foot long straightedge applied at two (2) or more different angles.
 - 3. Cut down high spots and fill low spots.
 - 4. Re-float slab immediately to a uniform sandy texture.
- D. Trowel Finish
 - 1. Float finish surface.
 - 2. Power trowel.
 - 3. Hand trowel as required to provide surface. Do not apply water (i.e., sprinkle) to surface of concrete in finishing operations.
 - 4. First troweling after power floating shall produce smooth surface relatively free of defects but which may still show some trowel marks.
 - 5. Second trowel by hand after surface has hardened.
 - 6. Leave finished surface essentially free of trowel marks, uniform in texture and appearance.
 - 7. On surfaces intended to support floor coverings, grind off defects which would show through floor coverings.

- E. “Dry Shake” Finish
1. Give surface a floated finish.
 2. Apply approximately two-thirds ($\frac{2}{3}$) of a blended material for required coverage to surface by a method that ensures even coverage without segregation.
 3. Begin floating immediately after application of first “dry shake”.
 4. After material has been embedded by floating, apply remainder of blended material to surface at right angles to prevent application.
 5. Make second application heavier in any areas not sufficiently covered by first application.
 6. Immediately follow with second floating.
 7. After selected material has been embedded by second floating, complete operation with a broomed, floated, or troweled finish, as indicated.
- F. For a non-slip finish, give surface a “dry shake” application, using crushed, ceramically bonded, aluminum oxide particles. Apply at twenty-five (25) pounds per one hundred (100) square feet.
- G. For an exposed aggregate finish, immediately after surface of concrete has been leveled and surface water has dissipated, spread aggregate uniformly over surface to provide complete coverage to the depth of a single stone.
1. Embed aggregate into surface by light tamping.
 2. Float surface until embedded aggregate is fully coated with mortar and surface has been brought to tolerance.
 3. Start exposure of aggregate after matrix has hardened sufficiently to prevent dislodgment.
 4. Flow ample quantities of water, without force, over surface of concrete while matrix encasing aggregate is removed by brushing with a fine bristle brush.
 5. Continue until aggregate is uniformly exposed.

6. An approved chemical retarder sprayed onto freshly floated surface may be used to extend working time.
- H. For a chemical-hardened finish, apply liquid chemical-hardener finish to interior concrete floors where indicated. Do not apply liquid chemical concrete hardener on floor areas scheduled to receive synthetic matrice terrazzo, setting beds for tile, terrazzo, vinyl flooring, or like items. Apply hardener after complete curing and drying of concrete surface in accordance with manufacturer's recommendations. Evenly apply each coat, and allow twenty-four (24) hours for drying between coats. After final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for items under this section.

4.02 BASIS OF PAYMENT

- A. No separate payment shall be made for items under this section. Full compensation shall be included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 03370

CONCRETE CURING AND SEALING

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of the concrete curing and sealing material requirements for all newly placed concrete.

1.02 RELATED WORK

- A. Section 03304 - Portland Cement Concrete.
- B. Section 03310 - Concrete Work.
- C. Section 03320 - Portland Cement Concrete Pavement.
- D. Section 03330 - Concrete Curbs and Combined Curbs and Gutters.
- E. Section 03340 - Concrete Sidewalks, Driveway Approaches, Curb Turn Fillets, Valley Gutters, & Miscellaneous New Concrete Construction

1.03 SUBMITTALS

- A. All submittals shall include manufacturer's specifications, test data, MSDS, and other data required to prove compliance with the specified requirements.
- B. Manufacturer's recommended installation procedures which, when approved by ENGINEER, shall become the basis for accepting or rejecting actual installation procedures used in the work.

1.04 QUALITY ASSURANCE

- A. Use workers who are trained, experienced, and completely familiar with the curing and protection requirements of ACI 301, ACI 305, and ACI 306 and the specified requirements and the methods needed for proper performance of the work of this section.
- B. Maintain concrete with minimum moisture loss at relatively constant temperature recommended by manufacturer for a period necessary for hydration of cement and hardening of concrete.

1.05

REFERENCES

- A. ACI 301: Specifications for Structural Concrete
- B. ACI 305: Hot Weather Concreting.
- C. ACI 306: Cold Weather Concreting.
- D. ASTM C171: Standard Specification for Sheet Materials for Curing Concrete.
- E. ASTM C309: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- F. ASTM C642: Standard Test Method for Specific Gravity, Absorption, and Voids in Hardened Concrete.

1.06

PRODUCT HANDLING

- A. Protect the materials of this section before, during, and after installation, and protect the work and materials of other trades.
- B. In the event of damage, immediately make replacements and repair at no additional cost to OWNER.

PART 2

PRODUCTS

2.01

WATER

- A. Clean, non-staining and non-detrimental.

2.02

MOISTURE-RETAINING SHEET MATERIALS

- A. ASTM C171: White, waterproof paper, polyethylene film, or burlap-polyethylene sheet.

2.03

ABSORPTIVE MAT MOISTURE COVER

- A. Burlap Cloth made from Jute or Kenaf AASHTO M182 (Class 3).

2.04

CURING COMPOUND

- A. Liquid membrane, in accordance with ASTM C309.
- B. Substance type: Unless indicated, CONTRACTOR to select from the following:

1. Chlorinated rubber.
 - a. Type of Compound: Type 2, white pigmented (Titanium Oxide (TiO₂)), seven (7) to nine (9) percent by weight of total solids.
 - b. Vehicle Solids Material: Class B, restricted to all resin materials. Forty (40) percent minimum by weight of total solids remainder of vehicles solids to chlorinated paraffin.
 - c. Total Solids: twenty-five (25) percent minimum by weight of compounds.
 - d. Viscosity: twenty (20) seconds maximum (Ford Cup).
 - e. Fineness of Grand: six (6) minimum.
 - f. Drying Time:
 - 1) Set to Touch: twenty (20) minutes maximum.
 - 2) Dry Hard: forty-five (45) minutes.
 - 3) Alkali Resistance: forty-eight (48) hours minimum.
 - g. Salt Spray (5% @ 95°F): five hundred (500) hours minimum.
2. Sodium silicate.
 - a. Type of Compound: Type 2, white pigmented.
 - b. Vehicle Solids Material: Class A, no restriction.
3. Poly-siloxane (alkyl-alkoxy siloxane).
 - a. Type of Compound: Type 1, clear or translucent without dye.
 - b. Vehicle Solids Material: Class B, restricted to all resin materials.

- C. Water Solubility: Less than one (1) percent.
- D. Weight Gain: At least 85% reduction of water absorption during initial twenty-four (24) hour curing period when compared to untreated test sample, ASTM C642.
- E. Scaling Resistance: Weight loss less than two (2) percent when subject to five hundred (500) cycles of freeze-thaw.

2.05 SEALING COMPOUND

- A. Blend of mineral sprits and boiled linseed oil.
- B. Shall meet or exceed AASHTO M233-86.
- C. Shall provide freeze/thaw protection and resist de-icing salts.
- D. Shall be Dayton Superior Chemical DayChem Anti Spall (J-33) or approved equal.

2.06 SEALING AND CURING COMPOUND

- A. To be used where the use of separate cure and seal products would cause a delay in opening new work for its intended use.
- B. Blend of silanes and acrylic copolymers.
- C. Liquid membrane, in accordance with ASTM C309.
- D. Penetrating sealer to provide freeze/thaw protection.
- E. Can be applied to fresh concrete.
- F. Shall be Dayton Superior Chemical Cure and Penetrant (J21CP) or equal.

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify concrete surfaces are ready for curing and/or sealing. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

- 3.02 PREPARATION
- A. Prepare the surface in strict accordance with manufacturer's recommendations.
- 3.03 MOISTURE COVER CURING
- A. Apply one (1) or both of the following methods.
1. Water or continuous water-fog spray.
2. Cover concrete surface with absorptive mat, thoroughly saturate with water, and keep continuously wet.
- B. Place absorptive mat to provide coverage of concrete surfaces and edges. Lap over adjacent absorptive covers.
- 3.04 MOISTURE-RETAINING SHEET CURING
- A. Place cover in widest practicable width with sides and ends lapped and sealed to prevent moisture loss.
- B. Repair any holes or tears during curing period.
- 3.05 FORMED SURFACE CURING
- A. Cure formed concrete surface, including undersides of beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed.
- B. When forms are removed, continue curing by curing compound or methods indicated above, as applicable.
- 3.06 UNFORMED SURFACE CURING
- A. Cure unformed surfaces, such as slabs, floor toppings, and other surfaces by application of appropriate curing method.
- B. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless approved otherwise.

3.07

CURING COMPOUNDS

- A. Apply the approved product to the designated surfaces in strict accordance with the manufacturer's recommended application procedures.
- B. Apply immediately following the final finishing operation as soon as the concrete is firm enough to work on.
- C. Apply uniformly in continuous operation.
- D. Maintain continuity of coating and repair damage during cure period.
- E. Should side forms be removed before expiration of cure period, coat exposed surface with curing compound.
- F. Unless specified otherwise by manufacturer of curing compound, do not use curing compound on surfaces which are to be covered with coating materials.

3.08

SEALING COMPOUNDS

- A. Apply the approved product to the designated surfaces in strict accordance with the manufacturer's recommended application procedures.
- B. Apply uniformly in continuous operation.
- C. Maintain continuity of coating and repair damage.
- D. Unless specified otherwise by manufacturer of sealing compound, do not use curing compound on surfaces which are to be covered with coating materials.

3.09

CURING AND SEALING COMPOUNDS

- A. Apply the approved product to the designated surfaces in strict accordance with the manufacturer's recommended application procedures.
- B. Apply immediately following the final finishing operation as soon as the concrete is firm enough to work on.
- C. Apply uniformly in continuous operation.

- D. Maintain continuity of coating and repair damage during cure period.
- E. Should side forms be removed before expiration of cure period, coat exposed surface with curing compound.
- F. Unless specified otherwise by manufacturer of curing compound, do not use curing compound on surfaces which are to be covered with coating materials.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. No separate measurement shall be made for items under this section.

4.02 BASIS OF PAYMENT

- A. No separate payment shall be made for items under this section. Full compensation shall be included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

SECTION 03480

PRECAST CONCRETE UNITS

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of precast concrete units, complete with required connecting and supporting devices.

1.02 SUBMITTALS

- A. Prepare shop drawings under seal of Professional Engineer registered in Wyoming.
- B. Submit shop drawings in accordance with SECTION 01340, SUBMITTALS.
- C. Indicate unit locations, unit identification marks, fabrication details, reinforcement, connection details, pertinent dimensions, and erection support points. Unit identification marks to appear on all manufactured units.
- D. Manufacturer's specifications, test data, and other data required to prove compliance with the specified requirements.
- E. Manufacturer's recommended installation procedures which, when approved by ENGINEER, shall become the basis for accepting or rejecting actual installation procedures used in the work.
- F. Do not proceed with fabrication until shop drawings have been accepted by the ENGINEER.

1.03 QUALITY ASSURANCE

- A. Design precast concrete units in accordance with ASTM C-478, ASTM C-857 Utilizing ACI-318 and ASSHTO HS-20-44 Loadings. Precast Concrete Box Culverts and Bridge Sections shall utilize AASHTO LRFD Loadings as required by project documents.
- B. Design units to support required stripping and handling loads, live, dead, and construction loads.

- C. Design component connections to provide adjustment to accommodate misalignment of structure during installation.

1.04 MANUFACTURER AND ERECTOR QUALIFICATIONS

- A. All precast Concrete Manufacturing Plants shall be certified by the National Precast Concrete Association (NPCA) or the American Concrete Pipe Association. (ACPA)
- B. Welders: certified in accordance with AWS D1.1 and AWS D1.4.

1.05 REFERENCES

- A. ACI318: Building Code Requirements for Reinforced Concrete. This reference standard includes other ASTM material standards.
- B. ASTM A36: Standard Specification for Carbon Structural Steel.
- C. ASTM C478: Standard Specification for Precast Reinforced Concrete Manhole Sections.
- D. ASTM C858: Standard Specification for Underground Precast Concrete Utility Structures.
- E. AWS D1.1: Structural Welding Code Steel.
- F. AWS D1.4: Structural Welding Code Reinforcing Steel.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Handle precast units in positions consistent with their shape and design. Lift and support only from support points indicated on shop drawings.
- B. Embedded lifting or handling devices shall be capable of supporting units in positions anticipated during manufacture, storage, transportation, and erection.
- C. Block and laterally brace units while stored at facility. Provide lateral bracing that is sufficient to prevent bowing and warping that is clean, non-staining, and will not inhibit uniform curing of exposed surfaces.
- D. Provide edges of units with adequate protection to prevent staining, chipping, or spalling of concrete.

PART 2 PRODUCTS

2.01 CONCRETE

- A. Concrete for above ground structures: 5000 psi minimum, in accordance with SECTION 03304, PORTLAND CEMENT CONCRETE and ACI 318, unless a different strength of concrete is indicated.
- B. Concrete for underground structures: 4000 psi minimum, in accordance with SECTION 03304, PORTLAND CEMENT CONCRETE and ASTM C478 or ASTM C858.
- C. All concrete shall conform to SECTION 03304, PORTLAND CEMENT CONCRETE.
- D. All sanitary sewer manholes and concrete pipe shall conform to SECTION 02700, SANITARY SEWER.

2.02 ACCESSORIES

- A. Connecting and Supporting Devices: Steel, in accordance with ASTM A36.
- B. Bolts, Nuts, and Washers: High-strength steel.
- C. Concrete Reinforcement: Minimum Grade sixty (60) reinforcing for all precast units unless approved in writing by ENGINEER.

2.03 FABRICATION

- A. Maintain plant records and quality control program during production of structural precast concrete. Make records available to ENGINEER.
- B. Use molds which are rigid and constructed of material that will result in uniform finished products.
- C. Deposit and vibrate concrete to ensure proper consolidation, elimination of unintentional cold joints, and minimize entrapped air on surface.
- D. Fabricate required connecting devices, plates, angles, items fit to steel framing members, bolts, and accessories.
- E. Ensure reinforcing steel, anchors, inserts, plates, angles, and other

cast-in items are sufficiently embedded, anchored, and properly located.

- F. Ensure finished surfaces of precast structural units are uniform.
- G. Cure units under identical conditions to develop specified concrete quality, and minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

2.04 DESIGN DEVIATIONS

- A. Deviation: Provide installation equivalent to basic intent without additional cost to OWNER. Deviations from exact required cross-section shall be permitted only with written approval from the ENGINEER.
- B. Manufacturer's Proposed Design: Supported by complete design calculations and drawings. When requested, submit design calculations for review bearing seal and signature of Professional Engineer.

2.05 OPENINGS

- A. Provide required openings, six (6) inches or larger. If approved, smaller sizes may be field constructed by coring or sawing.

2.06 FINISHES

- A. The required finish shall be described in one (1) of the following paragraphs. If no finish is indicated or selected by ENGINEER, use a standard finish.
- B. Standard Finish: Produced in forms such as plastic or metal lined that impart a smooth finish to the concrete. Small surface holes, normal form joint marks, minor chips and spalls are acceptable if approved. Major or unsightly imperfections, honeycomb, or structural defects are not acceptable.
- C. Commercial Finish: Produced in forms such as plywood or lumber that impart texture to concrete. Remove fins and large projections and fill large holes. Faces: true and well-defined. Correct exposed ragged edges by rubbing or grinding.
- D. Architectural Grade A Finish: Produced in forms such as plastic or metal lined that impart smooth finish to concrete. Fill holes over one-quarter (1/4) inch in diameter with sand-cement paste. Grind

smooth form offsets to fins over one-eighth ($\frac{1}{8}$) inch. Coat with neat cement paste using float. After paste coat has dried, rub with burlap to remove loose particles.

- E. Architectural Grade B Finish: Produced in forms such as plastic or metal lined that impart smooth finish to concrete. Fill holes over one-quarter ($\frac{1}{4}$) inch in diameter with sand-cement paste. Grind smooth form offsets or fins over one-eighth ($\frac{1}{8}$).
- F. Special Finishes: Sandblasting, acid washing, retarders, or form liners as approved by ENGINEER. Special finishes require submittal of two (2) - 12"x12" samples showing a representative color and texture to be used.
- G. Painted Finishes: Use only paint compatible form release agents on concrete that is to be painted.

2.07 REPAIR

- A. Repair of damaged units is acceptable if structural integrity or appearance is not impaired.

2.08 ALLOWABLE TOLERANCES

- A. Length: Plus or minus three-quarter ($\frac{3}{4}$) inch, or plus or minus one-eighth ($\frac{1}{8}$) inch per ten (10) feet of length, whichever is greater, or as indicated.
- B. End Squareness: one-half ($\frac{1}{2}$) inch maximum.
- C. Blockouts: one (1) inch of centerline location indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Do not install precast units until concrete has attained its design compressive strength.
- B. Clean weld marks or other marks, debris, or dirt from exposed surfaces of units.

3.02 PERFORMANCE REQUIREMENTS

- A. Conduct inspections, perform testing, and make repairs or replace unsatisfactory precast units as required.

- B. Rejection: Units may be rejected for any one (1) of the following:
 - 1. Exceeding specified installation tolerances.
 - 2. Damaged during construction operations.
 - 3. Exposed-to-view surfaces which develop surface deficiencies.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Measurement of precast concrete units shall be the number of each unit individually identified in the “Bid Schedule” complete in place and accepted.

4.02 BASIS OF PAYMENT

- A. Payment for precast concrete units shall be based on the contract lump sum unit price for each unit completed in place and accepted.
- B. Payment shall be considered as full compensation for furnishing all labor, materials, tools, equipment and other incidentals necessary to furnish, fabricate, transport and erect each completed precast concrete unit.

END OF SECTION

SECTION 03600

GROUT

PART 1 GENERAL

1.01 SUMMARY

- A. This section consists of pre-mixed non-metallic shrinkage resistant, pre-mixed water stop hydraulic cement, epoxy, and portland cement grouts for grouting for leveling beds of structural steel plates, sealing of joints and gaps between piping and structures, and sealing of joints between construction components.

1.02 REFERENCES

- A. ASTM C109: Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm Cube Specimens).
- B. ASTM C144: Standard Specification for Aggregate for Masonry Mortar.
- C. ASTM C150: Standard Specification for Portland Cement.
- D. ASTM C157: Standard Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete.
- E. ASTM E519: Standard Test Method for Diagonal Tension (Shear) in Masonry Assemblages.
- F. ASTM C207: Standard Specification for Hydrated Lime for Masonry Purposes.
- G. ASTM C472: Standard Methods for Physical Testing of Gypsum Plasters and Gypsum Concrete.
- H. ASTM C595: Standard Specification for Blended Hydraulic Cements.
- I. ASTM C827: Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens.
- J. ASTM C881: Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

- K. ASTM D570: Standard Test Method or Water Absorption of Plastics.
- L. ASTM D638: Standard Test Method for Tensile Properties of Plastics.
- M. ASTM D695: Standard Test Method for Compressive Properties of Rigid Plastics.
- N. ASTM C939: Standard Test Method for flow of Grout for PrePlaced-Aggregate Concrete (Flow Cone Method).
- O. ASTM C1107: Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- P. CE-CRD-C-621: Corps of Engineers specification for grouts.

1.03 SUBMITTALS

- A. Group mix components. Indicate proportions used, environmental conditions, and admixture limitations. Indicate material “Type”, “Grade”, and “Class” which suits project requirements.
- B. Manufacturer’s data for latex bonding agent.
- C. Manufacturer’s specifications, test data, MSDS, and other data required to prove compliance with the specified requirements.
- D. Manufacturer’s recommended installation procedures which, when approved by ENGINEER, shall become the basis for accepting or rejecting actual installation procedures used in the work.

PART 2 PRODUCTS

2.01 MATERIALS - GENERAL

- A. Portland cement: ASTM C150, natural color Type II (normal) or Type IIA (air entraining).
- B. Lime: ASTM C207, Type S, hydrated.
- C. Water: Clean, non-staining, and non-detrimental.
- D. Grout Aggregate: ASTM C144, standard masonry type.

2.02

PORTLAND CEMENT GROUT

- A. Concrete for grout shall be an approved batch meeting the following requirements:
 - 1. All grout shall have a minimum 28-day compressive strength equal to 3,200 psi.
 - 2. One cubic yard of grout shall contain a minimum of six (6) sacks of Type II Portland Cement.
 - 3. A maximum of 25% Type F Fly Ash may be substituted for Portland Cement.
 - 4. Aggregate for the grout shall meet gradation of Master Grading Band For Fine Aggregates in Section 03304, paragraph 2.05. The amount of material finer than a No. 200 sieve shall not exceed 2% by dry weight of aggregate.
 - 5. Slump shall be four (4) inches to seven (7) inches.
 - 6. Air entrainment shall be 4.5% - 7.5%.
 - 7. Grout shall contain one and one-half (1-1/2) pounds of Fibermesh, or approved equivalent, per cubic yard of grout when so specified by contract.
 - 8. Color Additive in required amounts shall be used when so specified by contract.

2.03

GYPSUM PLASTER GROUT

- A. Pre-mixed, prepackaged, wood fiber gypsum plaster with an ASTM C472 minimum average dry compressive strength of 2000 psi in twenty-eight (28) days. Mix with water in accordance with manufacturer's instructions for intended use to form a stiff plastic mix required for workability.

2.04

NON-METALLIC, SHRINKAGE RESISTANT GROUT

- A. Pre-mixed, nonmetallic, non-corrosive, non-staining product containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CE-CRD-C-621.

- B. Compressive Strength: ASTM C109, 6500 to 9000 psi in twenty-eight (28) days.
- C. Non-shrink Percentage: ASTM C827 and ASTM C157, one-half (½) percent.

2.05 NONSHRINK GROUT

- A. Pre-mixed, non-metallic, portland cement based material complying with ASTM C1107.
- B. Compressive strength: ASTM C939, 8000 to 14,000 psi in twenty-eight (28) days.

2.06 EPOXY ADHESIVE GROUT

- A. Two (2) component material suitable for use on dry or damp surfaces, one hundred (100) percent solids, high, moisture insensitive, complying with ASTM C881.
 - 1. Tensile Strength: ASTM D638, 5000 psi, minimum in fourteen (14) days.
 - 2. Tensile Elongation: ASTM D638, two (2) percent minimum.
 - 3. Compressive Strength: ASTM D695, 6500 psi minimum in twenty-four (24) hours and 70°F, 12,500 psi in twenty-eight (28) days and 70°F.
 - 4. Water Absorption: ASTM D570, one (1) percent maximum.
 - 5. Bond Strength:
 - a. Direct Shear: 400 psi.
 - b. Direct Tension: 250 psi.
 - c. Beam Break: 800 psi.
 - 6. Pot Life: five (5) minutes maximum at 70°F.

2.07 BONDING GROUT

- A. Of approximately one (1) part cement to one (1) part fine sand passing a No. 30 sieve with approved latex bonding agent when

allowed.

2.08 PNEUMATICALLY PLACED PLASTER (“GUNITE” OR “SHOTCRETE”)

- A. Materials: portland cement, lime, water, and sand.
- B. Compressive Strength: ASTM C 109, 2800 psi in twenty-eight (28) days.
- C. Proportioning: one (1) part cement to not more than five (5) parts sand.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Fill joints, voids, and pockets completely.
- B. Comply with manufacturer’s instructions and UBC Chapter 47.
- C. Finish surfaces exposed to view smooth.
- D. Pneumatically placed plaster: Screened and reused rebound material in an amount not greater than 25% of the total sand in any batch.

PART 4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Grouting for leveling for structural plates, sealing joints and gaps, filling voids and pockets and masonry cells shall not be measured for payment.
- B. Pneumatically placed plaster (“Gunite” or Shotcrete”) shall be measured by the actual areas in the plane of work.

4.02 BASIS OF PAYMENT

- A. No separate payment shall be made for items included in “A” above. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.
- B. Payment for Pneumatically placed plaster (“Gunite or Shotcrete”)

shall be based on the Contract Unit Price Bid and shall include full compensation for preparing the foundation, setting all formwork, and grounds, furnishings and placing reinforcement, placing the concrete, finishing surfaces, curing and structural backfill as shown on the Plans. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation shall be allowed therefore.

END OF SECTION

ATTACHMENT “A”

STANDARDS AND SPECIFICATIONS

FOR

POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

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STANDARDS AND SPECIFICATIONS FOR
POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

PART 1 GENERAL

1.01 MANUFACTURING - TESTING - DELIVERY:

- A. General:
All polyvinyl pipe shall be manufactured and marked in accordance with ANSI/AWWA C900, "Polyvinyl Chloride (PVC) Pressure Pipe, four (4) inch through twelve (12) inch, for Water", and have appropriate UL and FM Certification with the following additional requirements or exceptions.
- B. Size of Pipe:
This Specification shall cover polyvinyl chloride pipe in four (4) inch, six (6) inch, eight (8) inch, and twelve (12) inch nominal diameters with cast iron pipe equivalent outside diameters.
- C. Joint Type:
Pipe joints shall be made using an integral bell with an elastomeric gasket push-on joint. Manufacturer shall furnish gasket lubricant for each quantity of pipe furnished.
- D. Class and Type:
Size six (6) inch, eight (8) inch, and twelve (12) inch shall be no less than Class 150 dimension ratio 18 (DR 18). Size four (4) inch shall be no less than Class 200, dimension ratio 14 (DR 14).
- E. Pipe Material Requirements:
The PVC pipe shall be manufactured from a compound which meets ASTM D1784 Cell Classification 12454-A or 12454-B. All compounds shall qualify for a rating of 4000 psi (27.58 MPa) for water at 73.4°F (23°C) per the requirements of PPITR3. Additives and fillers, including but not limited to stabilizers antioxidants, lubricants, colorants, etc., shall not exceed ten (10) parts by weight per one hundred (100) parts of PVC resin in the compound; provided that the CAC03 filler content shall not exceed five and one-half (5.5) parts per one hundred (100) parts of PVC resin.
- F. Testing Requirements:
Pipe and resin compound shall be tested in accordance with all tests specified in AWWA C-900, with the following modifications or additions.

Impact resistance of the pipe shall be tested in accordance with Canadian Standard Association (CSA) standard CAN3-B137.0-M86, Clause 7.7, as supplemented by CAN3-B137.3-MB6, Clause 4.8.3.

The quality of the extruded pipe shall be tested by ASTM F1057.

Testing of the CAC03 content shall be performed in accordance with ASTM D2584.

G. Sampling & Testing:

It is hereby mutually understood and agreed that the BOPU may, at its discretion, inspect, test or have an independent laboratory test any or all deliveries in accordance with the specification criteria of these documents. The BOPU will not accept material that is damaged, does not meet specifications or is unsuitable for use in a potable water system.

Charges for all tests will be borne by the BOPU. However, should the material fail to meet test criteria, the following demands will be made upon the Contractor:

1. Removal of all unacceptable material.
2. Replacement of the materials removed with a like material meeting the Specification requirements.

H. Manufacture Process Requirements:

The cooling of the PVC pipe is considered to be a critical aspect of the manufacturing processing. The procedure used shall cool the pipe to a maximum of 100°F before the pipe is moved from the assembly line.

I. Pipe Length:

Each length of pipe delivered for use at the job site shall be standard laying length of twenty (20) feet. Random lengths shall not be acceptable.

J. Pipe Condition:

The pipe shall be delivered clean of any residue materials from the pipe manufacturing operation. The Contractor shall be responsible for replacement or cleaning of pipe received in an unacceptable condition.

K. Loading Instructions:

All pipe shall be palletized on flatbed trucks or flatbed trailers for commercial shipment and shall be suitable for unloading by means of a forklift truck. All standard length pipe to be palletized alternate

bell. Pipe to be banded, row and bundle. All stringers must be of a sufficient thickness to provide for forklift unloading. The pipe manufacturer will tarp the load of the pipe at the shipping point and it will remain in place until the pipe is delivered and unloaded.

Accessories will be bundled or palletized by size and suitable for unloading and handling by means of a forklift truck. Strapping, blocking, bracing and dunnage shall be in accordance with applicable traffic regulations and in keeping with sound practice within the industry.

L. Certification:

The manufacturer shall furnish a sworn statement that the inspection and all of the specified tests have been made, and the results thereof comply with the requirements of the applicable standards) herein specified. A copy of the Certification shall be sent to the Cheyenne Board of Public Utilities prior to the installation of any of the pipe.

M. Acceptable Manufacturers:

The following manufacturers are approved as being capable of meeting these specifications.

Certain-Teed Corporation
J-M Manufacturing Company
P.W. Eagle Inc.
Scepter Manufacturing Company
Diamond Plastics Corporation
North American Pipe

1.02 PRESSURE CLASS:

A. General:

No less than Class 150 pipe shall be used when the maximum static pressure in the main is less than one hundred (100) psi, except no less than Class 200 is to be used a all times for four (4) inch diameter pipe. For static pressures in the main exceeding one hundred (100) psi and no more than one hundred-fifty (150) psi all PVC pipe is to be Class 200. PVC pipe will not be allowed for static pressures in the main in excess of one hundred-fifty (150) psi.

PART 2 EXECUTION

2.01 INSTALLATION:

- A. Pipe installation shall comply with SECTION 02665, WATER DISTRIBUTION AND TRANSMISSION SYSTEMS.

2.02 SERVICE CONNECTIONS:

- A. Service connection shall comply with SECTION 02665, WATER DISTRIBUTION AND TRANSMISSION SYSTEMS

2.03 INSTALLATION OF BUTTERFLY VALVES:

- A. Special care needs to be taken when installing Butterfly Valves onto pressure class 200 pvc water pipe (ANSI-AWWA C900). It is advisable to take the following precautionary steps to assure proper valve performance.
 1. Cut the pipe that is to connect to the valve in a clean, straight and square manner, preventing spurs and ridges that might interfere with operation of the valve.
 2. It is prudent on class 200 PVC water pipe to bevel the inside edge slightly (removing approximately one-quarter (1/4) inch of the inside corner).
 3. Tighten all bolts on the follower ring and restraining gland uniformly to prevent egging.
 4. The weight of the fitting shall not be carried by the PVC pipe. All valves and fittings shall be supported by and adequately steel reinforced concrete pad with dimensions of no less than 2'x 2' with a thickness of six (6) inches. The concrete pad shall bear upon virgin or 95% recompacted soil material. (See Standard Drawing No. 02645-01)

2.04 FIRE HYDRANTS:

- A. The lead pipe for fire hydrants shall be connected to the PVC main by use of an MJ x MJ x swivel tee and valve. The lead pipe from the PVC main to the fire hydrant shall be ductile iron Class 52 pipe as per BOPU Standards and Specifications.

2.05 DISINFECTION AND TESTING:

- A. This shall comply with SECTION 02670, HYDROSTATIC TESTING and 02675, DISINFECTION.

**PART 3 METHOD OF MEASUREMENT AND BASIS OF PAYMENT
(APPLICABLE ONLY WHEN UNDER DIRECT CONTRACT WITH
THE BOPU)**

3.01 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

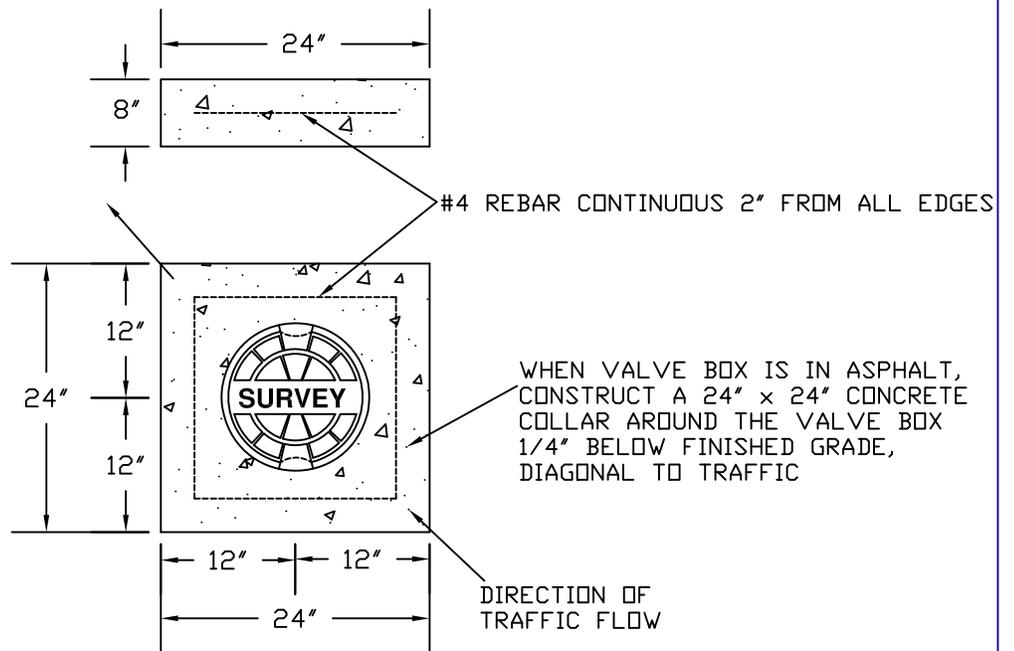
- A. Water Mains:
 - 1. Measurement of water main will be in lineal feet along the centerline of pipe through all valves, fittings, and appurtenances.
- B. Fittings:
 - 1. Measurement of water main fittings will be by numerical count of the various types and sizes listed in the Proposal.
- C. Water Valves:
 - 1. Measurement of water valve shall be made by numerical count of the sizes and types of valves listed in the Proposal.
- D. Thrust Blocks:
 - 1. No separate payment will be made for thrust blocks. Full compensation shall be considered as included in the prices paid for the various contract items and no additional compensation will be allowed therefore.
- E. Water Service Lines:
 - 1. Payment for water service connections will be made at the contract unit price bid each, which price shall include furnishing and installing the water service line from the main to the property line; tapping the main; furnishing and installing all fittings, corporation stops, curb stops and boxes, tapping saddles if required; all trench excavation, backfill, pipe bedding, shoring, and dewatering; cleanup and all other work necessary or incidental for completion of the item.

Payment for these items shall be full compensation for providing all materials, tools, labor and equipment necessary to complete the item and all incidental work, related thereto, whether specifically mentioned herein or not.

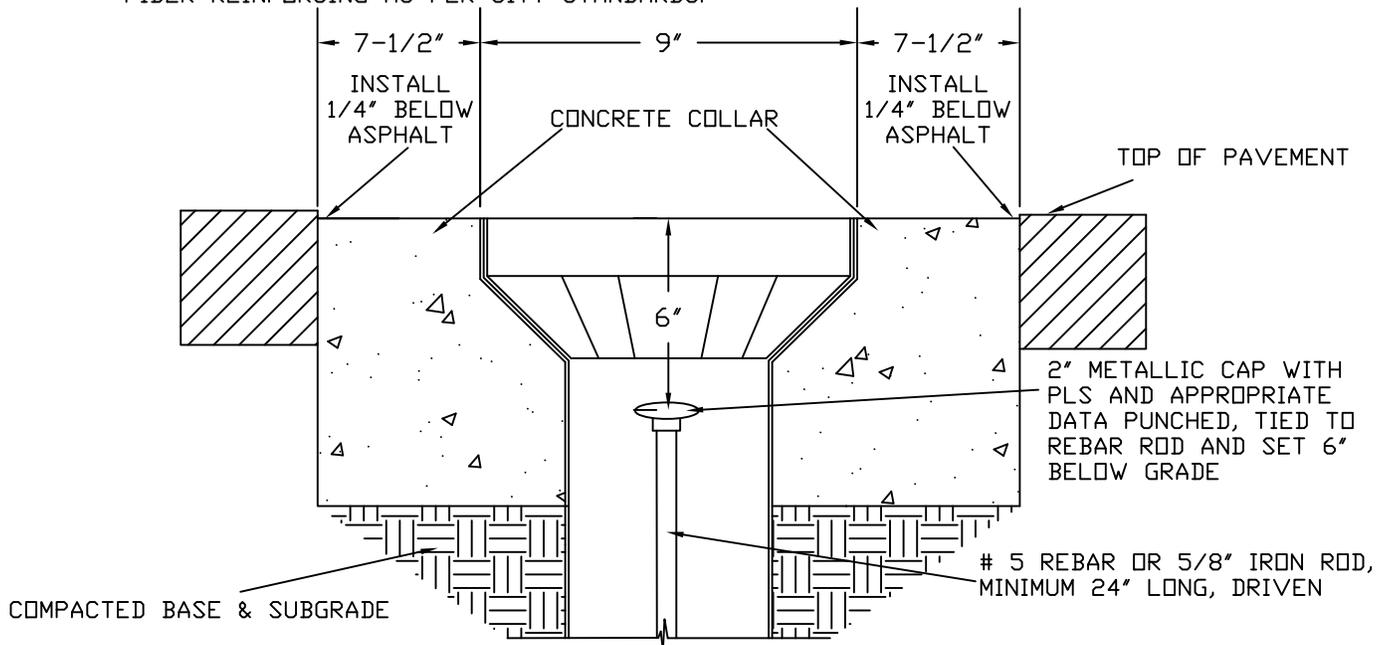
END OF SECTION

MONUMENT BOX COLLAR

NOT TO SCALE



NOTE:
CONCRETE SHALL BE 4500 PSI WITH
FIBER REINFORCING AS PER CITY STANDARDS.



MONUMENT BOX PLACEMENT AND ADJUSTMENT

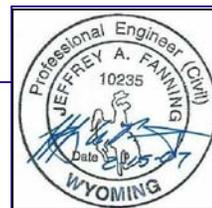
NOTES:

1. ADJUST MONUMENT BOX UPWARD OR DOWNWARD AS REQUIRED. FINAL ADJUSTMENT SHALL BE MADE AFTER PAVING AND BEFORE SEALING. ALL BOX SECTIONS SHALL BE POLYWRAPPED.
2. WHEN CONCRETE COLLAR IS PLACED ABUTTING CONCRETE PAVEMENT, DEPTH SHALL BE EQUAL TO THAT OF PAVEMENT SECTION, WITH A MINIMUM OF 8".



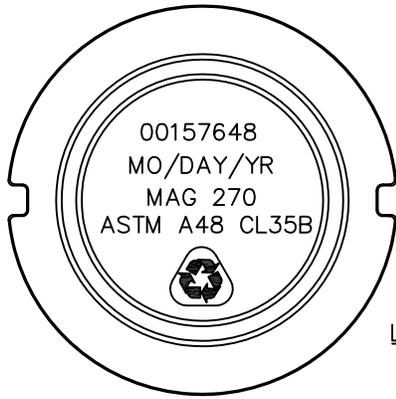
CITY OF CHEYENNE
AND
BOARD OF PUBLIC
UTILITIES
STANDARD DRAWING

MONUMENT BOX
SETTING AND ADJUSTMENT
DETAILS

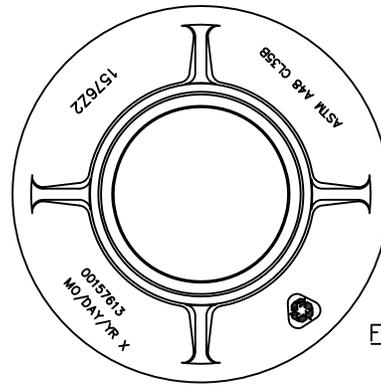


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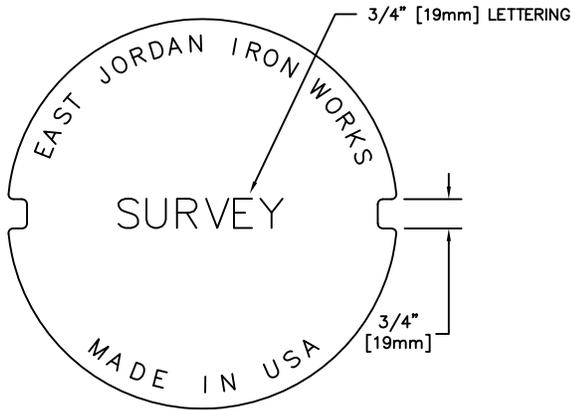
STANDARD
DRAWING NO.
01330-01



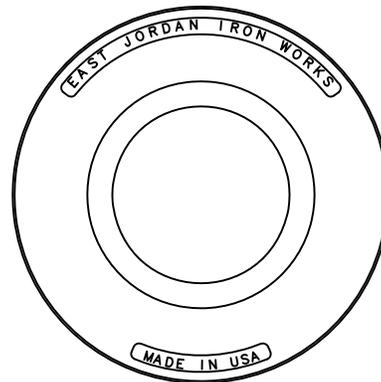
LID SECTION



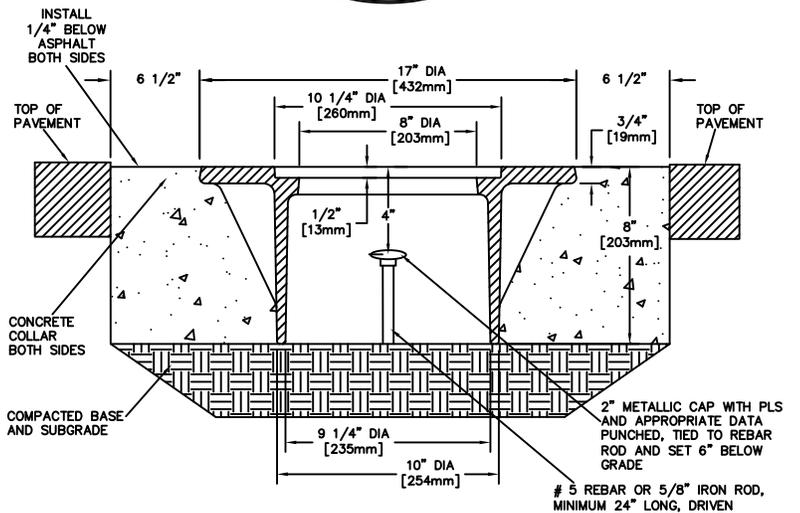
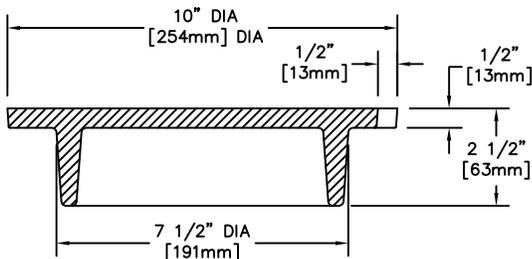
FRAME SECTION



LID DETAIL



FRAME DETAIL



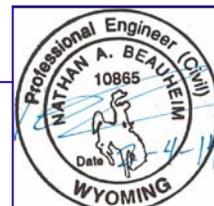
NOTES:

1. ADJUST MONUMENT BOX UPWARD OR DOWNWARD AS REQUIRED. FINAL ADJUSTMENT SHALL BE MADE AFTER PAVING AND BEFORE SEALING.
2. WHEN CONCRETE COLLAR IS PLACED TO CONCRETE PAVEMENT, COLLAR SHALL MATCH ADJACENT CONCRETE DEPTH WITH A MINIMUM OF 8" DEPTH.



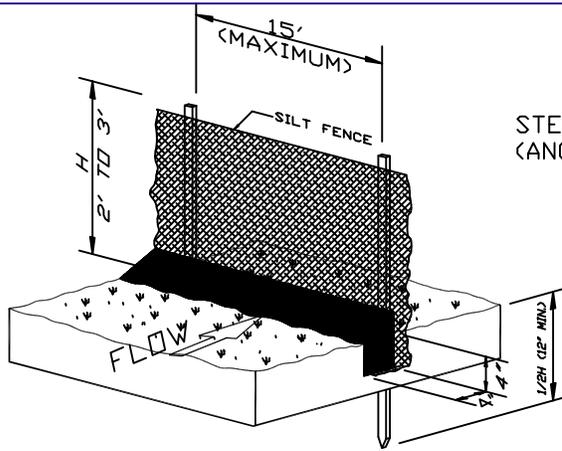
CITY OF CHEYENNE
AND
BOARD OF PUBLIC
UTILITIES
STANDARD DRAWING

MONUMENT BOX
SETTING AND ADJUSTMENT DETAILS
(OPTION UPON APPROVAL)



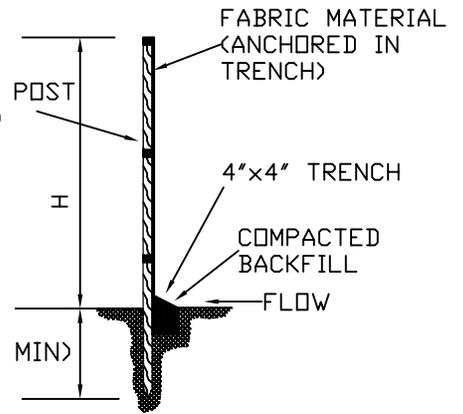
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STANDARD
DRAWING NO.
01330-02



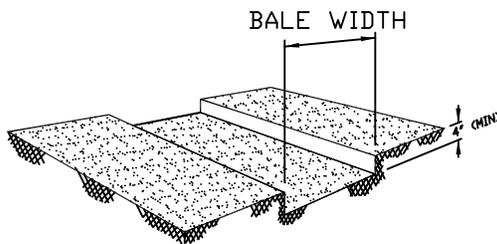
SILT FENCE INSTALLATION

STEEL OR 2"x4" WOOD POST
(ANCHORED TO FABRIC)

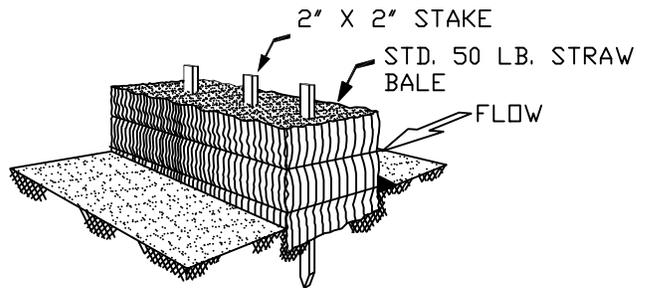


SECTION

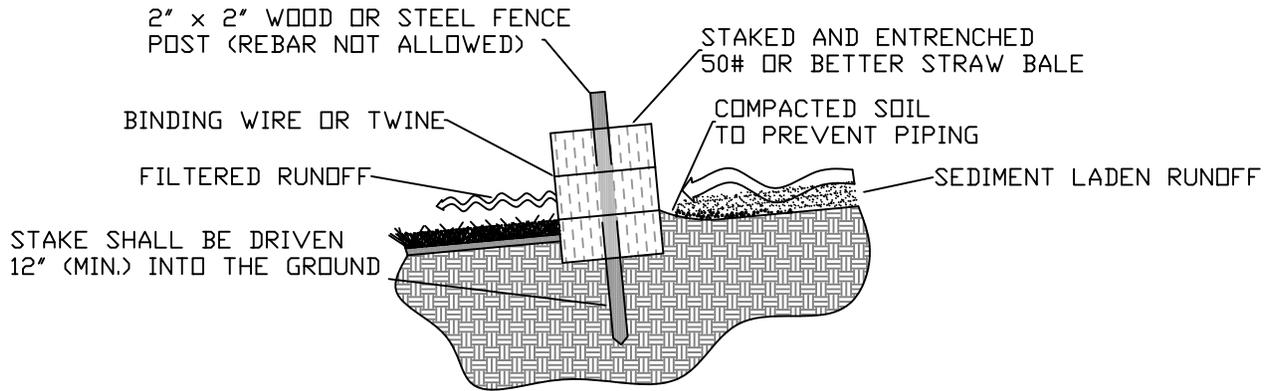
SILT FENCE EROSION BARRIER



TRENCH EXCAVATION

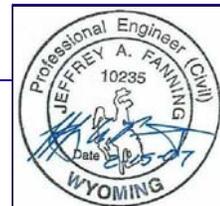


STRAW BALE INSTALLATION



STRAW BALE EROSION BARRIER

NOTE: EROSION CONTROL MEASURES SHALL BE MAINTAINED UNTIL LANDSCAPING IS COMPLETED AND ESTABLISHED, OR AS DIRECTED BY THE ENGINEER.



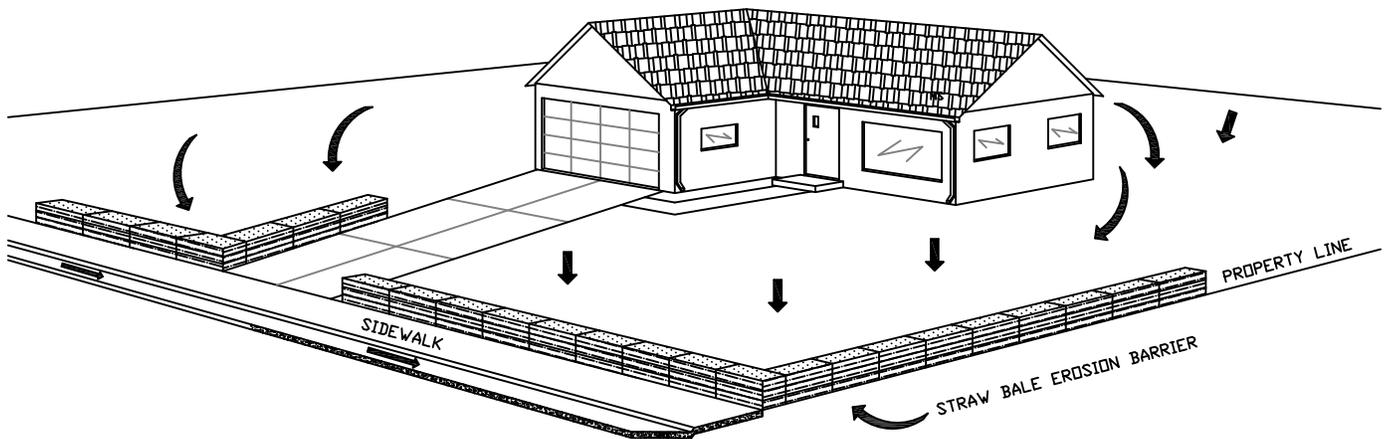
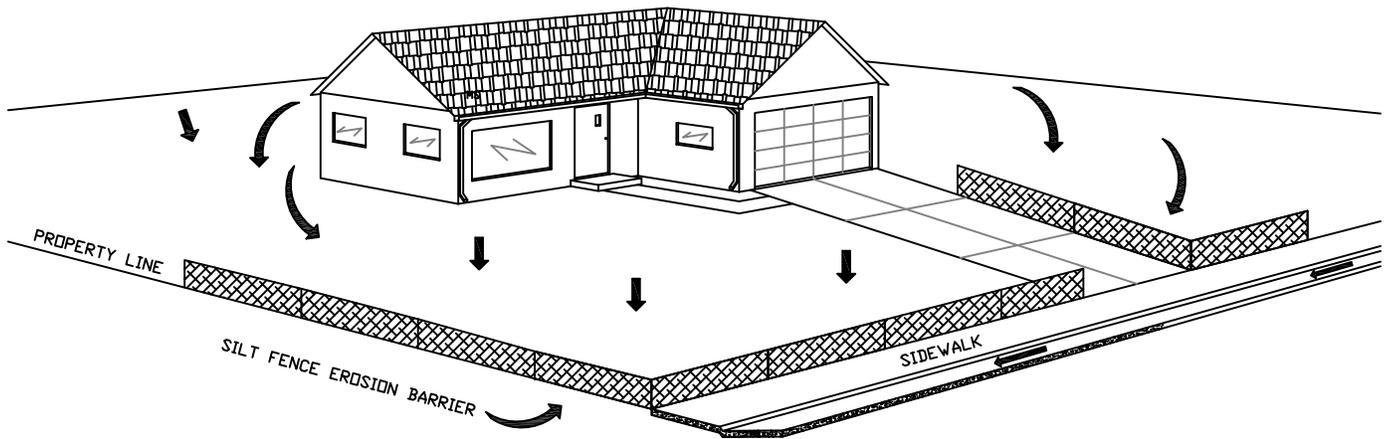
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STANDARD
DRAWING NO.
01563-01



CITY OF CHEYENNE
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UTILITIES
STANDARD DRAWING

EROSION CONTROL MEASURES

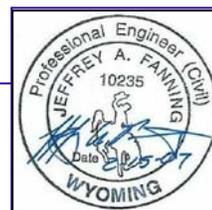


NOTE: EXTEND BARRIERS SO AS TO INTERCEPT ALL RUNOFF FROM THE RESIDENTIAL LOT.



