CITY OF COMMERCE CITY
Department of Public Works

ENGINEERING CONSTRUCTION STANDARDS AND SPECIFICATIONS

8602 Rosemary Street
Commerce City, Colorado 80022
303-289-8150

SUMMARY OF REVISIONS

Revision #	Chapter	Date Revised	Summary of Revision
1.	6	10/19/07	Changed specification on storm sewer bedding.
2.	7	10/19/07	Added requirements for concrete roadways. Other miscellaneous changes throughout chapter.
3.	8	10/19/07	Added Chapter and details
4.	3	10/31/07	Reduced width and allowance of residential access in Table 3-4.
5.	2	10/31/07	Changed number of copies of plan submittals to two and approval process.
6.	2	10/31/07	Updated permit fees to include use tax.
7.	2	10/31/07	Updated grading, storm sewer and street construction plan notes.
8.	4	10/14/10	Added aggregate gradation requirement for Hot Bituminous Pavement
9.	5 and 9	3/8/11	Added Chapter 9 and moved details from Chapter 5. Modified language in Chapter 5 to reference Chapter 9.
10.	4	4/11/11	Revised gradation and testing requirements for Hot Bituminous Pavement
11.	8	4/14/11	Added Permit Holders Inspection Report document
12.	5 and 9	1/10/12	Updated Street Name Sign Details
13.	3 and 5	4/18/12	Added detail for multimodal arterial to Chapter 3. This section was added to the tables in Chapter 3. The details for Chapters 3 and 5 have been renumbered to match the section they are discussed in. Language was removed from Chapter 5 that is now included in Chapter 9.
14.	8	8/8/12	Update Erosion Control General Notes Detail 800-01
15.	8	9/25/12	Updated WQCV requirements.

16.	8	10/9/12	Added waste control measure language on page 8-2, 8-5, 8-13, 8-50. Updated the corrective action response time on page 8-17. Included additional language for BMP Planning – Applicability on 8-40.
17.	3	2/13/13	Updated Curb Ramp Details.
18.	3	3/28/13	Updated Curb Ramp with Crosspan Detail.
19.	2	7/18/13	Updated Grading Plan General Notes.
20.	3	8/6/13	Updated concrete structures in the public right of way to be Class B 4200 psi from 4000 psi.
21.	7	11/7/13	Updated asphalt patching thickness to be 1” thicker than existing.
22.	7	4/28/14	Longitudinal bores cannot be located under City sidewalk, curb, or gutter.
23.	2 & 6	7/16/14	Removed 1’ sump requirement for inlets.
24.	7	9/22/14	Updated phone number for the Building Department from 303-289-3671 to 303-289-3652 (page 7-1).
25.	3	6/22/2016	Updated Sheet 3-19 Detail Index
26.	3	6/22/2016	Added Detail 308-03a Curb Ramps
27.	3	6/22/2016	Added Detail 308-03b Curb Ramps
28.	3	6/22/2016	Added Detail 308-03c Curb Ramps
29.	3	6/22/2016	Added Detail 308-03d Curb Ramps
30.	3	6/22/2016	Added Detail 308-10 Curb Detail with Sump Pipe Outlet
31.	3	6/22/2016	Added Detail 312-02 Pipe Stabilization
32.	3	6/22/2016	Updated all details in Chapter 3 with new approval signatures
33.	3	6/22/2016	Updated Sheet 5-15 Detail Index
34.	3	6/22/2016	Added Detail 503-02 Sign Post and Base
35.	3	6/22/2016	Updated all details in Chapter 5 with new approval signatures
36.	3	6/22/2016	Updated all details in Chapter 8 with new approval signatures
37.	3	6/22/2016	Revised Detail 900-01 with new sign text requirements

38.	3	6/22/2016	Updated all details in Chapter 9 with new approval signatures
39.	3	12/2/2016	Updated Detail 307-03 to note Major Collector
40.	3	12/2/2016	Updated Detail 307-10 with reference to other ADA details
41.	3	12/2/2016	Updated Detail 308-01 with maximum cross slope
42.	3	12/2/2016	Updated Detail 308-04 with reference to other ADA details
43.	Table 4-5	12/2/2016	Revised table to allow for a composite pavement section based upon the approved pavement report.
44.	4.04.2-1	12/2/2016	Revised pavement grade from 64-22 to 58-28
45.	4.04.2-2	12/2/2016	Revised gradation.
46.	Table 4-6	12/2/2016	Revised pavement grade from 64-22 to 58-28
47.	Table 4-7	12/2/2016	Revised pavement grade from 64-22 to 58-28
48.	3.08	12/2/2016	Revised concrete strength to 4500 psi
49.	8	12/2/2016	Updated Detail 800-08 to actual detail. Duplicate of 800-09 removed
50.	1.01	12/11/2017	Revised Purpose to reference City's Land Development Code
51.	2.02	12/11/2017	Revised submittal information for drainage reports
52.	2.03	12/11/2017	Revised requirements for approved plan submittals
53.	2.05.2	12/11/2017	Removed note pertaining to inlet one foot of clearance below invert to top of bottom slab
54.	Table 2-2	12/11/2017	Updated Street Construction Plan checklist used for development review
55.	2.06	12/11/2017	Removed as-built drawing certification requirement by a Public Works P.L.S.
56.	Table 3-5	12/11/2017	Note added that design for minimum curb return radii should be in accordance with vehicle type use in area and Public Works staff approval

57.	3.08.6	12/11/2017	Sidewalk expansion joint interval requirement changed to not more than 500 feet
58.	3.10	12/11/2017	Added clarification that sidewalk chases are not to be used to avoid use of standard inlet
59.	3	12/11/2017	Revised detail 307-01 thru 307-04 labels so that bike path and walk is typical for north and east sides of roads
60.	3	12/11/2017	Revised detail 307-03 to correctly label it as Minor Arterial
61.	3	12/11/2017	Updated details 308-03a-d Curb Ramps per current CDOT and ADA standards
62.	5	12/11/2017	Detail 503-01 updated to meet MUTCD requirements and show additional dimensions
63.	5	12/11/2017	Added details 503-03A and 503-03B for Speed Hump and Speed Table Installation Standards
64.	6.02.1	12/11/2017	Added note for section tie-in collars to inlet boxes
65.	6.02.2	12/11/2017	Removed note pertaining to inlet one foot of clearance below invert to top of bottom slab
66.	6.02.3	12/11/2017	Edited to include manholes for requirement to be flush with final paved surface
67.	7.01	12/11/2017	Revised phone numbers
68.	7.02.2	12/11/2017	Revised saw cut length to 2 feet beyond excavation limits for patching
69.	7.02.2	12/11/2017	Revised concrete pavement requirement to be 4500 psi
70.	7.03.9	12/11/2017	Revised saw cut length to 2 feet beyond excavation limits for asphalt pavement repair
71.	8.04	12/11/2017	Removed note allowing gravel or recycled concrete for inlet protection, reinforced rock berm, and stabilized staging area
72.	3.08.3	9/21/2021	Update Ramp Detail to add new 308-03E

73.	3.08.3	10/05/2021	Added detail 308-03E transition to curb ramp landings to orient crosswalks at intersections with 25 ft radii and meet current CDOT and ADA Standards for new residential and commercial development
74.	3.20	10/05/2021	Inserted “Typical Sidewalk Transitions to Curb Ramp Landing” to Detail Description and “308-03E” to Detail Number

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1.00 INTRODUCTION

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1.0 INTRODUCTION

These