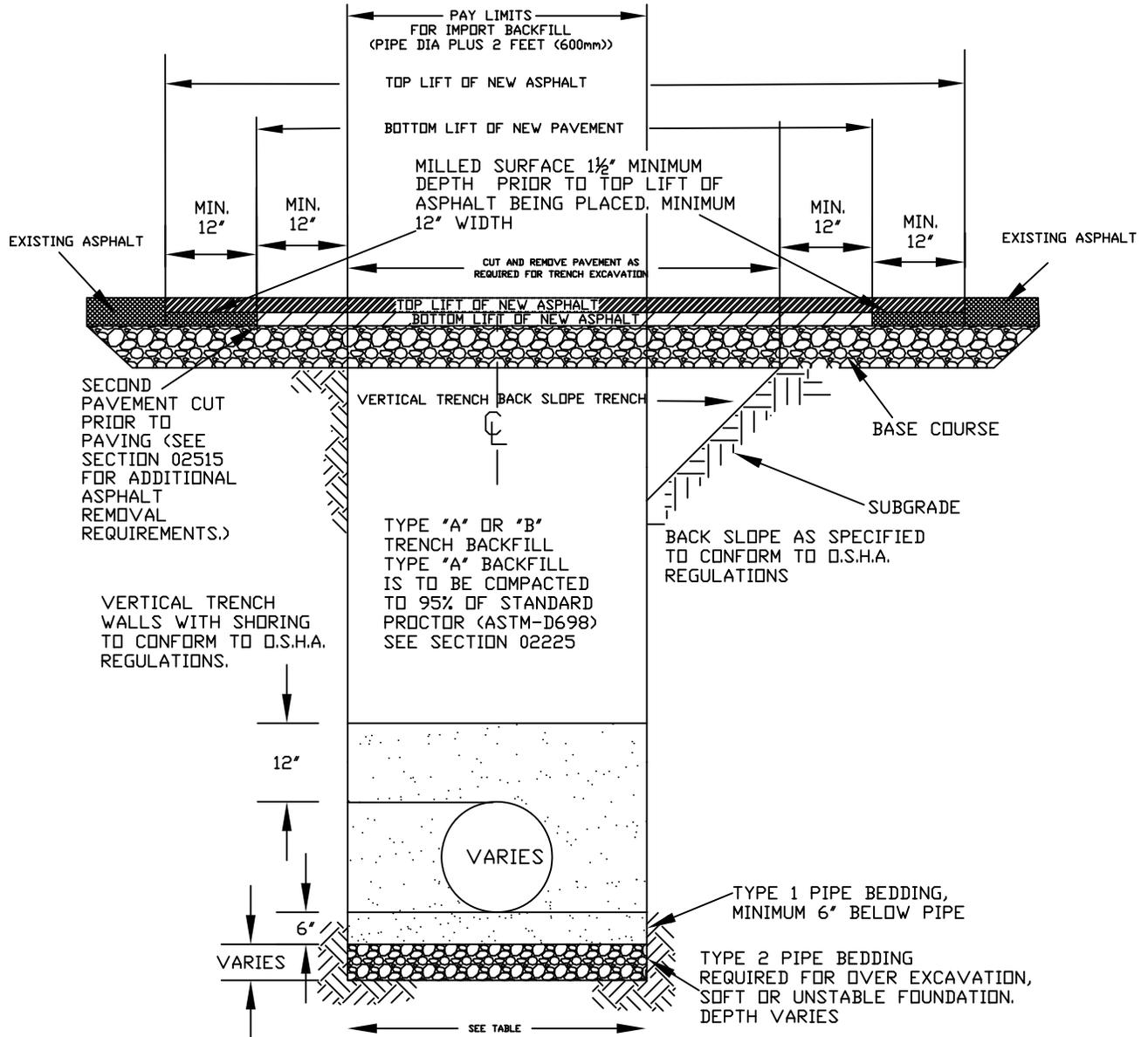
CITY OF CHEYENNE
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BOARD OF PUBLIC
UTILITIES
STANDARD DRAWING

EROSION CONTROL MEASURES



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2007

STANDARD
DRAWING NO.
01563-02



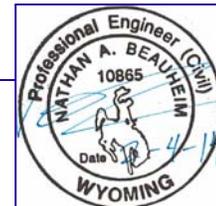
NOTES:

1. MATERIAL COMPACTION SHALL CONFORM TO SECTIONS 02220, 02225, 02226, 02231, AND 02512.
2. WHEN ANY PORTION OF THE PIPE HAS LESS THAN 18" COVER TO FINISH GRADE OR THE TRENCH IS LESS THAN 30" IN WIDTH, THE TRENCH SHALL BE BACKFILLED WITH CITY MIX 3 SLURRY.
3. DEPTH OF BITUMINOUS PATCH SHALL BE A MINIMUM OF 4" OR MATCH EXISTING UP TO 6" ON ALL STREETS DESIGNATED AS LOCAL STREETS OR ALLEYS. PATCH DEPTH OF 6" OR MATCH EXISTING UP TO 12" ARE REQUIRED ON ALL COLLECTORS AND ARTERIALS.
4. EXISTING PAVEMENT SHALL BE CUT BACK A MINIMUM OF 12" BEYOND ANY DISTURBED BASE COURSE, SUBGRADE OR BROKEN ASPHALT. IN ADDITION, THE ADJACENT PAVEMENTS SHALL BE MILLED A DEPTH OF 1 1/2" NO LESS THAN ONE FOOT WIDE AND THE TOP LIFT INLAID. SEE SECTION 02515 FOR ADDITIONAL ASPHALT REMOVAL AND PATCHING REQUIREMENTS.



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STANDARD DRAWING

TYPICAL TRENCH DETAIL
FOR STORM SEWER, WATER AND
SANITARY SEWER PIPE



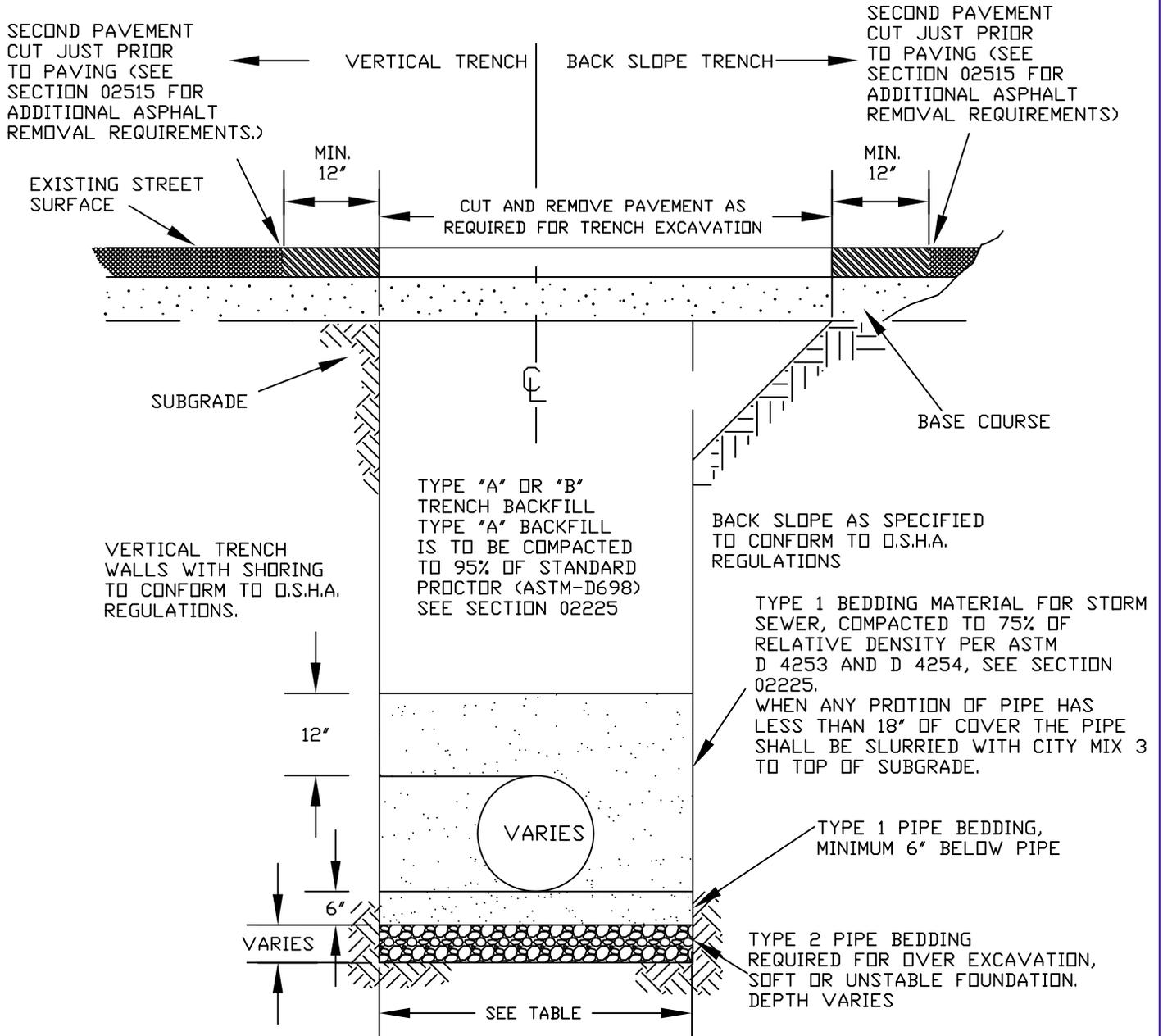
REVISED
2014

STANDARD
DRAWING NO.
02220-01

NOTE: WHERE TRENCH PASSES THROUGH EXISTING PAVEMENT THE PAVEMENT SHALL BE SAW CUT IN ACCORDANCE WITH SECTION 02075.

NOT TO SCALE

A TRENCH WIDTH OF 30" OR LESS IN PAVED AREAS REQUIRES SLURRY AS PER SECTION 02225.

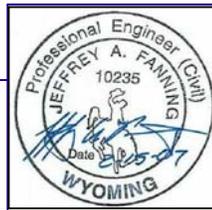


MINIMUM TRENCH (WIDTH)										
PIPE DIA.	4	6	8	10	12	14	16	20	24	36
TRENCH WIDTH	28	30	32	34	36	38	40	44	48	60



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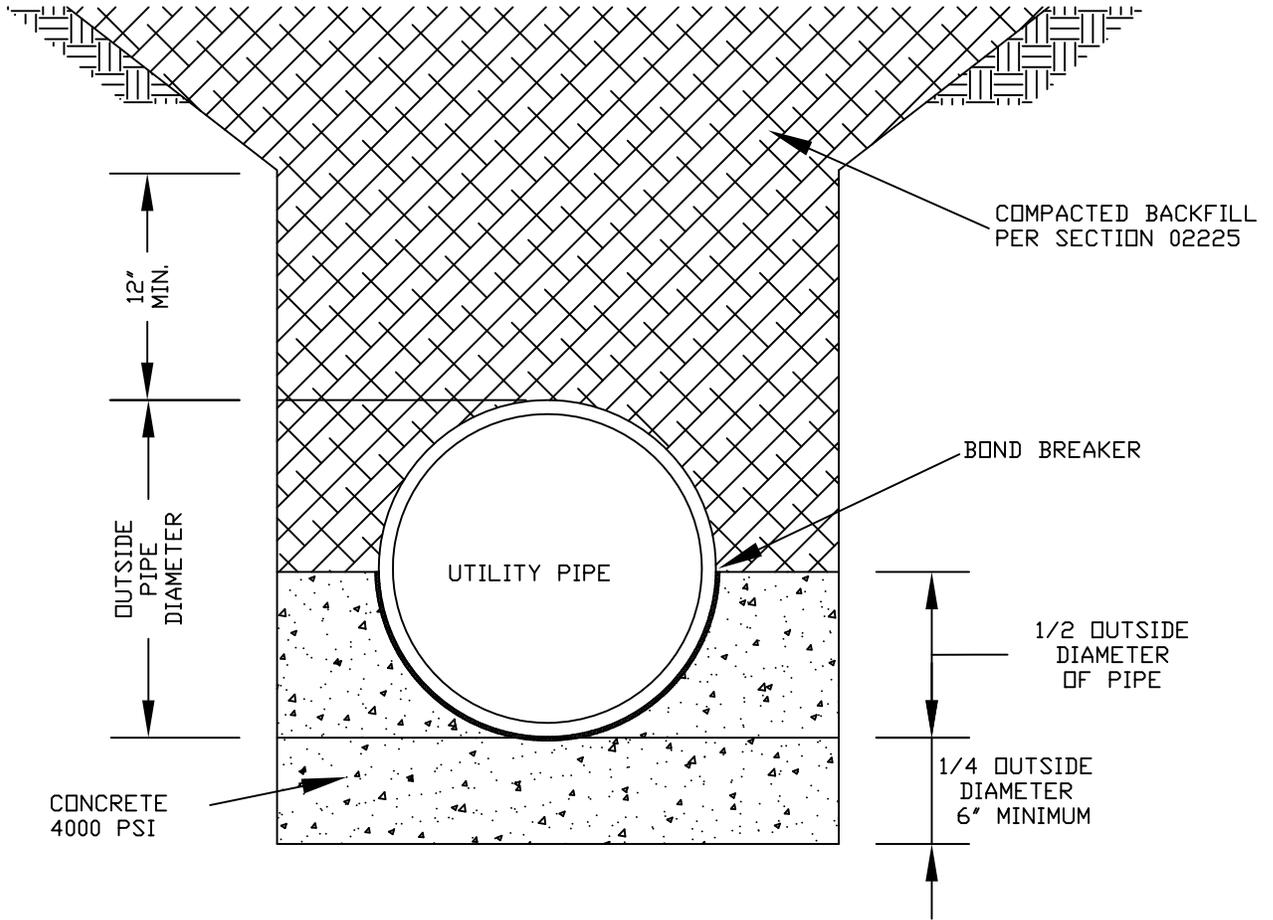
TYPICAL TRENCH DETAIL
FOR STORM SEWER PIPE



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STANDARD
DRAWING NO.
02220-02

NOT TO SCALE



CONCRETE SUPPORT CRADLE

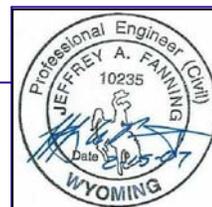
NOTE:

1. FOR USE WHEN WATER OR SEWER CROSSES OVER OTHER UTILITIES.
2. REBAR REINFORCEMENT FOR CRADLE SHALL BE PER ENGINEER'S REQUIREMENT.



CITY OF CHEYENNE
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UTILITIES
STANDARD DRAWING

TYPICAL CONCRETE
CRADLE SUPPORT

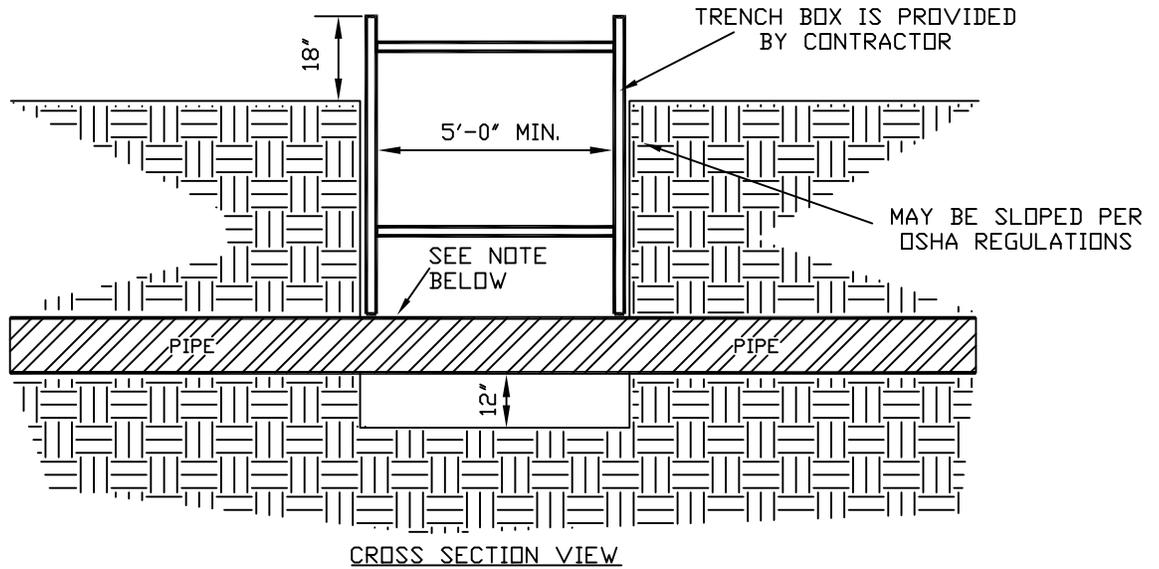


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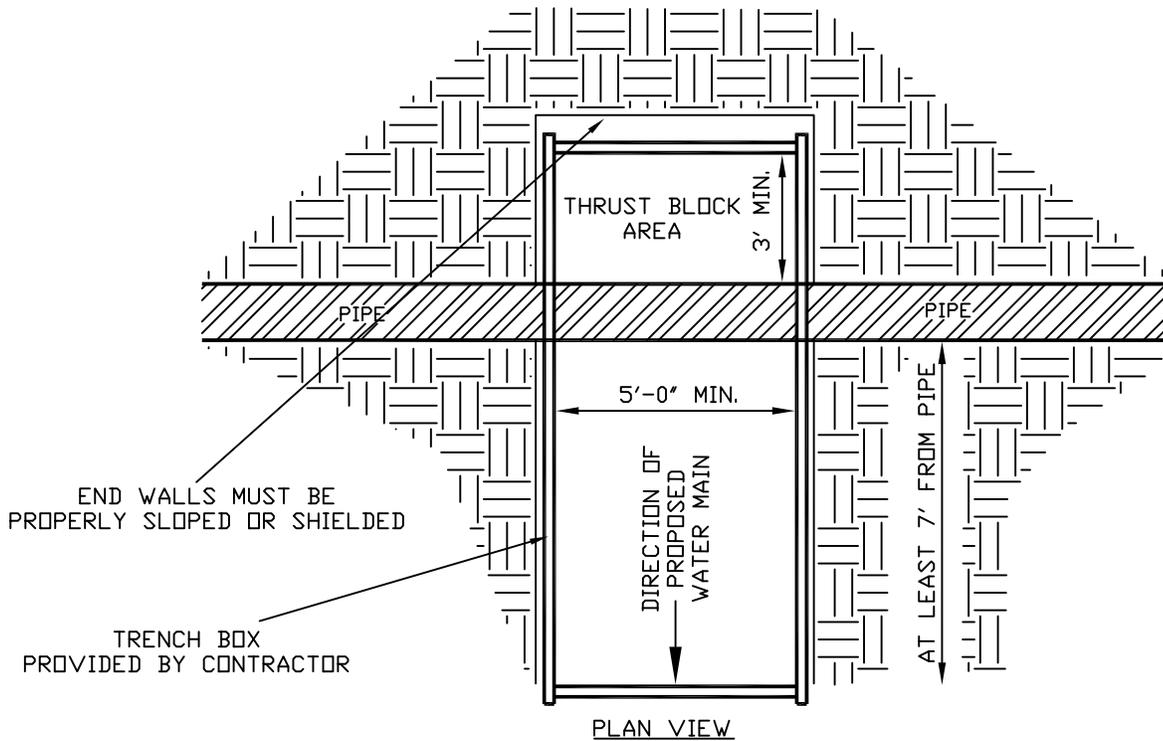
STANDARD
DRAWING NO.
02220-03

NOT TO SCALE

TRENCH EXCAVATION REQUIREMENTS FOR B.O.P.U. 4" AND LARGER WET TAPS



NOTE: FOR LARGER THAN 12" PIPE REFER TO OSHA REGULATIONS FOR ADDITIONAL SHIELDING AS REQUIRED

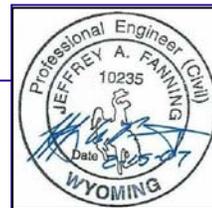


ALL TRENCHING AND SHIELDS SHALL BE PER OSHA REGULATIONS.



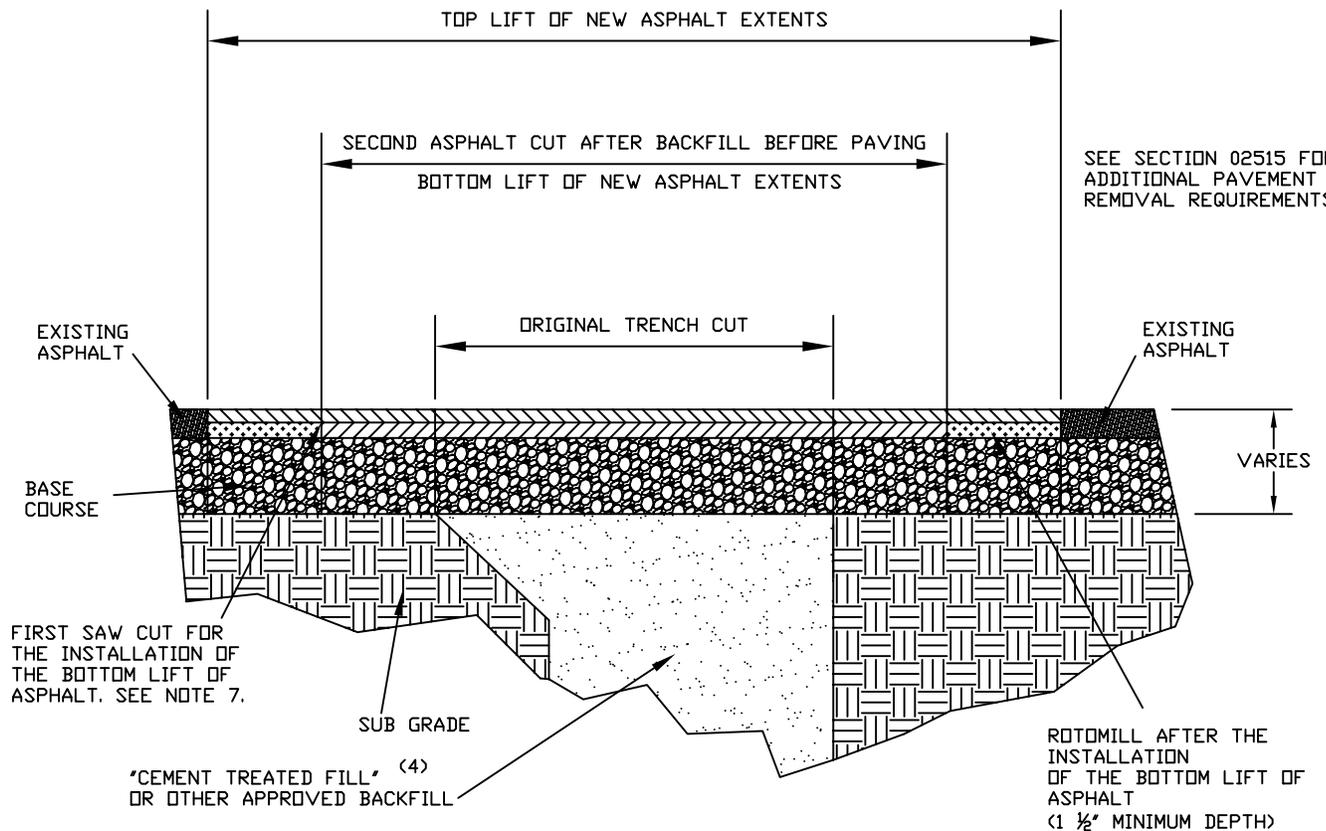
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STANDARD DRAWING

EXCAVATION FOR 4"
AND LARGER TAPS



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2007

STANDARD
DRAWING NO.
02220-04



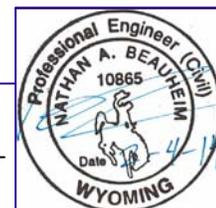
NOTES:

1. MATERIAL COMPACTION SHALL CONFORM TO SECTIONS 02220, 02225, 02226, 02231, AND 02512.
2. WHEN ANY PORTION OF THE PIPE HAS LESS THAN 18" OF COVER TO FINISH GRADE OR THE TRENCH IS LESS THAN 30" IN WIDTH THE TRENCH SHALL BE BACKFILLED WITH CITY MIX 3 SLURRY TO TOP OF SUBGRADE.
3. DEPTH OF BITUMINOUS PATCH SHALL BE A MINIMUM OF 4" OR MATCH EXISTING UP TO 6" ON ALL STREETS DESIGNATED AS LOCAL OR ALLEYS. PATCH DEPTH OF 6" OR MATCH EXISTING UP TO 12" ARE REQUIRED ON ALL STREETS DESIGNATED AS COLLECTOR OR ARTERIAL.
4. EXISTING PAVEMENT SHALL BE CUT BACK A MINIMUM OF 12" BEYOND ANY DISTURBED BASE, SUBGRADE OR ASPHALT. IN ADDITION, THE ADJACENT PAVEMENTS SHALL BE MILLED A DEPTH OF 1½" NO LESS THAN ONE FOOT WIDE AND THE TOP LIFT OF ASPHALT INLAID. SEE SECTION 02515 FOR ADDITIONAL ASPHALT REMOVAL AND PATCHING REQUIREMENTS.

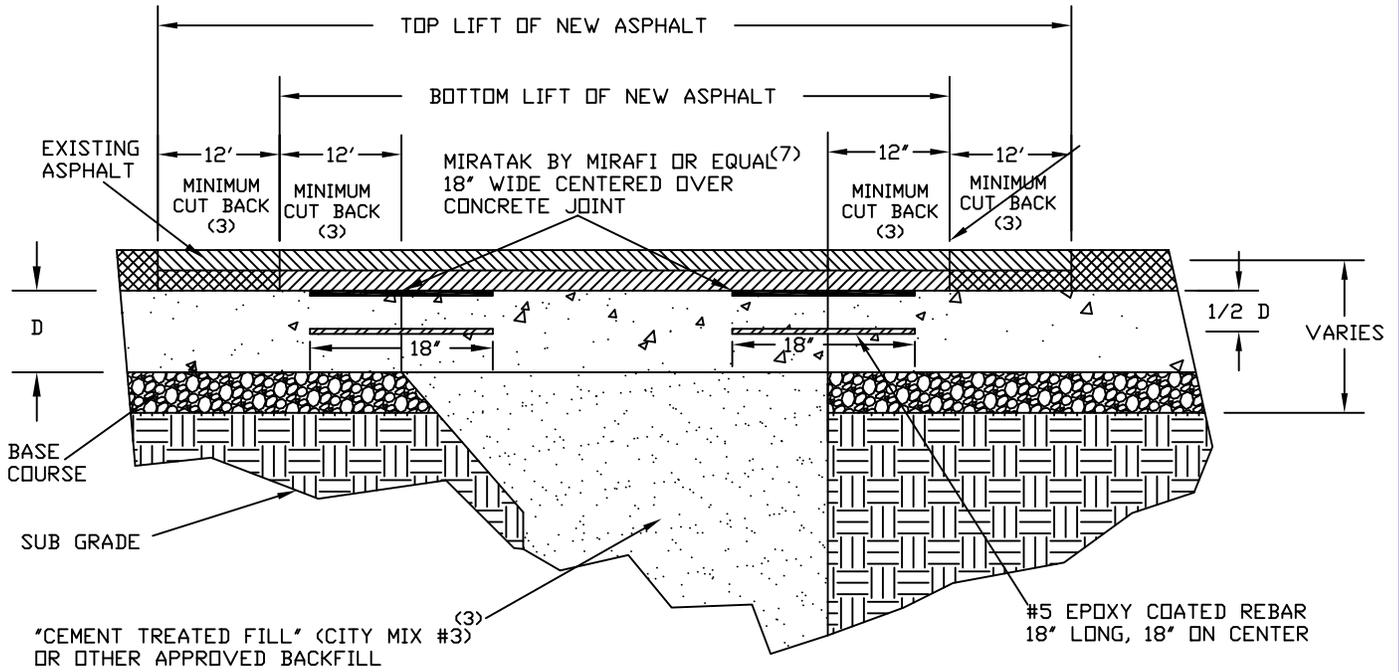


CITY OF CHEYENNE
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STANDARD DRAWING

STREET CUT REPAIRS
REPLACING BITUMINOUS PAVEMENT



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2014
STANDARD
DRAWING NO.
02515-01



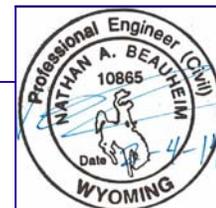
NOTES:

1. MATERIAL COMPACTION SHALL CONFORM TO SECTIONS 02220, 02225, 02226, 02231, AND 02512.
2. WHEN ANY PORTION OF THE PIPE HAS LESS THAN 18" OF COVER TO TOP OF FINISH GRADE OR THE TRENCH IS LESS THAN 30" IN WIDTH THE TRENCH SHALL BE BACKFILLED WITH CITY MIX 3 SLURRY.
3. CONCRETE BASE SHALL BE REINSTALLED WITH #5 EPOXY COATED REBAR, 18 INCHES ON CENTER AND 18" LONG CENTERED IN CONCRETE. MIRITAK FABRIC OR APPROVED EQUAL SHALL BE INSTALLED WITH THE CENTER OVER THE JOINT AND EXTENDED 3" BEYOND SAWCUT END.
4. DEPTH OF BITUMINOUS PATCH SHALL BE A MINIMUM OF 4" OR MATCH EXISTING UP TO 6" ON ALL STREETS DESIGNATED AS LOCAL OR ALLEYS. PATCH DEPTH OF 6" OR MATCH EXISTING UP TO 12" ON ALL STREETS DESIGNATED AS COLLECTOR OR ARTERIALS.
5. EXISTING PAVEMENT SHALL BE CUT BACK A MINIMUM OF 12" BEYOND ANY DISTURBED BASE COURSE, SUBGRADE OR BROKEN ASPHALT. IN ADDITION, THE ADJACENT PAVEMENT SHALL BE MILLED A DEPTH OF 1 1/2" NO LESS THAN ONE FOOT WIDE AND THE TOP LIFT OF PATCH INLAID. SEE SECTION 02515 FOR ADDITIONAL ASPHALT REMOVAL AND PATCHING REQUIREMENTS.



CITY OF CHEYENNE
AND
BOARD OF PUBLIC
UTILITIES
STANDARD DRAWING

STREET CUT REPAIRS
REPLACING ASPHALT WHERE
CONCRETE BASE EXIST

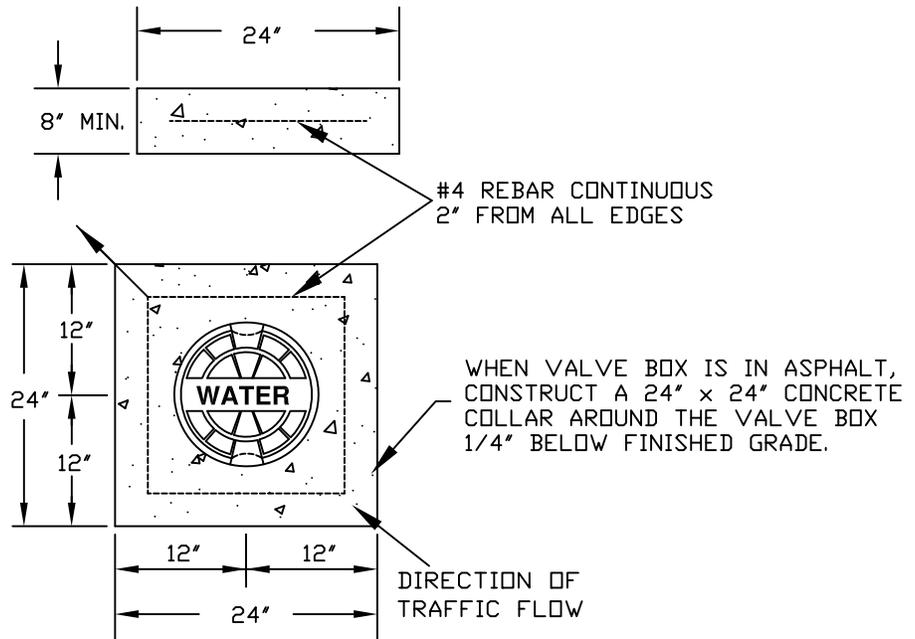


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2014

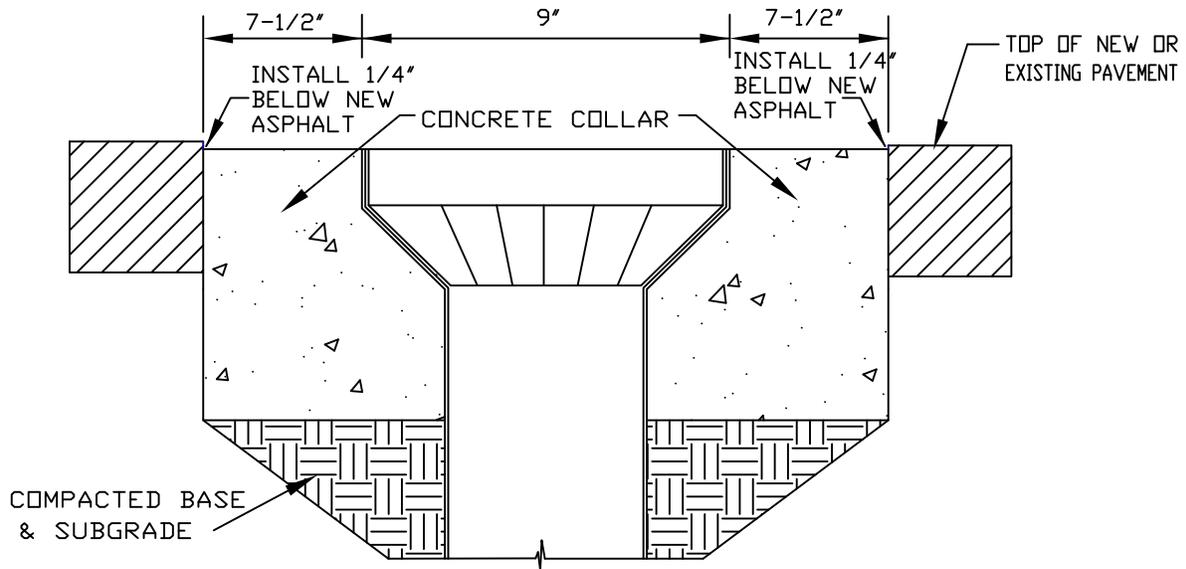
STANDARD
DRAWING NO.
02515-02

VALVE BOX COLLAR

NOT TO SCALE



NOTE:
CONCRETE SHALL BE 4500 PSI FIBER
REINFORCED AS PER CITY STANDARDS

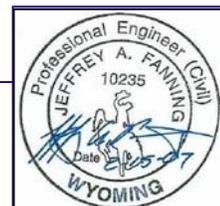


WATER VALVE ADJUSTMENT

NOTE:

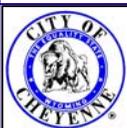
ADJUST WATER VALVES UPWARD OR DOWNWARD AS REQUIRED, FINAL ADJUSTMENTS SHALL BE MADE AFTER PAVING AND BEFORE SEAL COATING. NO PAYMENT SHALL BE MADE BEFORE ADJUSTMENT OF NEW VALVES TO FINAL GRADE.

* WHEN CONCRETE COLLAR IS PLACED ABUTTING CONCRETE PAVEMENT, DEPTH SHALL BE EQUAL TO THAT OF PAVEMENT SECTION, WITH A MINIMUM OF 8".



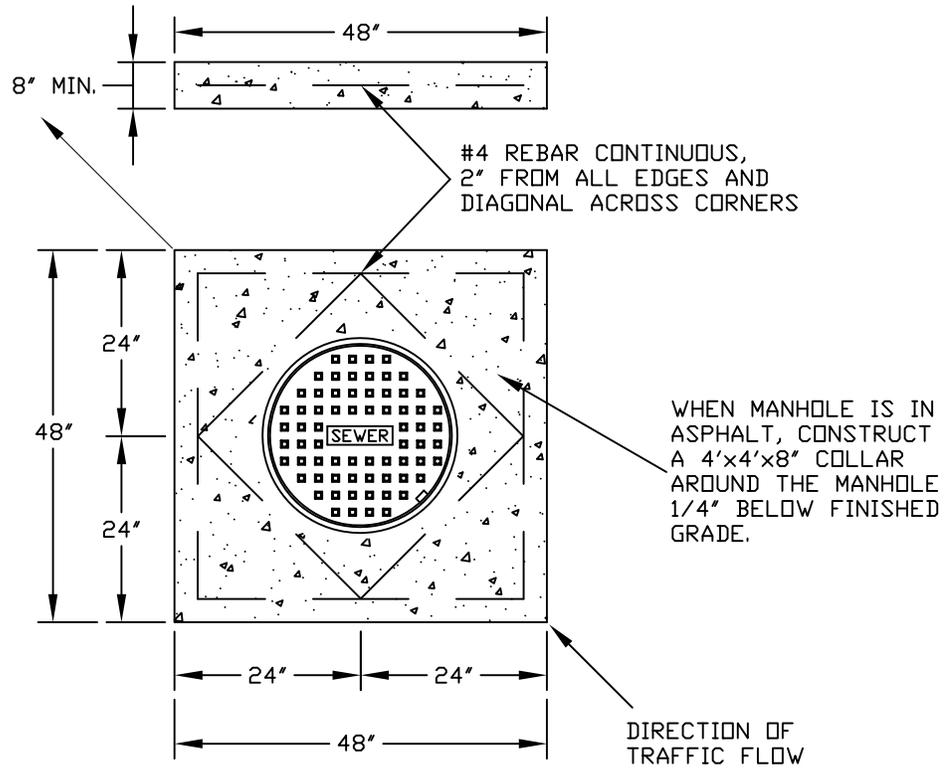
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2007

STANDARD
DRAWING NO.
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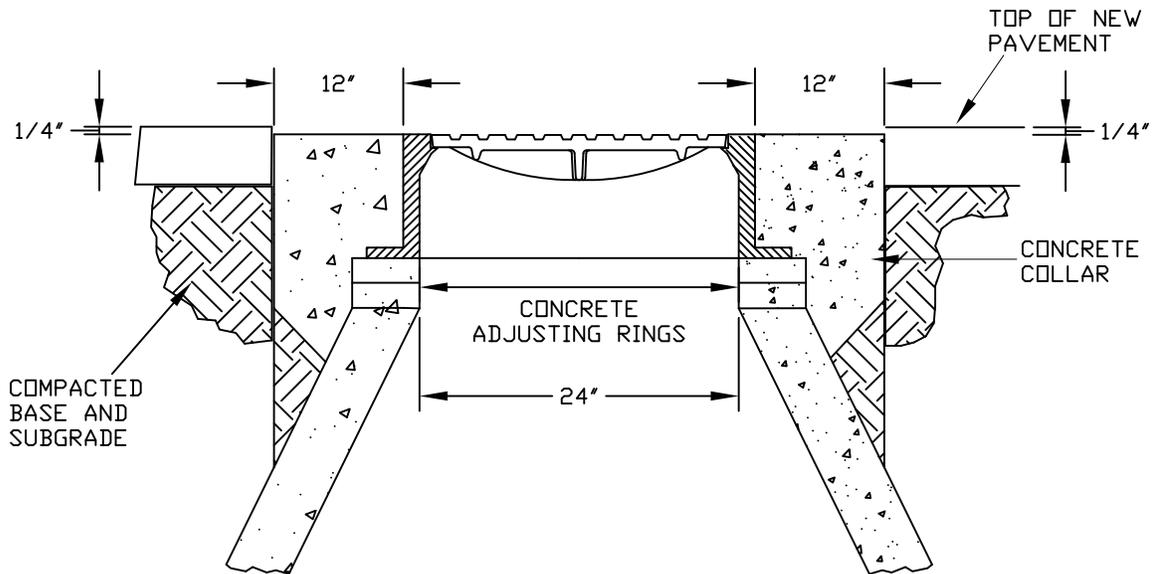


CITY OF CHEYENNE
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BOARD OF PUBLIC
UTILITIES
STANDARD DRAWING

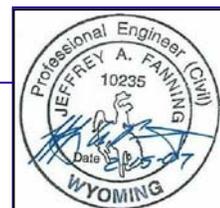
VALVE BOX
ADJUSTMENT DETAIL



NOTE:
THE CONCRETE SHALL BE 4500 PSI FIBER REINFORCED AS PER CITY STANDARDS



NOTE:
ADJUST MANHOLE UPWARD WITH ADJUSTING RINGS UNDER FRAME. ADJUST MANHOLE DOWNWARDS BY REMOVING A PORTION OF THE MANHOLE RISER AND REBUILDING TO PROPER DIAMETER. SLOPE MANHOLE RING AS REQUIRED TO MATCH STREET GRADE AND CROSS SLOPE. FINAL MANHOLE ADJUSTMENT WILL BE MADE AFTER PAVING AND BEFORE SEAL COATING.
6" MAX. ADJUSTMENT ON ALL NEW INSTALLATIONS



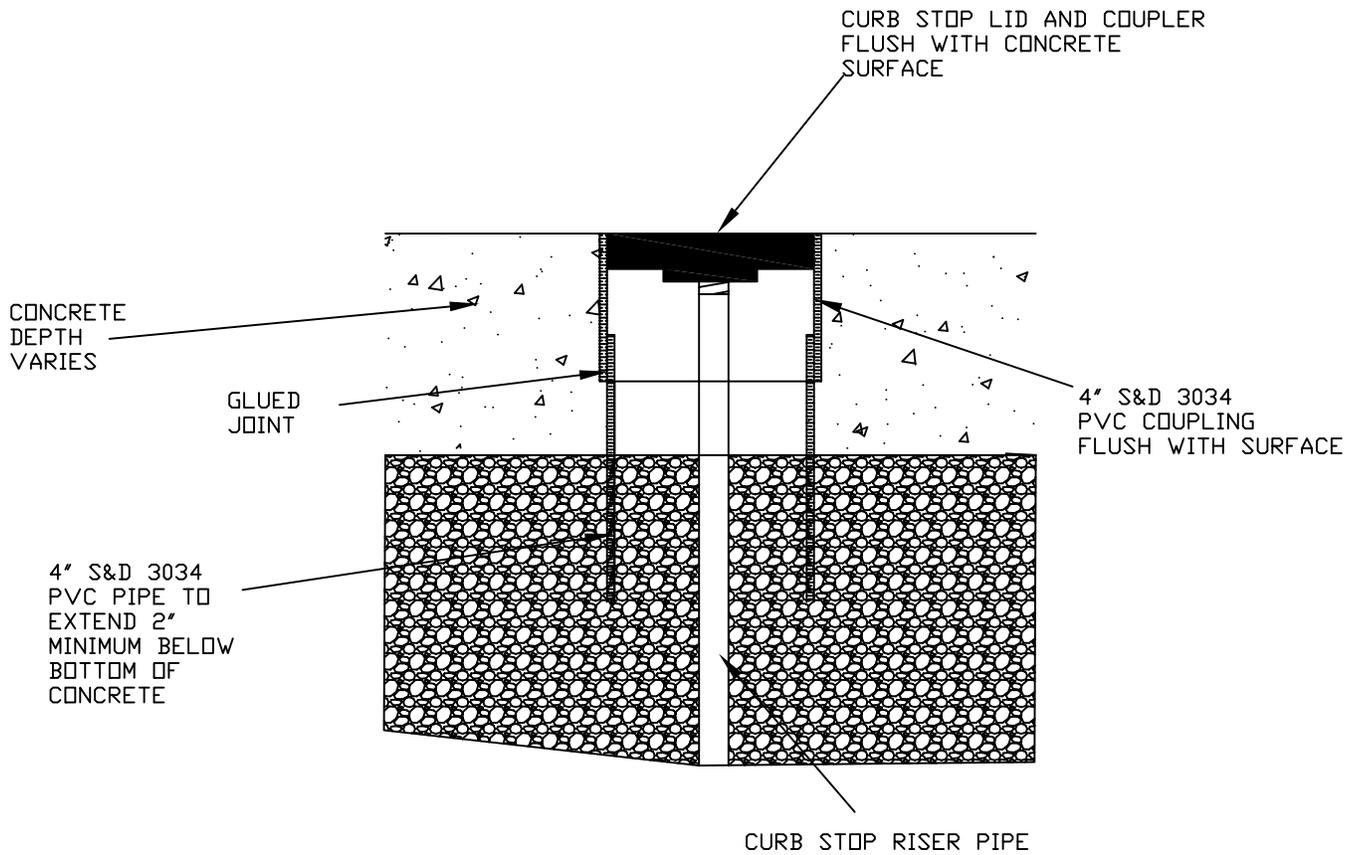
REVISED
2007

STANDARD
DRAWING NO.
02570-02



CITY OF CHEYENNE
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BOARD OF PUBLIC
UTILITIES
STANDARD DRAWING

MANHOLE COVER
AND
MANHOLE ADJUSTMENT DETAILS



TYPICAL CURB STOP ADJUSTMENT

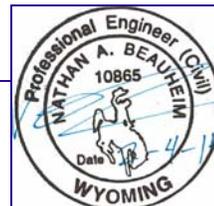
NOTES:

1. ALL CURB STOPS PLACED IN CONCRETE SHALL BE SLEEVED IN ACCORDANCE WITH THIS DRAWING.



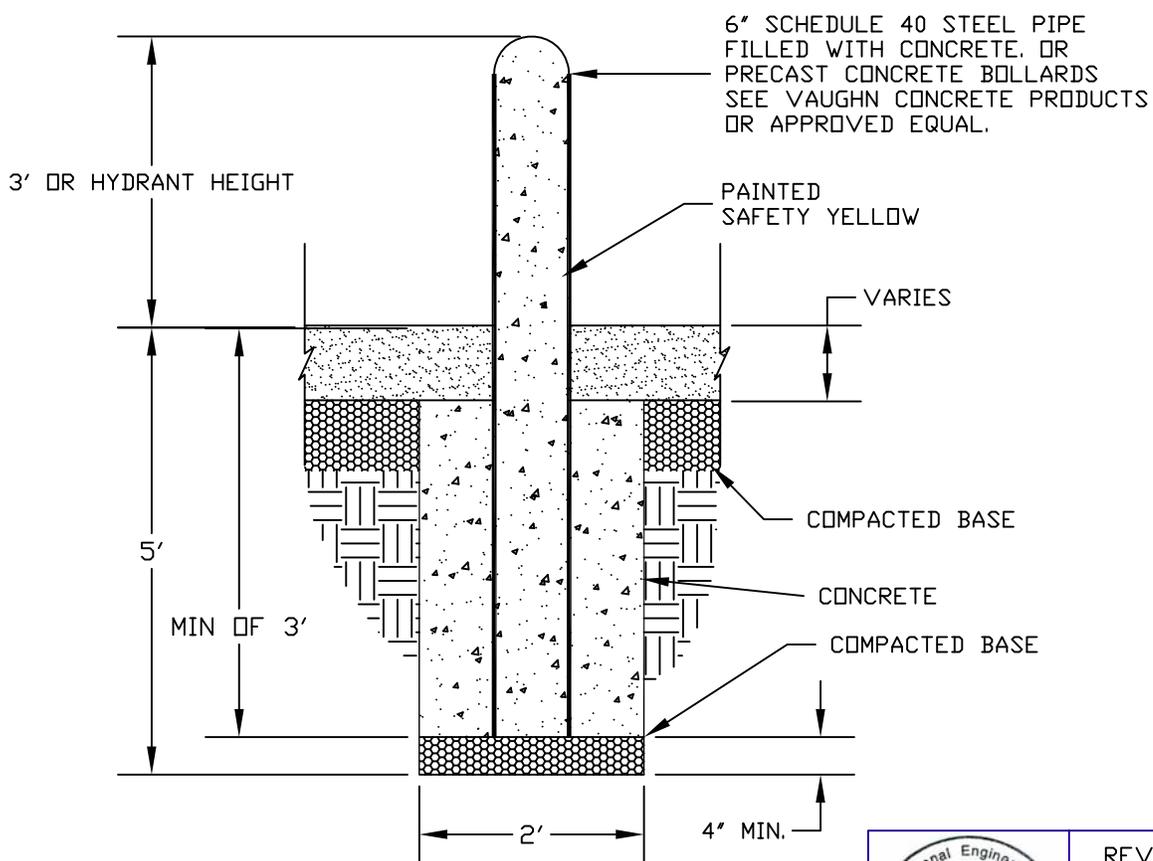
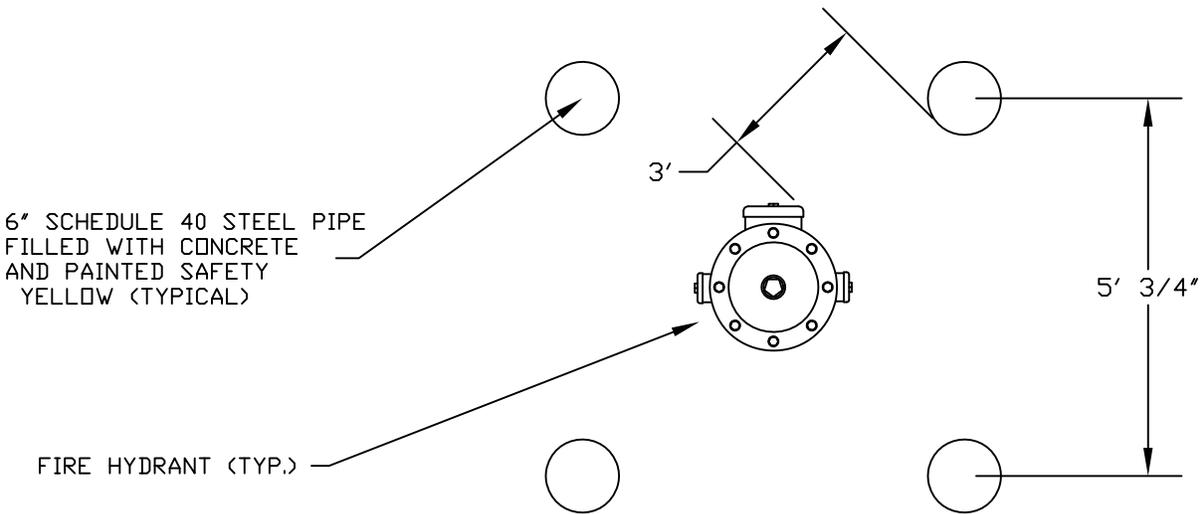
CITY OF CHEYENNE
AND
BOARD OF PUBLIC
UTILITIES
STANDARD DRAWING

ADJUSTING CURB STOP IN CONCRETE DETAIL



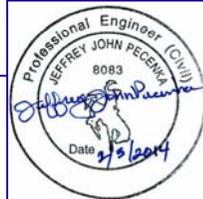
NEW
2014

STANDARD
DRAWING NO.
02570-03



CITY OF CHEYENNE
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STANDARD DRAWING

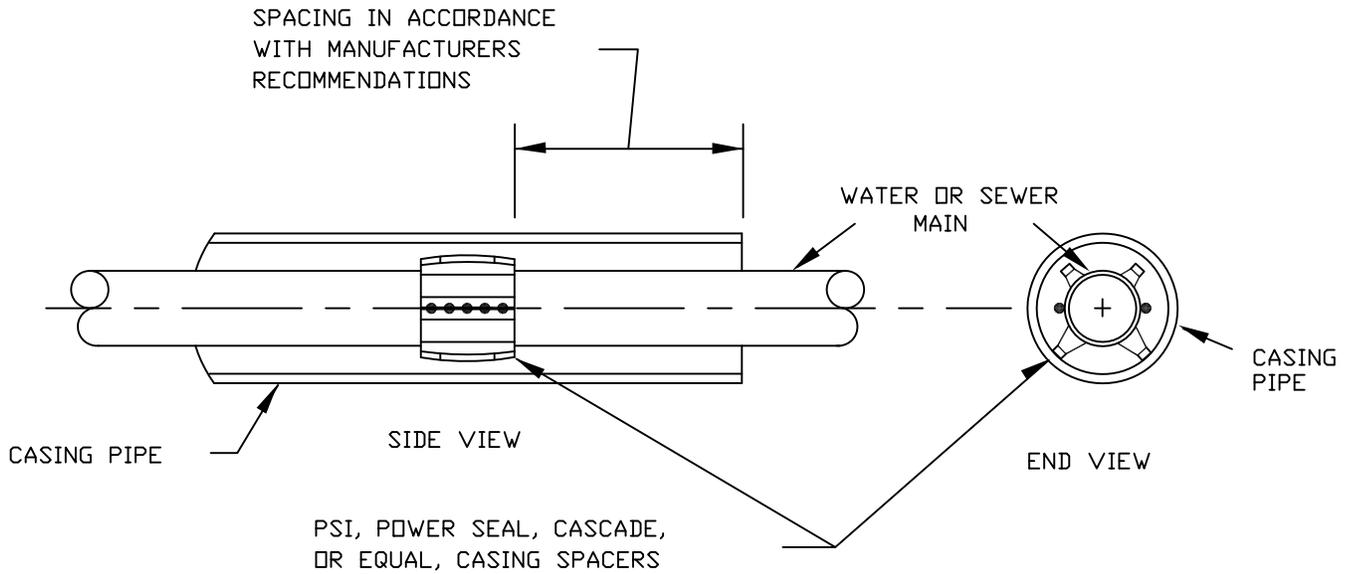
BOLLARD DETAIL



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2014

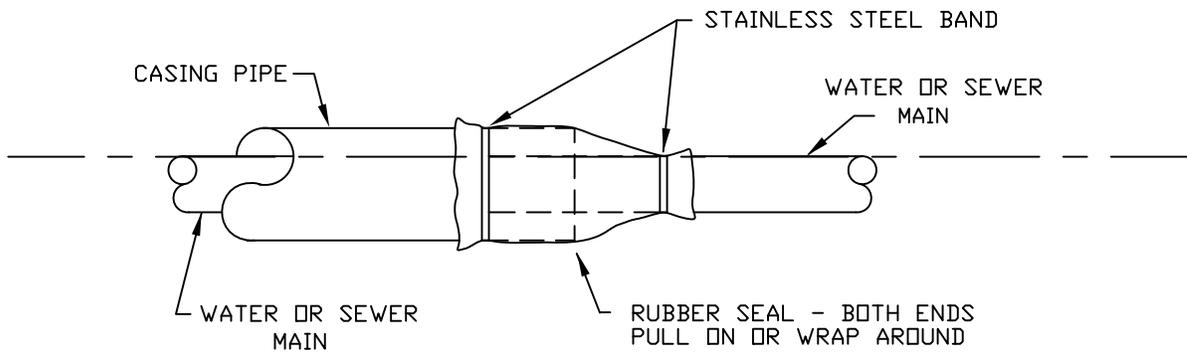
STANDARD
DRAWING NO.
02645-02

CARRIER PIPE SKID (CASING SPACERS)



NOTE:

1. VENT PIPE SHALL BE INSTALLED WHEN REQUIRED BY THE B.O.P.U.
2. CASING PIPE WILL BE C-900 PVC-DR-25 WATER PIPE FOR 12" AND SMALLER C-905 DR-41 FOR LARGER THAN 12".
3. CASING SHALL EXTEND 10' EITHER SIDE OF CROSSING WITH OTHER UTILITY.
4. CASING SHALL BE PROPERLY DESIGNED FOR ROAD AND RAILWAY CROSSING.
5. THE INSIDE DIAMETER OF THE CASING PIPE SHALL BE OF ADEQUATE SIZE TO ACCOMMODATE THE CARRIER PIPE AND SPACERS.



CASING END SEALS



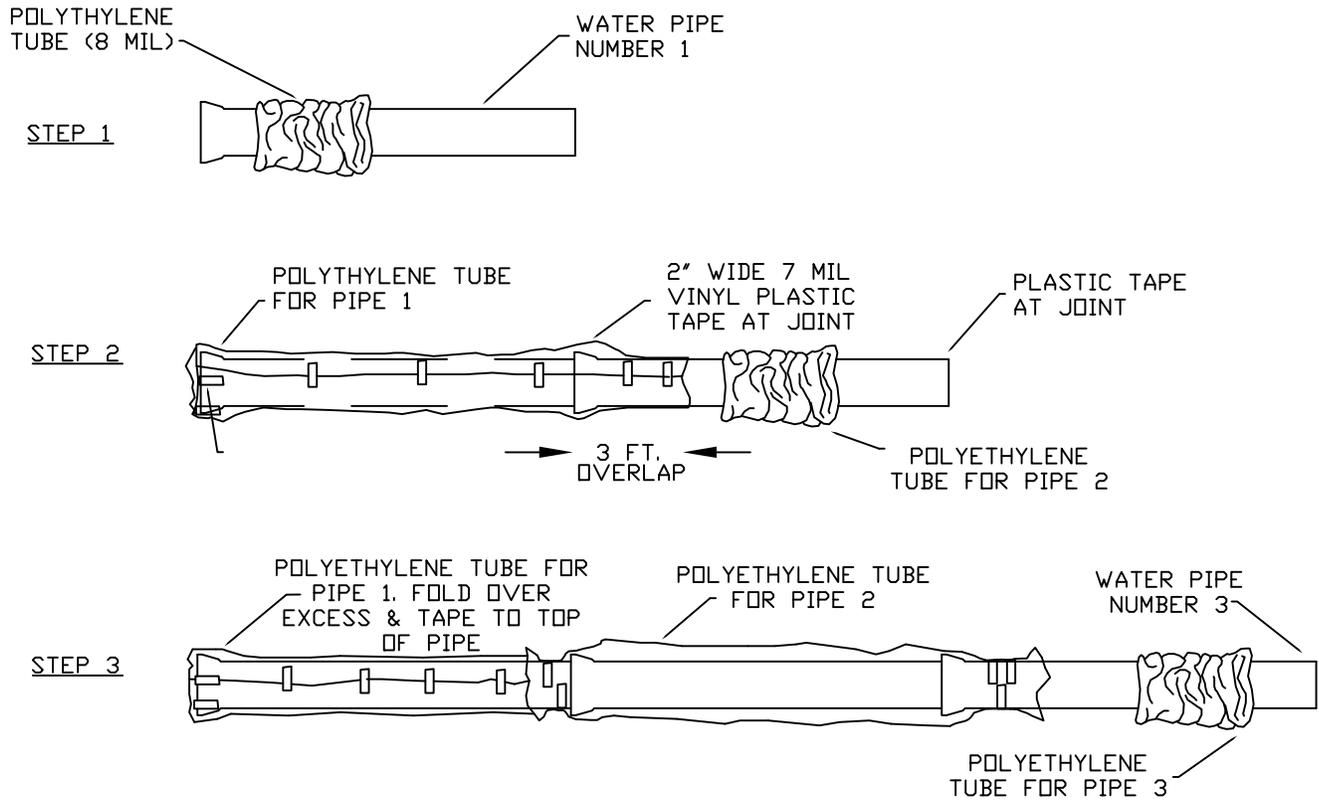
CITY OF CHEYENNE
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BOARD OF PUBLIC
UTILITIES
STANDARD DRAWING

CASING PIPE DETAIL



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2007

STANDARD
DRAWING NO.
02665-01



FIELD INSTALLATION - POLYETHYLENE WRAP

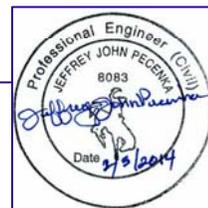
- STEP 1 PLACE TUBE OF 8 MIL THICKNESS, ANSI AWWA C105/A215 V-BID FILM POLYETHYLENE TUBE MATERIAL ON PIPE JUST PRIOR TO LOWERING IT INTO THE TRENCH. NOT WHEN IT IS STOCKPILED.
- STEP 2 PULL THE TUBE OVER THE LENGTH OF THE PIPE. TAPE TUBE TO JOINT. FOLD MATERIAL AROUND THE ADJACENT SPIGOT END AND WRAP WITH TAPE TO HOLD PLASTIC IN PLACE.
- STEP 3 OVERLAP FIRST TUBE WITH ADJACENT TUBE OF 4 MIL CROSS LAMINATED POLYETHYLENE TUBE ENCASMENT AND SECURE WITH PLASTIC ADHESIVE TAPE, THE POLYETHYLENE TUBE MATERIAL COVERING THE PIPE SHALL BE LOOSE, EXCESS MATERIAL SHALL BE NEATLY DRAWN AROUND THE PIPE BARREL, FOLDED ON TOP OF THE PIPE AND TAPED IN PLACE WITH 3 FOOT OVERLAPS.

NOTE:
DUCTILE IRON PIPE AND RELATED CONSTRUCTION MATERIALS SHALL BE DOUBLE WRAPPED.

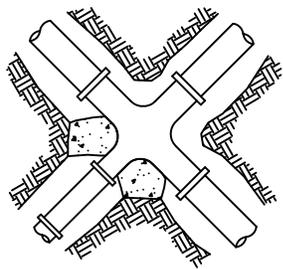


CITY OF CHEYENNE
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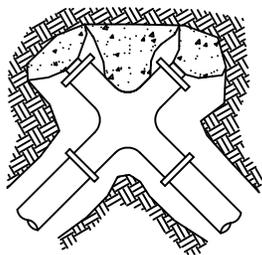
POLYETHYLENE WRAP



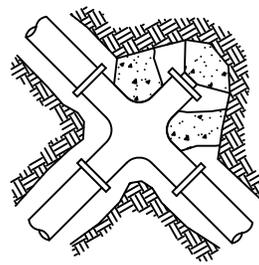
REVISED
2014
STANDARD
DRAWING NO.
02665-02



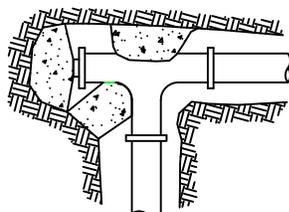
UNBALANCED CROSS



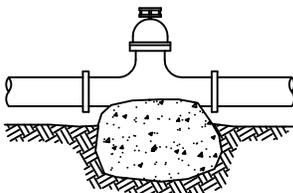
PLUGGED CROSS



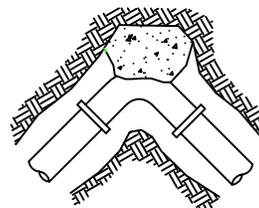
PLUGGED CROSS



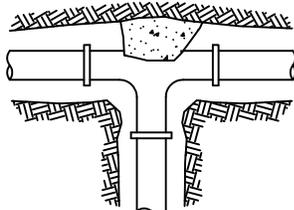
PLUGGED TEE



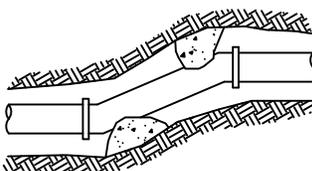
VALVE



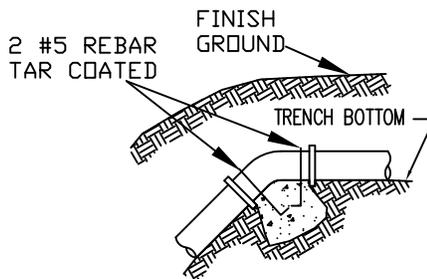
HORIZONTAL BEND



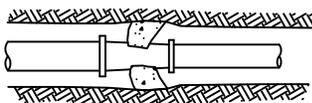
TEE



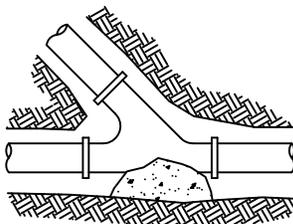
HORIZONTAL OFFSET



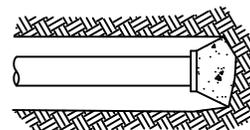
VERTICAL BEND
ENGINEER TO SPECIFY CONSTRUCTION



REDUCER



"Y" BRANCH



PLUG OR CAP DEAD END

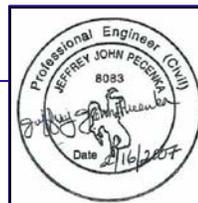
NOTES:

1. ALL BLOCKING SHALL BEAR AGAINST UNDISTURBED MATERIAL.
2. FITTINGS TO BE SEPARATED FROM THRUST BLOCK WITH 2 LAYERS OF 8 MIL. POLYETHYLENE.
3. ALL TIE DOWN RODS SHALL BE TAR COATED.
4. ALL CONCRETE SHALL HAVE A MINIMUM 28 DAY STRENGTH OF 4,000 PSI.



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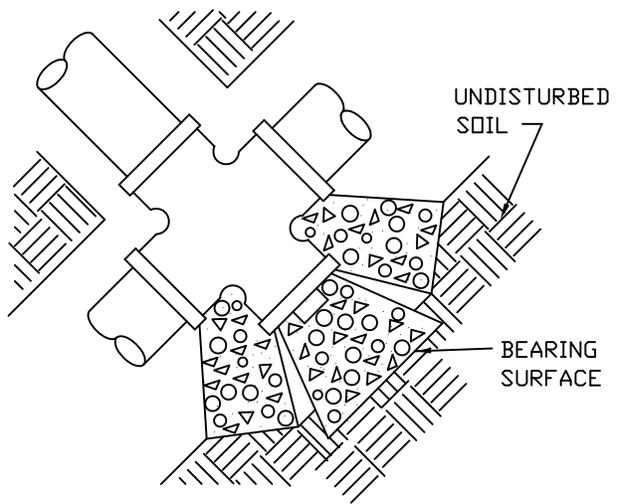
THRUST BLOCK DETAIL



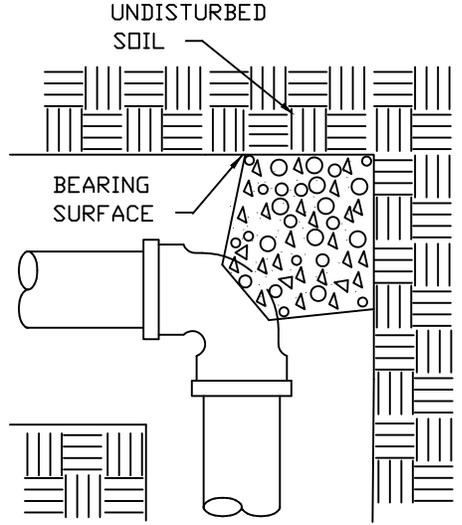
REVISED
2007

STANDARD
DRAWING NO.
02665-03

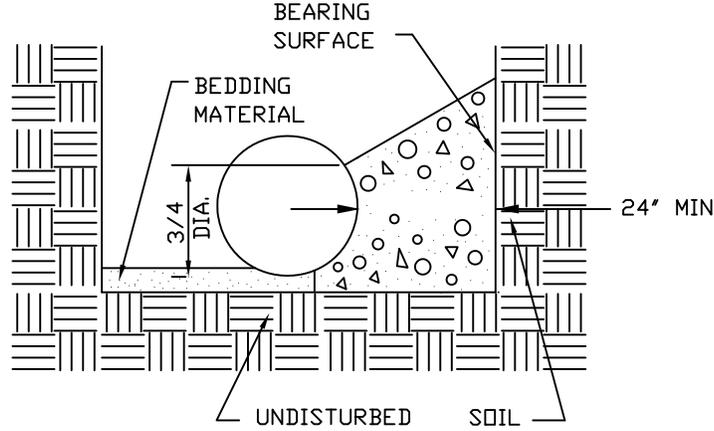
NOT TO SCALE



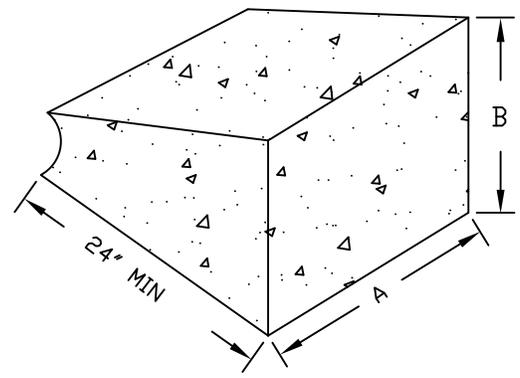
SINGLE PLUGGED CROSS



HORIZONTAL BEND



TYPICAL CROSS SECTION



THRUST BLOCK

MINIMUM DIMENSIONS FOR THRUST BLOCKING

FITTING SIZE	TEES & PLUGS		90° BENDS		45° BENDS & WYES		REDUCERS & 22 1/2° BENDS		11 1/4° BENDS	
	A	B	A	B	A	B	A	B	A	B
4"	1'-8"	1'-6"	2'-0"	1'-6"	2'-0"	1'-6"	1'-6"	0'-9"	1'-6"	0'-9"
6"	2'-8"	2'-0"	3'-3"	2'-9"	2'-6"	2'-0"	2'-6"	1'-0"	1'-6"	0'-6"
8"	3'-6"	3'-0"	4'-3"	3'-6"	3'-8"	2'-6"	2'-3"	2'-0"	1'-6"	1'-0"
10"	4'-3"	4'-0"	4'-6"	5'-3"	4'-0"	3'-3"	3'-0"	2'-3"	1'-6"	1'-0"
12"	5'-6"	4'-6"	6'-8"	5'-0"	4'-6"	4'-0"	3'-6"	2'-9"	2'-0"	1'-0"

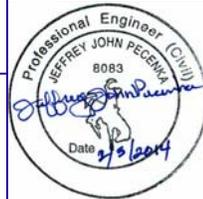
NOTE:

1. FITTINGS TO BE SEPARATED FROM BLOCKS WITH AN APPROVED BOND BREAKER, SUCH AS POLY WRAP.
2. ALL BLOCKS TO BEAR AGAINST UNDISTURBED MATERIAL.
3. ALL CONCRETE SHALL HAVE A MINIMUM STRENGTH OF 4,000 PSI.
4. FOR FIRE HYDRANTS, THRUST BLOCKS A = 39", B = 33", LENGTH = 36"



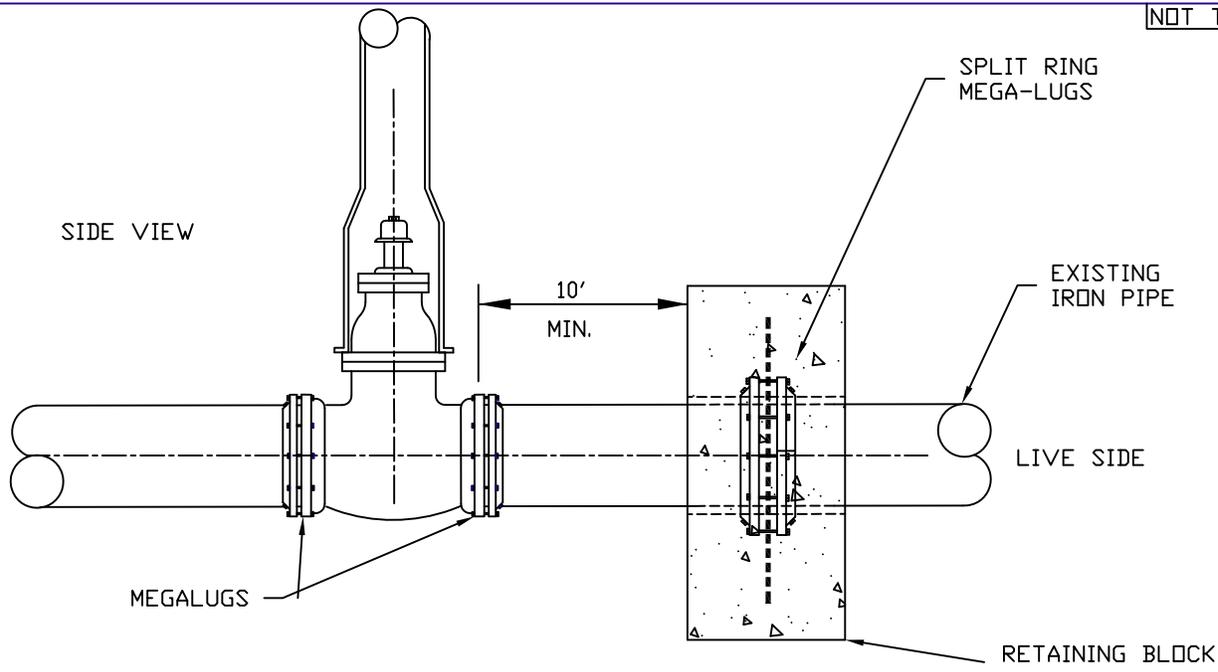
CITY OF CHEYENNE AND BOARD OF PUBLIC UTILITIES STANDARD DRAWING

MINIMUM THRUST BLOCK REQUIREMENTS



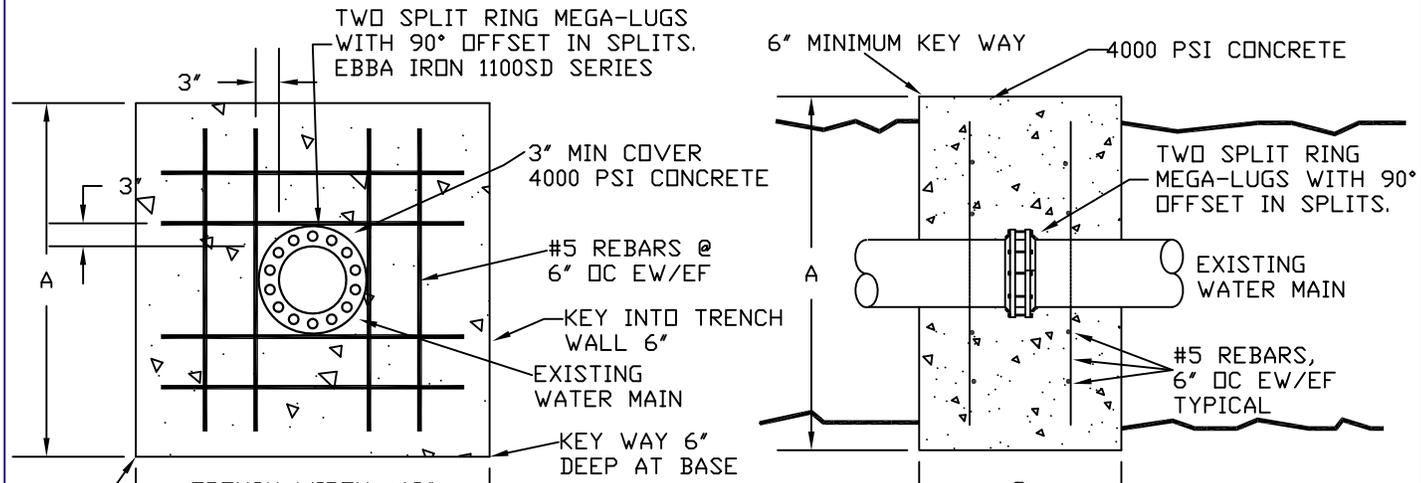
REVISED 2014
STANDARD DRAWING NO. 02665-04

NOT TO SCALE



NOTES:

1. ALL CONSTRUCTION SHALL BE PLACED FIVE DAYS PRIOR TO ANY CONSTRUCTION WORK ON THE WATER MAIN. THREE DAYS LEAD TIME IS PERMISSABLE IF HIGH EARLY STRENGTH CONCRETE IS USED.
2. LOADING AND MATERIAL TO BE BASED ON 150 PSI WORKING PRESSURE WITH A MINIMUM SAFETY FACTOR OF 2:1.
3. PLACE ALL COMPACTED BACKFILL OR SLURRY MIX BEFORE PRESSURIZING MAIN.
4. KEY THRUST BLOCK INTO TRENCH WALL AT LEAST 6".

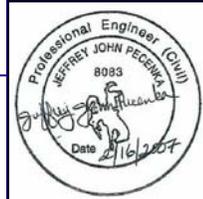


FITTING SIZES	A	B
4"	2'-4"	2'-0"
6"	2'-4"	2'-6"
8"	3'-6"	3'-3"
10"	4'-3"	4'-0"
12"	5'-6"	4'-6"

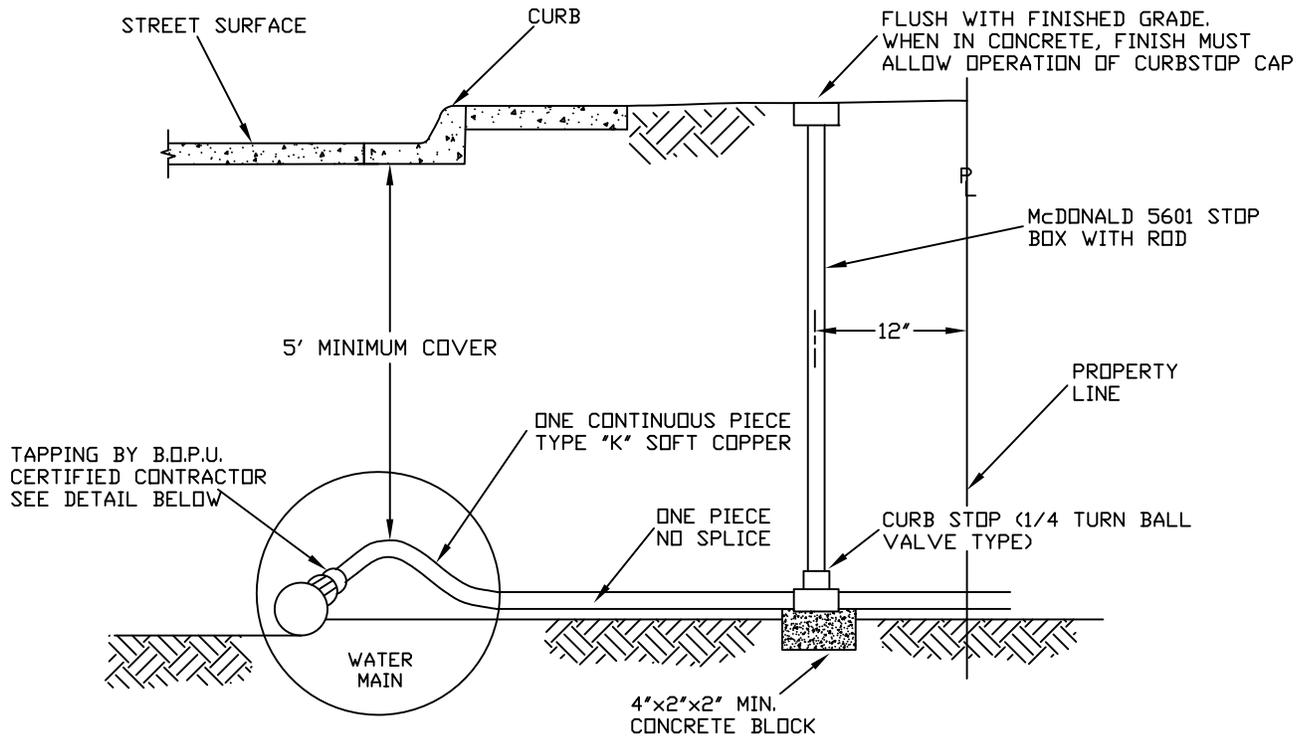


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STANDARD DRAWING

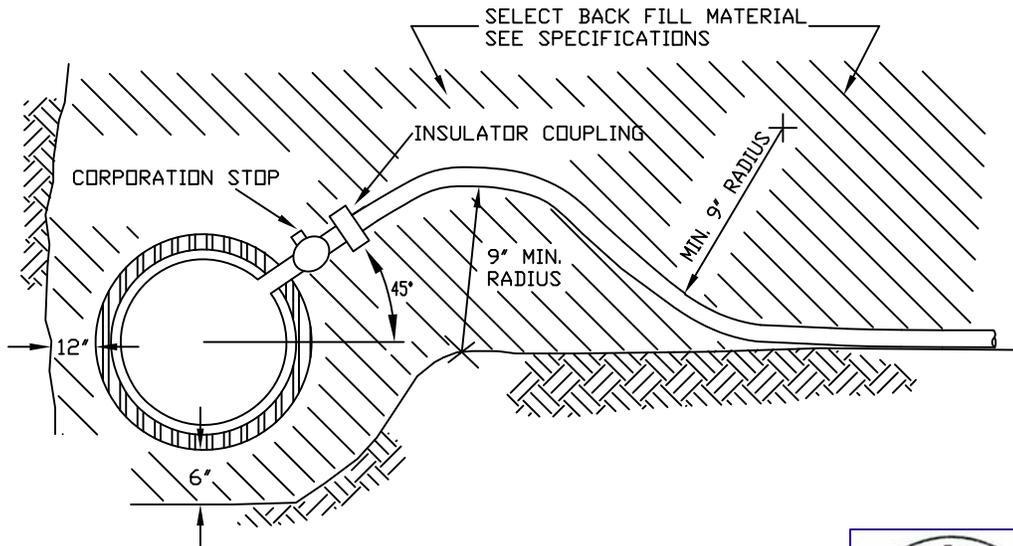
VALVE RESTRAINT BLOCK



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2007
STANDARD
DRAWING NO
02665-05

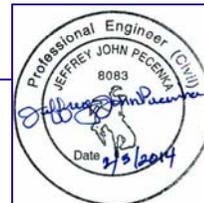


- NOTE:
1. B.O.P.U. MAKES TAPS 3" AND LARGER.
 2. THIS DRAWING IS FOR TAPPING DUCTILE IRON PIPE. SEE PVC SPECIFICATIONS FOR TAPPING PVC PIPE.
 3. ALL METERS PITS SHALL BE LOCATED A MIN. OF 2' (FEET) AND A MAX. OF 5' (FEET) INSIDE PROPERTY LINE OR AS APPROVED ON PLANS.
 4. 1½" TO 2" WILL BE ALLOWED TO TAP AT 90 DEGREES TO MAIN.
 5. ALL METERS 1½" AND LARGER SHALL BE INSTALLED IN PITS.

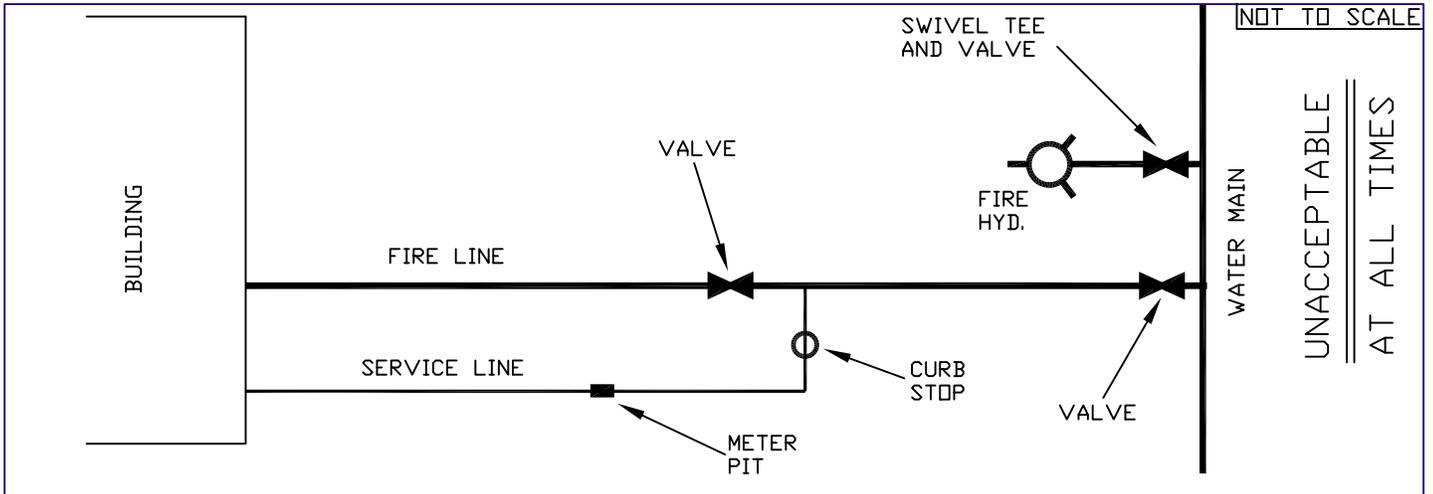


CITY OF CHEYENNE
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STANDARD DRAWING

WATER SERVICE LINE AND TAP

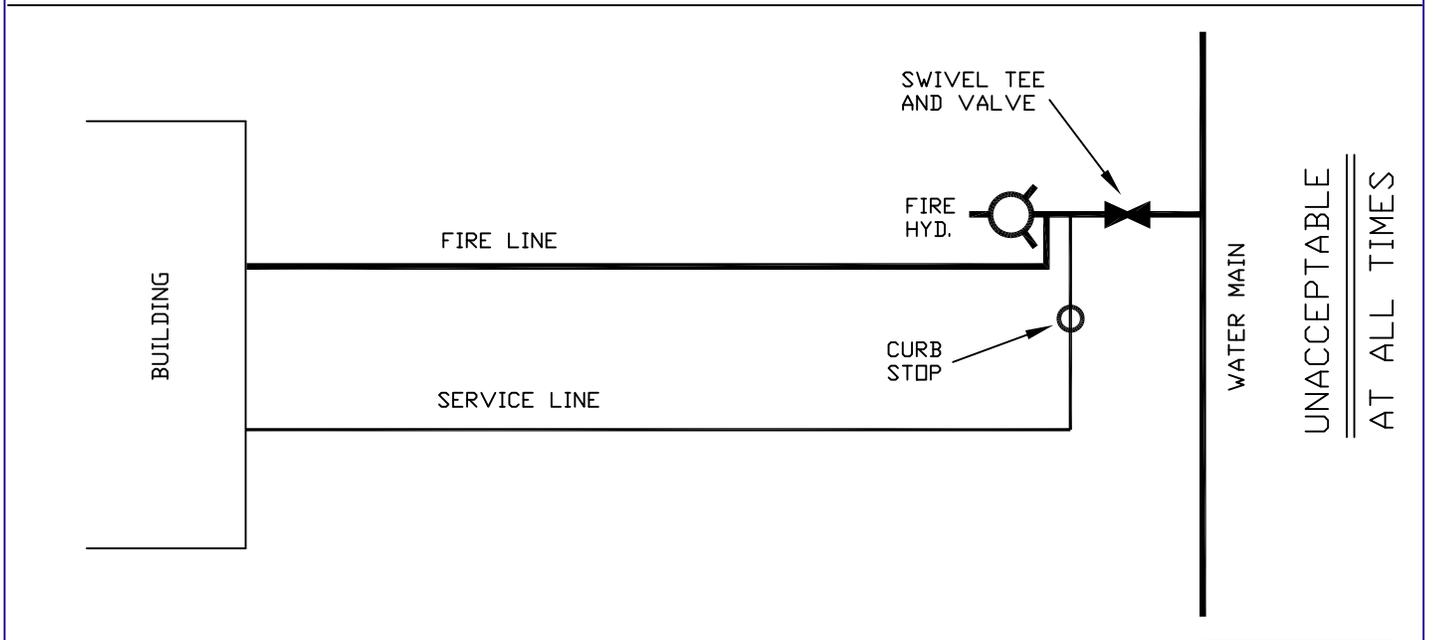


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2014
STANDARD
DRAWING NO.
02665-06

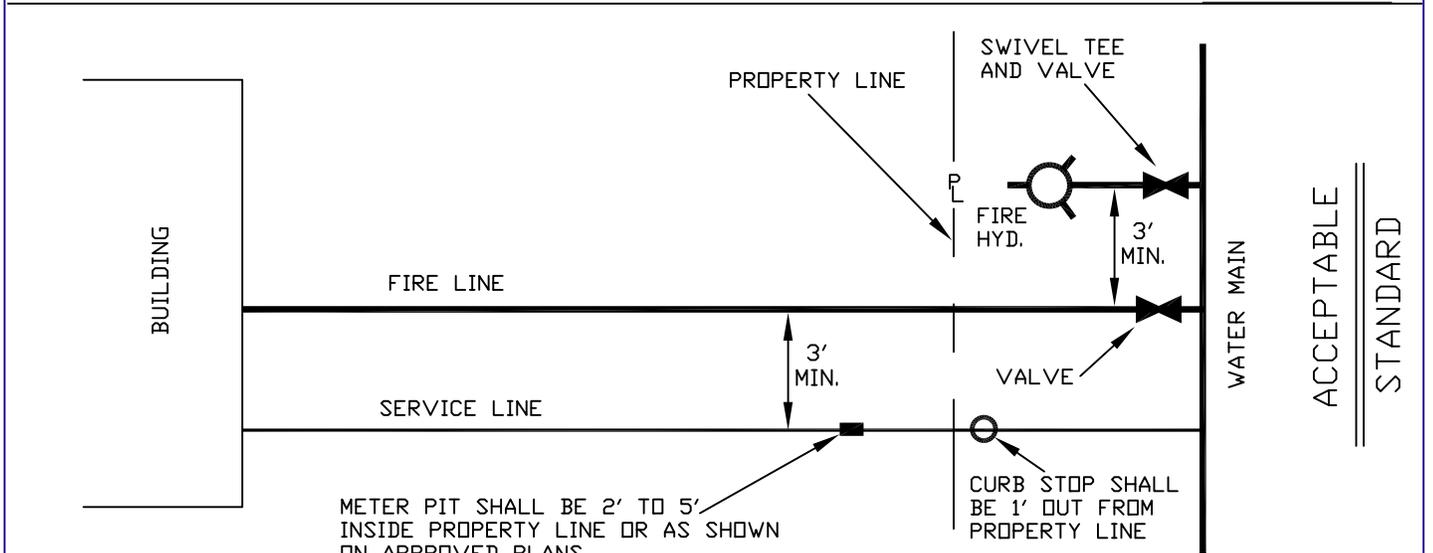


NOT TO SCALE

UNACCEPTABLE
AT ALL TIMES



UNACCEPTABLE
AT ALL TIMES

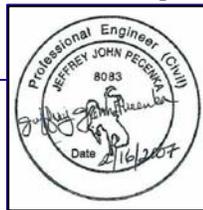


ACCEPTABLE
STANDARD



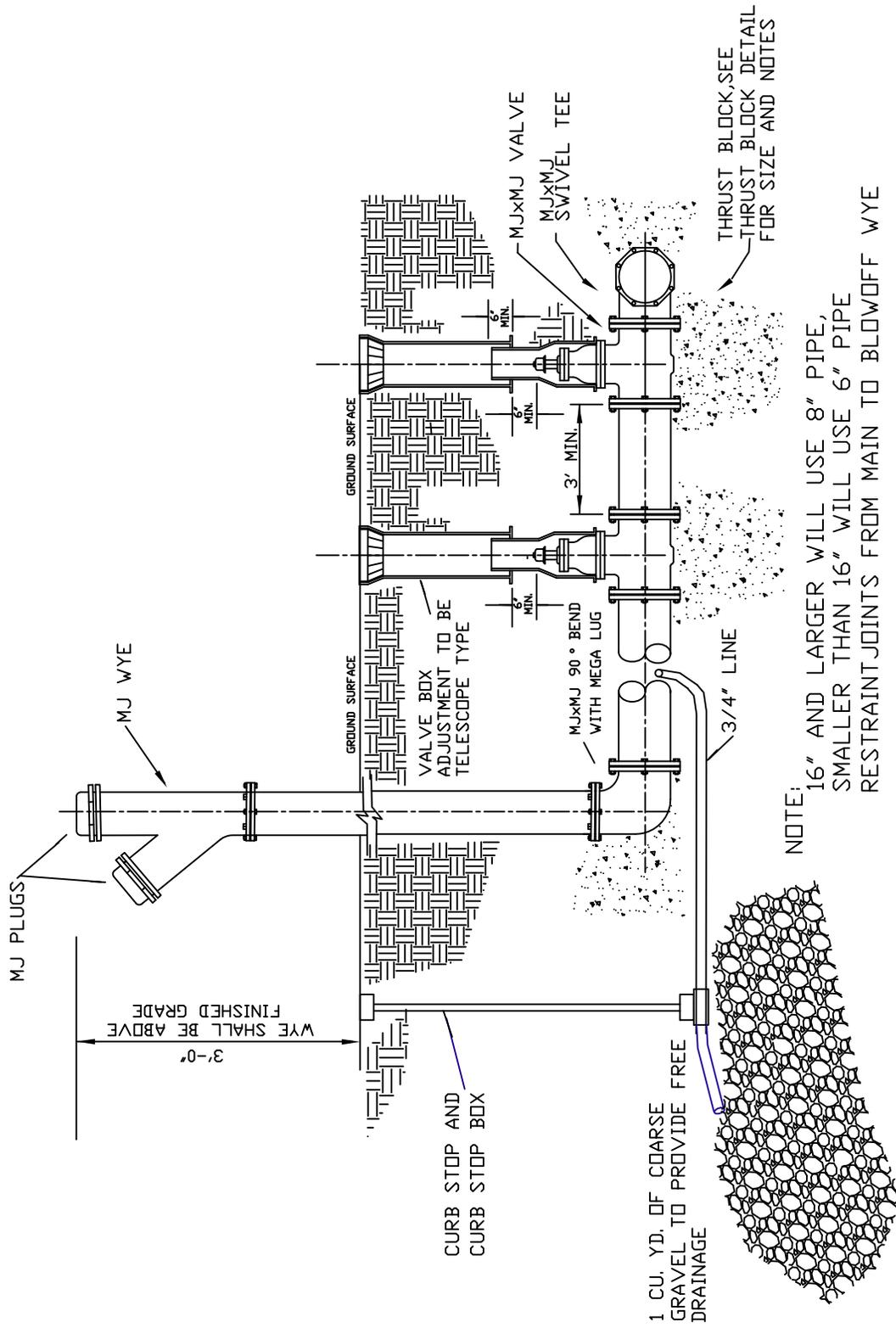
CITY OF CHEYENNE
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UTILITIES
STANDARD DRAWING

SERVICE LINE / FIRE LINE
INSTALLATIONS



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2007

STANDARD
DRAWING NO.
02665-07

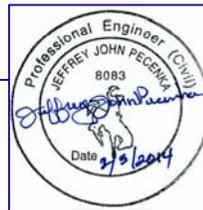


NOTE:
 16" AND LARGER WILL USE 8" PIPE,
 SMALLER THAN 16" WILL USE 6" PIPE
 RESTRAINT JOINTS FROM MAIN TO BLOWOFF WYE
 ALL VALVES SHALL HAVE VALVE BOX ADAPTOR II



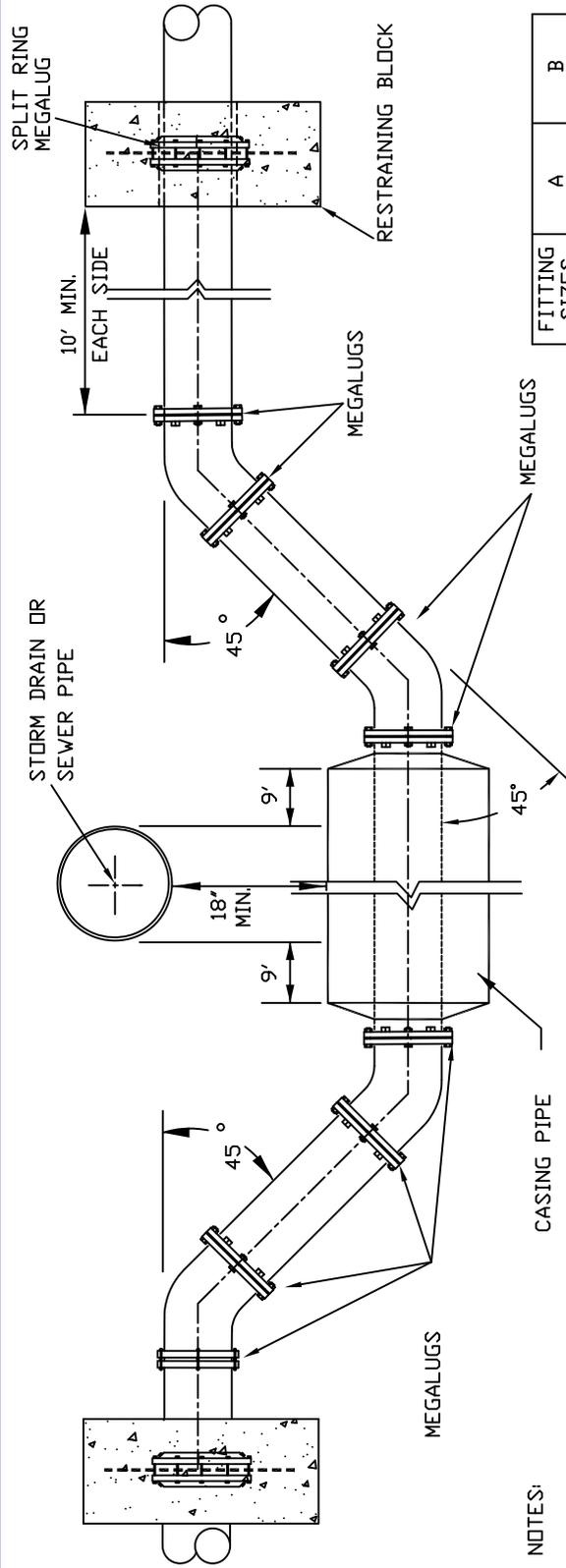
CITY OF CHEYENNE
 AND
 BOARD OF PUBLIC
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 STANDARD DRAWING

6" BLOW OFF DETAIL



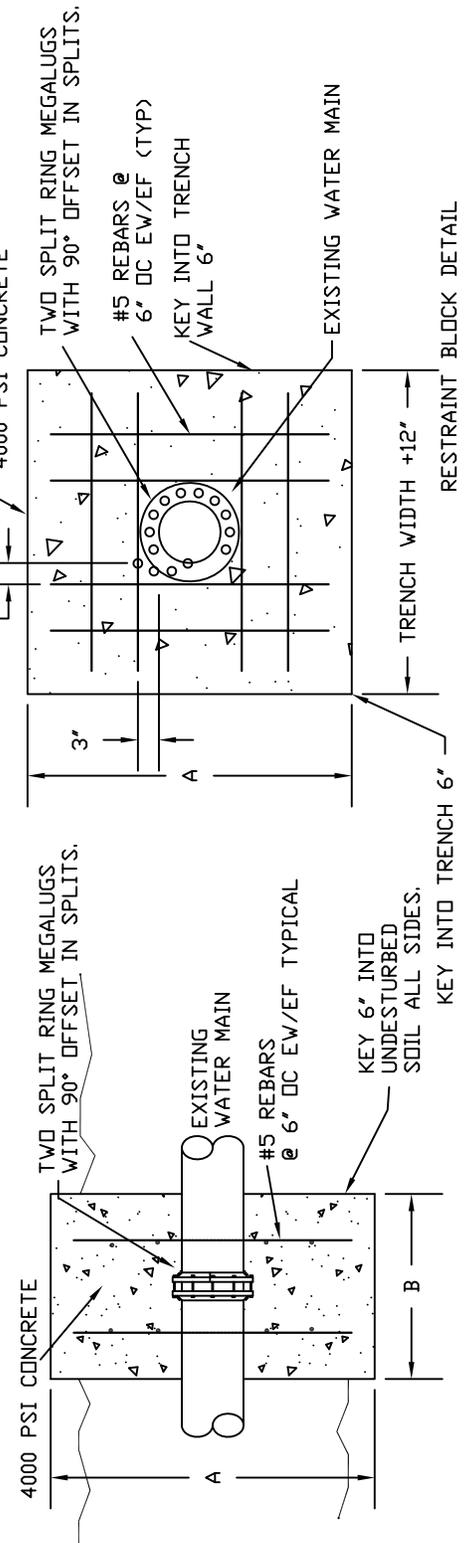
REVISED
 2014

STANDARD
 DRAWING NO.
 02665-08



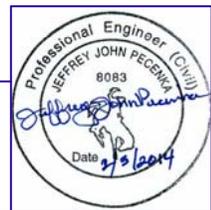
FITTING SIZES	A	B
4"	2'-4"	2'-0"
6"	2'-4"	2'-6"
8"	3'-6"	3'-3"
10"	4'-3"	4'-0"
12"	5'-6"	4'-6"

- NOTES:
1. THRUST BLOCKS MAY BE REQUIRED IN UNSTABLE MATERIAL.
 2. PER D.E.Q. REQUIREMENTS, A CASING PIPE OR APPROPRIATE PIPE ENCASUREMENT, SHALL BE REQUIRED WHEN WATER MAIN IS LESS THAN 18" ABOVE A SANITARY OR STORM SEWER.
 3. JOINTS INSIDE THE CASING PIPE OR THE PIPE ENCASUREMENT MUST ALSO BE RESTAINED.
 4. SUPPORT SANITARY SEWER OVER WATER MAIN.
 5. SEE DRAWING 02665-01 FOR DETAILS ON CASING PIPE SPACERS AND END SEALS.

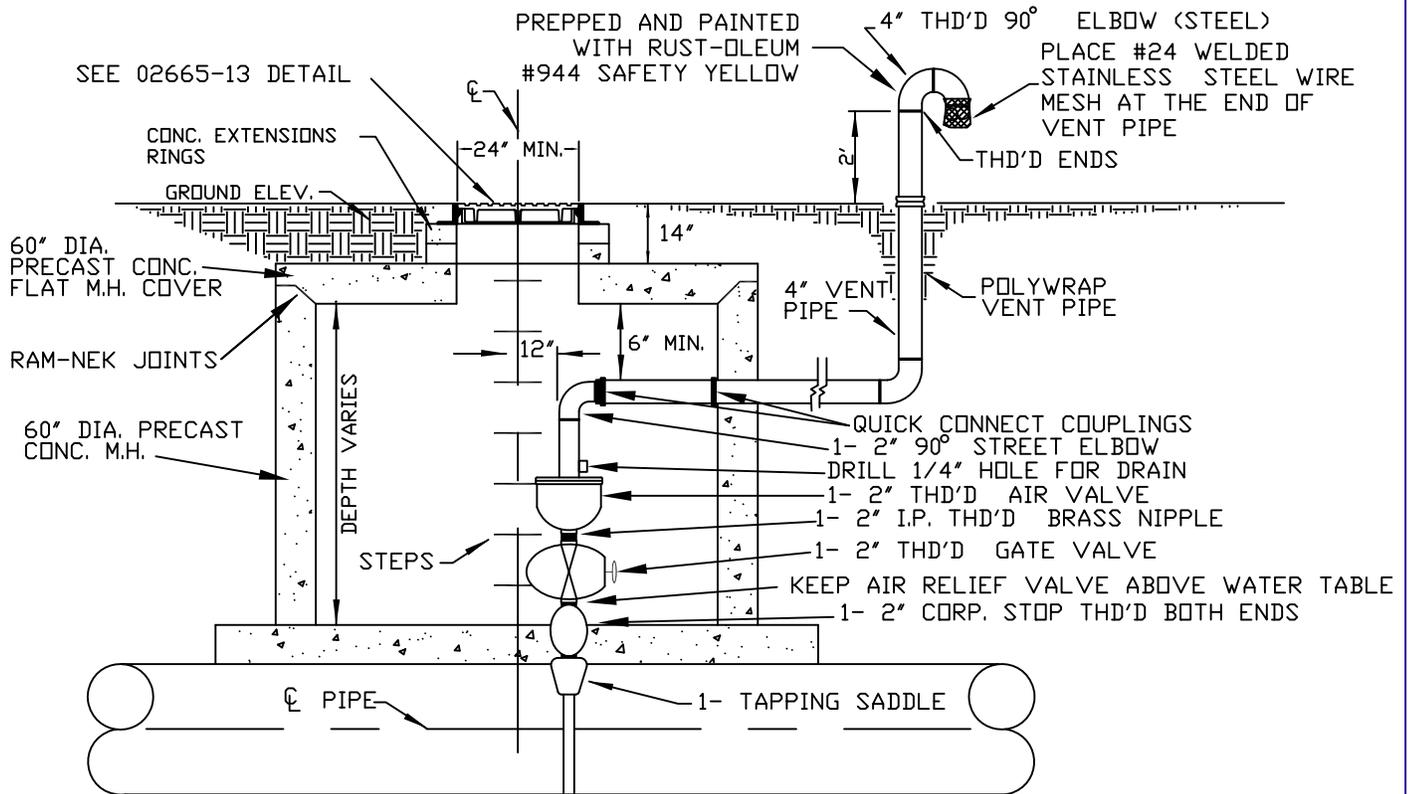


CITY OF CHEYENNE
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STANDARD DRAWING

WATER MAIN ADJUSTMENT

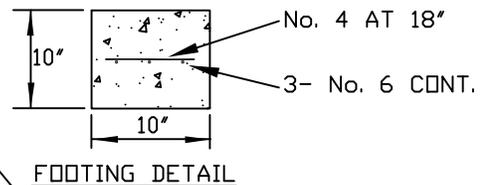


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2014
STANDARD
DRAWING NO.
02665-09

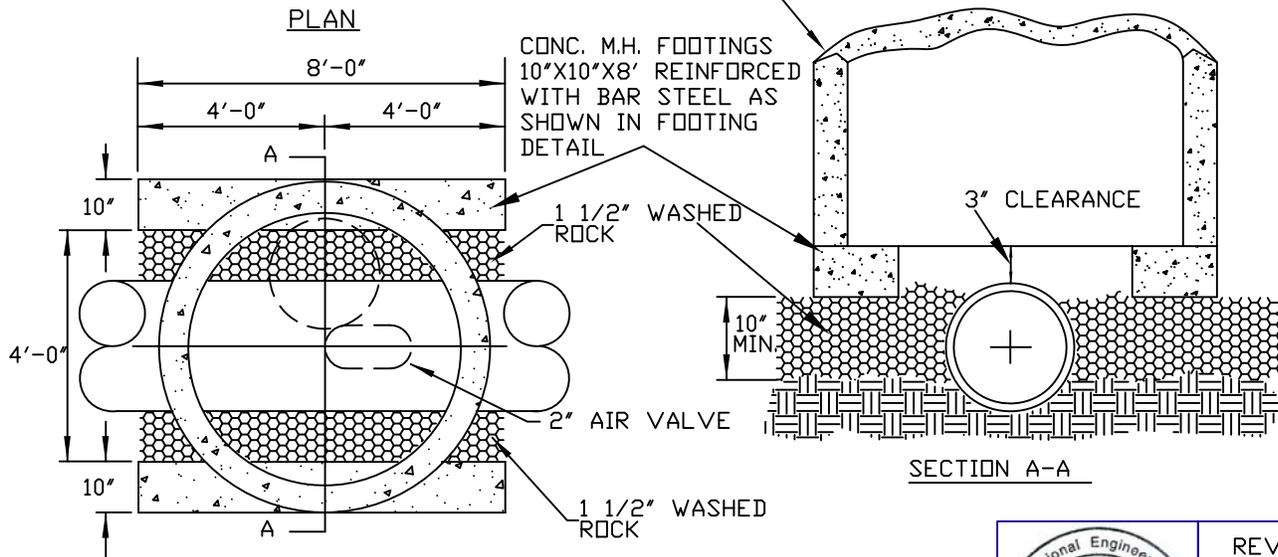


ELEVATION

NOTE:
 1. AIR VALVE SHALL BE VAL-MATIC OR APCO.
 * PRECAST MANHOLE SECTIONS SHALL CONFORM TO ASTM C 478



FOOTING DETAIL

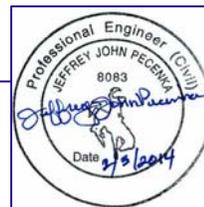


SECTION A-A



CITY OF CHEYENNE
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 STANDARD DRAWING

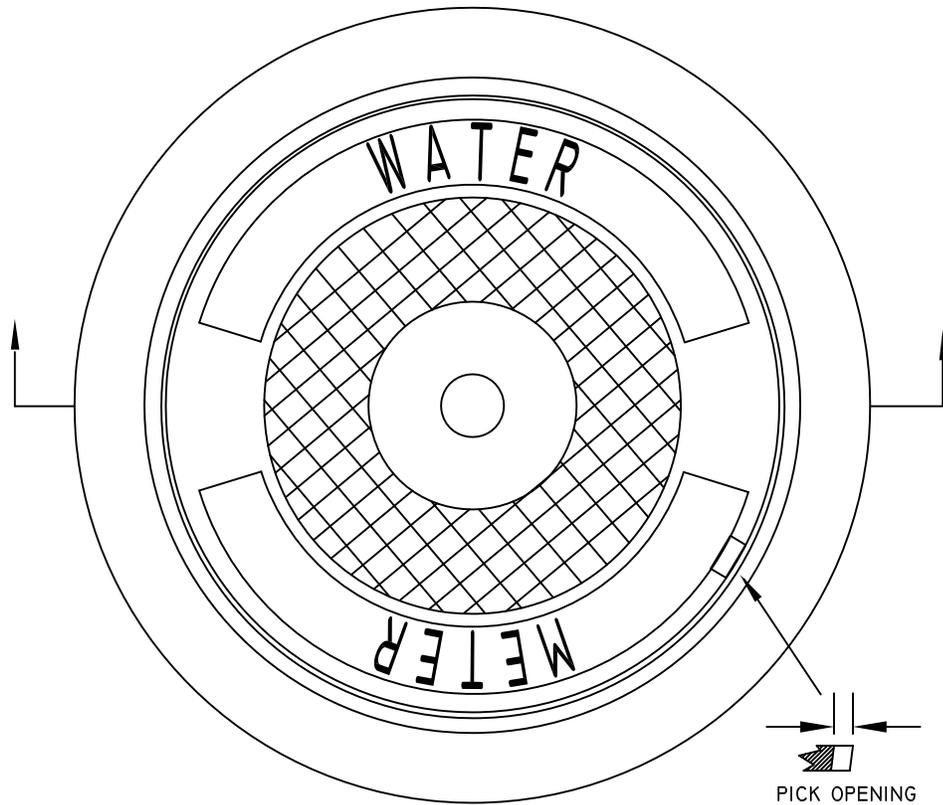
STANDARD AIR VALVE
 FOR MAINS 10 INCH AND SMALLER



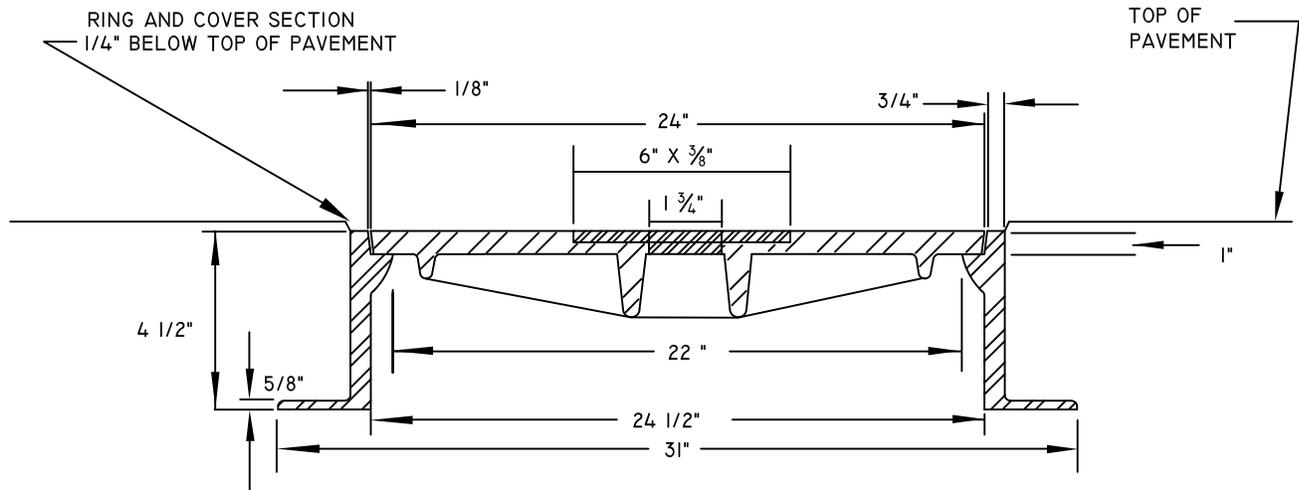
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 2014

STANDARD
 DRAWING NO.
 02665-10

NOT TO SCALE



RING AND COVER SECTION



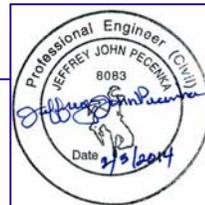
NOTES:

1. WITH APPROVED BOLT DOWN COVER AND WATER TIGHT GASKET IN FLOOD PLAIN AND OTHER AREAS SUBJECT TO INUNDATION.
2. CASTING INC. CI.-24-R / AL- 24-R OR APPROVED EQUAL. MUST MEET HS-20-44 LOADING.
3. WEIGHT OF CASTING LIDS SHALL BE A MINIMUM OF 135 POUND COVER
4. 1 3/4" HOLE IN CENTER OF LID WITH A 6"x3/8" RECESS IN CENTER OF LID FOR A NEPTUNE PITANTAN 12527-000 RADIO READ OUT



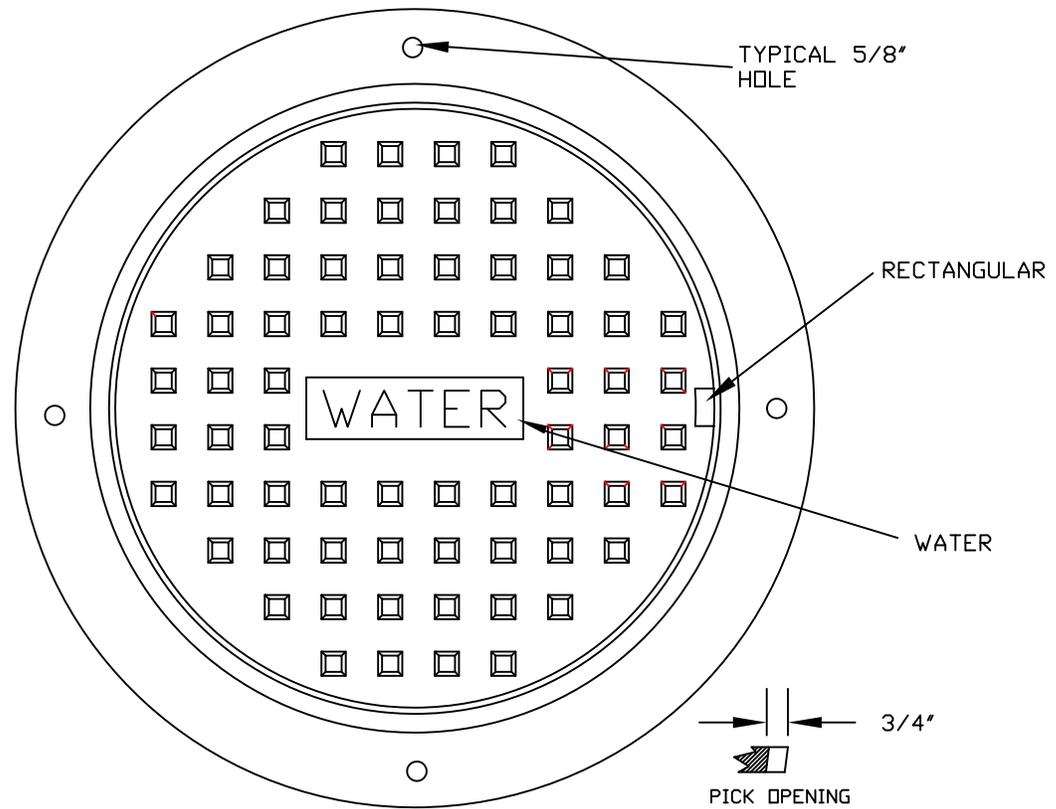
CITY OF CHEYENNE
AND
BOARD OF PUBLIC UTILITIES
STANDARD DRAWING

TRAFFIC AREA METER PIT
RING AND COVER DETAILS



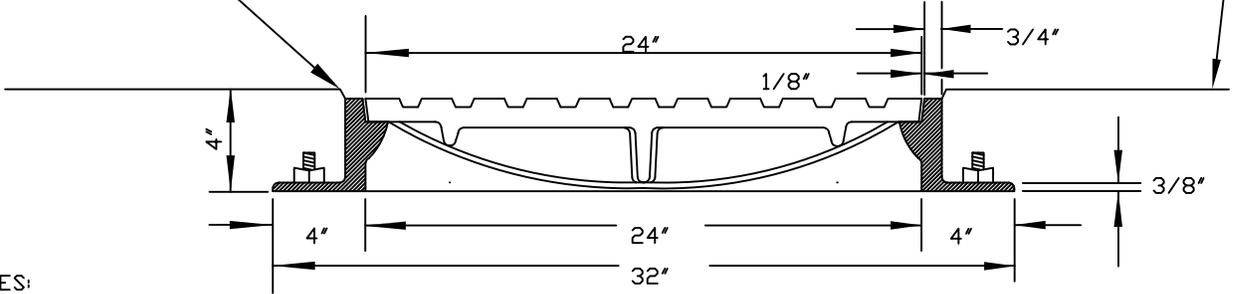
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2014
STANDARD
DRAWING NO.
02665-12

NOT TO SCALE



RING AND COVER SECTION
 1/4" BELOW TOP OF PAVEMENT

TOP OF PAVEMENT



NOTES:

1. FIT BETWEEN RING AND COVER MUST BE MACHINED.
2. MUST HAVE APPROVED BOLT DOWN COVER AND GASKET IN FLOOD PLAIN AND OTHER AREAS SUBJECT TO INUNDATION.
3. MANHOLES OUTSIDE PAVED STREETS OR ALLEYS SHALL HAVE BOLT TYPE COVER THAT BOLTS TO THE RING AND THE RING SHALL BE BOLTED TO CONE SECTION OR FLAT TOP SECTION OF MANHOLE. USE FOUR (4) 1/2" DIAMETER X 3" LONG STAINLESS STEEL RAM SET ANCHORS OR APPROVED EQUAL.
4. EAST JORDAN IRON WORKS 330-4 RING WITH A CHECKERED FLUSH MOUNT COVER MARKED "WATER" OR APPROVED EQUAL.
5. USE A MINIMUM 135 POUND COVER.



CITY OF CHEYENNE
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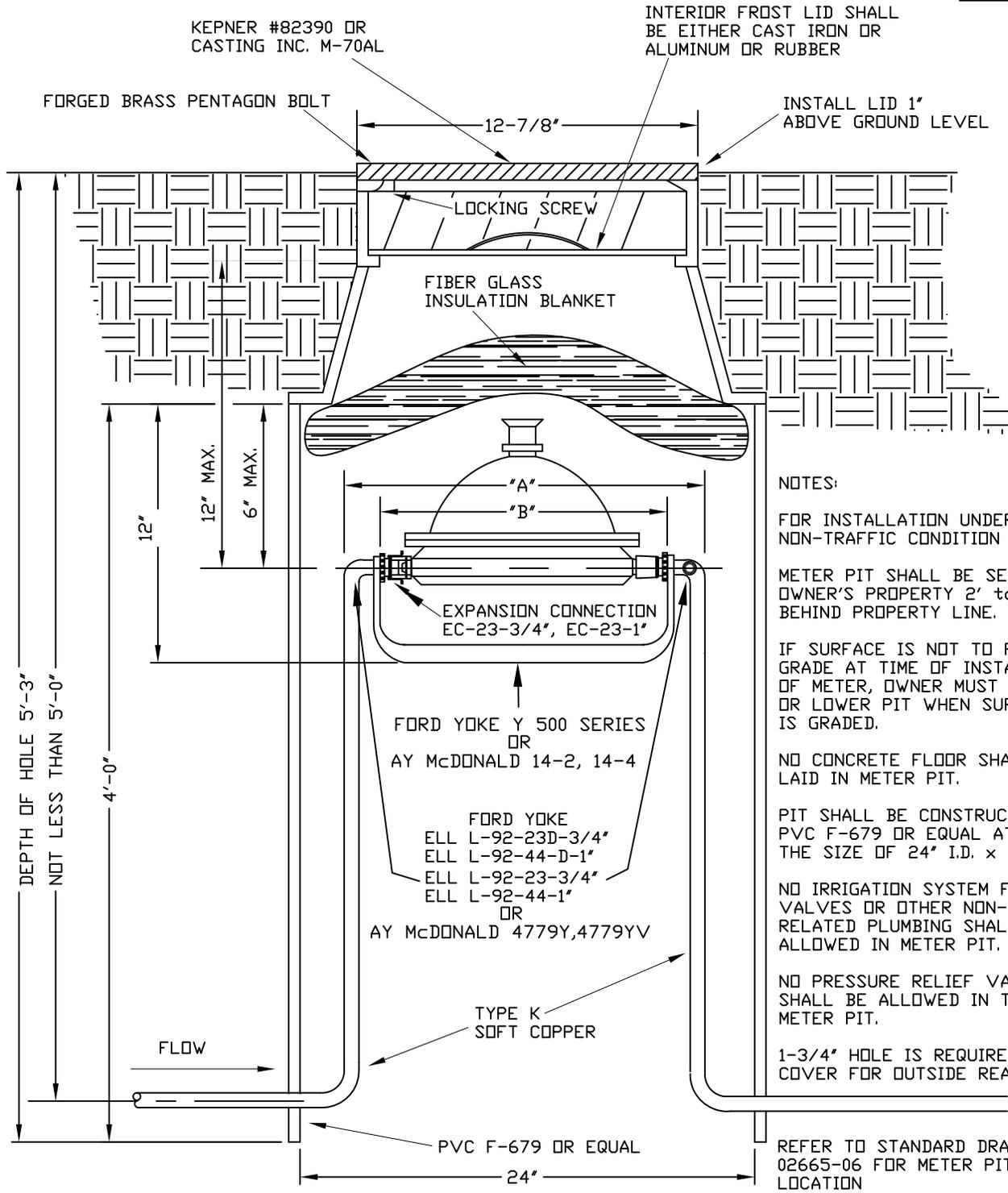
AIR VAULT RING AND COVER
 DETAILS



REVISED
 2014

STANDARD
 DRAWING NO.
 02665-13

NOT TO SCALE



NOTES:

FOR INSTALLATION UNDER NON-TRAFFIC CONDITION ONLY.

METER PIT SHALL BE SET ON OWNER'S PROPERTY 2' TO 5' BEHIND PROPERTY LINE.

IF SURFACE IS NOT TO FINAL GRADE AT TIME OF INSTALLATION OF METER, OWNER MUST RAISE OR LOWER PIT WHEN SURFACE IS GRADED.

NO CONCRETE FLOOR SHALL BE LAID IN METER PIT.

PIT SHALL BE CONSTRUCTED OF PVC F-679 OR EQUAL AT THE SIZE OF 24" I.D. x 48".

NO IRRIGATION SYSTEM FITTINGS, VALVES OR OTHER NON-SERVICE RELATED PLUMBING SHALL BE ALLOWED IN METER PIT.

NO PRESSURE RELIEF VALVE SHALL BE ALLOWED IN THE METER PIT.

1-3/4" HOLE IS REQUIRED IN COVER FOR OUTSIDE READOUT.

METER SIZE	"A"	"B"
3/4"	14-1/4"	10-5/8"
1"	17-1/4"	12-5/8"

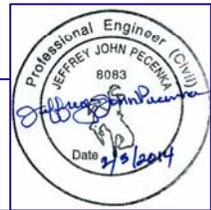
WARNING! INSTALLATION OF A BACK FLOW PREVENTER REQUIRES INSTALLATION OF AN EXPANSION TANK IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS.

REFER TO STANDARD DRAWING 02665-06 FOR METER PIT LOCATION



CITY OF CHEYENNE AND BOARD OF PUBLIC UTILITIES STANDARD DRAWING

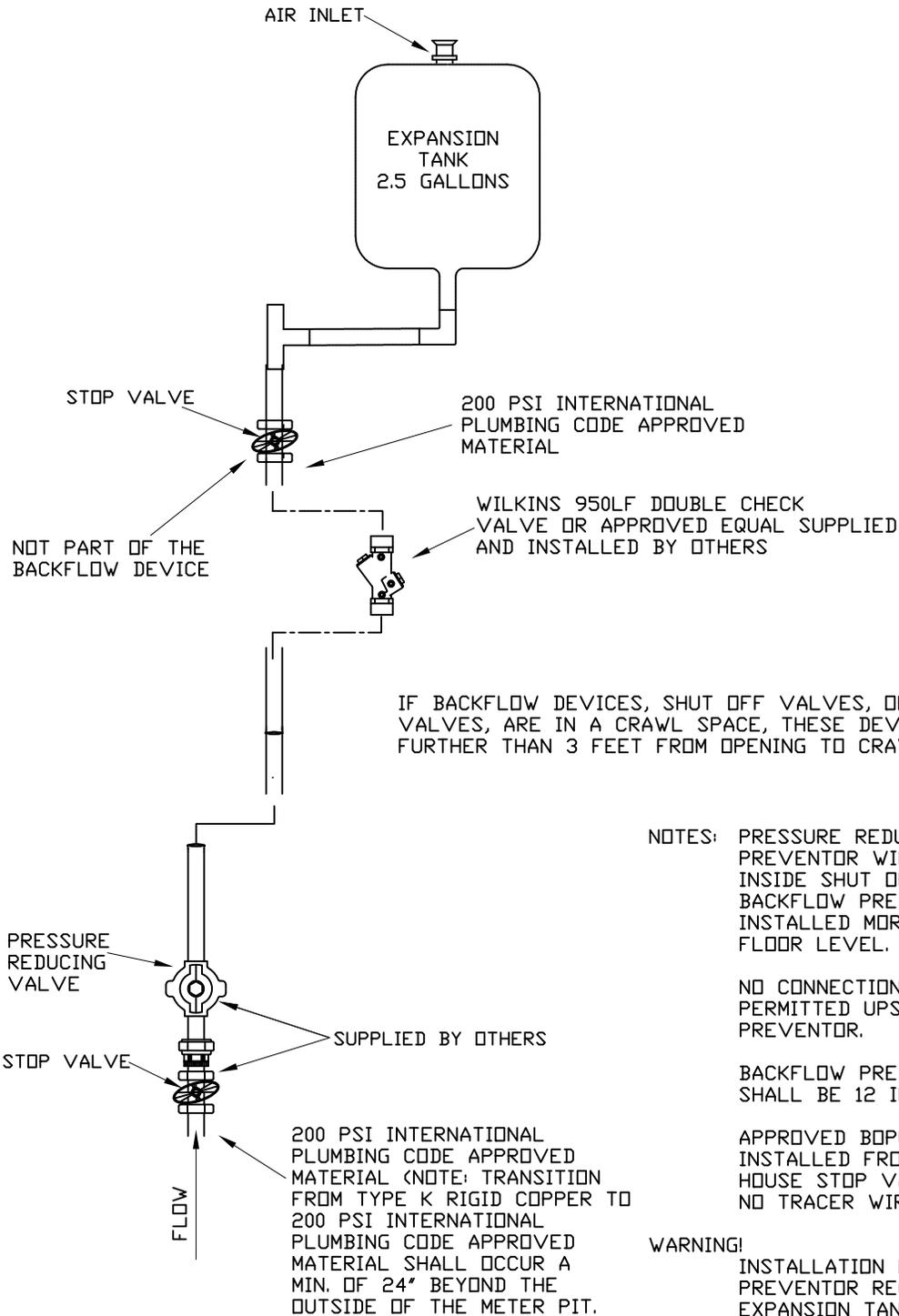
NON-TRAFFIC INSTALLATION OUTSIDE METER PIT DETAIL FOR 3/4" AND 1" METERS



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STANDARD DRAWING NO. 02665-14

NOT TO SCALE



IF BACKFLOW DEVICES, SHUT OFF VALVES, OR PRESSURE REDUCING VALVES, ARE IN A CRAWL SPACE, THESE DEVICES SHALL BE NO FURTHER THAN 3 FEET FROM OPENING TO CRAWL SPACE

NOTES: PRESSURE REDUCING VALVE AND BACKFLOW PREVENTOR WILL BE INSTALLED AFTER INSIDE SHUT OFF VALVE. BACKFLOW PREVENTOR SHALL NOT BE INSTALLED MORE THAN FOUR FEET OFF FLOOR LEVEL.

NO CONNECTIONS TO THE SERVICE SHALL BE PERMITTED UPSTREAM OF THE BACKFLOW PREVENTOR.

BACKFLOW PREVENTOR SET CLEARANCE SHALL BE 12 INCHES ON ALL SIDES.

APPROVED BOPU TRACER WIRE SHALL BE INSTALLED FROM THE METER PIT TO THE HOUSE STOP VALVE. IF COPPER IS USED NO TRACER WIRE IS REQUIRED.

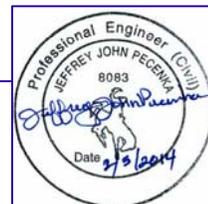
WARNING! INSTALLATION OF A BACK FLOW PREVENTOR REQUIRES INSTALLATION OF AN EXPANSION TANK IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS.

METER SIZE	WILKINS DOUBLE CHECK VALVE
3/4" & 1"	950LF OR EQUAL



CITY OF CHEYENNE AND BOARD OF PUBLIC UTILITIES STANDARD DRAWING

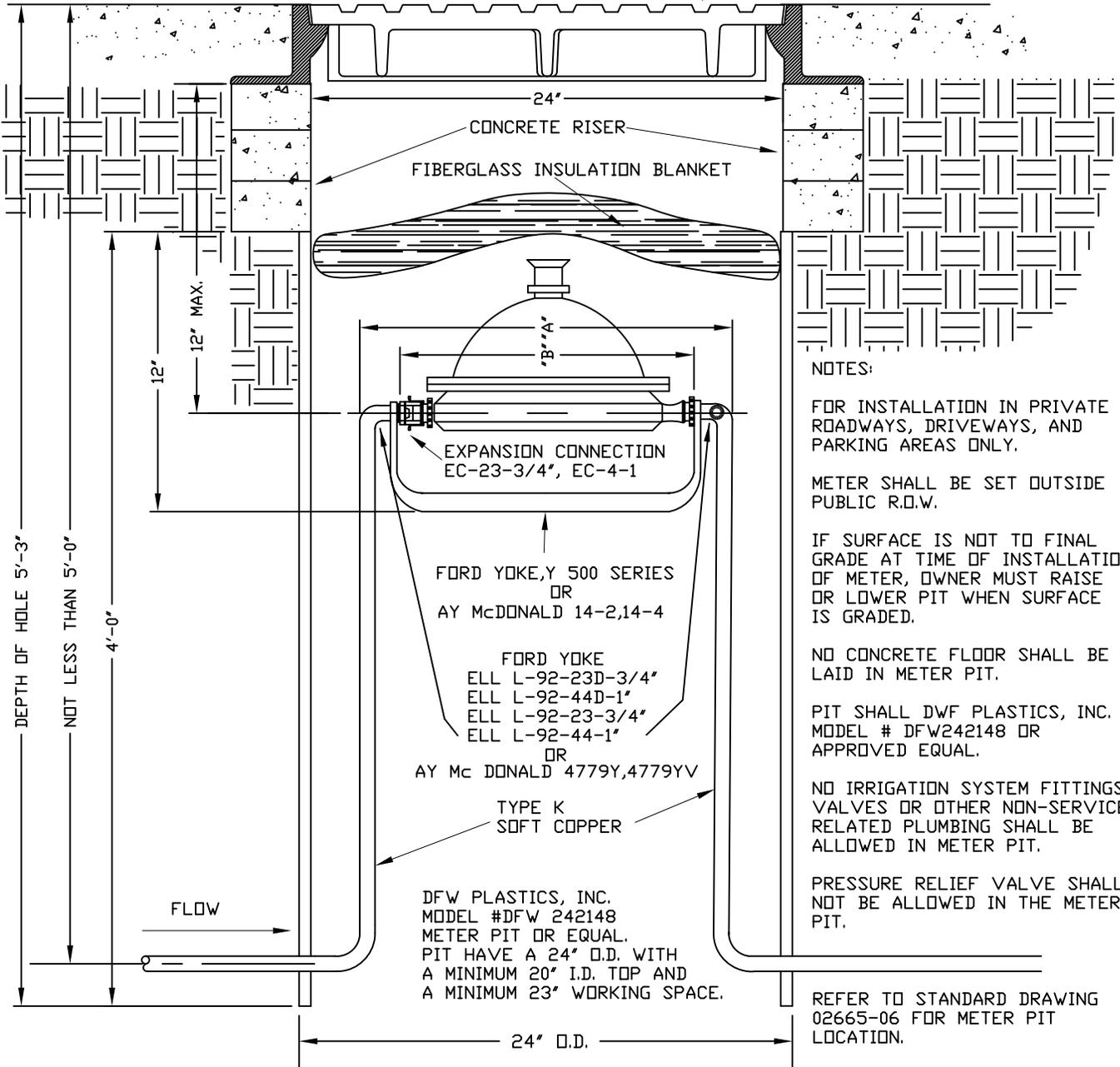
INSIDE INSTALLATION OF BACKFLOW PREVENTER W/ OUTSIDE METER PIT FOR 3/4" AND 1" METER DETAILS



REVISED 2014 STANDARD DRAWING NO. 02665-15

INSTALL LID TO MATCH ASPHALT OR CONCRETE ELEVATION

SEE NEW DETAIL 02665-12 TRAFFIC AREA METER PIT RING AND COVER



NOTES:

FOR INSTALLATION IN PRIVATE ROADWAYS, DRIVEWAYS, AND PARKING AREAS ONLY.

METER SHALL BE SET OUTSIDE PUBLIC R.O.W.

IF SURFACE IS NOT TO FINAL GRADE AT TIME OF INSTALLATION OF METER, OWNER MUST RAISE OR LOWER PIT WHEN SURFACE IS GRADED.

NO CONCRETE FLOOR SHALL BE LAID IN METER PIT.

PIT SHALL DWF PLASTICS, INC. MODEL # DFW242148 OR APPROVED EQUAL.

NO IRRIGATION SYSTEM FITTINGS, VALVES OR OTHER NON-SERVICE RELATED PLUMBING SHALL BE ALLOWED IN METER PIT.

PRESSURE RELIEF VALVE SHALL NOT BE ALLOWED IN THE METER PIT.

REFER TO STANDARD DRAWING 02665-06 FOR METER PIT LOCATION.

DFW PLASTICS, INC. MODEL #DFW 242148 METER PIT OR EQUAL. PIT HAVE A 24" O.D. WITH A MINIMUM 20" I.D. TOP AND A MINIMUM 23" WORKING SPACE.

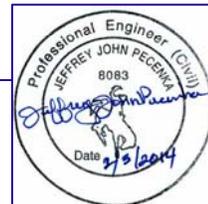
WARNING: INSTALLATION OF A BACK FLOW PREVENTER REQUIRES INSTALLATION OF AN EXPANSION TANK IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS.

METER SIZE	"A"	"B"
3/4"	14 1/4"	10-5/8"
1"	17 1/4"	12-5/8"



CITY OF CHEYENNE AND BOARD OF PUBLIC UTILITIES STANDARD DRAWING

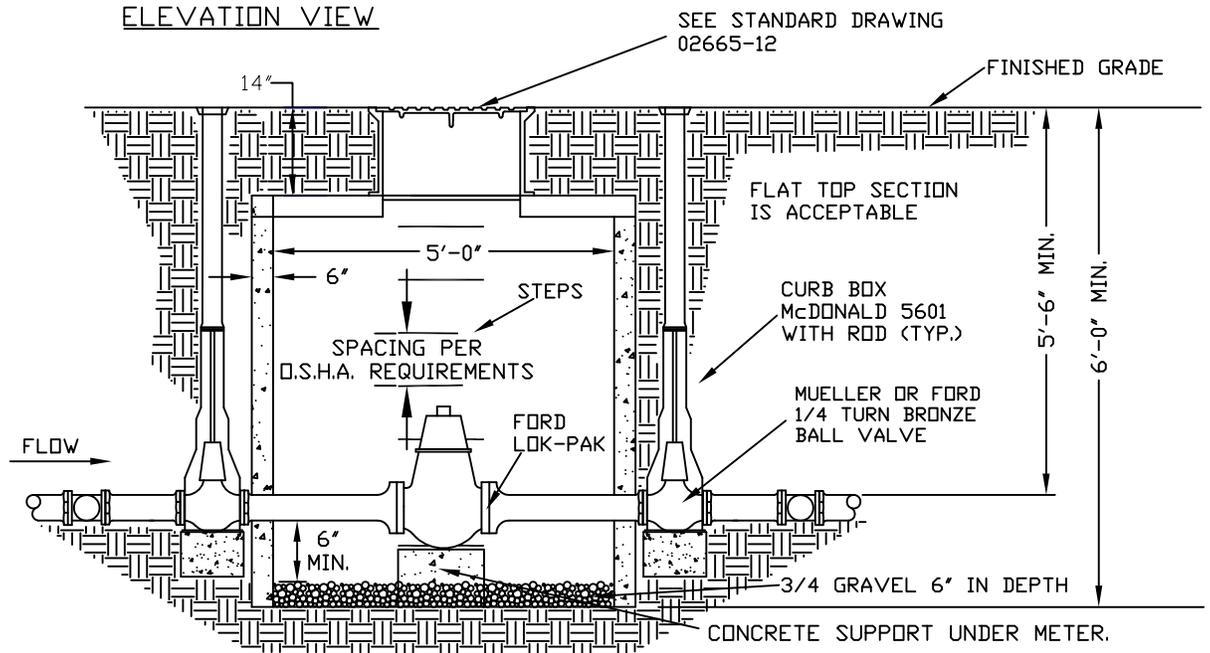
TRAFFIC INSTALLATION OUTSIDE METER PIT DETAIL FOR 3/4" AND 1" METERS



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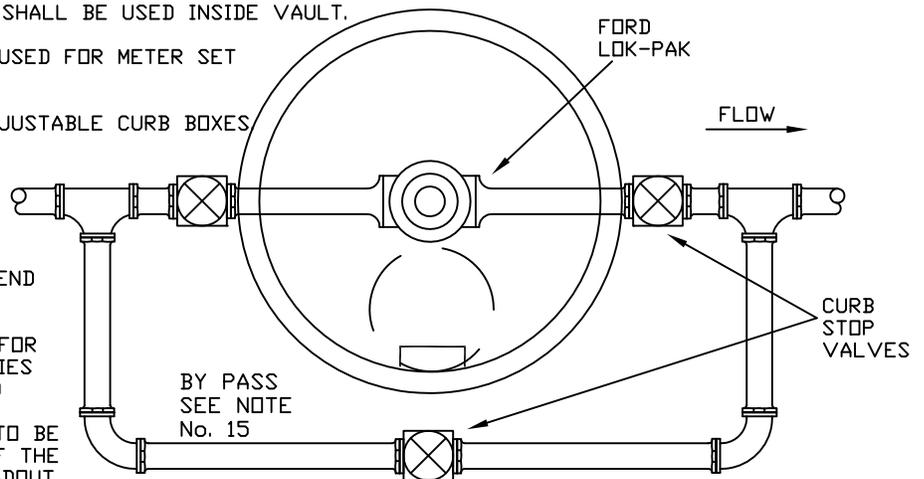
STANDARD DRAWING NO. 02665-16

NOT TO SCALE



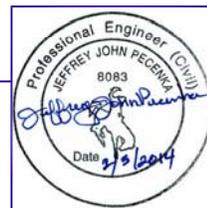
NOTES:

1. IF SURFACE IS NOT TO FINAL GRADE AT THE TIME OF INSTALLATION OF METER, OWNER MUST ADJUST PIT TO FINISH GRADE.
2. METER PIT TO BE LOCATED ON PRIVATE PROPERTY, CURB STOP TO BE LOCATED IN THE RIGHT OF WAY.
3. METER SETTING MUST BE INSPECTED PRIOR TO BACKFILLING.
4. NO CONCRETE IS TO BE PLACED IN FLOOR OF METER PIT. 3/4" ROCK SHALL BE INSTALLED ON PIT FLOOR TO A DEPTH OF 6".
5. MATERIALS USED FOR SERVICE LINE PIPING THROUGH PIT SHALL BE 1-1/2" OR 2" TYPE "K" SOFT COPPER 20'S. COILED SOFT COPPER IS NOT ALLOWED THROUGH METER PIT. ALL FITTINGS SHALL BE FLARED OR MUELLER 110 COMPRESSION FITTINGS.
6. IF GROUND CONDITIONS ARE UNSTABLE, FOOTINGS SHALL BE REQUIRED.
7. THE WORD "WATER" SHALL BE CAST ON THE LID.
8. COPPER COMPRESSION JOINTS SHALL BE USED INSIDE VAULT.
9. FORD CF LOK-PAK SHALL BE USED FOR METER SET INSIDE PIT.
10. ALL VALVES SHALL HAVE ADJUSTABLE CURB BOXES
11. RIGID COPPER AND SILVER SOLDER IS ALLOWED FOR METER PITS.
12. MANHOLE STEPS SHALL BEGIN 2'-4" MAX. FROM COVER AND END 1'-6" MAX. FROM FLOOR.
13. A BYPASS IS ONLY ALLOWED FOR MEDICAL AND DENTAL FACILITIES UNLESS OTHERWISE APPROVED
14. A 1-3/4" DIAMETER HOLE IS TO BE DRILLED NEAR THE CENTER OF THE MANHOLE COVER FOR THE READOUT.



CITY OF CHEYENNE
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WATER METER PIT DETAIL
FOR 1 1/2" and 2" LINES

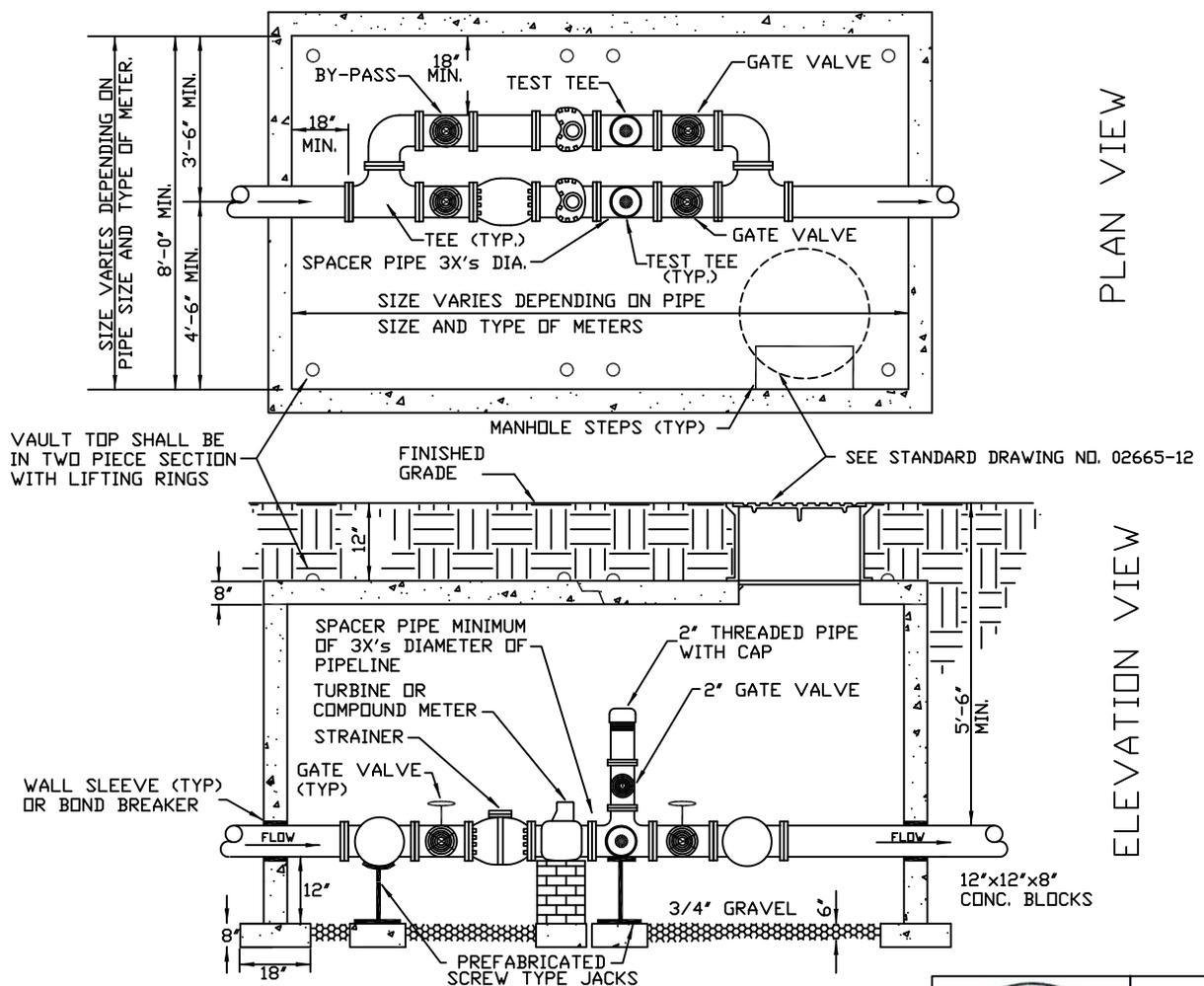


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2014

STANDARD
DRAWING NO.
02665-17

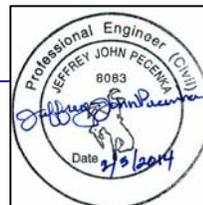
NOTES:

1. IF SURFACE IS NOT TO FINISHED GRADE AT TIME OF METER PIT INSTALLATION, OWNER SHALL RAISE OR LOWER PIT LID, WHEN SURFACE IS GRADED.
2. METER VAULT SHALL BE INSPECTED BEFORE BACKFILLING TOP.
3. BYPASS SHALL BE INSTALLED UNLESS OTHERWISE SPECIFIED.
4. ALL GATE VALVES SHALL BE DUCTILE IRON AND FITTINGS SHALL BE FLANGED.
5. ALL PIPE SHALL BE DUCTILE IRON AND ALL FITTINGS SHALL BE FLANGED.
6. SPEC. CASTING INC. CI-24-R OR AL-24-R OR APPROVED EQUIVALENT.
7. SUPPORT UNDER METER MAY BE BRICK OR CONCRETE BLOCK.
8. 3/4" ROCK SHALL BE PLACED ON FLOOR OF PIT TO A DEPTH OF 6".
9. METER ON BYPASS IS AT OPTION OF B.O.P.U. SPOOL PIECE IS TO BE PROVIDED IF METER IS NOT INSTALLED.
10. SIZE OF BYPASS TO BE DETERMINED BY B.O.P.U.
11. MANHOLE STEPS TO BEGIN 2'-4" MAX. DOWN FROM COVER AND END 1'-6" MAX. UP FROM FLOOR. STEPS TO BE SPACED 12" OR 16", SEE D.S.H.A. REQUIREMENT.
12. VAULT SHALL BE CONSTRUCTED TO HS-20-44 LOAD.



CITY OF CHEYENNE
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METER SETTING FOR 3" AND
LARGER METER
WITH VALVE AND BYPASS



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STANDARD
DRAWING NO.
02665-18

B.O.P.U. METER SET LENGTH

METER SIZE	TYPE	SET LENGTH	LENGTH WITH STRAINERS
3/4"	T-10	13-1/2"	
1'	T-10	15-1/2"	
1-1/2"	T-10	13-1/2"	
2"	T-10	17-1/2"	
2"	HP/COMPOUND	15-1/2"	22-3/4"
3"	COMPOUND	17-1/4"	23-3/8"
4"	COMPOUND	20-1/4"	27-3/4"
6"	COMPOUND	24-1/4"	33-3/4"
1-1/2"	HP/T	10-1/4"	N/A
2"	HP/T	10-1/4"	17-3/8"
3"	HP/T	12-1/2"	18-3/8"
4"	HP/T	14-1/4"	21-7/8"
6"	HP/T	18-1/4"	27-3/8"
8"	HP/T	20-1/4"	30-3/8"
10"	HP/T	26-1/4"	41-3/8"
12"	HP/T	20"	37"
16"	HP/T	23-7/8"	49-3/8"
20"	HP/T	31-3/4"	50-1/2"

METER SET LENGTH FOR 3/4" INCH, MEASURES FROM FACE TO FACE FOR FEMALE ADAPTERS
 METER SET LENGTH FOR 1-1/2" INCH AND LARGER METERS, ARE MEASURED FROM INSIDE FLANGE FACES.
 METER SET LENGTH FOR 1-1/2" INCH AND LARGER METERS, INCLUDES THICKNESS FOR GASKETS MATERIAL.



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METER SET LENGTH



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 DRAWING NO.
 02665-19

NOT TO SCALE

METER VAULTS FOR WATER METER
THREE INCH AND LONGER

SIZE	6' x 8' x 6'	8' x 10' x 6'	8' x 12' x 6'
3" HPT	X		
4" HPT	X		
6" HPT	X		
8" HPT		X	
10" HPT		X	
12" HPT		X	
3" COMP	X		
4" COMP	X		
6" COMP		X	
6"x8" COMP		X	
4" HP PRO		X	
6" HP PRO		X	
8" HP PRO			X
10" HP PRO			X
3" HP FS	X		
4" HP FS	X		
6" HP FS	X		
8" HP FS		X	
10" HP FS		X	

HPT = HIGH PERFORM (HP) TURBINE METER
COMP = COMPOUND METER
SIZE = WIDTH x LENGTH x HEIGHT

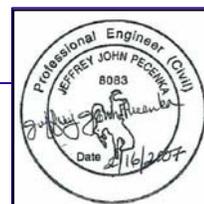
HP PRO = HP PROTECTION III FIRE SERVICE METER
HP FS = HP FIRE SERVICE TURBINE METER

PLEASE CONTACT THE BOARD OF PUBLIC UTILITIES METER DEPARTMENT FOR ANY QUESTIONS 307-637-6471



CITY OF CHEYENNE
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STANDARD DRAWING

METER VAULTS
FOR WATER METERS
THREE INCH AND LARGER

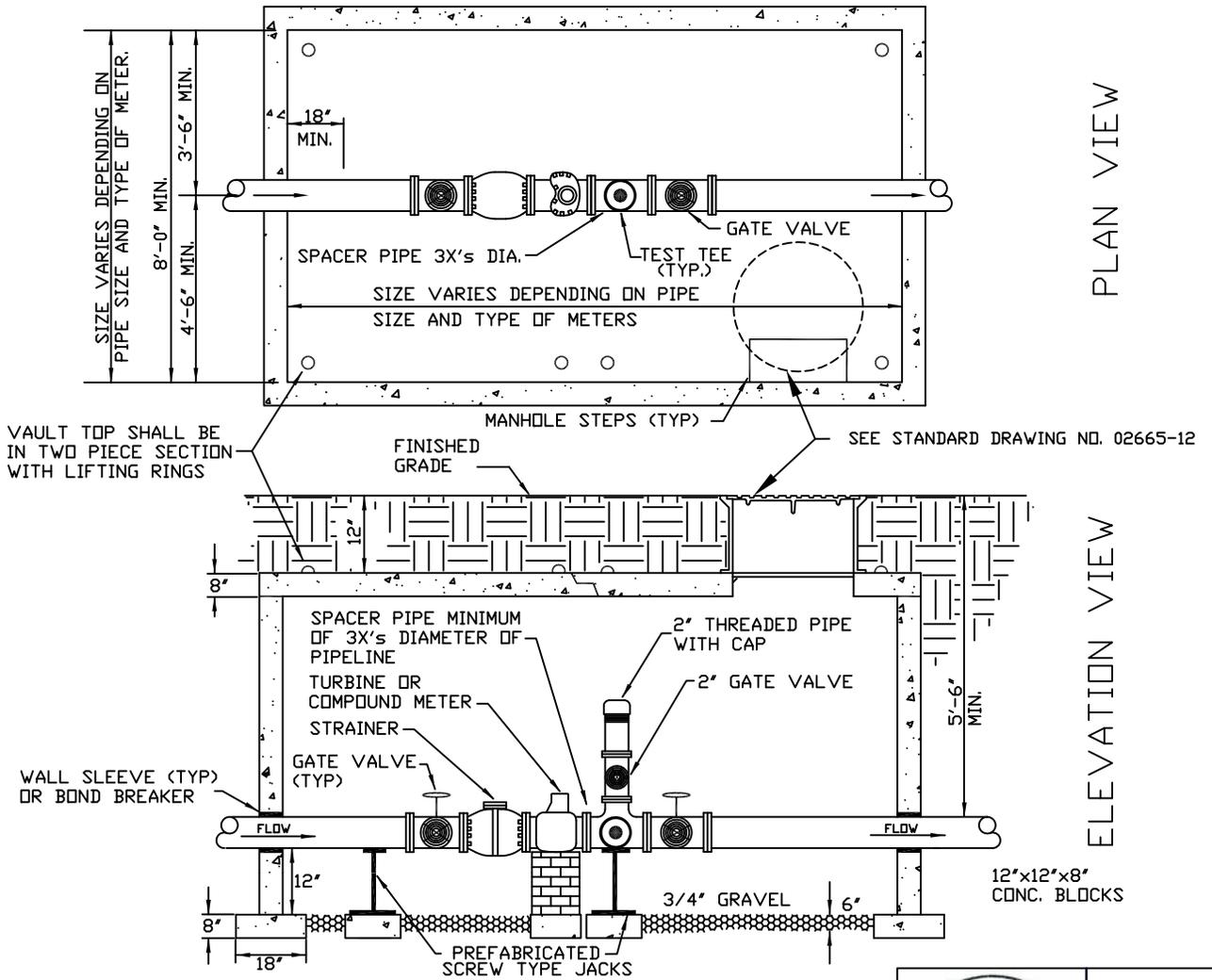


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2007
STANDARD
DRAWING NO.
02665-20

NOT TO SCALE

NOTES:

1. IF SURFACE IS NOT TO FINISHED GRADE AT TIME OF METER PIT INSTALLATION, OWNER MUST RAISE OR LOWER PIT LID, WHEN SURFACE IS GRADED.
2. METER VAULT SHALL BE INSPECTED BEFORE BACK FILLING TOP.
3. ALL GATE VALVES SHALL BE A NON-RISING STEM.
4. ALL PIPE SHALL BE DUCTILE IRON AND FITTINGS SHALL BE FLANGED.
5. SPEC. CASTING INC. CI-24-R, AL-24-R OR APPROVED EQUIVALENT
6. SUPPORT UNDER METER MAY BE BRICK OR CONCRETE BLOCKS.
7. 1/2" TO 3/4" ROCK SHALL BE PLACED ON FLOOR OF PIT, 6" THICK.
8. MANHOLE STEPS TO BEGIN 2'-4" MAX. DOWN FROM COVER AND END 1'-6" MAX. UP FROM FLOOR. STEPS TO BE SPACED 12" OR 16", SEE SPACING PER D.S.H.A. REQUIREMENT.
9. VAULT SHALL BE CONSTRUCTED TO HS-20-44 LOAD.
10. SIZE VARIES DEPENDING ON PIPE SIZE AND TYPE OF METER (SEE STANDARD DRAWING NO. 02665-20)



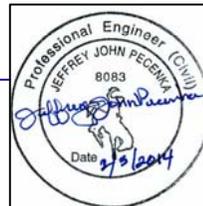
PLAN VIEW

ELEVATION VIEW



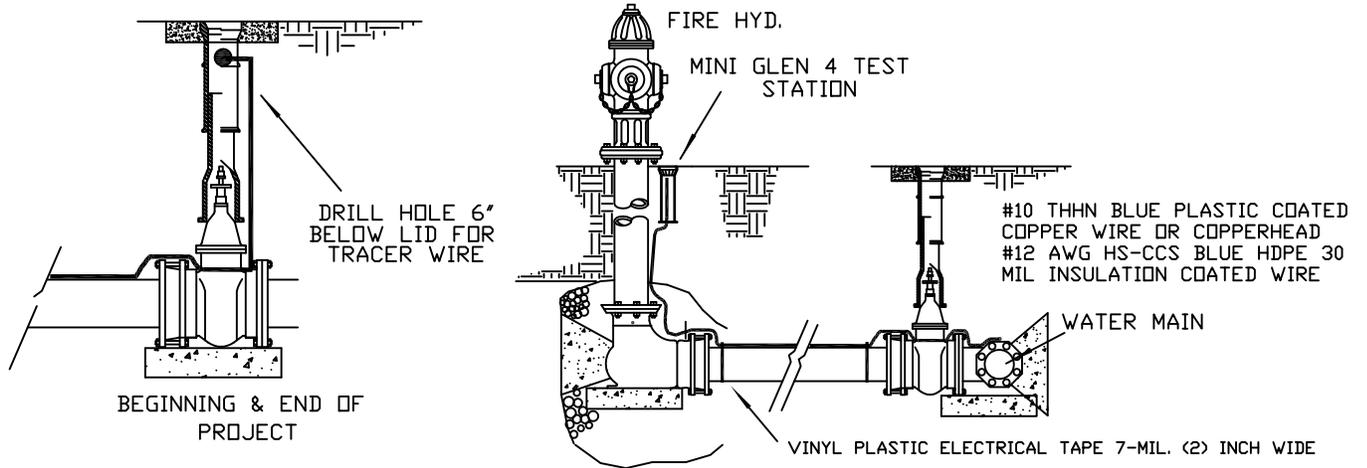
CITY OF CHEYENNE
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BOARD OF PUBLIC
UTILITIES
STANDARD DRAWING

IRRIGATION METER SETTING
FOR 3" AND LARGER METER



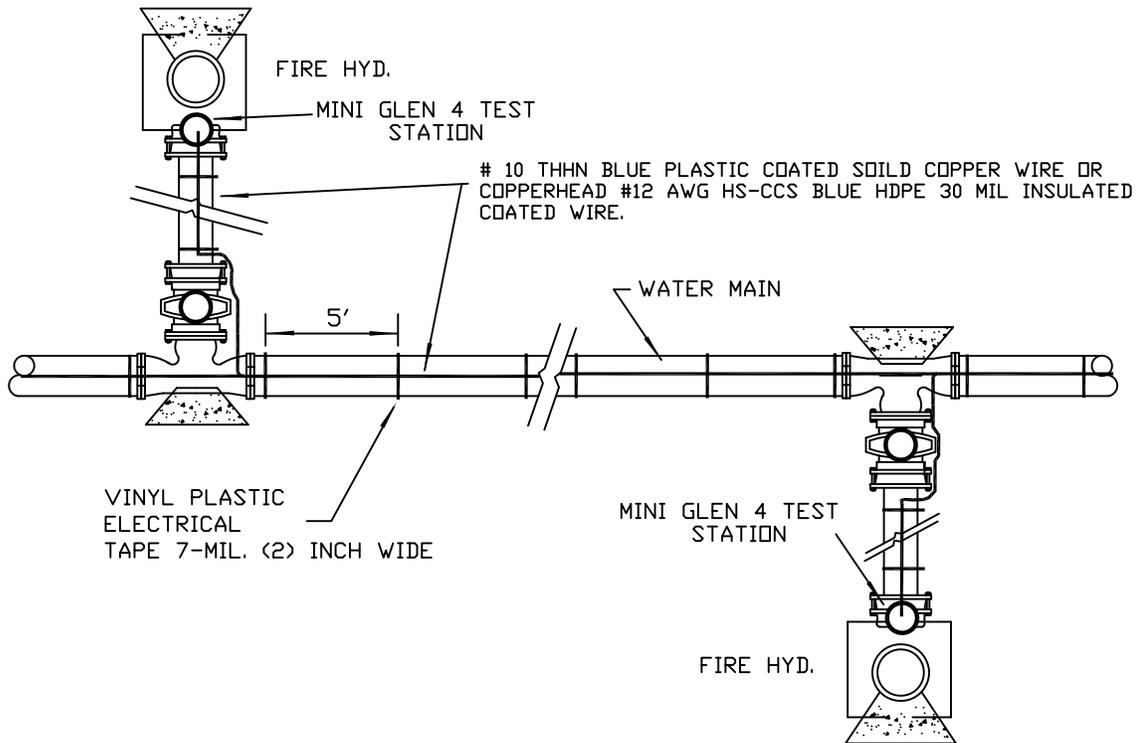
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STANDARD
DRAWING NO.
02665-21



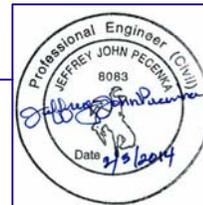
NOTES:

1. A #10 THHN BLUE PLASTIC COATED SOLID COPPER WIRE OR COPPERHEAD #12 AWG HS-CCS BLUE HDPE 30 MIL INSULATION COATED WIRE RUN CONTINUOUSLY. THE TRACER WIRE SHALL BE FASTENED SECURELY TO THE TOP OF THE PIPE WITH VINYL PLASTIC ELECTRICAL TAPE 7-MIL. (2) INCH WIDE
2. ALL SPLICES SHALL BE MADE WITH A 3M R/Y CONNECTOR, CAPABLE OF HANDLING 3-#10 WIRES.
3. AT EVERY FIRE HYDRANT LOCATION A MINI GLEN 4 STATION OR B.O.P.U. APPROVED EQUAL SHALL BE INSTALLED 1 FOOT IN FRONT OF THE HYDRANT (NOT WITHIN SIDEWALK), CONNECTED TO THE TRACER WIRE.
4. WHEN TRACER WIRE IS RUN UP THE VALVE BOX AT THE END AND BEGINNING OF THE PROJECT, RUN THE TRACER WIRE UP THE OUTSIDE OF THE VALVE BOX AND DRILL A HOLE 6 INCHES BELOW THE TOP OF THE VALVE BOX LID AND COIL 18 INCHES OF THE WIRE IN THE VALVE BOX TOP.



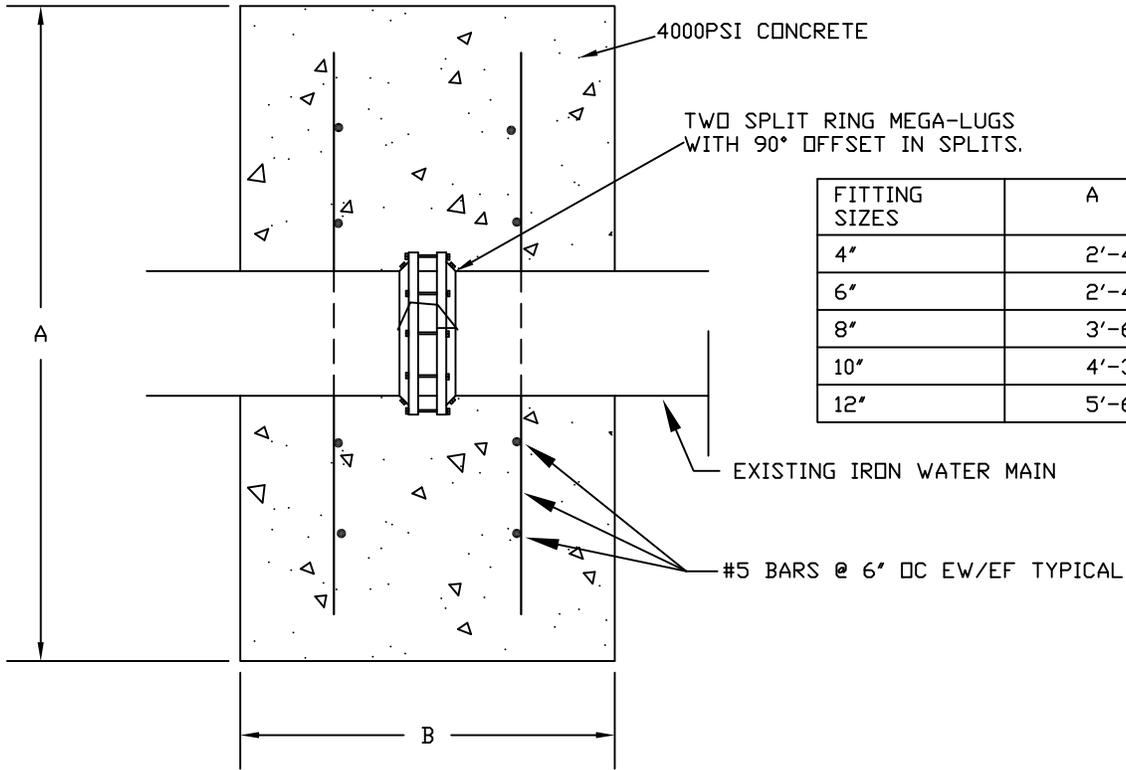
CITY OF CHEYENNE
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 STANDARD DRAWING

WATER MAIN
 TRACER WIRE

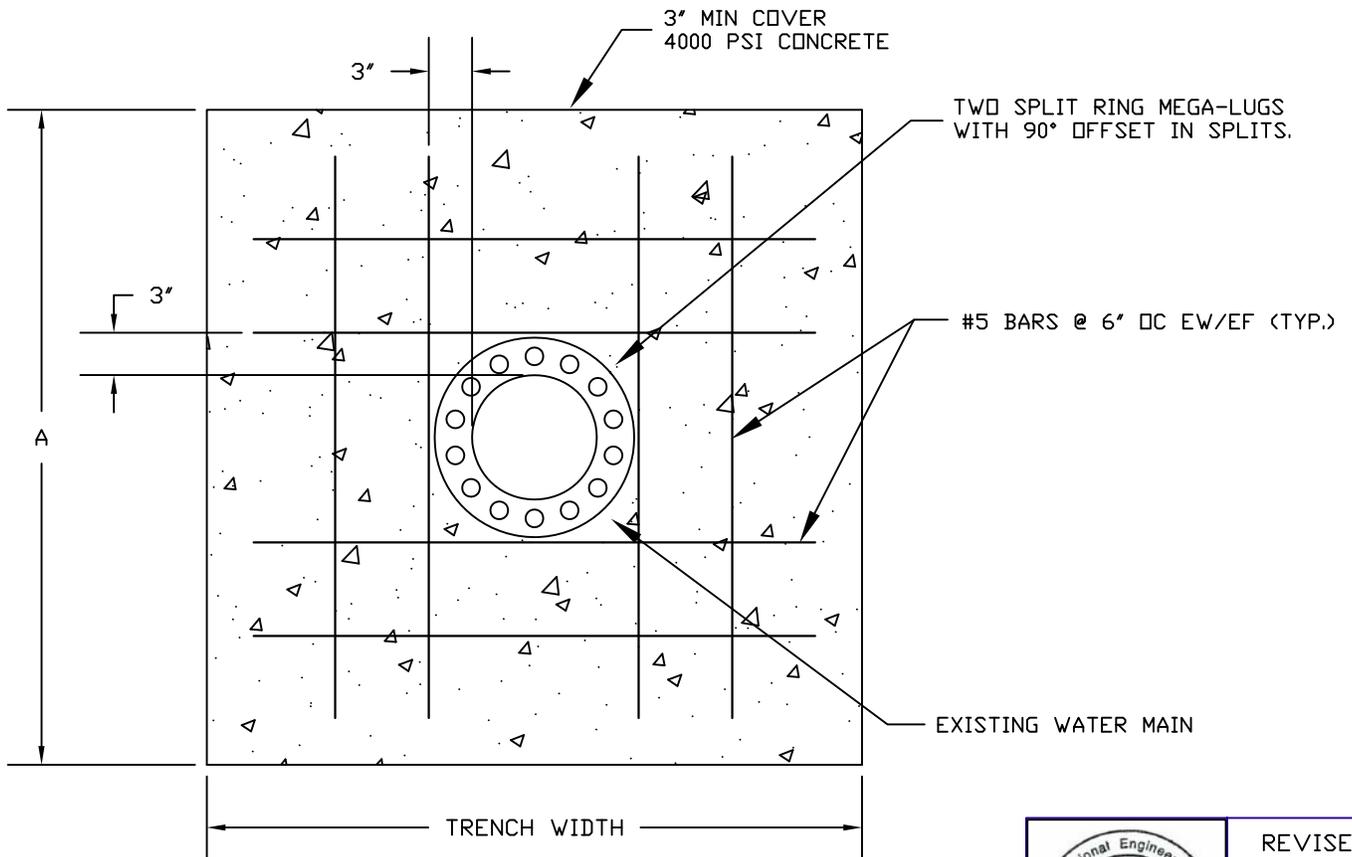


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 STANDARD
 DRAWING NO.
 02665-22

NOT TO SCALE

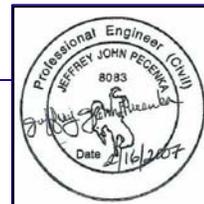


FITTING SIZES	A	B
4"	2'-4"	2'-0"
6"	2'-4"	2'-6"
8"	3'-6"	3'-3"
10"	4'-3"	4'-0"
12"	5'-6"	4'-6"



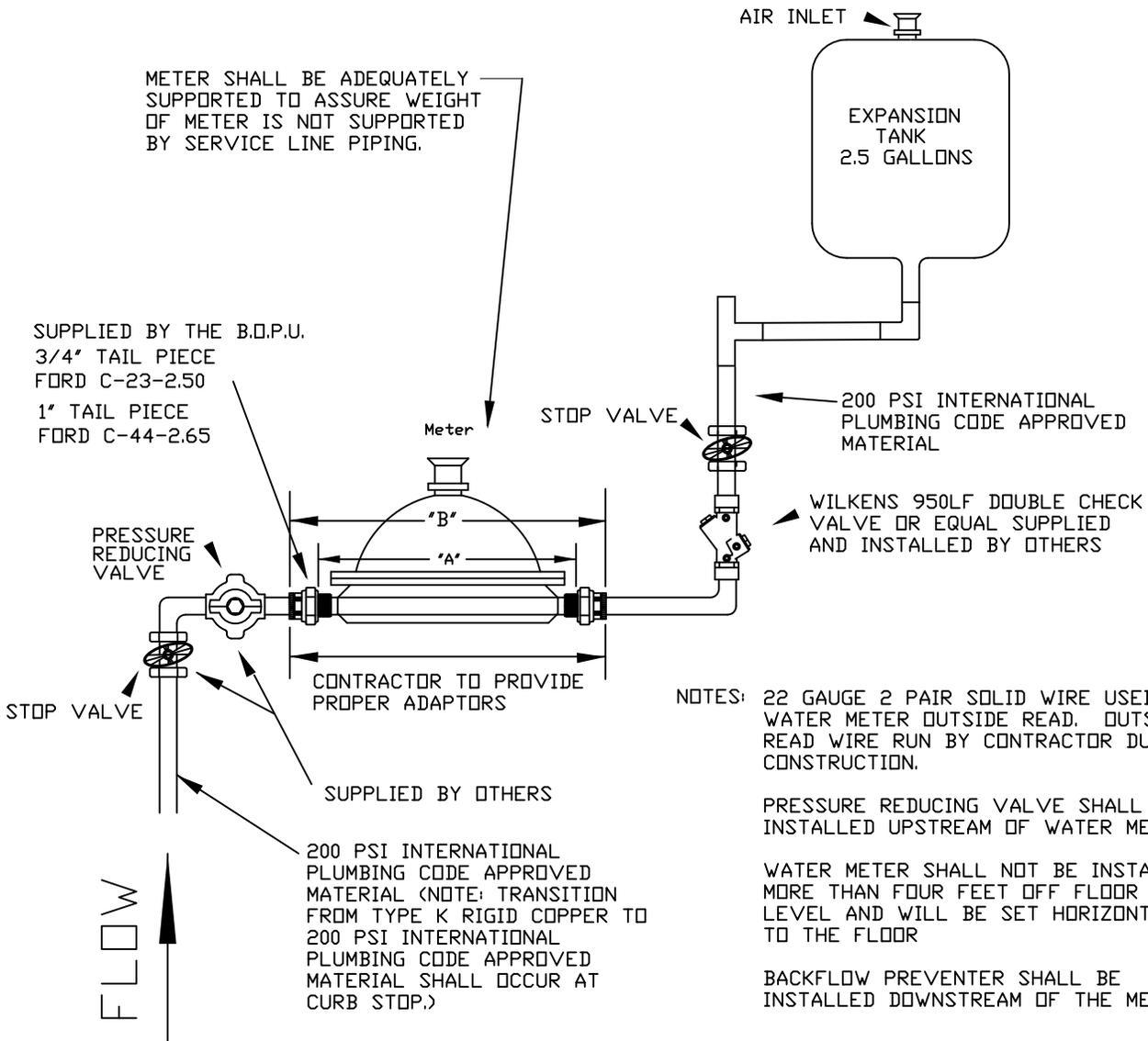
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RESTRAINT BLOCK DETAIL



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STANDARD
DRAWING NO.
02665-23



METER SHALL BE ADEQUATELY SUPPORTED TO ASSURE WEIGHT OF METER IS NOT SUPPORTED BY SERVICE LINE PIPING.

SUPPLIED BY THE B.O.P.U.
 3/4" TAIL PIECE
 FORD C-23-2.50
 1" TAIL PIECE
 FORD C-44-2.65

PRESSURE REDUCING VALVE

STOP VALVE

FLOW

CONTRACTOR TO PROVIDE PROPER ADAPTORS

SUPPLIED BY OTHERS

200 PSI INTERNATIONAL PLUMBING CODE APPROVED MATERIAL (NOTE: TRANSITION FROM TYPE K RIGID COPPER TO 200 PSI INTERNATIONAL PLUMBING CODE APPROVED MATERIAL SHALL OCCUR AT CURB STOP.)

AIR INLET

EXPANSION TANK
 2.5 GALLONS

STOP VALVE

200 PSI INTERNATIONAL PLUMBING CODE APPROVED MATERIAL

WILKENS 950LF DOUBLE CHECK VALVE OR EQUAL SUPPLIED AND INSTALLED BY OTHERS

NOTES: 22 GAUGE 2 PAIR SOLID WIRE USED FOR WATER METER OUTSIDE READ. OUTSIDE READ WIRE RUN BY CONTRACTOR DURING CONSTRUCTION.

PRESSURE REDUCING VALVE SHALL BE INSTALLED UPSTREAM OF WATER METER.

WATER METER SHALL NOT BE INSTALLED MORE THAN FOUR FEET OFF FLOOR LEVEL AND WILL BE SET HORIZONTALLY TO THE FLOOR

BACKFLOW PREVENTER SHALL BE INSTALLED DOWNSTREAM OF THE METER

NO CONNECTIONS TO THE SERVICE SHALL BE PERMITTED UPSTREAM OF THE WATER METER.

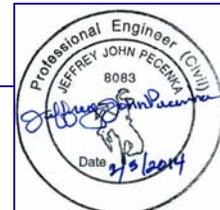
WATER METER SET CLEARANCES:
 FROM BACK: 6 INCHES;
 FROM SIDES: 2 FEET;
 FROM FRONT: 2 FEET.

APPROVED BOPU TRACER WIRE SHALL BE INSTALLED FROM THE CURB STOP TO THE HOUSE STOP VALVE. IF COPPER IS USED NO TRACER WIRE IS REQUIRED.

WARNING!

INSTALLATION OF A BACK FLOW PREVENTER REQUIRES INSTALLATION OF AN EXPANSION TANK IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS.

METER SIZE	"A"	"B"
3/4"	9"	13-3/4"
1"	11"	15-3/4"



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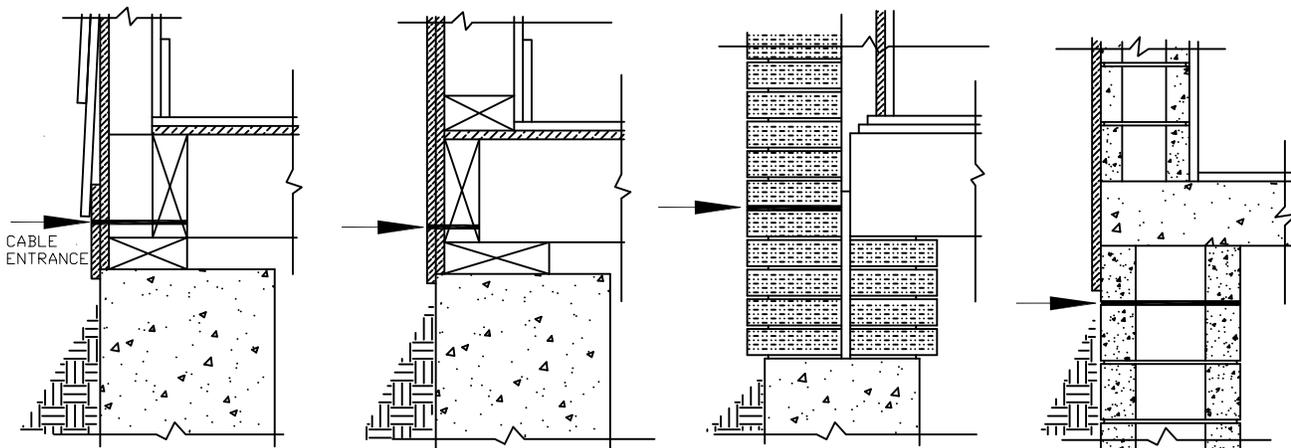
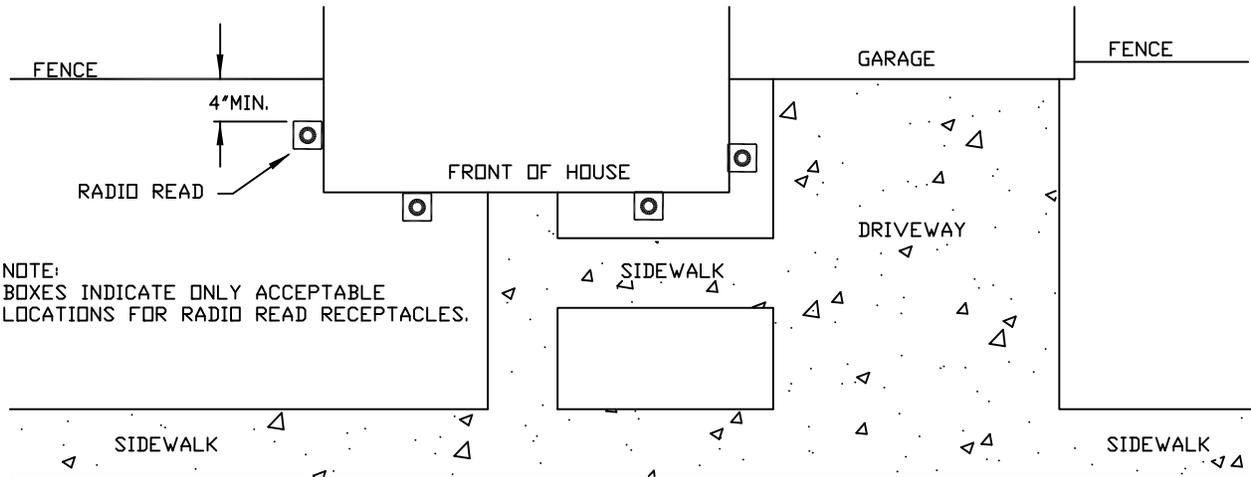
STANDARD DRAWING NO. 02665-24



CITY OF CHEYENNE AND BOARD OF PUBLIC UTILITIES STANDARD DRAWING

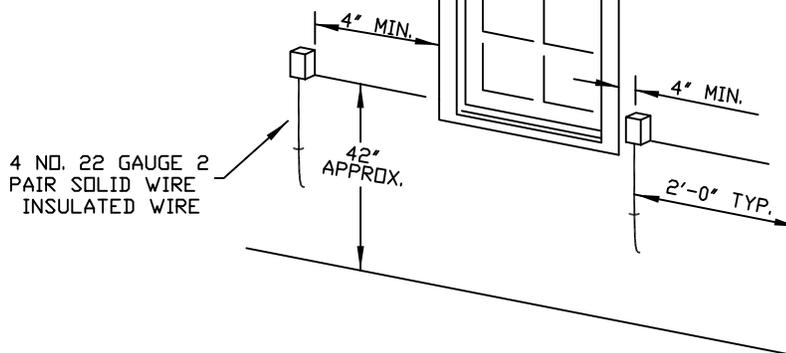
INSIDE INSTALLATION DETAIL FOR 3/4" AND 1" WATER METER

BOXES INDICATE ONLY ACCEPTABLE LOCATIONS FOR RADIO READ RECEPTACLE



SUGGESTED LOCATIONS FOR CABLE ENTRANCE HOLES IN FOUNDATIONS

NOTE:
READOUT WIRE IS REQUIRED TO BE
INSTALLED BY THE CONTRACTOR
DURING CONSTRUCTION.



NOTE:

- 4" MINIMUM SPACE FROM OUTSIDE READ TO OBSTRUCTIONS
- OUTSIDE READ WIRE IS NO. 22 GAUGE, TWO PAIR, SOLID WIRE
- ALL READOUT RECEPTACLES WILL BE ACCESSIBLE TO METER READERS.
- ALL READ OUT RECEPTACLES SHALL NOT BE MORE THAN TWO FEET FROM FRONT CORNER.

EXAMPLE OF OUTSIDE RADIO READ RECEPTACLE LOCATION OUTSIDE OF HOUSE.



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STANDARD
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02665-25

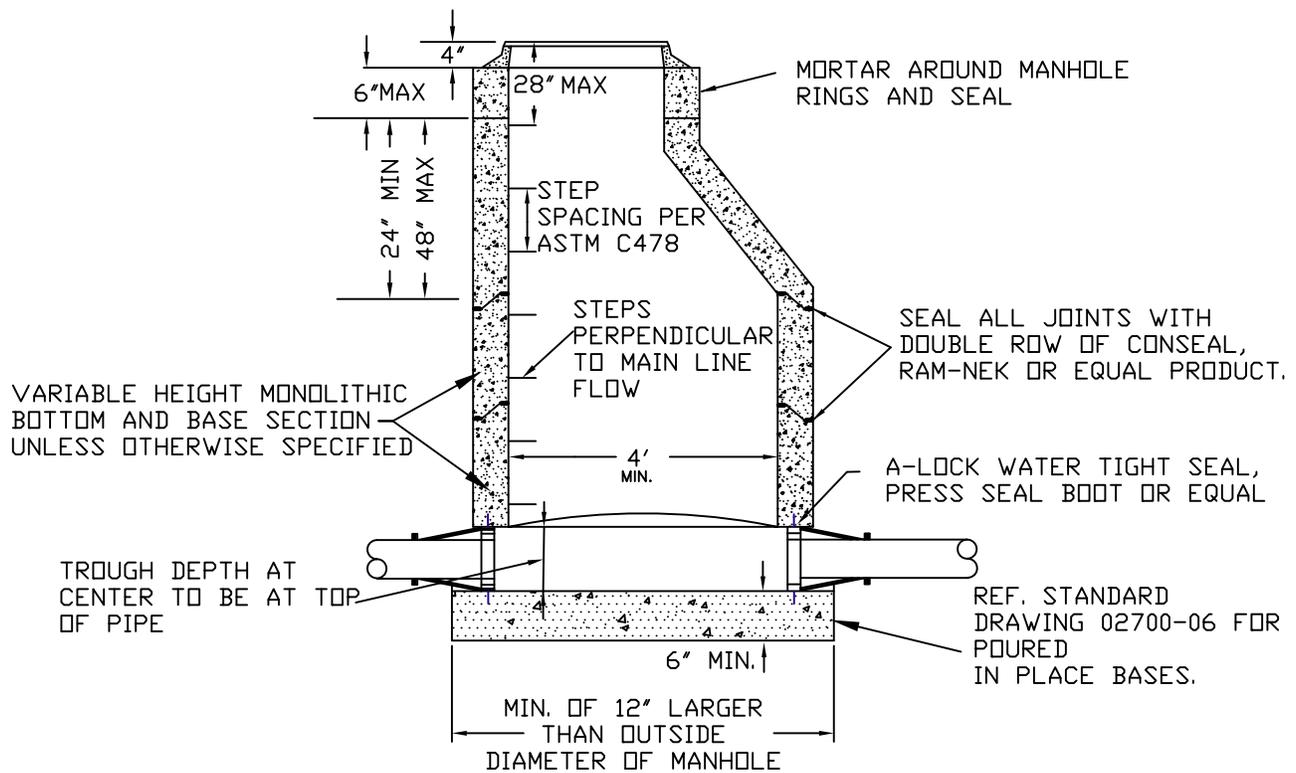


CITY OF CHEYENNE
AND
BOARD OF PUBLIC
UTILITIES
STANDARD DRAWING

OUTSIDE RADIO READ
RECEPTACLE INSTALLATION
FOR INSIDE WATER METER

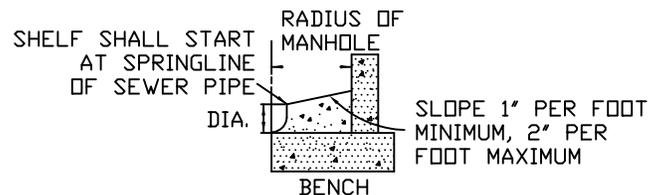
NOTES:

1. DROP ACROSS THE MANHOLE SHALL BE THE SAME SLOPE AS THE ADJACENT SEWER MAINS, BUT NOT LESS THAN 0.1 FOOT.
2. DROP ACROSS TURN INVERT SHALL BE GREATER THAN OR EQUAL TO SLOPE OF ADJACENT SEWER, BUT NOT LESS THAN 0.1 FOOT.
3. MANHOLES OUTSIDE PAVED STREETS OR ALLEYS, REFERENCE STANDARD DRAWING 02700-08.
4. PRECAST MANHOLE SECTIONS SHALL CONFORM TO ASTM C 478 FOR AASHTO HS-20-44 LOADINGS.
5. MANHOLES AT DEPTHS GREATER THAN TWENTY FEET SHALL REQUIRE A PLATFORM. REFERENCE STANDARD DRAWING NO. 02700-04.
6. THE MONOLITHIC CONE SECTION HEIGHT SHALL BE 24" MINIMUM AND 48" MAXIMUM.
7. TOTAL HEIGHT OF CONCRETE ADJUSTMENT RINGS SHALL NOT EXCEED 6". NO CAST IRON RING INSERTS WILL BE ALLOWED TO RAISE THE ELEVATION OF THE RING OR COVER.
8. PIPES WILL BE LAID INTO MANHOLES BEFORE TROUGHS ARE POURED.



MANHOLE INSIDE DIAMETER REQUIREMENTS		
PIPE DIAMETER	DEPTH OF LINE	MANHOLE DIAMETER
8" THRU 12"	UP TO 15 FEET	FOUR FEET
15" THRU 21"	15 TO 20 FEET	FIVE FEET
	GREATER THAN 20 FEET	SIX FEET

24" AND LARGER REQUIRE BOPU APPROVAL



CITY OF CHEYENNE
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STANDARD DRAWING

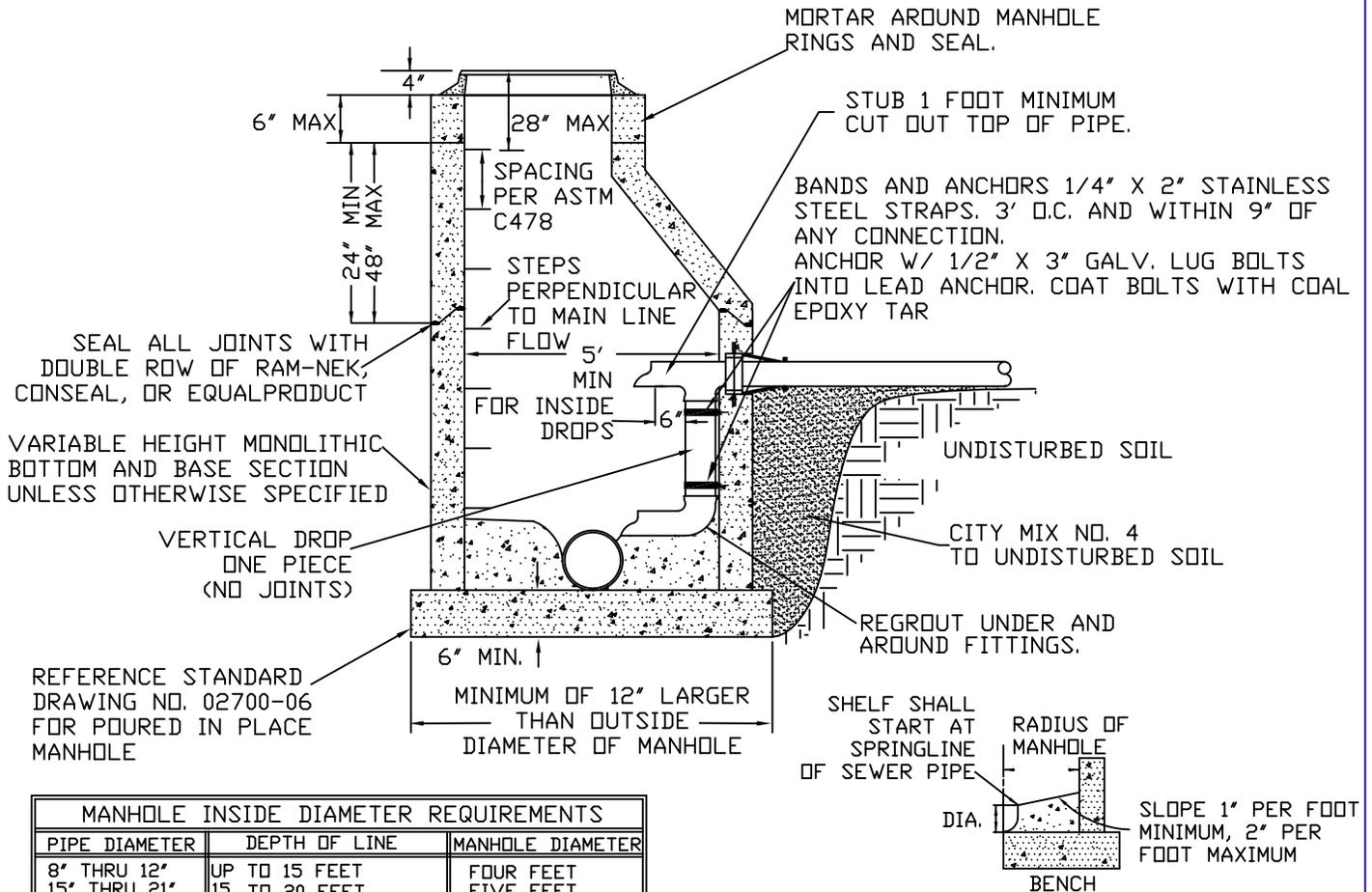
STANDARD MANHOLE DETAIL



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STANDARD
DRAWING NO.
02700-01

NOTES:

1. ALL INSIDE DROP MANHOLES MUST BE APPROVED BY THE BOPU BEFORE CONSTRUCTION BEGINS.
2. ALL INSIDE DROP MANHOLES SHALL BE PLACED IN A 5' DIAMETER MANHOLES.
3. DROP ACROSS THE MANHOLE SHALL BE THE SAME SLOPE AS THE ADJACENT SEWER MAIN, BUT NOT LESS THAN 0.1 FOOT.
4. DROP ACROSS TURN INVERT SHALL BE GREATER THAN OR EQUAL TO SLOPE OF ADJACENT SEWER, BUT NOT LESS THAN 0.1 FOOT.
5. MANHOLES OUTSIDE PAVED STREETS OR ALLEYS, REFERENCE STANDARD DRAWING NO. 02700-08.
6. PRECAST MANHOLE SECTIONS SHALL CONFORM TO ASTM C 478 FOR AASHTO HS-20-44 LOADINGS.
7. MANHOLES AT DEPTHS GREATER THAN TWENTY FEET SHALL REQUIRE A PLATFORM. REFERENCE STANDARD DRAWING NO. 02700-04.
8. THE MONOLITHIC CONE SECTIONS HEIGHT SHALL BE 24" MINIMUM AND 48" MAXIMUM.
9. TOTAL HEIGHT OF CONCRETE ADJUSTMENT RINGS SHALL NOT EXCEED 6". NO CAST IRON RING INSERTS WILL BE ALLOWED TO RAISE THE ELEVATION OF THE RING OR COVER.
10. PIPES WILL BE LAID INTO MANHOLES BEFORE TROUGHS ARE POURED.



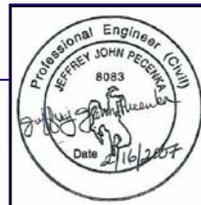
MANHOLE INSIDE DIAMETER REQUIREMENTS		
PIPE DIAMETER	DEPTH OF LINE	MANHOLE DIAMETER
8" THRU 12"	UP TO 15 FEET	FOUR FEET
15" THRU 21"	15 TO 20 FEET	FIVE FEET
	GREATER THAN 20 FEET	SIX FEET

24" AND LARGER REQUIRE BOPU APPROVAL



CITY OF CHEYENNE
AND
BOARD OF PUBLIC
UTILITIES
STANDARD DRAWING

TYPICAL INSIDE DROP MANHOLE

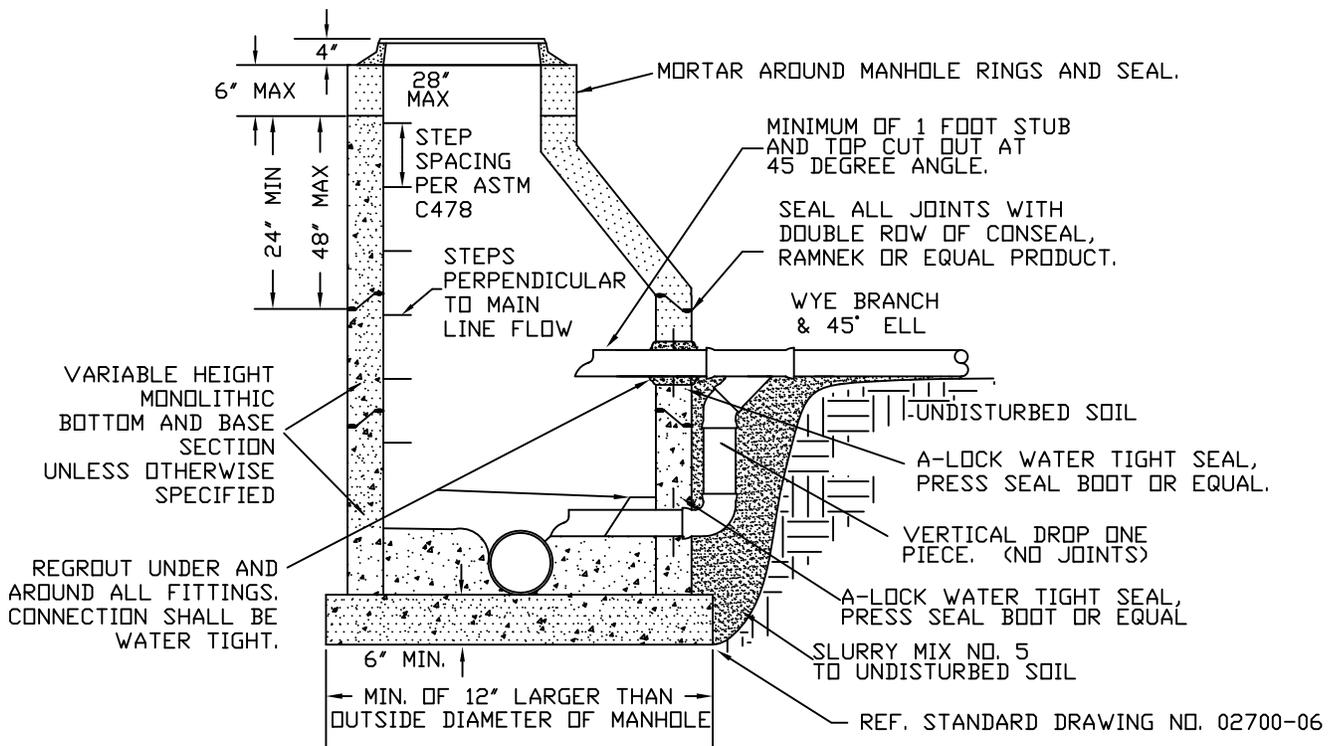


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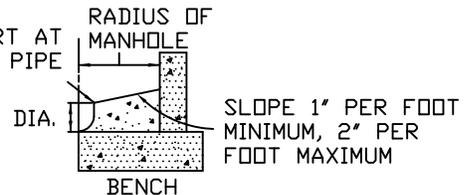
STANDARD
DRAWING NO.
02700-02

NOTES:

1. ALL OUTSIDE DROP MANHOLES MUST BE APPROVED BY THE BOPU BEFORE CONSTRUCTION BEGINS.
2. DROP ACROSS THE MANHOLE SHALL BE THE SAME SLOPE AS THE ADJACENT SEWER MAIN, BUT NOT LESS THAN 0.1 FOOT.
3. DROP ACROSS TURN INVERT SHALL BE GREATER THAN OR EQUAL TO SLOPE OF ADJACENT SEWER, BUT NOT LESS THAN 0.1 FOOT.
4. MANHOLES OUTSIDE PAVED STREETS OR ALLEYS, REFERENCE STANDARD DRAWING NO. 02700-08.
5. PRECAST MANHOLE SECTIONS SHALL CONFORM TO ASTM C478 FOR AASHTO HS-20-44 LOADINGS.
6. MANHOLES AT DEPTHS GREATER THAN TWENTY FEET SHALL REQUIRE A PLATFORM. REFERENCE STANDARD DRAWING NO. 02700-04.
7. THE MONDLITHIC CONE SECTION HEIGHT SHALL BE 24" MINIMUM AND 48" MAXIMUM.
8. TOTAL HEIGHT OF CONCRETE ADJUSTMENT RINGS SHALL NOT EXCEED 6". NO CAST IRON RING INSERTS WILL BE ALLOWED TO RAISE THE ELEVATION OF THE RING OR COVER.
9. PIPES WILL BE LAID INTO MANHOLES BEFORE TROUGHS ARE POURED.



SHELF SHALL START AT SPRINGLINE OF SEWER PIPE



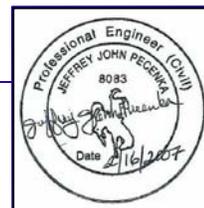
MANHOLE INSIDE DIAMETER REQUIREMENTS		
PIPE DIAMETER	DEPTH OF LINE	MANHOLE DIAMETER
8" THRU 12"	UP TO 15 FEET	FOUR FEET
15" THRU 21"	15 TO 20 FEET	FIVE FEET
	GREATER THAN 20 FEET	SIX FEET

24" AND LARGER REQUIRE BOPU APPROVAL



CITY OF CHEYENNE
AND
BOARD OF PUBLIC
UTILITIES
STANDARD DRAWING

TYPICAL OUTSIDE DROP MANHOLE



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DRAWING NO.
02700-03

NOT TO SCALE

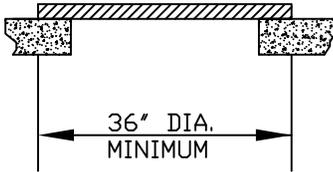
TO BE USED WHEN THE DISTANCE FROM INVERT TO TOP OF COVER EXCEEDS 20 FEET.

ALIGN STEPS ABOVE PLATFORM OPENING AS SHOWN TO TOP OF MANHOLE

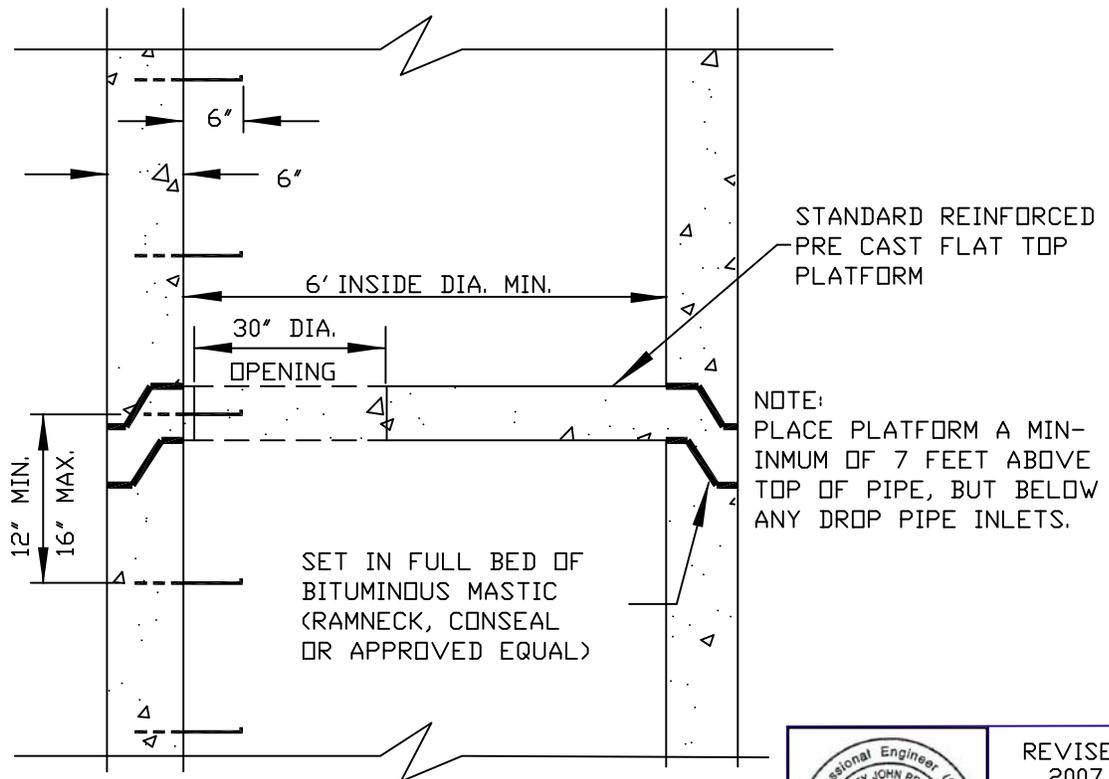
NON-CORROSIVE SAFE-T-GRID APPROVED BY BOPU

RING

MESH

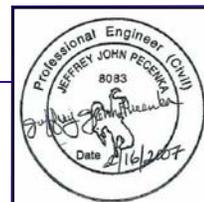


ALL MANHOLES AND MANHOLE PARTS SHALL BE MANUFACTURED IN ACCORDANCE WITH ASTM C-478 FOR AASHTO HS-22-44 LOADING.



CITY OF CHEYENNE
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STANDARD DRAWING

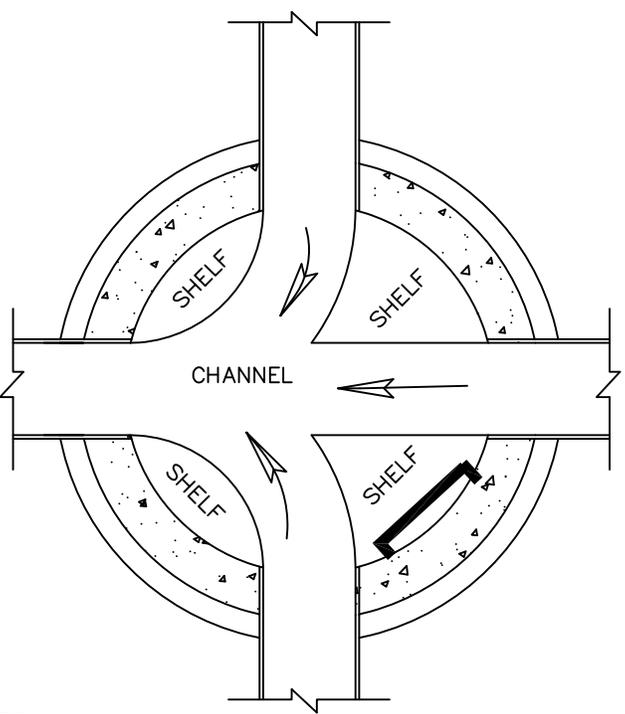
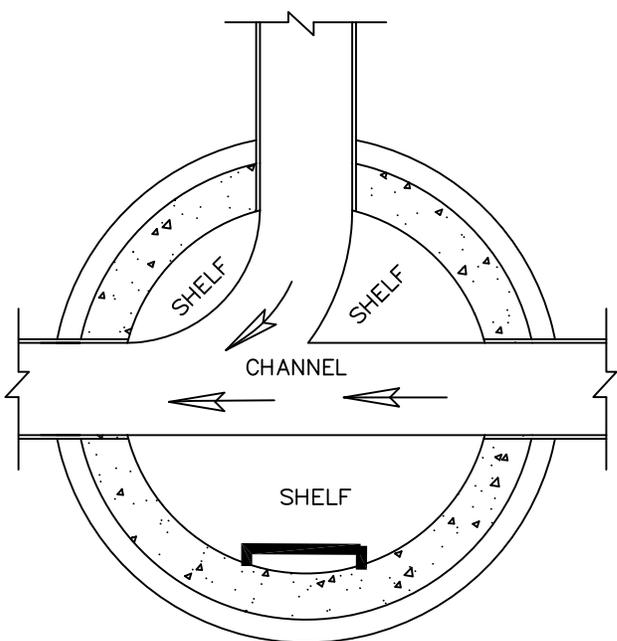
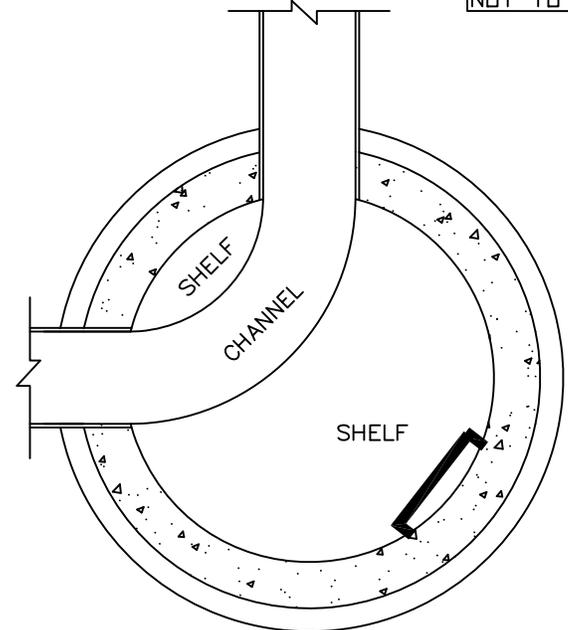
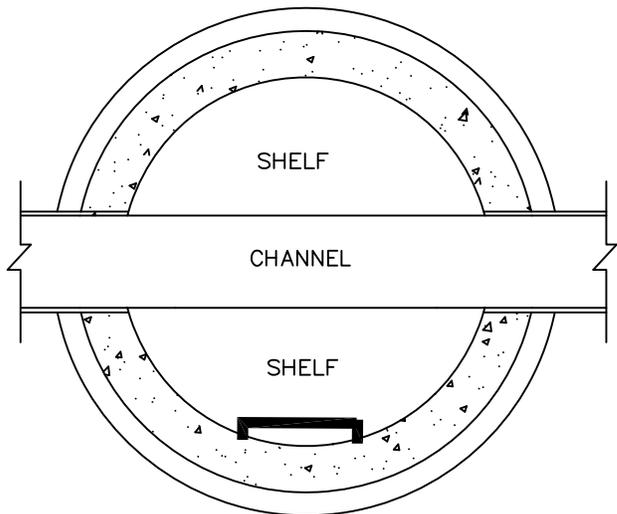
INTERMEDIATE PLATFORM FOR
MANHOLES OVER 20 FOOT DEEP



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2007

STANDARD
DRAWING NO.
02700-04

NOT TO SCALE



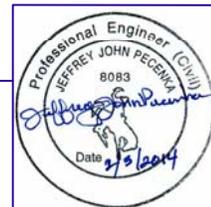
NOTES:

1. SLOPE ALL SHELVES TO CHANNEL AT 1" TO 2" PER FOOT.
2. SEE PLAN AND PROFILE SHEETS FOR SLOPE OF CHANNEL.
3. DROP ACROSS INVERT SHALL BE GREATER THAN OR EQUAL TO SLOPE OF ADJACENT SEWER, BUT NOT LESS THAN 0.1 FOOT.
4. SHELVES SHALL BE GIVEN A ROUGH BRUSHED FINISH WHEN PLACED.
5.  LOCATION FOR STEPS.
6. ALL TROUGHS SHALL BE COATED WITH A TYPE #3 EPOXY.



CITY OF CHEYENNE
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STANDARD DRAWING

TYPICAL MANHOLE CHANNEL
DETAILS

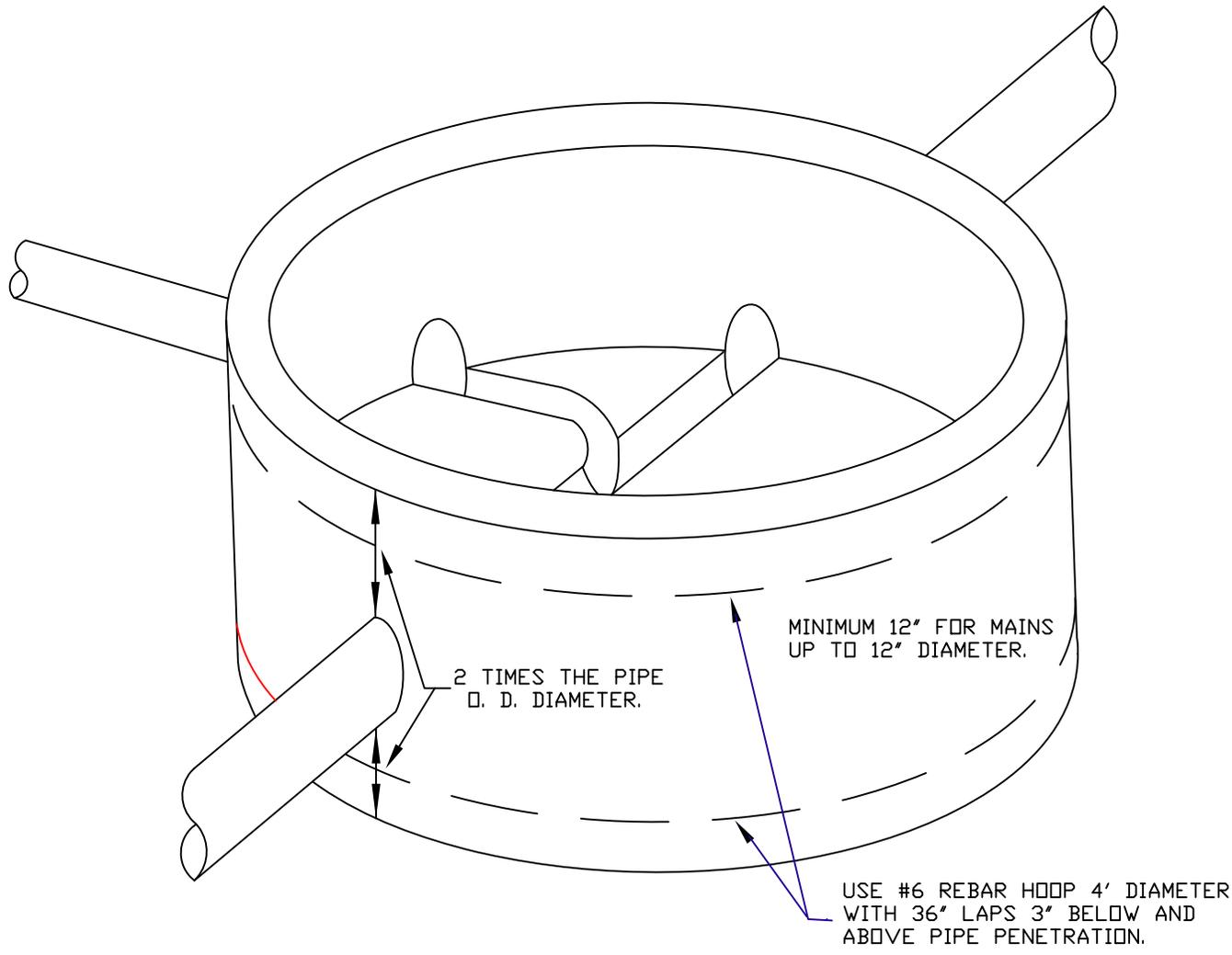


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STANDARD
DRAWING NO.
02700-05

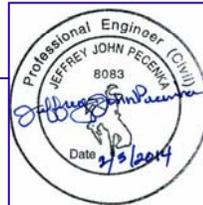
NOTES:

1. Concrete shall be four thousand (4,000) PSI meeting BOPU's concrete requirements.
2. Concrete shall be allowed to cure for five (5) day before setting M.H. sections.
3. No concrete blocks allowed.
4. Use one (1) inch to four (4) inch rock in unstable conditions.
5. Use number six (#6) rebar hoop four (4) foot diameter with thirty-six (36) inch laps three (3) inches above and below pipe penetration.
6. Use number five (#5) rebar twelve (12) inch on center below pipe penetration.
7. Concrete shall be poured two (2) times the diameter of the pipe below and above the pipe.
8. A rubber water stop material shall be around all pipe penetrations into base.
9. Double Con Seal or Ramneck used when setting barrel section on to concrete base.
10. Poured in placed bases not allowed on new construction.
11. Precast and poured in place base trough's shall have an Epoxy Type 3 lining



CITY OF CHEYENNE
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UTILITIES
STANDARD DRAWING

POURED IN PLACE BASES
FOR 12" AND SMALLER SEWER



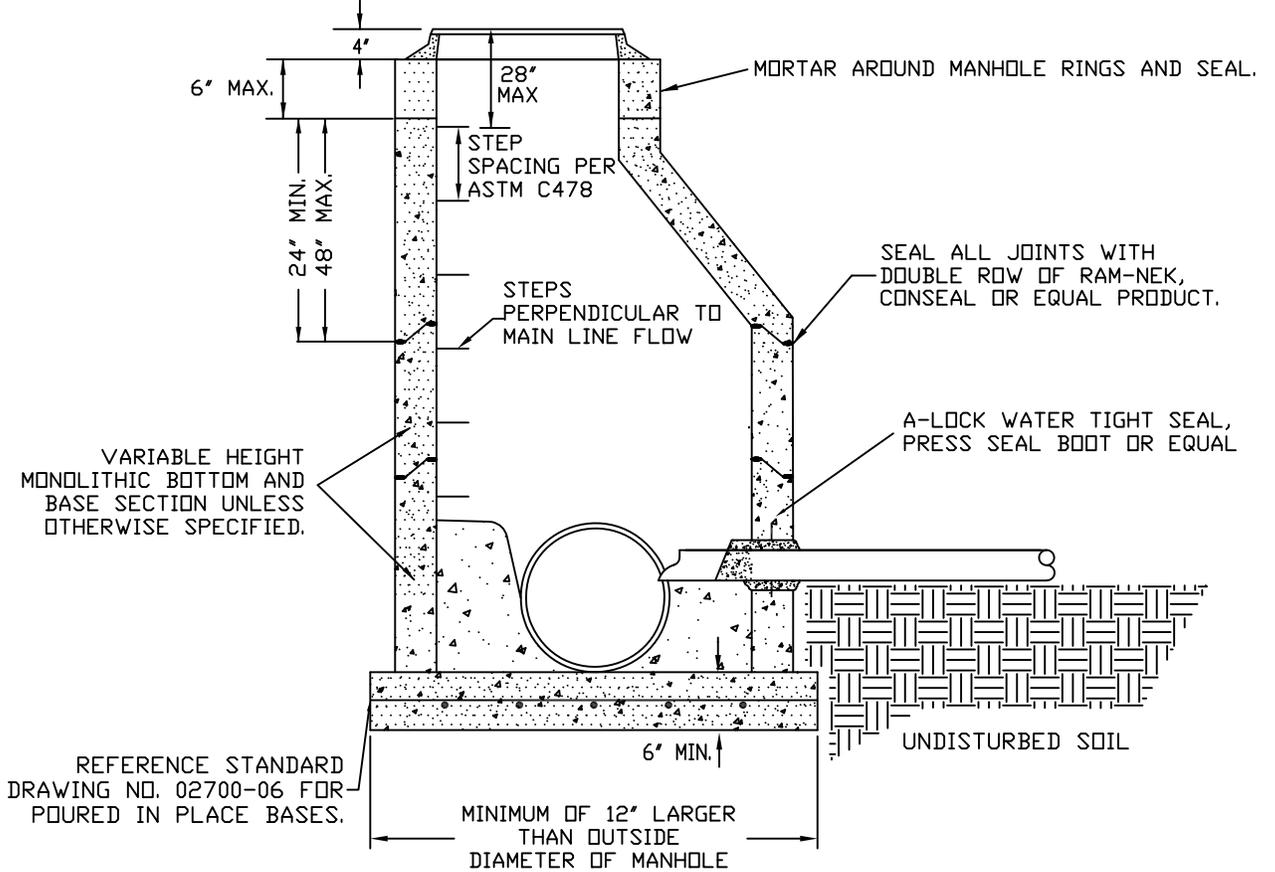
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STANDARD
DRAWING NO.
02700-06

NOTES:

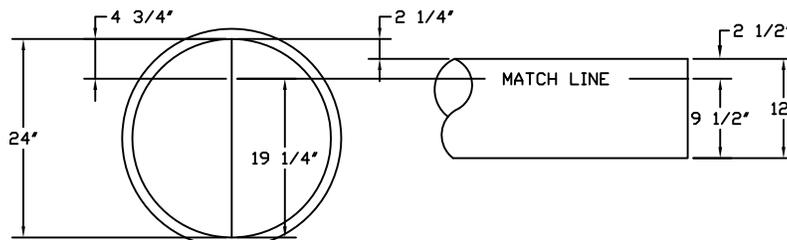
NOT TO SCALE

1. MINIMUM REQUIREMENTS TO MAINTAIN THE SAME ENERGY GRADIENT LINE IS TO PLACE 0.8 DEPTH POINT FOR EACH LINE AT THE SAME POINT, WHERE TOPOGRAPHY IS ADEQUATE, IT IS TYPICAL TO MATCH PIPE CROWNS.
2. THE MONOLITHIC CONE SECTION HEIGHT SHALL BE 24" MINIMUM AND 48" MAXIMUM.
3. TOTAL HEIGHT OF CONCRETE ADJUSTMENT RINGS SHALL NOT EXCEED 6". NO CAST IRON RING INSERTS WILL BE ALLOWED TO RAISE THE ELEVATION OF THE RING AND COVER.



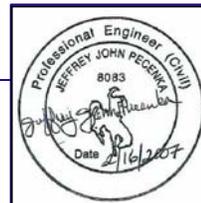
EXAMPLE:

- 1.) 12" I.D. PIPE INTERSECTING 24" I.D. PIPE
- 2.) FOUR FIFTH'S (0.8) DEPTH OF 12" I.D. PIPE = 9 1/2"
- 3.) FOUR FIFTH'S (0.8) DEPTH OF 24" I.D. PIPE = 19 1/4"
- 4.) THE CROWN OF THE 12" PIPE IS THEREFORE 2 1/4" BELOW THE CROWN OF THE 24" PIPE WHICH MATCH'S THE FOUR FIFTH'S (0.8) DEPTH OF BOTH PIPES.



CITY OF CHEYENNE
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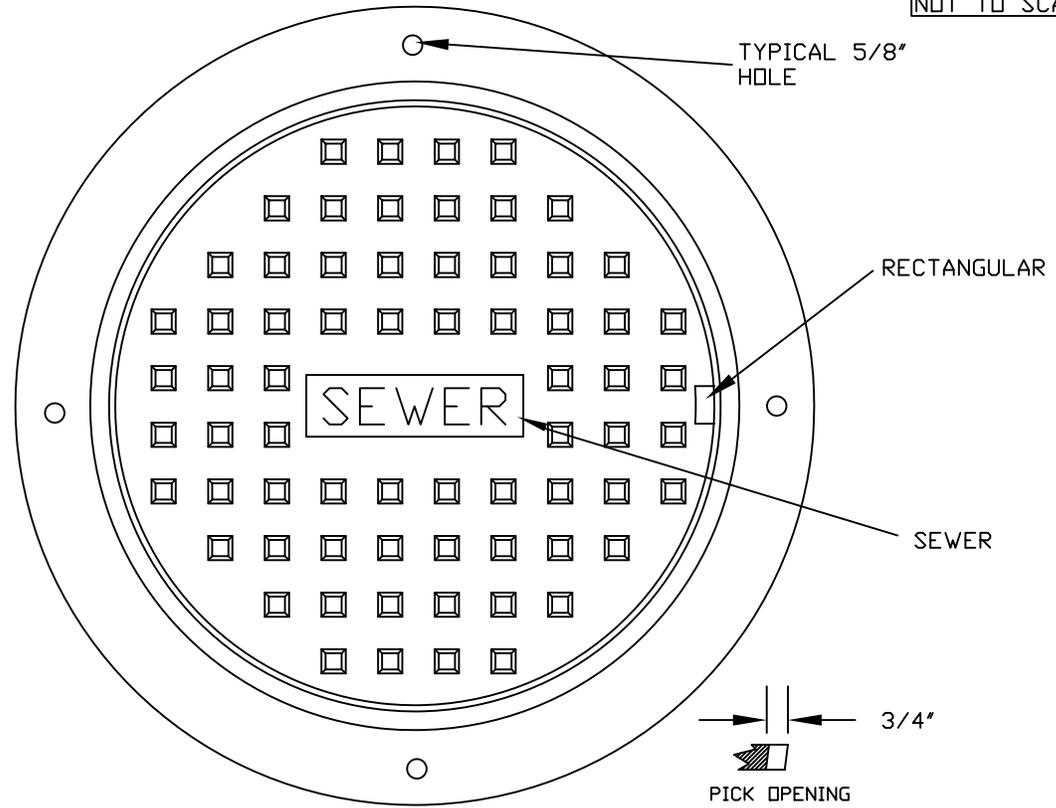
SEWER CONNECTION BRANCH TO
INTERCEPTOR DETAIL



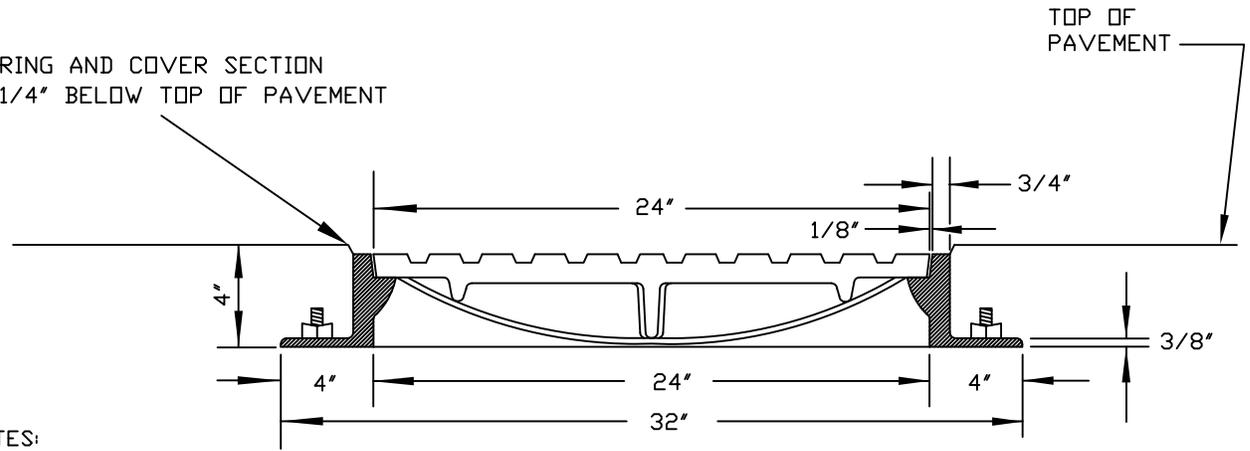
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STANDARD
DRAWING NO.
02700-07

NOT TO SCALE



RING AND COVER SECTION
1/4" BELOW TOP OF PAVEMENT



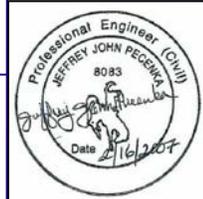
NOTES:

1. FIT BETWEEN RING AND COVER MUST BE MACHINED.
2. MUST HAVE APPROVED BOLT DOWN COVER AND GASKET IN FLOOD PLAIN AND OTHER AREAS SUBJECT TO INUNDATION.
3. MANHOLES OUTSIDE PAVED STREETS OR ALLEYS SHALL HAVE BOLT TYPE COVER THAT BOLTS TO THE RING AND THE RING SHALL BE BOLTED TO CONE SECTION OR FLAT TOP SECTION OF MANHOLE. USE FOUR (4) 1/2" DIAMETER X 3" LONG STAINLESS STEEL RAM SET ANCHORS OR APPROVED EQUAL.
4. EAST JORDAN IRON WORKS 330-4 RING WITH A CHECKERED FLUSH MOUNT COVER MARKED "SEWER" OR APPROVED EQUAL.
5. USE A MINIMUM 135 POUND COVER.
6. IN NON PAVED AREAS OTHER THAN TRAVELWAYS. PLACE TOP OF MANHOLE ONE FOOT ABOVE GROUND.



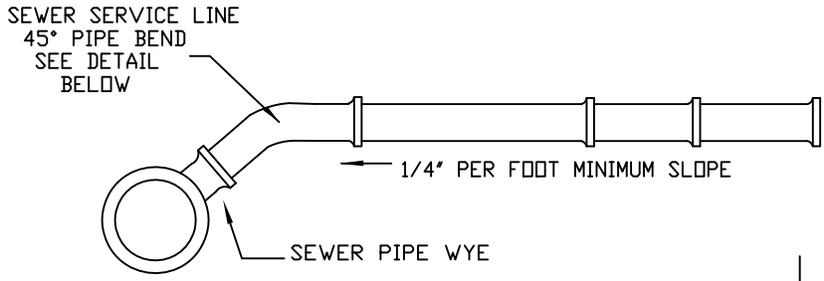
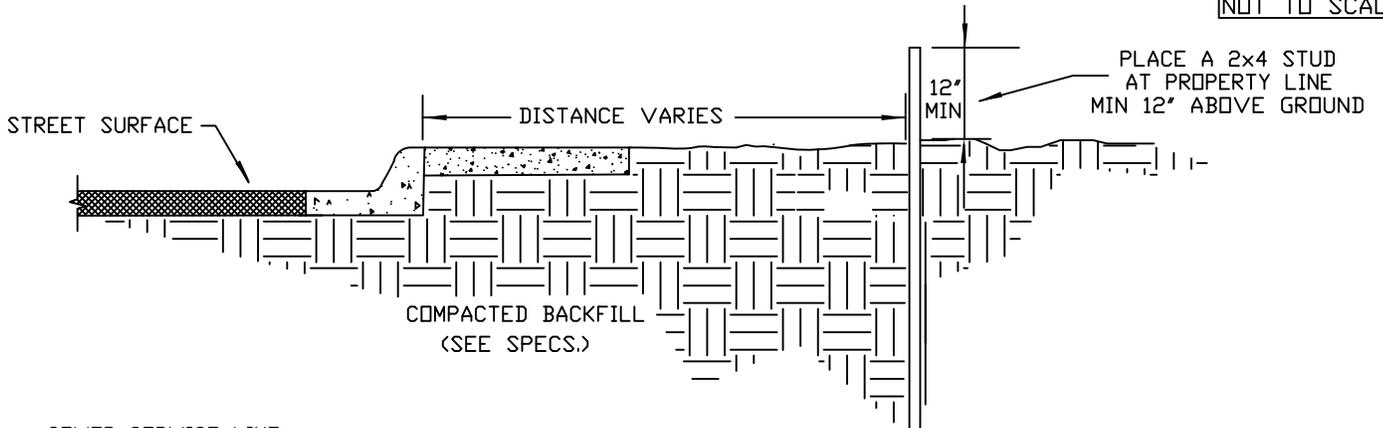
CITY OF CHEYENNE
AND
BOARD OF PUBLIC
UTILITIES
STANDARD DRAWING

MANHOLE RING AND COVER
DETAILS

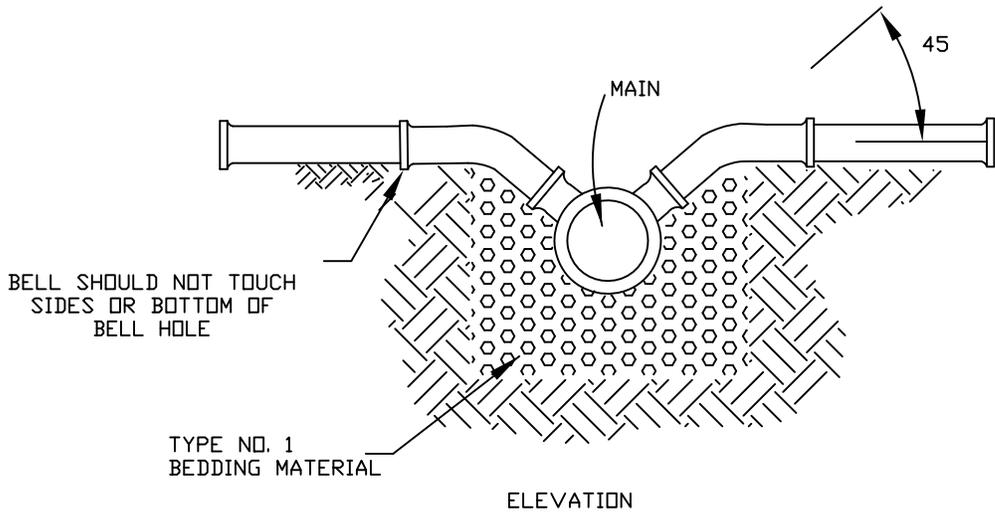
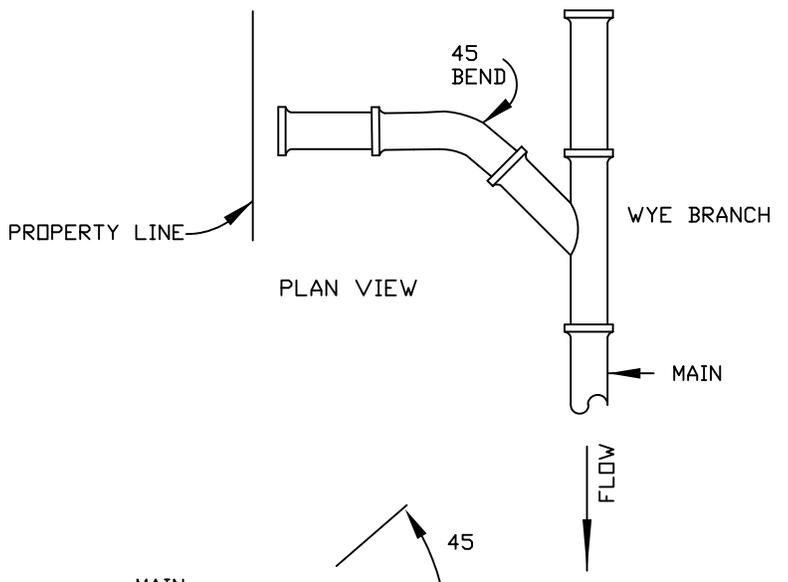


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STANDARD
DRAWING NO.
02700-08

NOT TO SCALE

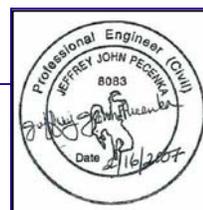


SANITARY SEWER MAIN LINE

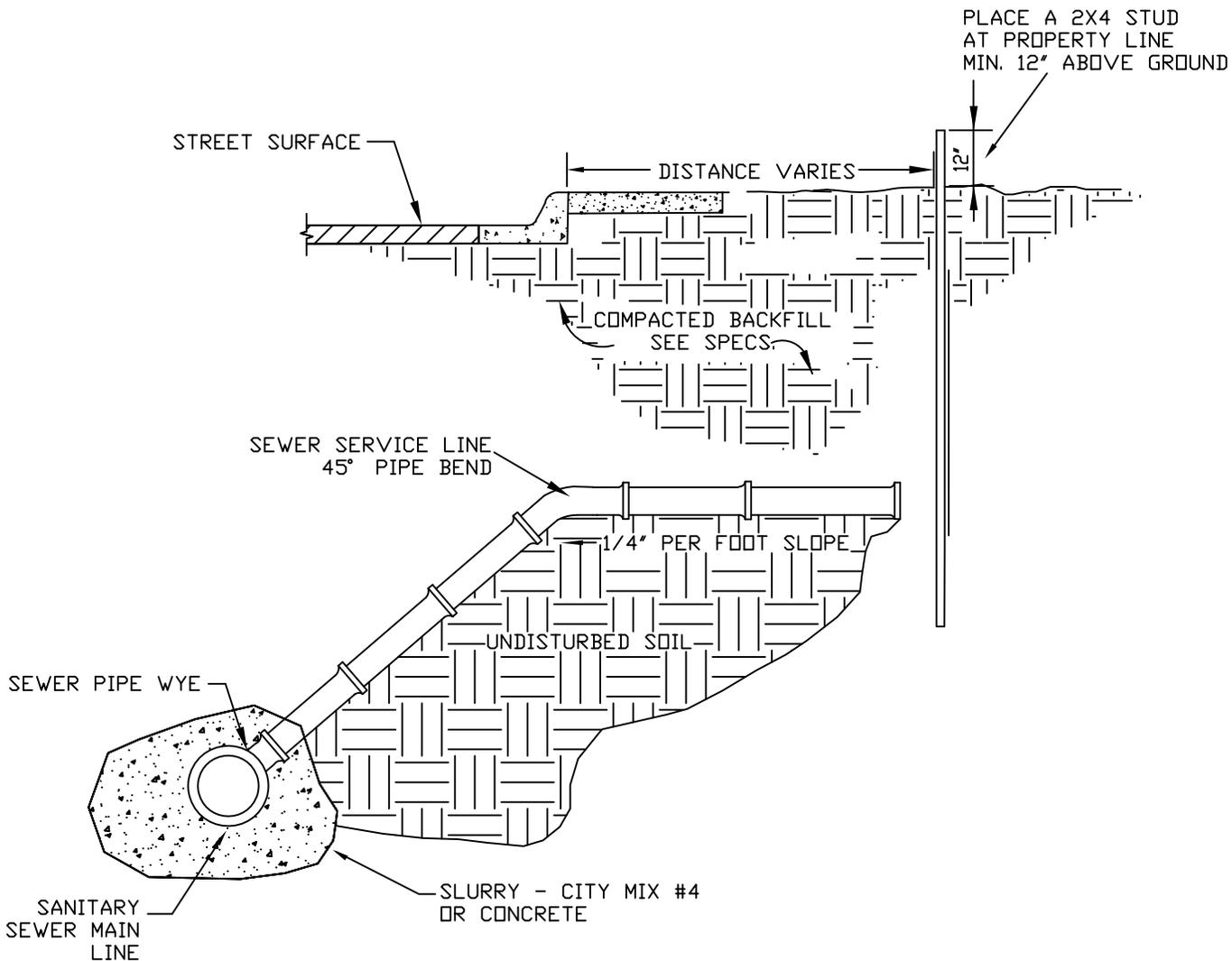


CITY OF CHEYENNE
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STANDARD DRAWING

SANITARY SEWER SERVICE LINE

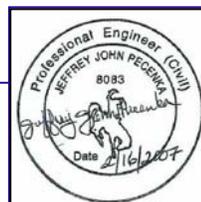


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STANDARD
DRAWING NO.
02700-09



CITY OF CHEYENNE
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UTILITIES
STANDARD DRAWING

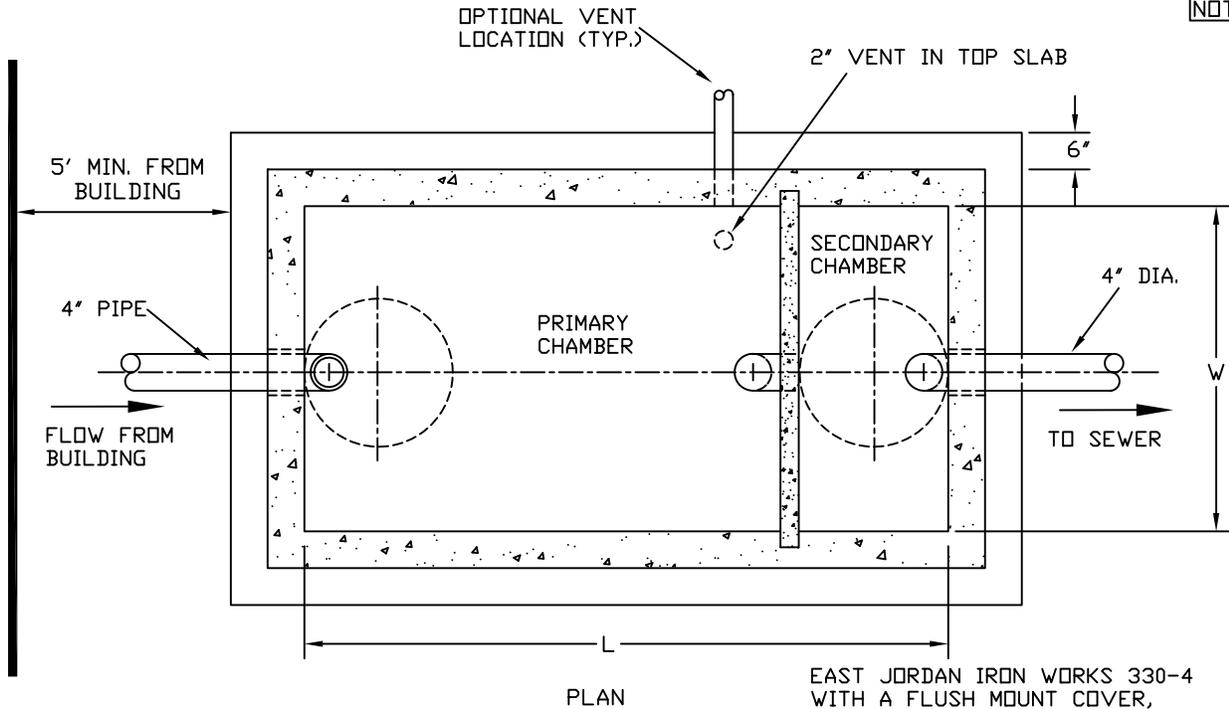
DEEP SERVICE DETAIL
FOR 12 FOOT OR DEEPER



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DRAWING NO.
02700-10

NOT TO SCALE



PLAN

EAST JORDAN IRON WORKS 330-4 WITH A FLUSH MOUNT COVER, OR A PRE-APPROVED EQUAL

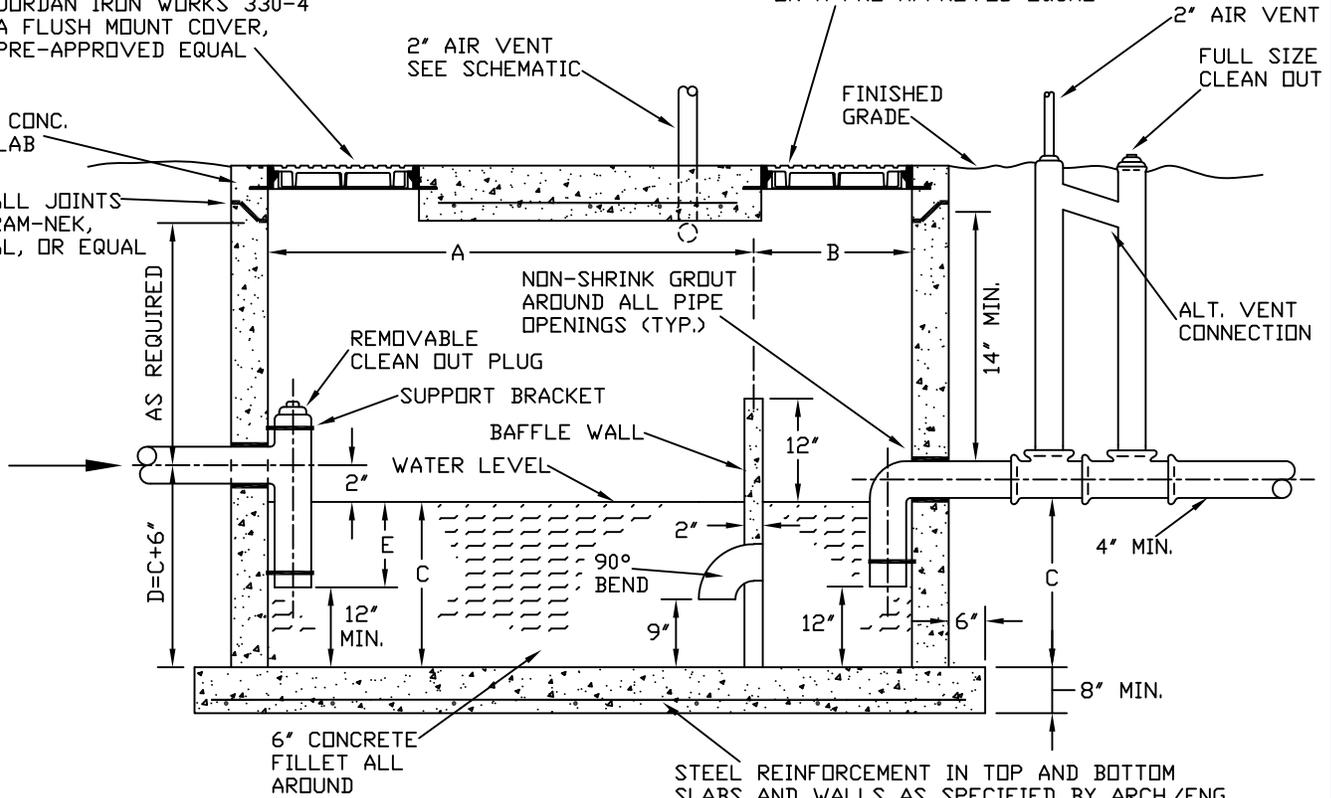
2" AIR VENT SEE SCHEMATIC

EAST JORDAN IRON WORKS 330-4 WITH A FLUSH MOUNT COVER, OR A PRE-APPROVED EQUAL

2" AIR VENT FULL SIZE CLEAN OUT

REINF. CONC. TOP SLAB

SEAL ALL JOINTS WITH RAM-NEK, CONSEAL, OR EQUAL



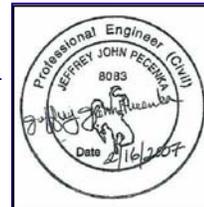
NOTES:

- GREASE AND SAND TRAPS ARE TO MEET THE REQUIREMENTS OF CHAPTER 44 OF THE CITY CODE AND THE UNIFORM PLUMBING CODES AS ADOPTED BY THE CITY OF CHEYENNE.
- VAULT SHALL BE CONSTRUCTED TO HS-20-44 LOADING.
- VAULT SHALL BE LOCATED OUTSIDE OF BUILDING.
- SEE STANDARD DRAWING NO. 02700-11B FOR TABLE SHOWING A,B,C,D,E,L,&W DIMENSIONS.



CITY OF CHEYENNE
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STANDARD DRAWING

TYPICAL SAND
AND
GREASE TRAP



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STANDARD
DRAWING NO.
02700-11A

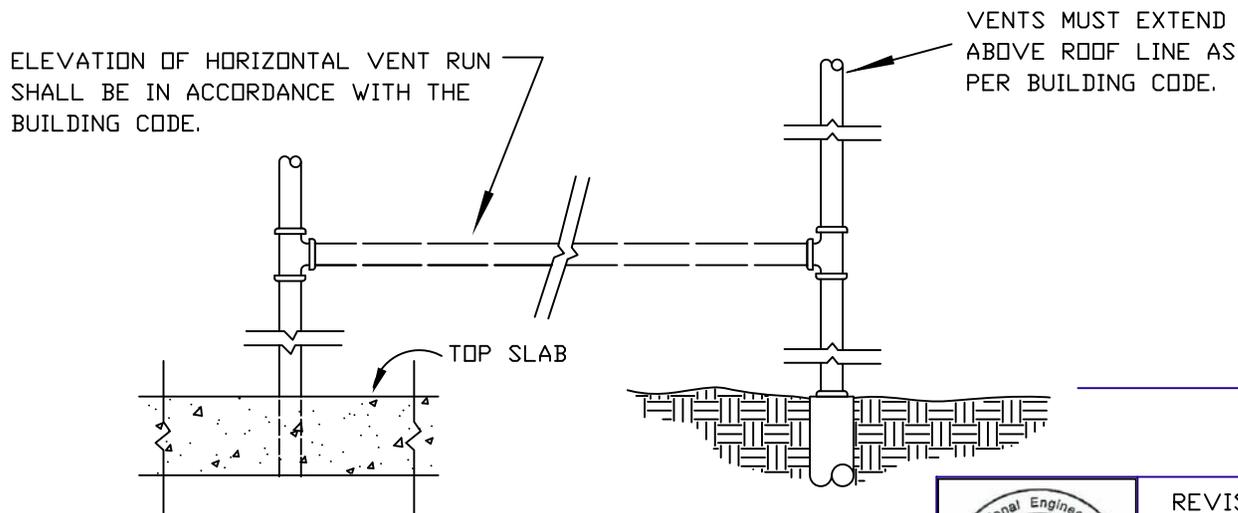
- W = TOTAL INSIDE WIDTH.
- L = TOTAL INSIDE LENGTH.
- A = NOMINAL INSIDE LENGTH OF PRIMARY TANK.
- B = NOMINAL INSIDE LENGTH OF SECONDARY TANK.
- C = TOTAL DEPTH OF LIQUID (WATER AND GREASE) = INVERT ELEVATION OF EFFLUENT PIPE ABOVE BASE.
- D = INVERT ELEVATION OF INFLUENT PIPE ABOVE BASE = C + 2"
- E = MAXIMUM ALLOWABLE DEPTH OF GREASE BUILD UP (APPROXIMATE) = 0.75 FOOT (C-9")

SIZE OF GREASE INTERCEPTOR										
TOTAL RATE OF FLOW (GPM)	TOTAL WATER CAPACITY APPROX.		GREASE CAPACITY CUBIC FOOT APPROX.	DIMENSIONS						
				TWO COMPARTMENT TANK (INCHES)						
	FT. ³	GAL.		W	L	A	B	C	D	E
LESS THAN 100	44	330	13	48	72	48	24	22	24	10
100-200	107	800	41	48	96	64	32	40	42	23
200-300	153	1145	57	72	108	72	36	34	36	19
300-400	200	1500	77	72	120	80	40	40	42	23

NOTES:

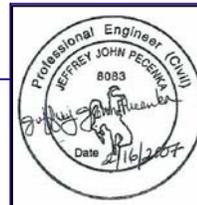
1. MINIMUM ALLOWABLE RETENTION TIME FOR INTERCEPTOR = 3 MINUTES.
2. MINIMUM ACCEPTABLE TOTAL WATER CAPACITY FOR INTERCEPTOR = 300 GAL.

SCHEMATIC
OPTIONAL CONNECTION
(VENTING SYSTEM)



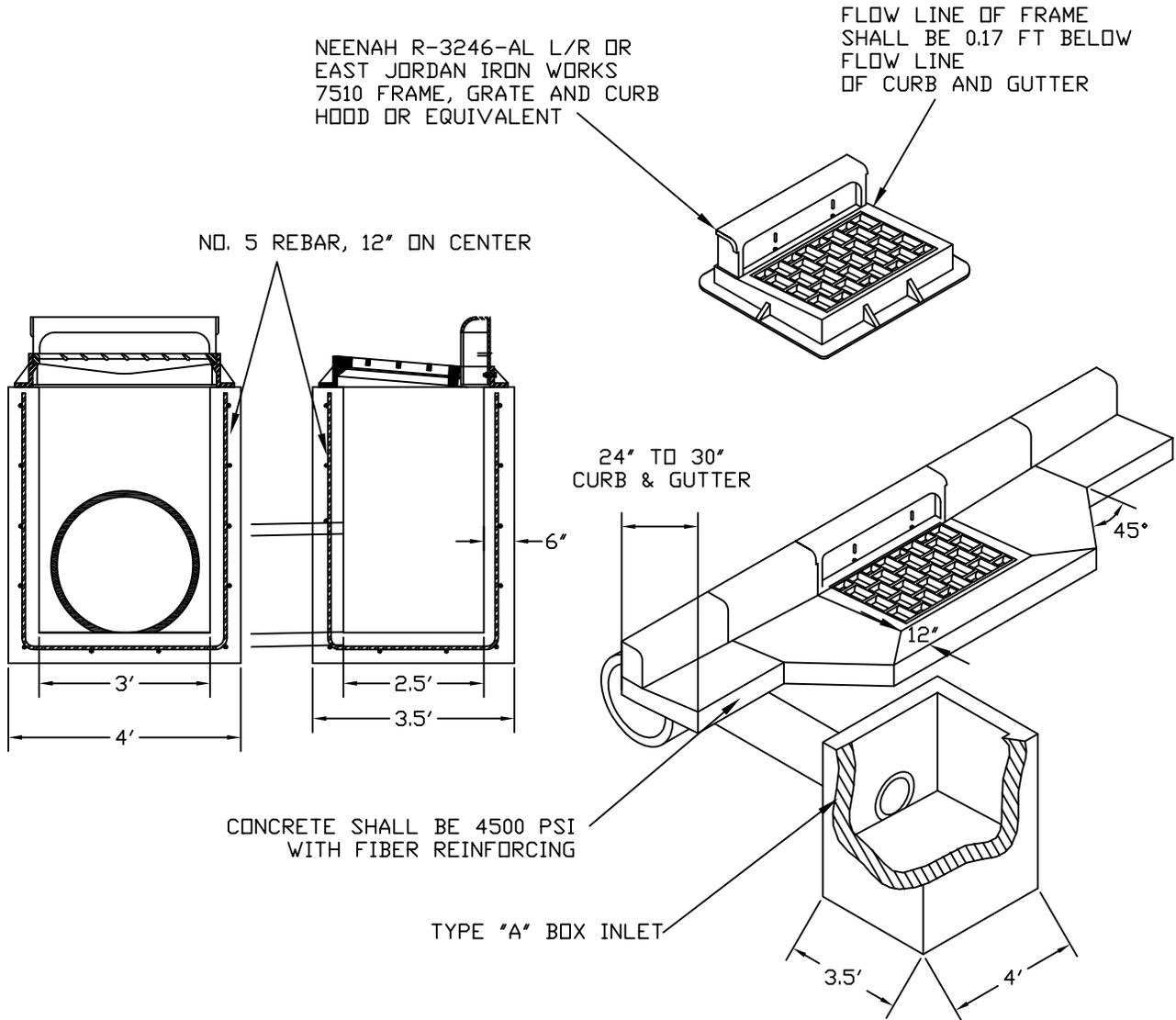
CITY OF CHEYENNE
AND
BOARD OF PUBLIC
UTILITIES
STANDARD DRAWING

TYPICAL SAND
AND
GREASE TRAP



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DRAWING NO.
02700-11B



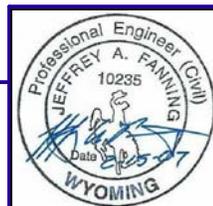
NOTES:

1. PIPE INLET AND OUTLET HOLES FOR PRECAST INLETS SHALL BE PREFORMED. ALL PIPES SHALL BE GROUTED WITH A NONSHRINK GROUT IN ACCORDANCE WITH SECTION 03600.
2. A 1/8" PER FOOT TAPER IN BOX WALLS IS ALLOWED TO EASE FORM REMOVAL.
3. LIVE LOADING SHALL CONFORM TO HS 20-44.
4. NO. 5 REBAR SHALL BE GRADE 60 AND PLACED ON 12" CENTERS.
5. WHEN BOX IS POURED IN PLACE THE CONCRETE SHALL BE 4500 PSI WITH FIBER REINFORCING. PRECAST SHALL BE 4000 PSI AND CONFORM WITH SECTION 03480.
6. BOTTOM OF BOX SHALL BE SLOPED TO OUTFLOW PIPE.
7. INLET FRAME SHALL BE SET 0.17' BELOW EXTENDED FLOW LINE.



CITY OF CHEYENNE
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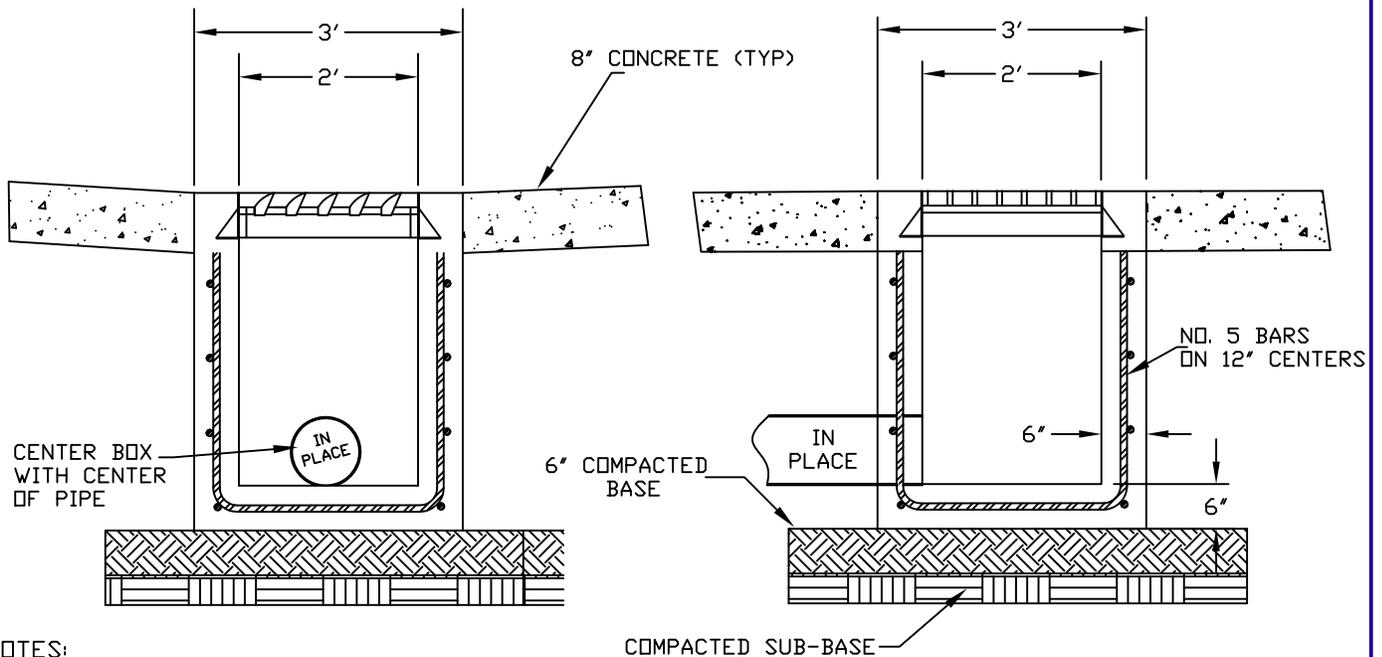
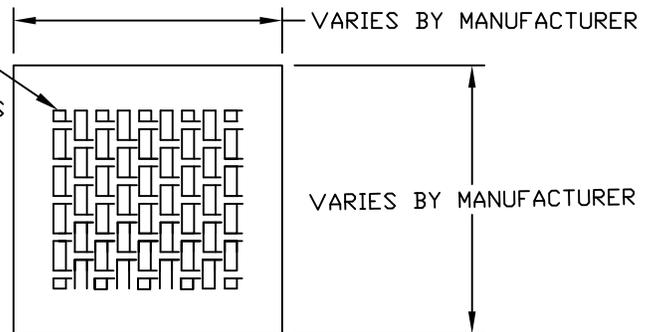
STORM SEWER CATCH BASIN
TYPE "A"



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STANDARD
DRAWING NO.
02725-01

CITY STANDARD SHALL BE NEENAH #R-3210-L FOR 6" DEPTH, NEENAH #R-3588L FOR 8" DEPTH OR EAST JORDAN IRON WORKS 5370 WITH 5344M VANE GRATE, OR APPROVED EQUAL. FLOW LINE OF GRATE AND FRAME SHALL BE 0.17' BELOW FLOW LINE. ALL GRATES SHALL BE THE VANE TYPE UNLESS OTHERWISE APPROVED.



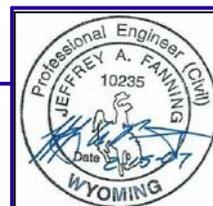
NOTES:

1. PIPE INLET AND OUTLET HOLES FOR PRECAST INLETS SHALL BE PREFORMED. ALL PIPES SHALL BE GROUTED WITH A NONSHRINK GROUT IN ACCORDANCE WITH SECTION 03600.
2. A 1/8" PER FOOT TAPER IN BOX WALLS IS ALLOWED TO EASE FORM REMOVAL.
3. LIVE LOADING SHALL CONFORM TO HS 20-44.
4. NO. 5 REBAR SHALL BE GRADE 60 AND PLACED ON 12" CENTERS.
5. WHEN BOX IS POURED IN PLACE THE CONCRETE SHALL BE 4500 PSI WITH FIBER REINFORCING. PRECAST SHALL BE 4000 PSI AND CONFORM WITH SECTION 03480.
6. BOTTOM OF BOX SHALL BE SLOPED TO OUTFLOW PIPE.
7. INLET FRAME SHALL BE SET 0.17' BELOW EXTENDED FLOW LINE.



CITY OF CHEYENNE
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STANDARD DRAWING

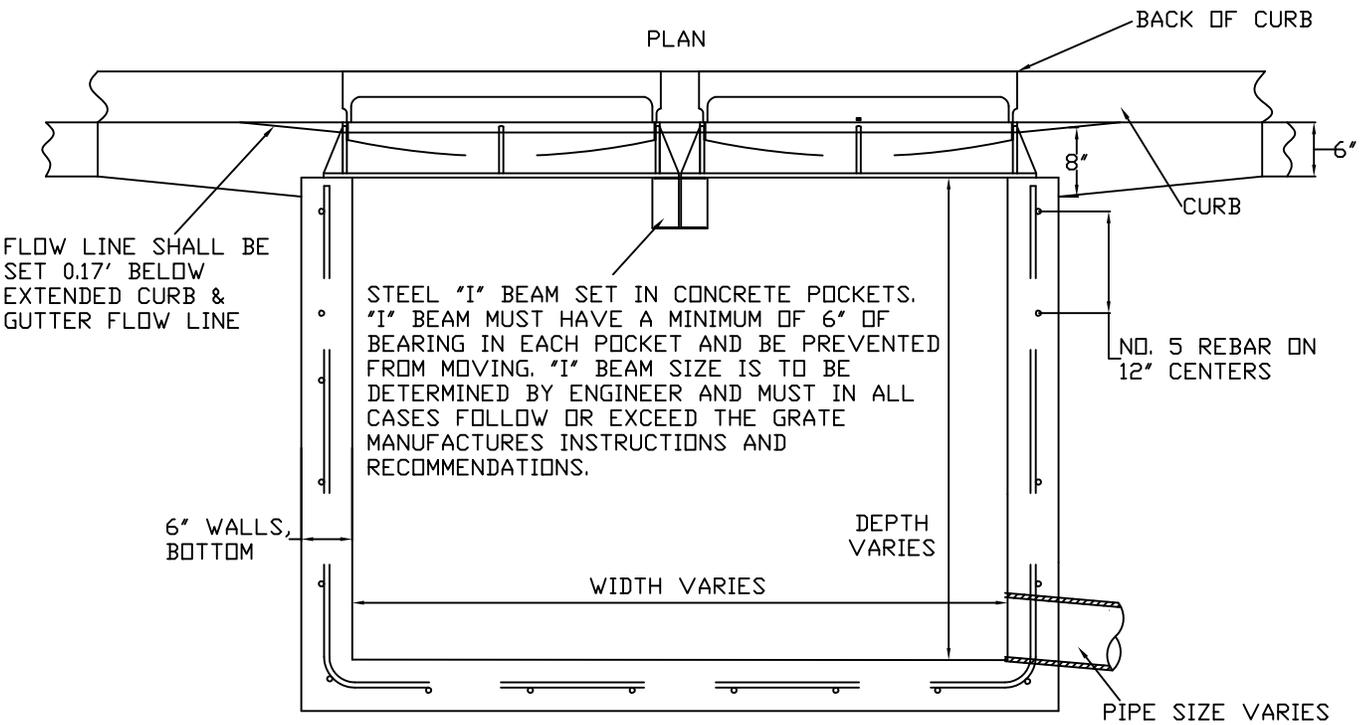
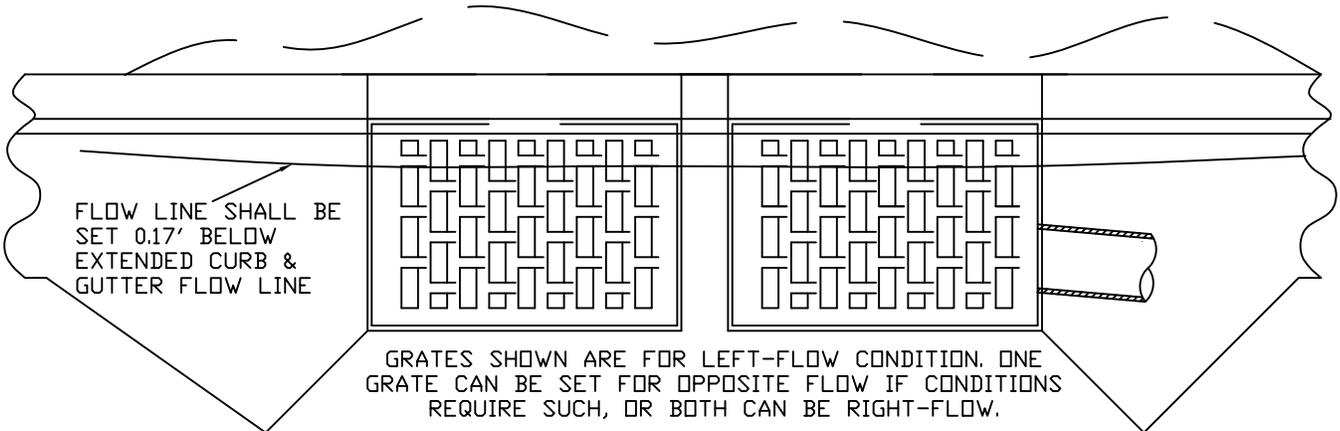
STORM SEWER CATCH BASIN
TYPE "B"



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STANDARD
DRAWING NO.
02725-02

NOT TO SCALE



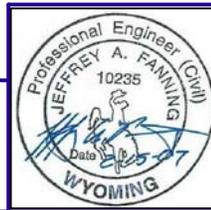
NOTES:

1. PIPE INLET AND OUTLET HOLES FOR PRECAST INLETS SHALL BE PREFORMED. ALL PIPES SHALL BE GROUTED WITH A NONSHRINK GROUT IN ACCORDANCE WITH SECTION 03600.
2. A 1/8" PER FOOT TAPER IN BOX WALLS IS ALLOWED TO EASE FORM REMOVAL.
3. LIVE LOADING SHALL CONFORM TO HS 20-44.
4. NO. 5 REBAR SHALL BE GRADE 60 AND PLACED ON 12" CENTERS.
5. WHEN BOX IS POURED IN PLACE THE CONCRETE SHALL BE 4500 PSI WITH FIBER REINFORCING. PRECAST SHALL BE 4000 PSI AND CONFORM WITH SECTION 03480.
6. BOTTOM OF BOX SHALL BE SLOPED TO OUTFLOW PIPE.
7. INLET FRAME SHALL BE SET 0.17' BELOW EXTENDED FLOW LINE.



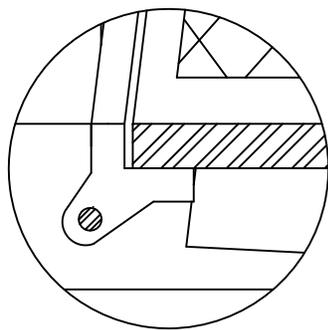
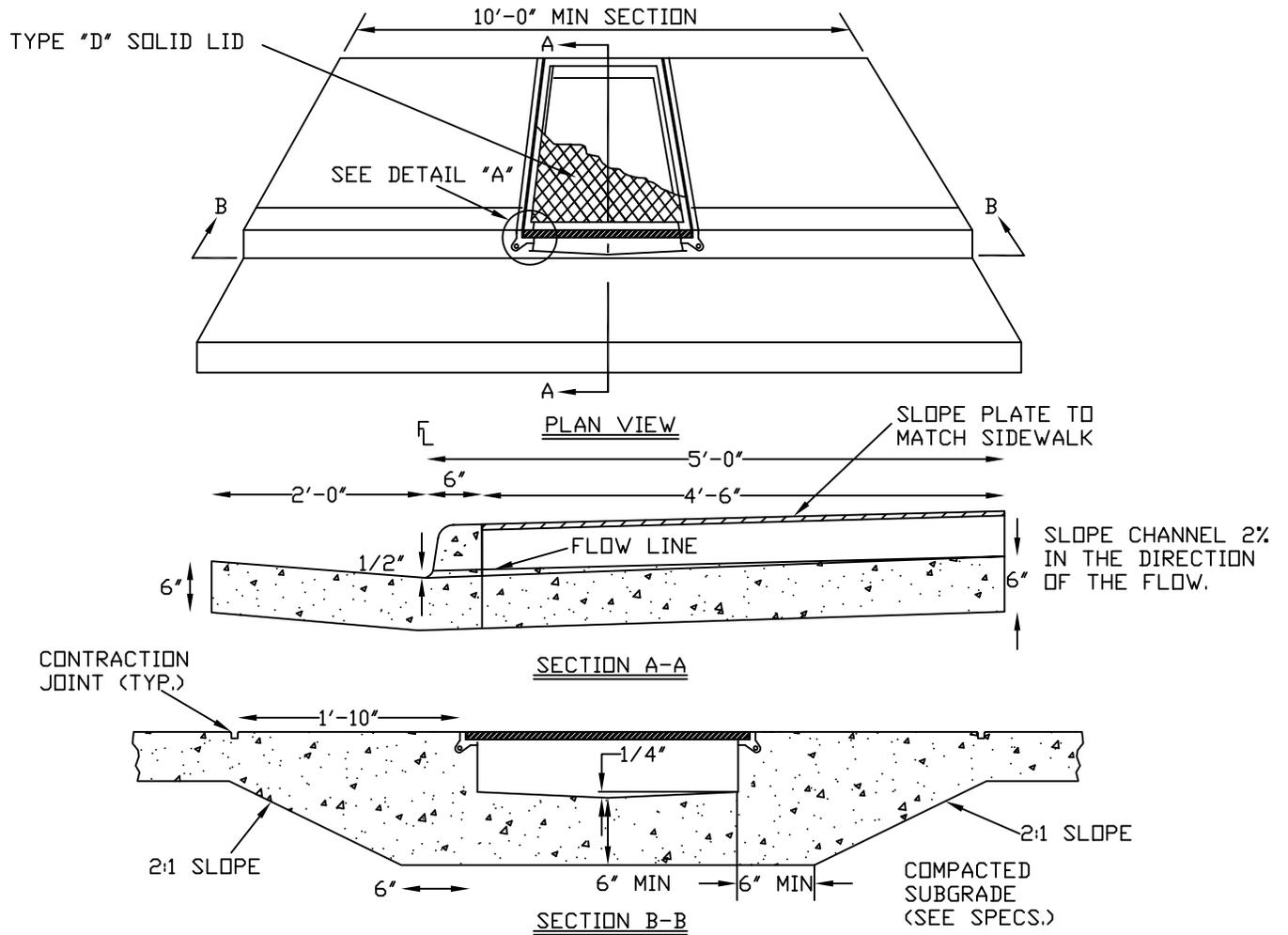
CITY OF CHEYENNE
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UTILITIES
STANDARD DRAWING

DOUBLE INLET
TYPE "AA"



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DRAWING NO.
02725-03



DETAIL "A"

INSERT #3 REBAR AS ANCHOR ROD THROUGH LENGTH OF CHASE.

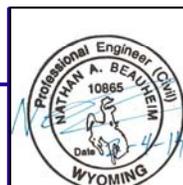
NOTES:

1. WHEN THE CURB IS SEPARATED FROM THE SIDEWALK, THE STEEL PLATE SHALL BE PLACED ON THE SIDEWALK AND THE CONCRETE CHANNEL (WITH 6" THICK WALLS ON EACH SIDE) CONTINUED INTO THE CURB AND GUTTER.
2. NEENAH R-4999HX SERIES BOLTED TRANSVERSE DRAINAGE STRUCTURE WITH SOLID CHECKERED TYPE "D" GRATE OR EQUAL SHALL BE USED.
3. SIZE OF DRAINAGE OPENING SHALL BE CALLED OUT ON THE CIVIL CONSTRUCTION PLANS.



CITY OF CHEYENNE
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UTILITIES
STANDARD DRAWING

SIDEWALK CHASE

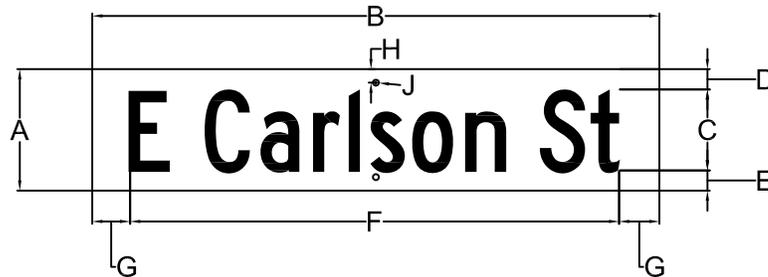


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2014

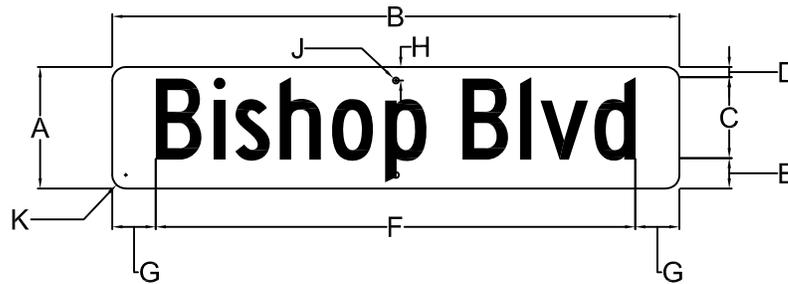
STANDARD
DRAWING NO.
02725-04

Dimensions (inches)										
	A	B	C	D	E	F	G	H	J	K
Type I	6	(1)	4C*	1	1	(2)	1.5 Min	1 (3)	$D=7/16$ (3)	R=1 (4)
Type I with Descenders	6	(1)	4C*	0.5	1.5	(2)	1.5 Min	1 (3)	$D=7/16$ (3)	R=1 (4)
Type II	9	(1)	6C**	1.5	1.5	(2)	2 Min	1 (3)	$D=7/16$ (3)	R=1 (4)
Type II with Descenders	9	(1)	6C**	0.75	2.25	(2)	2 Min	1 (3)	$D=7/16$ (3)	R=1 (4)

* Type I upper case 4" min., and lower case 3" min.
 ** Type II upper case 6" minimum, and lower case 4 1/2" minimum



Types I & II



Types I & II with Descenders

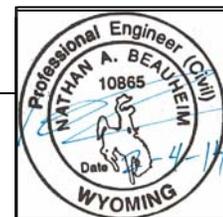
Notes

- (1) - As needed; 24" Minimum
- (2) - As needed
- (3) - Typ. of 2
- (4) - Optional

Type I Street Name Signs used at the intersection of two local roads speed limits of 25 mph or less.

Type II Street Name Signs used at all intersections on collectors and arterials with posted speed limits of 40 mph or less or 2 lane road any speed.

COLORS: LEGEND -WHITE (RETROREFLECTIVE)
 BACKGROUND -GREEN (RETROREFLECTIVE)



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STANDARD DRAWING NO. 02806-01

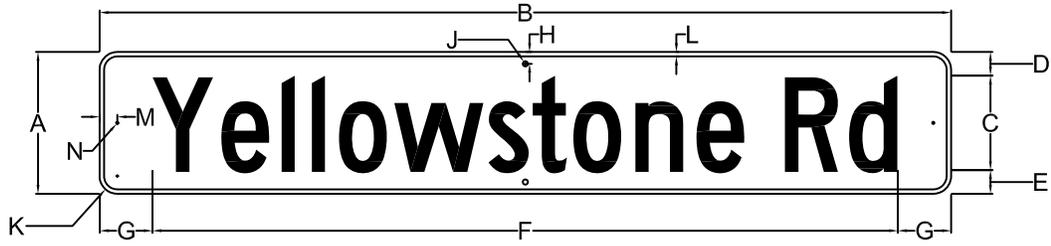


CITY OF CHEYENNE AND BOARD OF PUBLIC UTILITIES STANDARD DRAWING

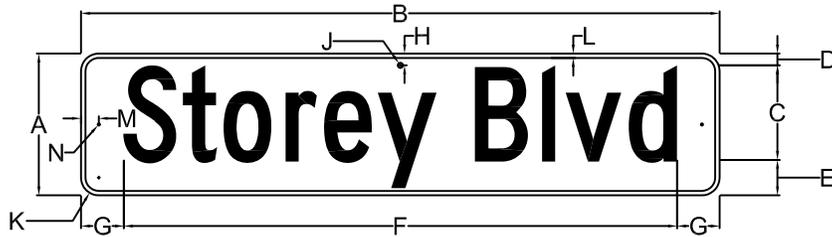
TYPE I AND TYPE II STREET NAME SIGN DETAILS

Dimensions (inches)													
	A	B	C	D	E	F	G	H	J	K	L	M	N
Type III	12	(1)	8C*	2	2	(2)	2 Min.	1 (3)	$D=7/16$ (3)	R=1.5	3/8	1.5 (3)	$D=3/16$ (3)
Type III with descenders	12	(1)	8C*	1	3	(2)	2 Min.	1 (3)	$D=7/16$ (3)	R=1.5	3/8	1.5 (3)	$D=3/16$ (3)

* Type III lower case 6" minimum



Type III



Type III with Descenders

Notes

- (1) - As needed; 24" Minimum
- (2) - As needed
- (3) - Typ. of 2

Type III Street Name Signs used at all intersections on streets with posted speed limits of more than 40 mph.

COLORS: LEGEND AND BORDER -WHITE (RETROREFLECTIVE)
 BACKGROUND -GREEN (RETROREFLECTIVE)



NEW
2014

STANDARD
DRAWING NO.
02806-02

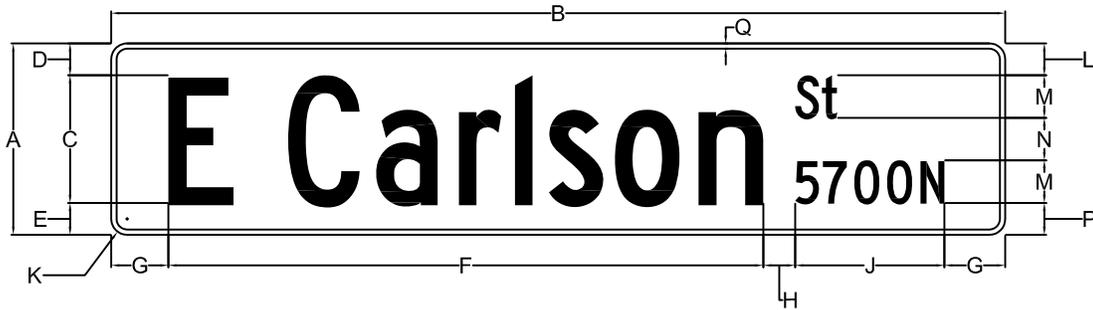


CITY OF CHEYENNE
AND
BOARD OF PUBLIC UTILITIES
STANDARD DRAWING

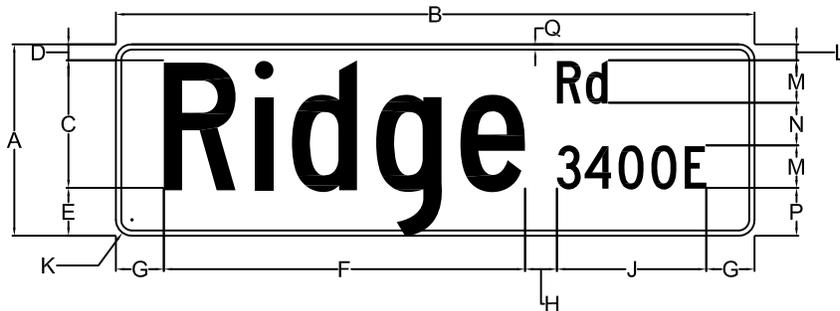
TYPE III
STREET NAME SIGN DETAILS

Dimensions (inches)															
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q
Type IV	18	(1)	12C*	3	3	(2)	3 Min.	3	(2)	R=1.5	3	3C**	4	3	0.5
Type IV with descenders	18	(1)	12C*	1.5	4.5	(2)	3 Min.	3	(2)	R=1.5	1.5	3C**	4	4.5	0.5

* Type IV lower case 9" minimum
 ** Type IV lower case 2.25" minimum



Type IV



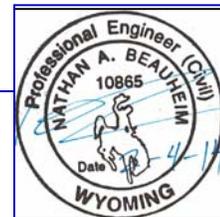
Type IV with Descenders

Notes

- (1) - As needed; 36" Minimum
- (2) - As needed

Type IV Street Name Signs to be used at all signalized intersections.

COLORS: LEGEND AND BORDER -WHITE (RETROREFLECTIVE)
 BACKGROUND -GREEN (RETROREFLECTIVE)



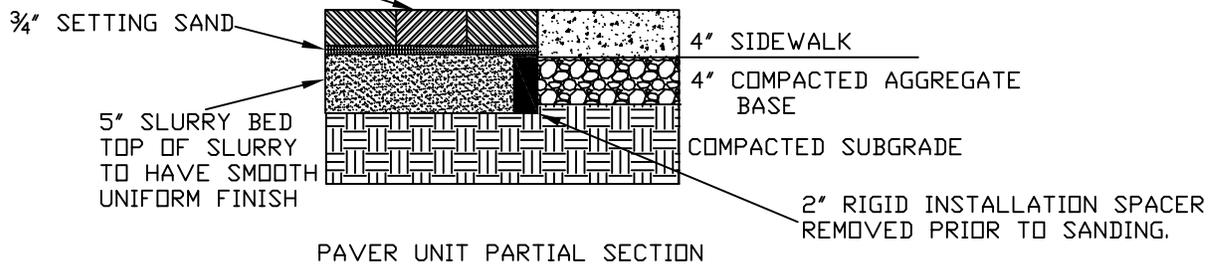
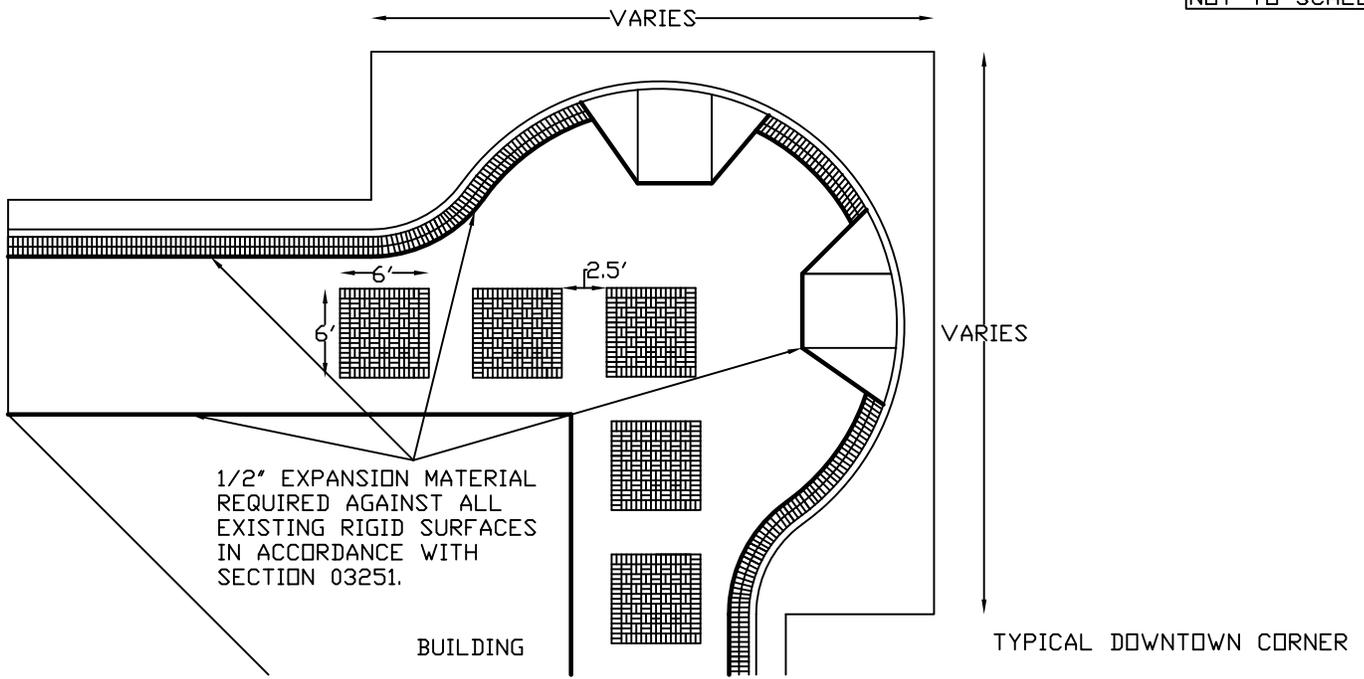
NEW
2014

STANDARD
DRAWING NO.
02806-03



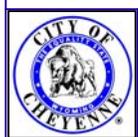
CITY OF CHEYENNE
AND
BOARD OF PUBLIC UTILITIES
STANDARD DRAWING

TYPE IV
STREET NAME SIGN DETAILS



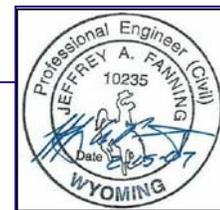
NOTES:

1. COMPACT SOIL SUBGRADE UNIFORMLY TO AT LEAST 95% OF ASTM D698.
2. SLURRY SHALL BE 2000 PSI AND BE INSTALLED TO A DEPTH OF 5". THE SLURRY SHALL BE LEVEL AND FINISH SMOOTH. ENGINEER SHALL APPROVE SLURRY BED PRIOR TO CONTRACTOR PROCEEDING.
3. PLACE SAND FOR LEVELING COURSE AND SCREED TO A DEPTH OF 3/4" MINIMUM, TAKING CARE THAT MOISTURE CONTENT REMAINS CONSTANT AND THE DENSITY IS LOOSE AND CONSTANT UNTIL PAVERS ARE SET AND COMPACTED.
4. SET PAVERS HAND TIGHT AGAINST CONCRETE WALKS, RETAINING WALLS, OR EDGE RESTRAINT. USE STRING LINES TO KEEP STRAIGHT LINES WHERE NECESSARY. SELECT UNITS AT RANDOM TO PROPERLY BLEND COLOR AND TEXTURE VARIATIONS. FILL GAPS BETWEEN UNITS THAT EXCEED 3/16" WITH PIECES CUT TO FIT FROM FULL SIZE UNIT PAVERS.
5. VIBRATE PAVERS INTO LEVELING COURSE WITH A LOW AMPLITUDE PLATE VIBRATOR CAPABLE OF A 3500 TO 5000 POUND COMPACTION FORCE.
6. SPREAD DRY SAND AND FILL JOINTS IMMEDIATELY AFTER VIBRATING PAVERS INTO LEVELING COURSE. BRUSH AND VIBRATE SAND JOINTS UNTIL JOINTS ARE COMPLETELY FILLED, THEN REMOVE SURPLUS SAND.
7. DO NOT ALLOW TRAFFIC ON INSTALLED PAVERS UNTIL SAND HAS BEEN VIBRATED INTO JOINTS.
8. REPEAT JOINT FILLING PROCESS 30 DAYS LATER.



CITY OF CHEYENNE
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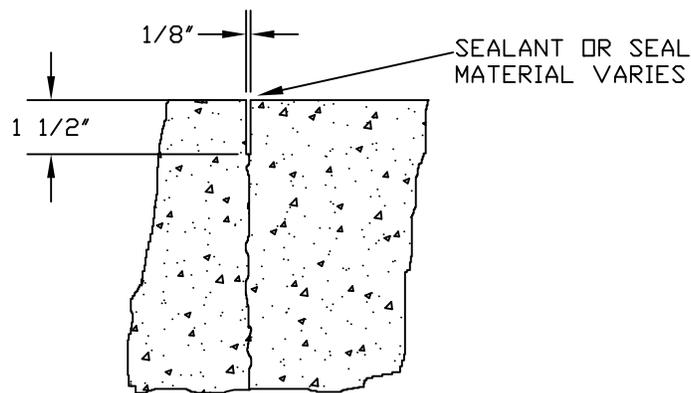
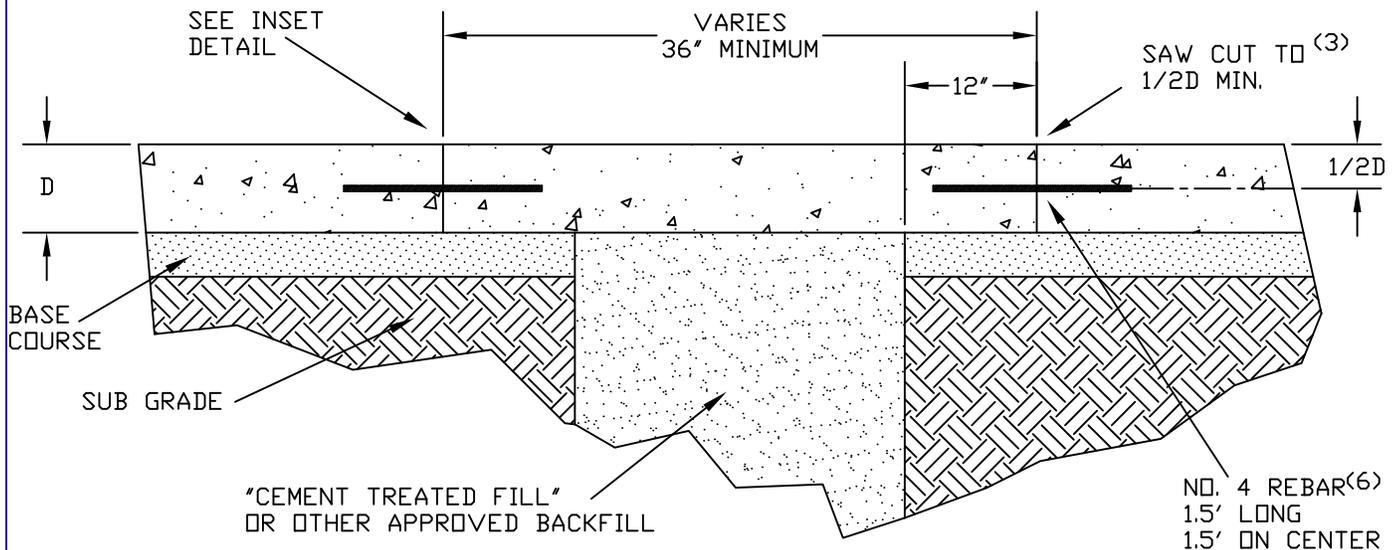
UNIT PAVER
INSTALLATION DETAIL



NEW
2007

STANDARD
DRAWING NO.
02915-01

NOT TO SCALE



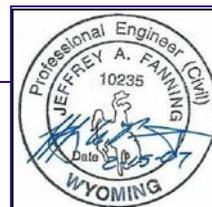
NOTES:

1. MATERIAL COMPACTION SHALL CONFORM TO SECTION 02225.
2. DEPTH OF CONCRETE PATCH SHALL BE 8 INCHES OR MATCH EXISTING, WHICHEVER IS GREATER.
3. EXISTING PAVEMENT SHALL BE CUT BACK A MIN. OF 12" BEYOND ANY DISTURBED BASE COURSE OR SUBGRADE.
4. TRENCHES IN EXCESS OF 30" MAY USE ALTERNATIVE COMPACTION AND MATERIALS AND METHODS FOUND IN SECTION 02225 OR AS APPROVED BY THE CITY PRIOR TO ACTUAL CUTTING OF STREET.
5. CEMENT TREATED FILL SHALL BE CONSOLIDATED BY A 6000VPM VIBRATOR.
6. WHEN BARS ARE USED, #4 GRADE 60 REBAR SHALL BE USED TO TIE EXISTING CONCRETE TO NEW CONCRETE.



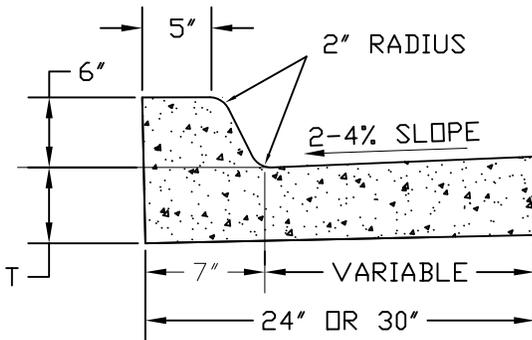
CITY OF CHEYENNE
AND
BOARD OF PUBLIC
UTILITIES
STANDARD DRAWING

STREET CUT REPAIRS
REPLACING CONCRETE PAVEMENT

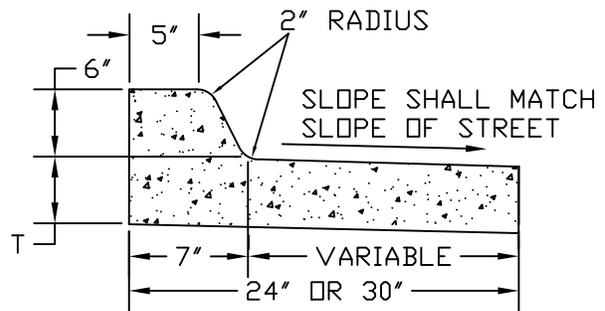


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2007

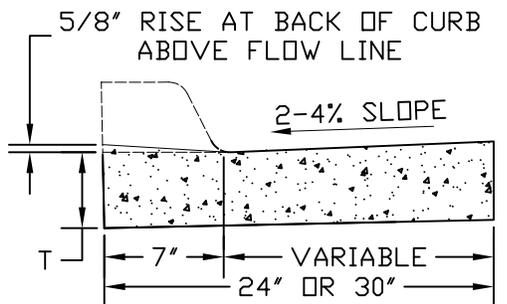
STANDARD
DRAWING NO.
03320-01



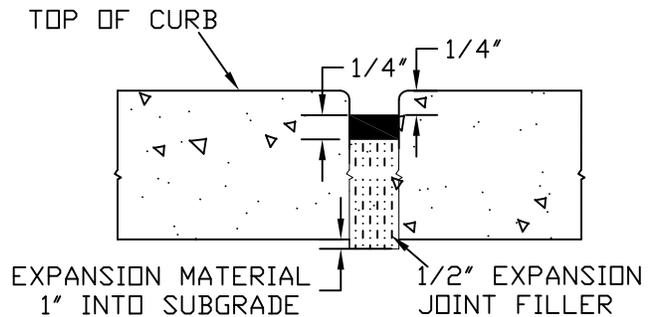
INFLOW CURB



OUTFLOW CURB



TYPE A CURB MODIFICATION
AT WHEELCHAIR RAMP



PREFORMED EXPANSION
JOINT FILLER DETAIL

NOTES:

1. MATERIAL COMPACTION SHALL CONFORM TO SECTION 02231.
2. 1/2" EXPANSION JOINT MATERIAL SHALL BE PLACED AT THE INTERFACE OF EXISTING CONCRETE, AT THE P.C. AND P.T.
3. CONTRACTION AND EXPANSION JOINTS SHALL CONFORM TO SECTIONS 03251 AND 03330.
4. CONCRETE SHALL NOT BE PLACED WITHOUT A FINAL FORM AND GRADE INSPECTION BY THE CITY CONSTRUCTION DEPARTMENT.
5. CONCRETE SHALL BE 4500 PSI WITH FIBER REINFORCING.
6. "T" = THICKNESS OF ALLEY APPROACH, DRIVE APPROACH, VALLEY GUTTER OR FILLET.

UNLESS SPECIFIED OTHERWISE:

T = 6" WHERE ADJACENT TO PLANTMIX PAVEMENT.

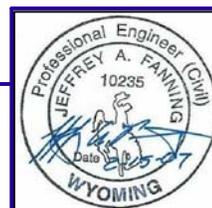
T = CONCRETE PAVEMENT THICKNESS WHERE ADJACENT TO CONCRETE PAVEMENT UNLESS OTHERWISE SPECIFIED.

7. ENSURE ALL PAVEMENT SURFACES ARE SMOOTHLY TAPERED AND FLUSH AT CURB RAMPS TO FACILITATE WHEELCHAIR MOVEMENT.



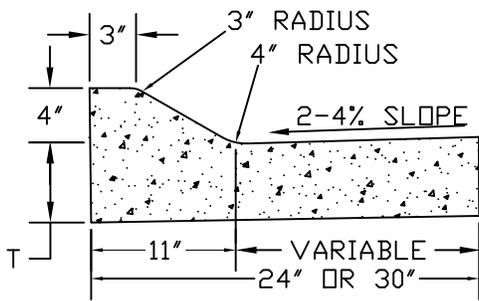
CITY OF CHEYENNE
AND
BOARD OF PUBLIC
UTILITIES
STANDARD DRAWING

TYPE "A"
CURB AND GUTTER
DETAILS

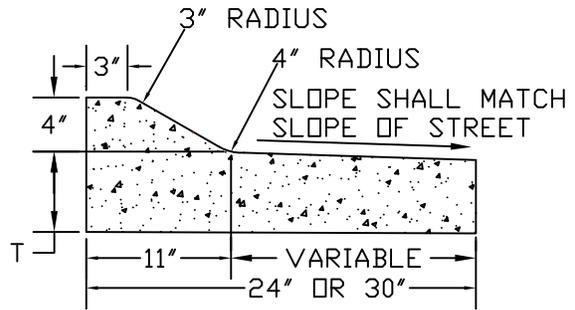


REVISED
2007

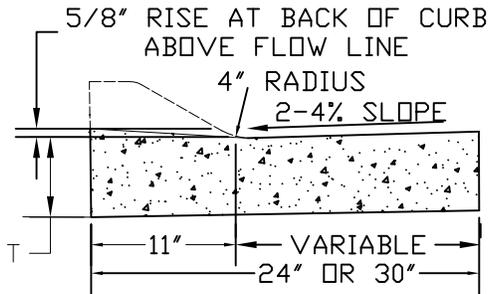
STANDARD
DRAWING NO.
03330-01



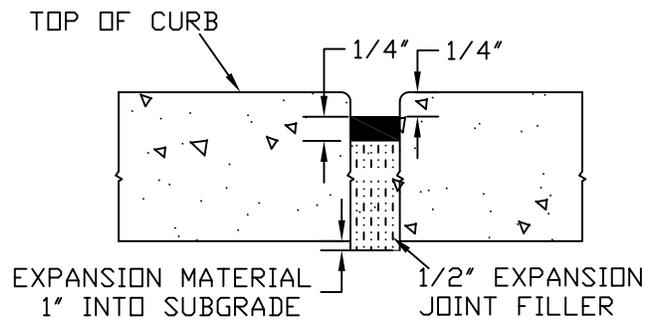
INFLOW CURB



OUTFLOW CURB



TYPE B CURB MODIFICATION
AT WHEELCHAIR RAMP



PREFORMED EXPANSION
JOINT FILLER DETAIL

NOTES:

1. MATERIAL COMPACTION SHALL CONFORM TO SECTION 02231.
2. CONTRACTION AND EXPANSION JOINTS SHALL CONFORM TO SECTIONS 03251 AND 03330.
3. CONCRETE SHALL NOT BE PLACED WITHOUT A FINAL FORM AND GRADE INSPECTION BY THE CITY CONSTRUCTION DIVISION.
4. CONCRETE SHALL BE 4500 PSI WITH FIBER REINFORCING.
5. "T" = THICKNESS OF ALLEY APPROACH, COMMERCIAL DRIVE APPROACH, VALLEY GUTTER OR FILLET.

UNLESS SPECIFIED OTHERWISE:

T = 6" WHERE ADJACENT TO PLANTMIX PAVEMENT.

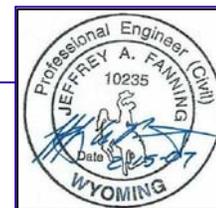
T = CONCRETE PAVEMENT THICKNESS WHERE ADJACENT TO CONCRETE PAVEMENT UNLESS OTHERWISE SPECIFIED.

6. ENSURE ALL PAVEMENT SURFACES ARE SMOOTHLY TAPERED AND FLUSH AT CURB RAMPS TO FACILITATE WHEELCHAIR MOVEMENTS.



CITY OF CHEYENNE
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UTILITIES
STANDARD DRAWING

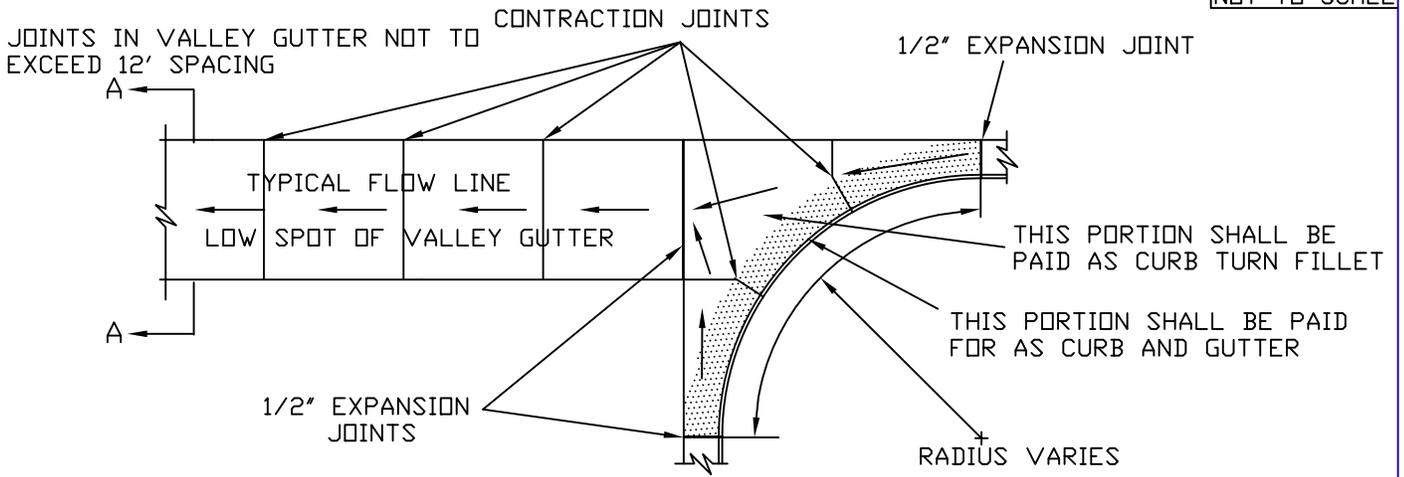
TYPE "B"
CURB AND GUTTER
DETAILS



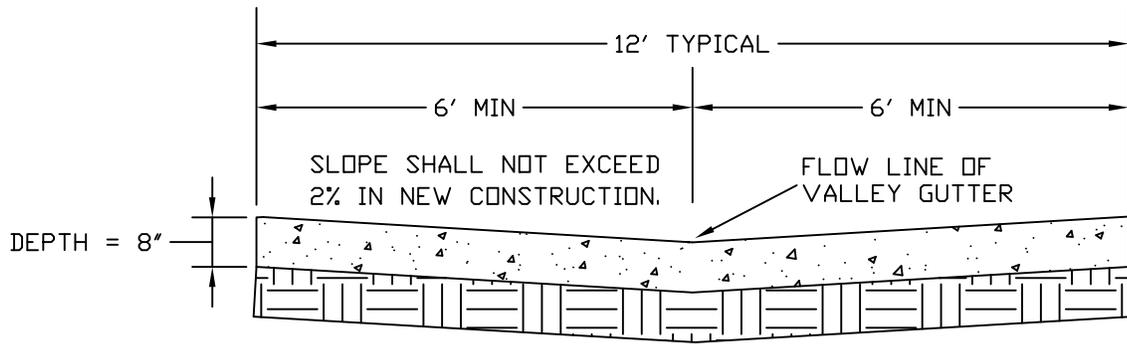
REVISED
2007

STANDARD
DRAWING NO.
03330-02

NOT TO SCALE



PLAN VIEW



SECTION A-A

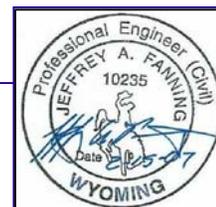
NOTES:

1. MATERIAL COMPACTION SHALL CONFORM TO SECTION 02231.
2. CONTRACTION AND EXPANSION JOINTS SHALL BE AS SHOWN AND CONFORM WITH SECTIONS 03251 AND 03340.
3. NO CONCRETE SHALL BE PLACED WITHOUT A FINAL FORM AND GRADE INSPECTION BY THE CITY CONSTRUCTION DEPARTMENT.
4. CONCRETE SHALL BE 4500 PSI WITH FIBER REINFORCEMENT AND CONFORM WITH SECTION 03405.
5. ALL LANDINGS SHALL BE 5' X 5'.
6. ENSURE ALL PAVEMENT SURFACES ARE SMOOTHLY TAPERED AND FLUSH AT CURB RAMPS TO FACILITATE WHEELCHAIR MOVEMENTS.



CITY OF CHEYENNE
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UTILITIES
STANDARD DRAWING

VALLEY GUTTER
AND
CURB TURN FILLET DETAIL



REVISED
JAN 2007

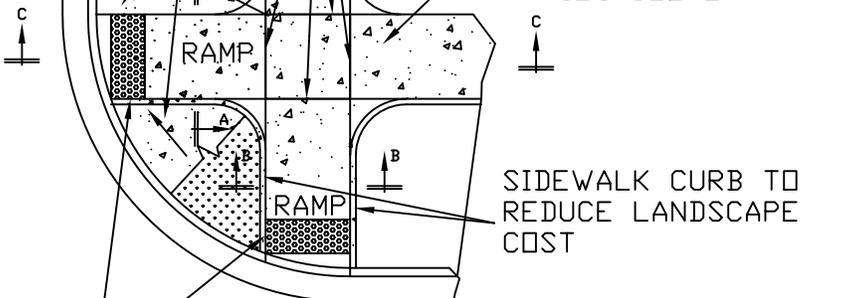
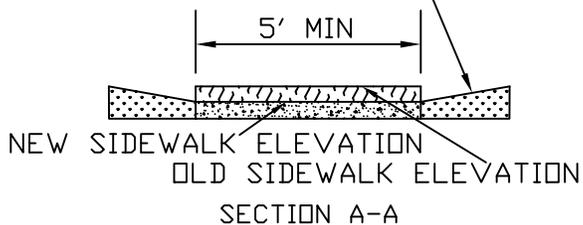
STANDARD
DRAWING NO.
03340-01

EXPANSION JOINTS SHALL BE CONSTRUCTED AT THESE LOCATIONS

SLOPE NOT TO EXCEED 1:10

SLOPE EARTH TO MEET RAMP ELEVATIONS

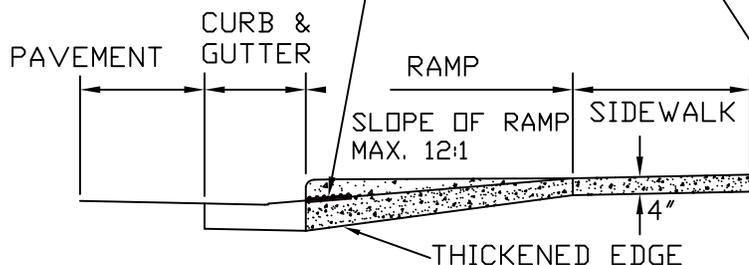
REMOVE & REPLACE AS NECESSARY TO MEET MAX 12:1 SLOPE



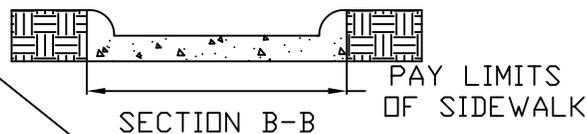
VIEW PLAN

DETECTABLE WARNING PLATES

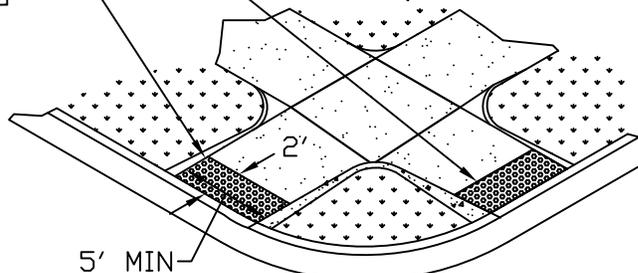
MAINTAIN SIDEWALK WIDTH BETWEEN CURBS



SECTION C-C



SECTION B-B



PERSPECTIVE

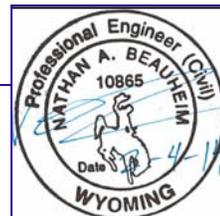
NOTES:

1. MATERIAL COMPACTION SHALL CONFORM TO SECTION 02231.
2. CONTRACTION AND EXPANSION JOINTS SHALL BE AS SHOWN AND CONFORM WITH SECTIONS 03251 AND 03340.
3. NO CONCRETE SHALL BE PLACED WITHOUT A FINAL FORM AND GRADE INSPECTION BY THE CITY CONSTRUCTION DEPARTMENT.
4. CONCRETE SHALL BE 4500 PSI WITH FIBER REINFORCEMENT AND CONFORM WITH SECTION 03304.
5. ALL LANDINGS SHALL BE 5' X 5'.
6. ENSURE ALL PAVEMENT SURFACES ARE SMOOTHLY TAPERED AND FLUSH AT CURB RAMPS TO FACILITATE WHEELCHAIR MOVEMENTS
7. DETECTABLE WARNINGS SHALL BE EAST JORDON IRON WORKS 7005 SERIES NATURAL FINISH (7006 SERIES ON RADIUS TYPE), NEENAH 4984 SERIES DETECTABLE WARNING PLATES OR APPROVED EQUAL.
8. DETECTABLE WARNING PLATES SHALL BE PLACED AT BOTTOM OF RAMP AND EXTEND two (2') FEET BACK FROM EDGE AND A MINIMUM LENGTH OF 5 FEET (TO MATCH WIDTH OF RAMP).



CITY OF CHEYENNE
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STANDARD DRAWING

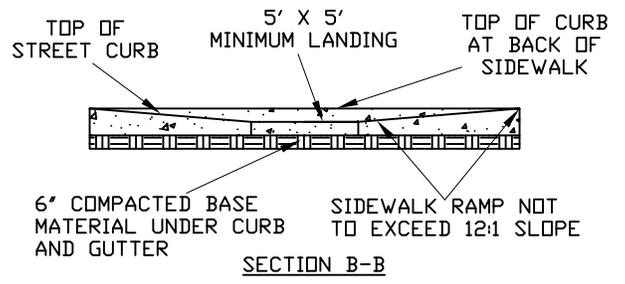
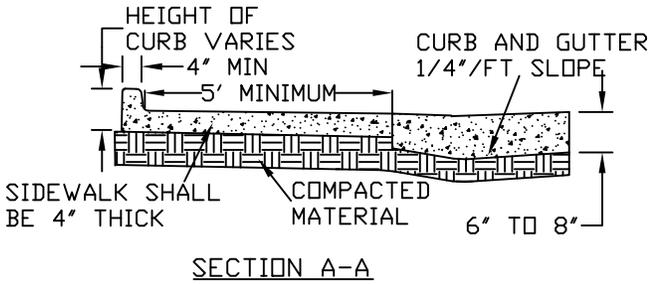
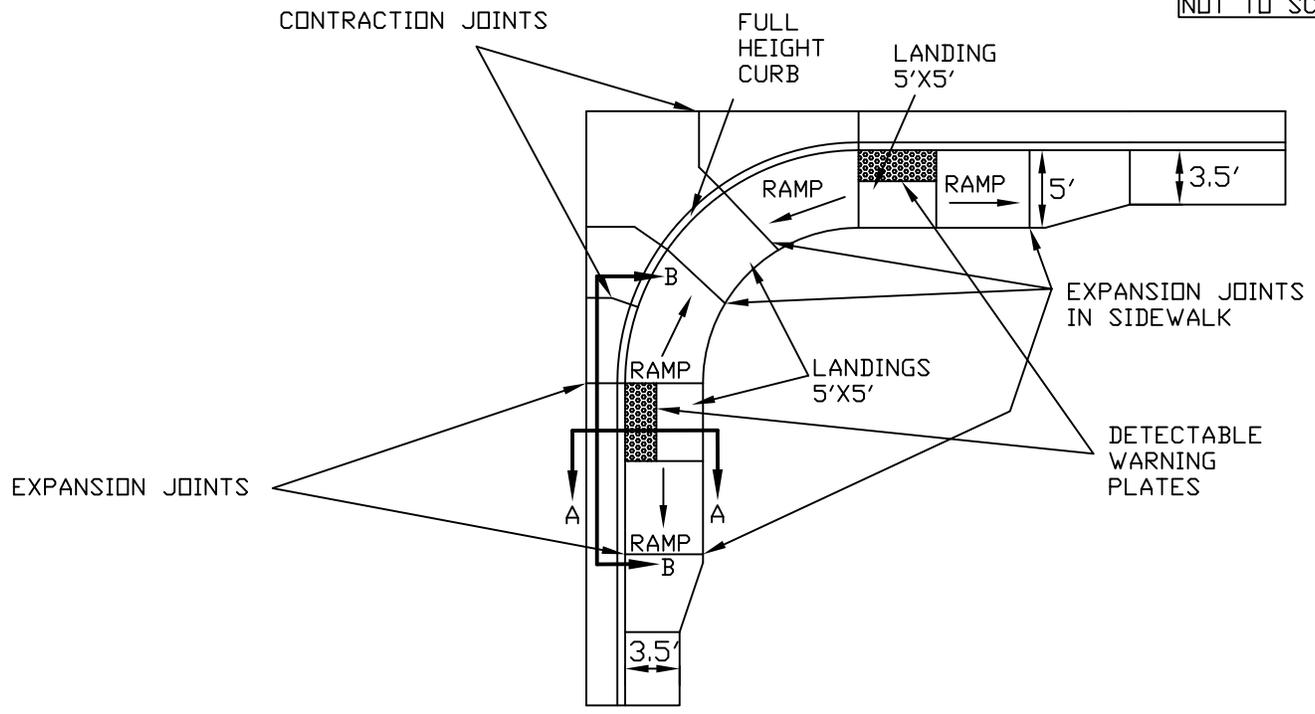
WHEELCHAIR RAMP
TYPE "A" WITH
DETECTABLE WARNING PLATES



REVISED
2014

STANDARD
DRAWING NO.
03340-02

NOT TO SCALE



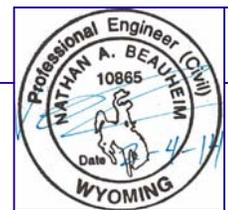
NOTES:

1. MATERIAL COMPACTION SHALL CONFORM TO SECTION 02231.
2. CONTRACTION AND EXPANSION JOINTS SHALL BE AS SHOWN AND CONFORM WITH SECTIONS 03251 AND 03340.
3. NO CONCRETE SHALL BE PLACED WITHOUT A FINAL FORM AND GRADE INSPECTION BY THE CITY CONSTRUCTION DEPARTMENT.
4. CONCRETE SHALL BE 4500 PSI WITH FIBER REINFORCEMENT AND CONFORM WITH SECTION 03405.
5. ALL LANDINGS SHALL BE 5' X 5'.
6. ENSURE ALL PAVEMENT SURFACES ARE SMOOTHLY TAPERED AND FLUSH AT CURB RAMPS TO FACILITATE WHEELCHAIR MOVEMENTS.
7. DETECTABLE WARNINGS SHALL BE EAST JORDON IRON WORKS 7005 SERIES NATURAL FINISH (7006 SERIES ON RADIUS TYPE) DETECTABLE WARNING PLATES OR APPROVED EQUAL.
8. DETECTABLE WARNING PLATES SHALL BE PLACED AT BOTTOM OF RAMP AND EXTEND 2 FEET BACK FROM EDGE AND A MINIMUM LENGTH OF 5 FEET (TO MATCH WIDTH OF RAMP).



CITY OF CHEYENNE
AND
BOARD OF PUBLIC
UTILITIES
STANDARD DRAWING

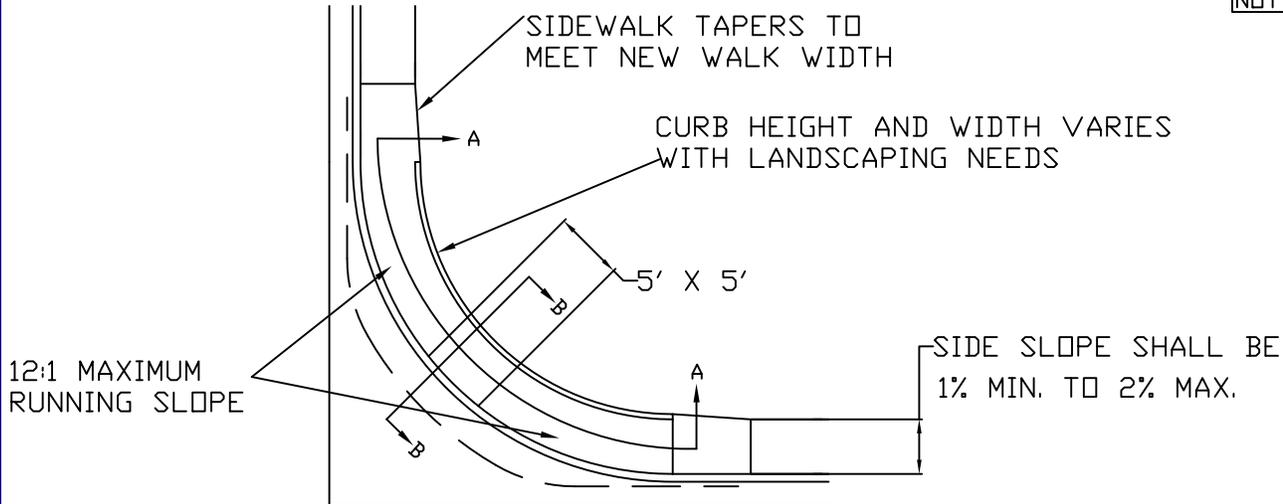
WHEEL CHAIR RAMP
TYPE "B", WITH
DETECTABLE WARNING PLATES



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2014

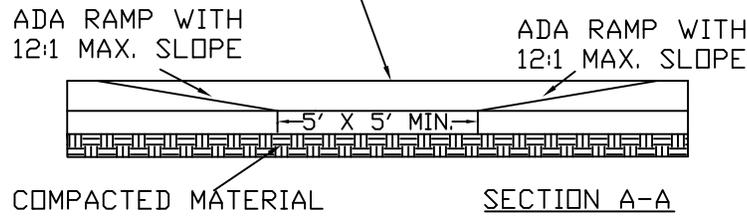
STANDARD
DRAWING NO.
03340-03

NOT TO SCALE



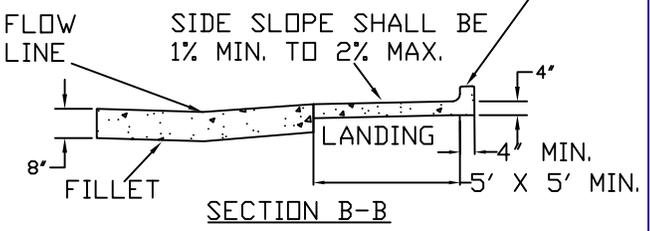
PLAN VIEW

CURB AT BACK OF SIDEWALK HEIGHT VARIES AND IS ONLY USED AS NEEDED



SECTION A-A

CURB AT BACK OF SIDEWALK HEIGHT VARIES AND IS OPTIONAL AS NEEDED



SECTION B-B

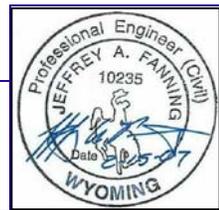
NOTES:

1. MATERIAL COMPACTION SHALL CONFORM TO SECTION 02231.
2. CONTRACTION AND EXPANSION JOINTS SHALL BE AS SHOWN AND SHALL CONFORM TO SECTIONS 03251 AND 03340.
3. NO CONCRETE SHALL BE PLACED WITHOUT A FINAL FORM AND GRADE INSPECTION BY THE CITY CONSTRUCTION DIVISION.
4. CONCRETE SHALL BE 4500 PSI WITH FIBER REINFORCEMENT AND CONFORM TO SECTION 03405.
5. ALL LANDINGS SHALL BE 5 FOOT BY 5 FOOT.
6. THICKNESS OF DRIVE APPROACH AND GUTTER SECTION SHALL BE 6" FOR RESIDENTIAL AND 8" FOR COMMERCIAL DRIVE AND ALLEY APPROACHES.
7. NOT FOR USE IN NEW CONSTRUCTION. ONLY TO BE USED WITH PRIOR APPROVAL BY THE CITY ENGINEER IN RETROFIT CONSTRUCTION.



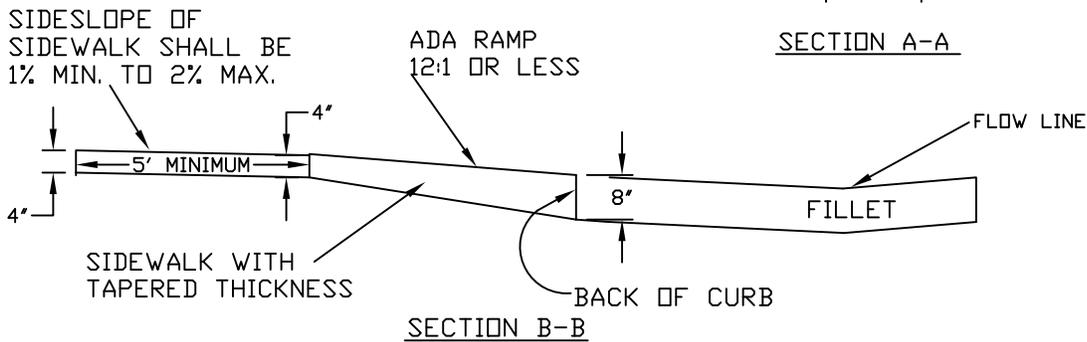
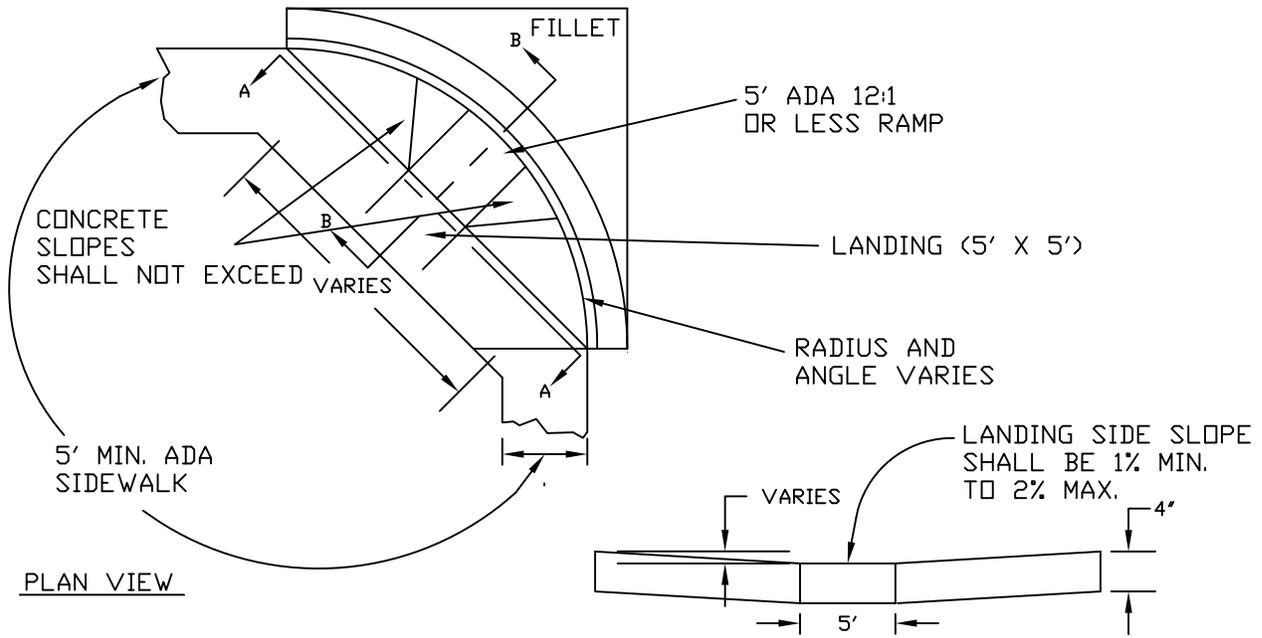
CITY OF CHEYENNE AND BOARD OF PUBLIC UTILITIES STANDARD DRAWING

WHEEL CHAIR RAMP TYPE "C"



REVISED 2007

STANDARD DRAWING NO. 03340-04



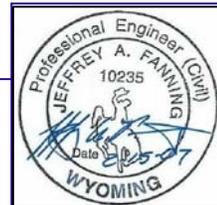
NOTES:

1. MATERIAL COMPACTION SHALL CONFORM TO SECTION 02231.
2. CONTRACTION AND EXPANSION JOINTS SHALL CONFORM TO SECTIONS 03251 AND 03340.
3. NO CONCRETE SHALL BE PLACED WITHOUT A FINAL FORM AND GRADE INSPECTION BY THE CITY CONSTRUCTION DIVISION.
4. CONCRETE SHALL BE 4500PSI WITH FIBER REINFORCEMENT AND CONFORM TO SECTION 03405.
5. ALL LANDINGS SHALL BE 5 FOOT BY 5 FOOT.
6. ENSURE ALL PAVEMENT SURFACES ARE SMOOTHLY TAPERED AND FLUSH AT CURB RAMPS TO FACILITATE WHEELCHAIR MOVEMENTS.
7. THICKNESSES OF DRIVE APPROACH AND GUTTER SECTION SHALL BE 6" FOR RESIDENTIAL AND 8" FOR COMMERCIAL DRIVE AND ALLEY APPROACHES THRU THE BACK OF THE SIDEWALK.
8. NOT FOR USE IN NEW CONSTRUCTION. ONLY TO BE USED WITH PRIOR APPROVAL BY CITY ENGINEER IN RETROFIT CONSTRUCTION.



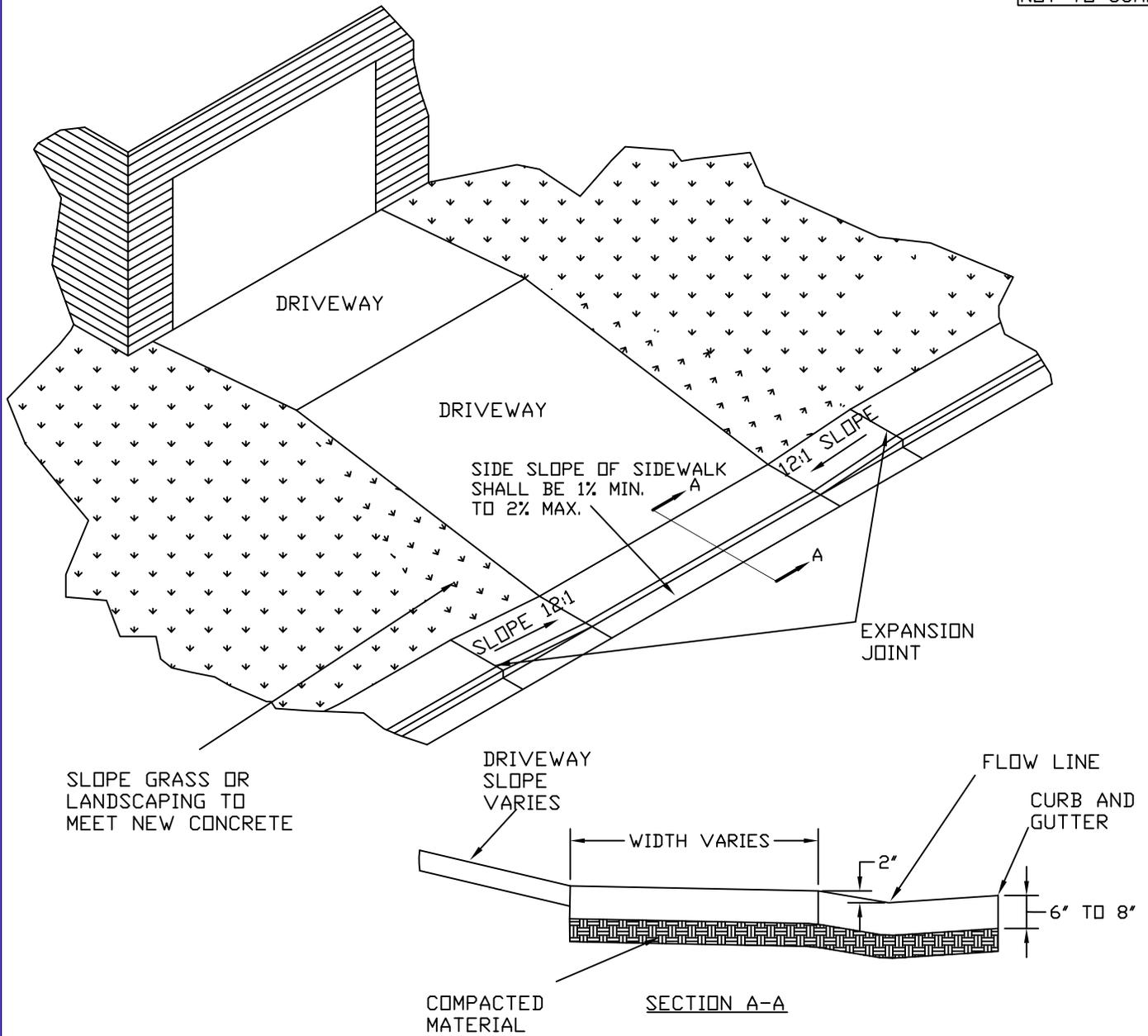
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STANDARD DRAWING

WHEEL CHAIR RAMP
MODIFIED "C"



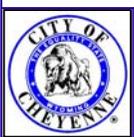
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2007

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03340-05



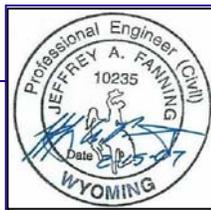
NOTES:

1. MATERIAL COMPACTION SHALL CONFORM TO SECTION 02231.
2. CONTRACTION AND EXPANSION JOINTS SHALL BE AS SHOWN AND CONFORM TO SECTIONS 03251 AND 03340.
3. NO CONCRETE SHALL BE PLACED WITHOUT A FINAL FORM AND GRADE INSPECTION BY THE CITY OF CHEYENNE CONSTRUCTION DIVISION.
4. CONCRETE SHALL BE 4500 PSI WITH FIBER REINFORCEMENT AND CONFORM TO SECTION 03405.
5. THICKNESS OF DRIVE APPROACH SHALL BE 6" FOR RESIDENTIAL AND 8" FOR COMMERCIAL DRIVE AND ALLEY APPROACHES.



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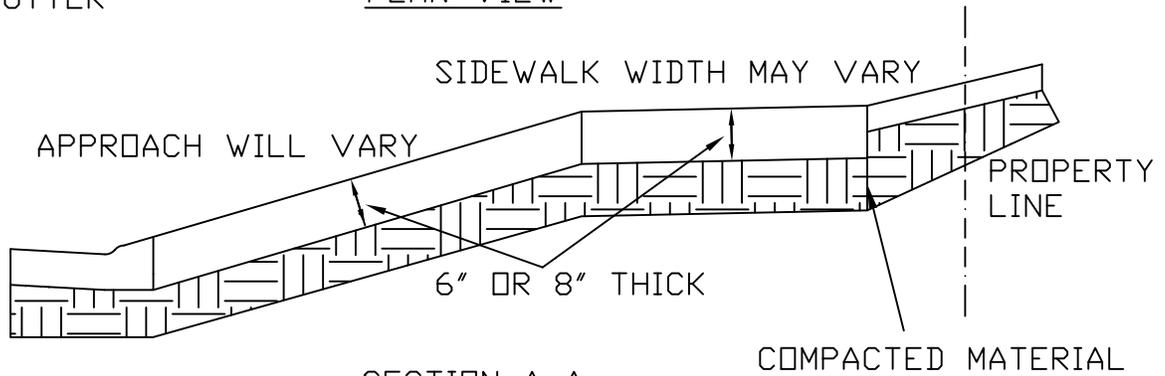
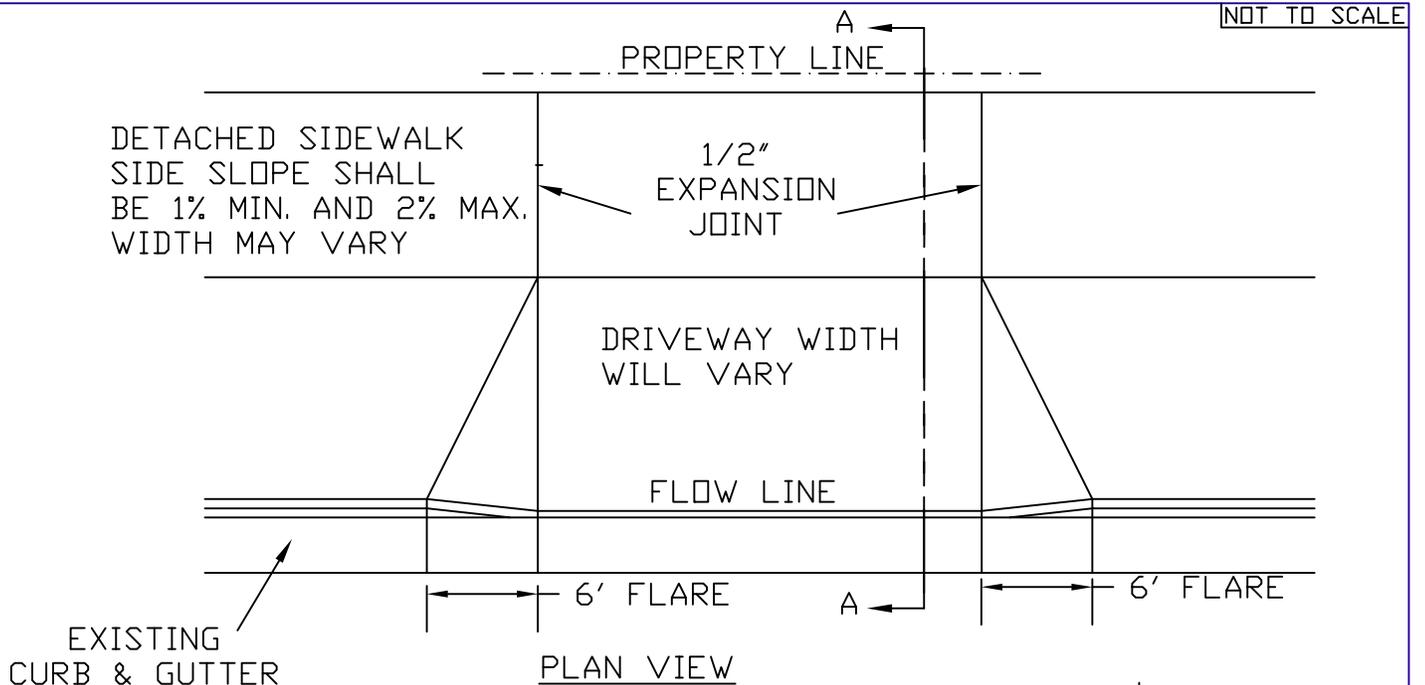
DRIVE AND ALLEY APPROACH
FOR
ATTACHED SIDEWALK



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03340-06

NOT TO SCALE



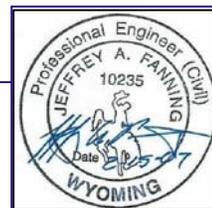
ED NOTES:

1. MATERIAL COMPACTION SHALL CONFORM TO SECTION 02231.
2. CONTRACTION AND EXPANSION JOINTS SHALL BE AS SHOWN AND CONFORM TO SECTIONS 03251 AND 03340.
3. NO CONCRETE SHALL BE PLACED WITHOUT A FINAL FORM AND GRADE INSPECTION THE CITY CONSTRUCTION DIVISION.
4. CONCRETE SHALL BE 4500 WITH FIBER REINFORCEMENT AND CONFORM TO SECTION 03405.
5. FOR USE IN RETRO-FIT CONSTRUCTION ONLY.
6. THICKNESS OF DRIVE APPROACH AND GUTTER SECTION SHALL BE 6" FOR RESIDENTIAL AND 8" FOR COMMERCIAL DRIVE AND ALLEY APPROACHES THRU THE BACK OF THE SIDEWALK.



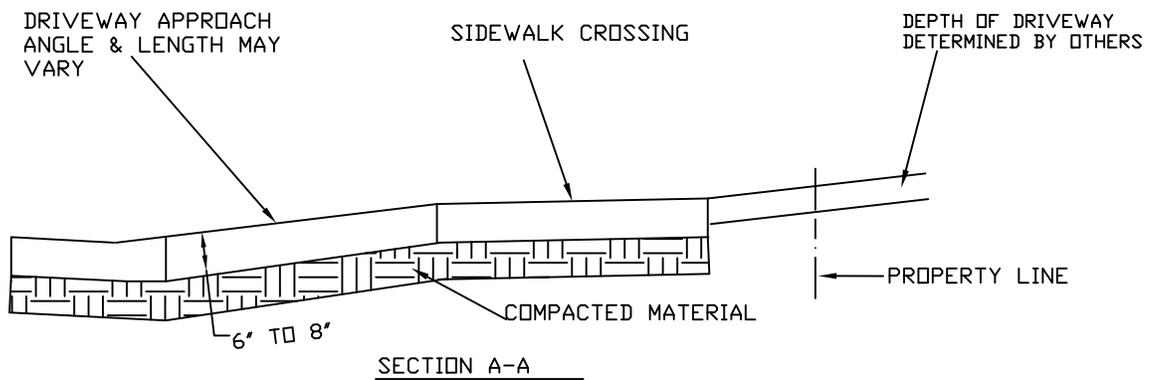
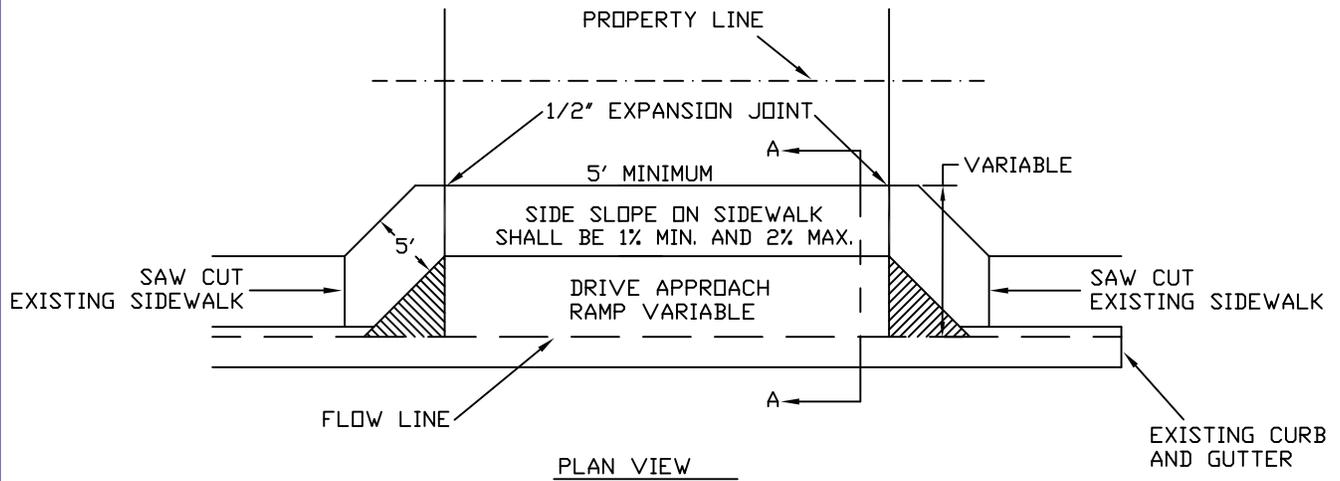
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DRIVE AND ALLEY APPROACH
FOR
DETACHED SIDEWALK



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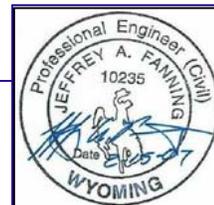
NOTES:

1. MATERIAL COMPACTION SHALL CONFORM TO SECTION 02231.
2. CONTRACTION AND EXPANSION JOINTS SHALL CONFORM TO SECTIONS 03251 AND 03340.
3. NO CONCRETE SHALL BE PLACED WITHOUT A FINAL FORM AND GRADE INSPECTION BY THE CITY CONSTRUCTION DIVISION.
4. CONCRETE SHALL BE 4500 WITH FIBER REINFORCEMENT AND CONFORM TO SECTION 03405.
5. FOR USE IN RETRO-FIT CONSTRUCTION ONLY.
6. THICKNESS OF DRIVE APPROACH AND GUTTER SECTION SHALL BE 6" FOR RESIDENTIAL AND 8" FOR COMMERCIAL DRIVE AND ALLEY APPROACHES THRU THE BACK OF THE SIDEWALK.



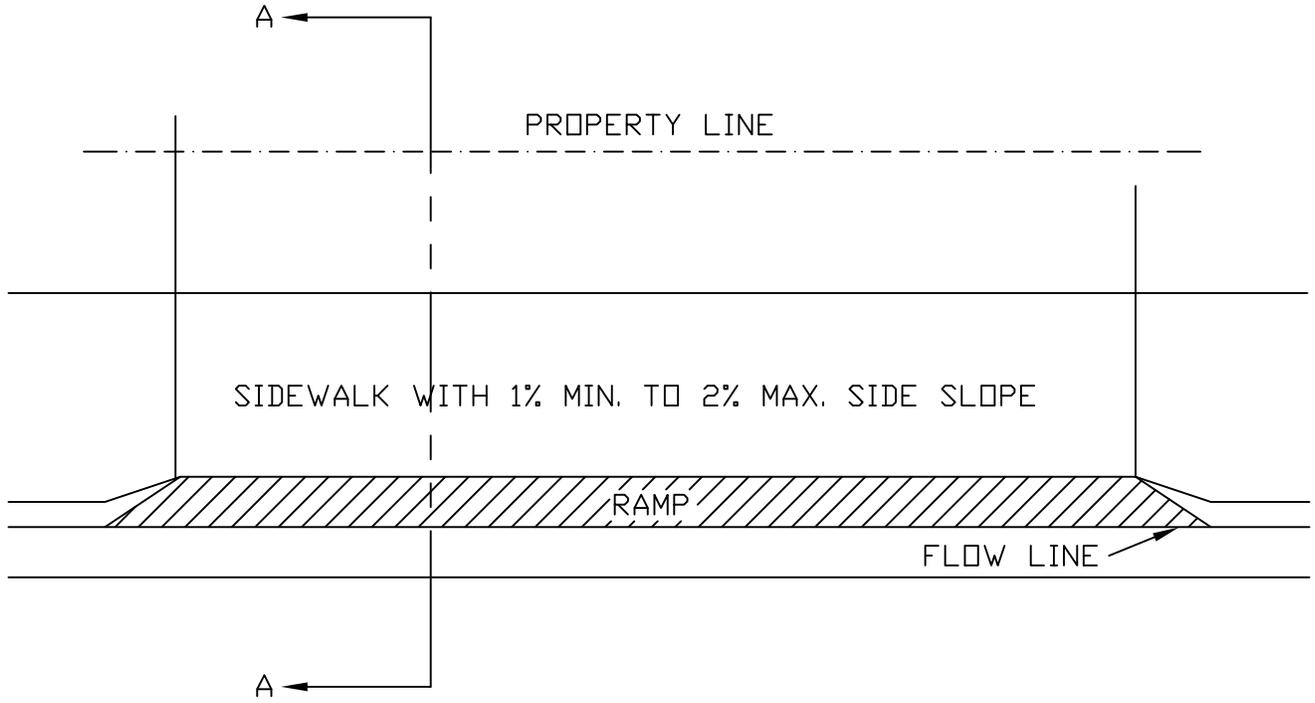
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DRIVE AND ALLEY APPROACH
FOR ATTACHED SIDEWALK,
ALTERNATE "A"



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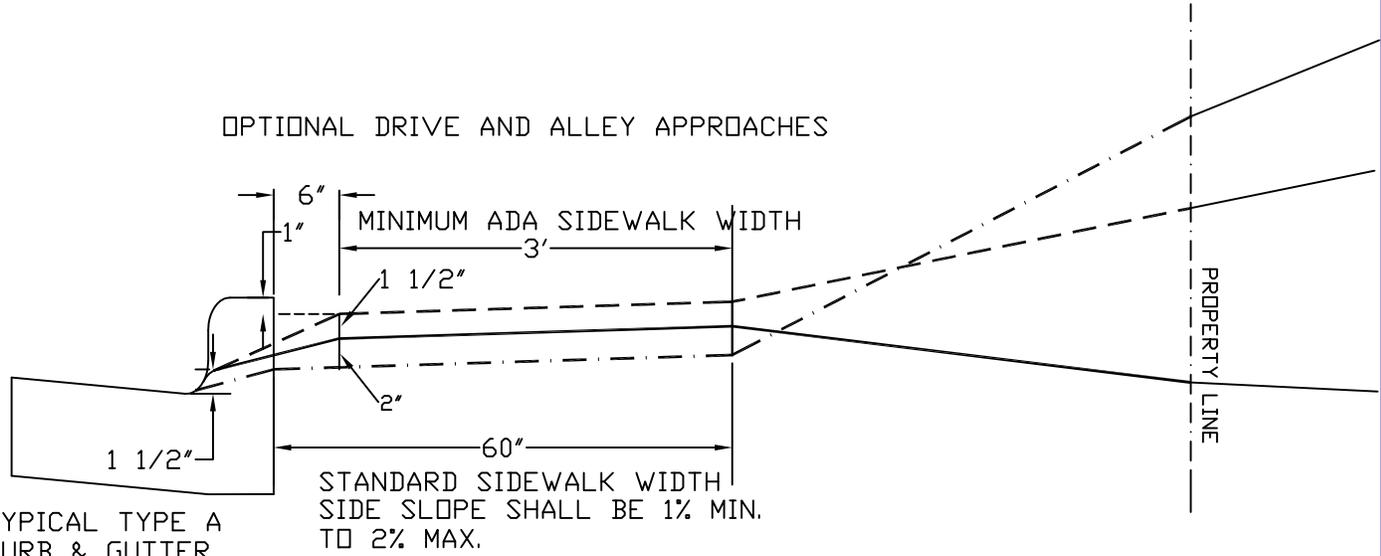
STANDARD
DRAWING NO.
03340-08



NOTES:

1. DRIVE APPROACH CHOICE IS DEPENDENT UPON THE LAY OF LAND AND POSITION OF THE GARAGE IN RELATION TO THE FLOW LINE.
2. IT MAY BE NECESSARY TO REMOVE A PORTION OF THE EXISTING DRIVEWAY IN ORDER TO MAKE DRIVE APPROACH WORK.

OPTIONAL DRIVE AND ALLEY APPROACHES

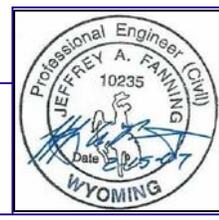


SECTION A-A



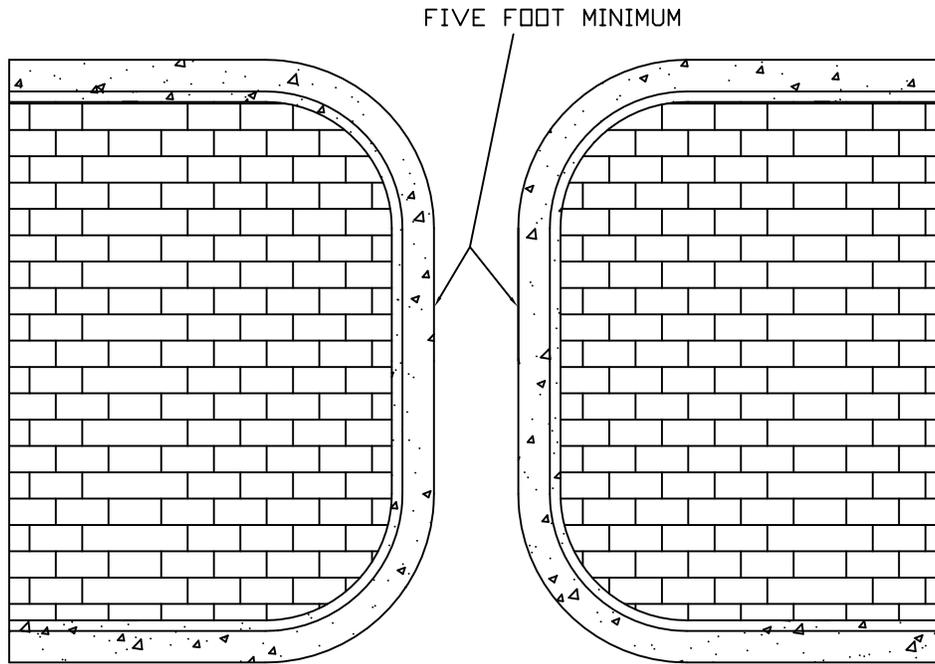
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CROSS SECTION
THRU DRIVE APPROACHES

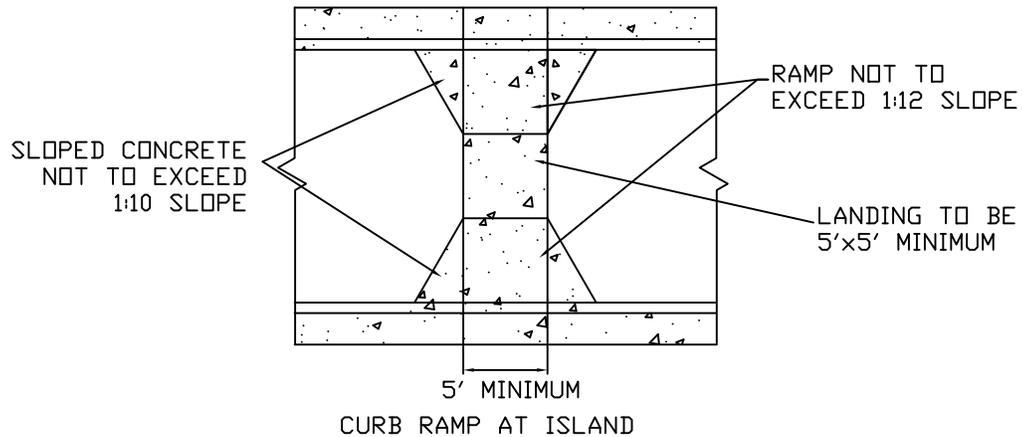


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CUT THRU AT ISLAND



5' MINIMUM CURB RAMP AT ISLAND

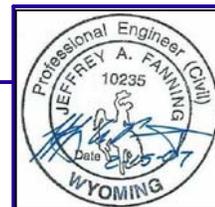
NOTES:

1. MATERIAL COMPACTION SHALL CONFORM TO SECTION 02231.
2. CONTRACTION AND EXPANSION JOINTS SHALL COMPLY WITH SECTIONS 03251 AND 03340.
3. NO CONCRETE SHALL BE PLACED WITHOUT A FINAL FORM AND GRADE INSPECTION BY THE CITY CONSTRUCTION DIVISION.
4. CONCRETE SHALL BE 4500 PSI WITH FIBER REINFORCEMENT AND CONFORM TO SECTION 03405.
5. RAISED ISLANDS SHALL HAVE CUT THROUGH LEVEL WITH STREET OR HAVE CURB RAMPS ON BOTH SIDES.
6. ALL WALKWAYS AND CUT THROUGHS OF ISLAND SHALL BE A MINIMUM OF 5 FEET WIDE.



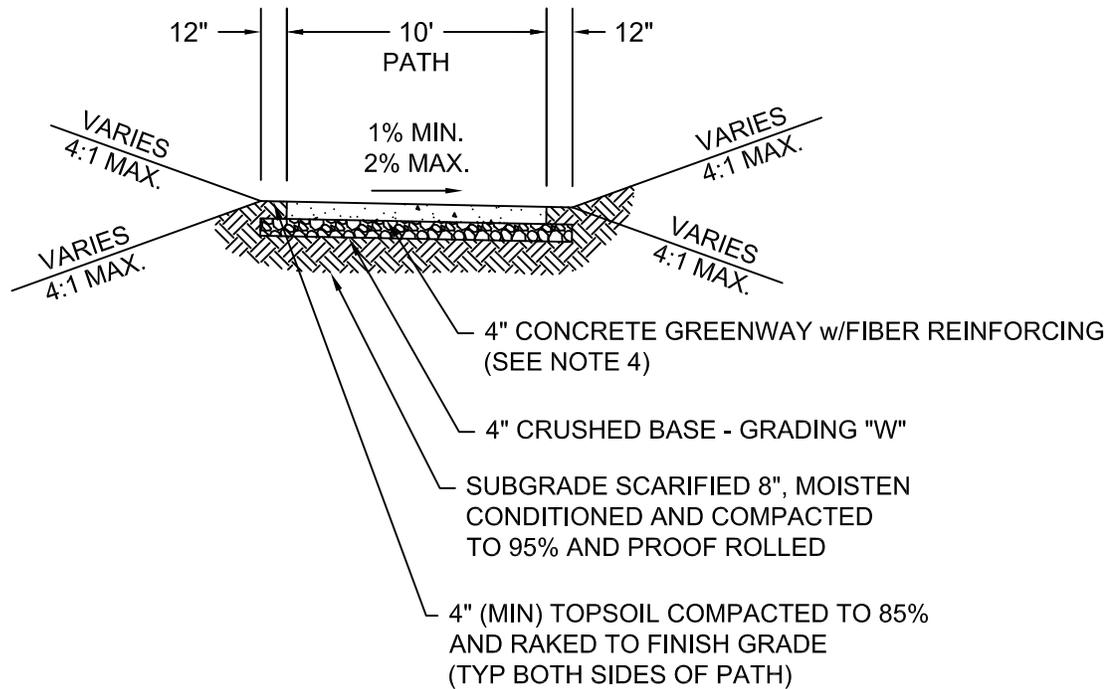
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ADA REQUIREMENTS
FOR
ISLANDS



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TYPICAL SECTION

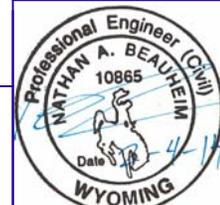
NOTES:

- 1.) FULL WIDTH TRANSVERSE GREENWAY JOINT SPACING SHALL BE 10'-0" (SAWCUT). 1" MIN. DEPTH.
- 2.) EXPANSION GREENWAY JOINT SPACING SHALL BE 150'. USE PREFORMED JOINT MATERIAL FULL DEPTH. GROUT AND SEAL WITH SILICONE. EXPANSION JOINT SHALL BE CONSIDERED SUBSIDIARY TO THE GREENWAY.
- 3.) ALL CONCRETE SHALL BE 4500 PSI WITH FIBER REINFORCEMENT AND CONFORM TO SECTION 03405.
- 4.) ALL GREENWAY PATH WILL BE 4" THICK EXCEPT FOR ACROSS APPROACHES. THICKNESS OF DRIVE APPROACH SHALL BE 6" FOR RESIDENTIAL AND 8" FOR COMMERCIAL DRIVE AND ALLEY APPROACHES.
- 5.) CRUSHED BASE IS TO EXTEND 12" PAST EDGE OF PATH AND COMPACTED PER SECTION 02231.
- 6.) NO CONCRETE SHALL BE PLACED WITHOUT A FINAL FORM AND GRADE INSPECTION BY THE CITY.
- 7.) MAX. LONGITUDINAL GRADE SHALL NOT EXCEED 5% PER ADA STANDARDS.



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GREENWAY TYPICAL SECTION



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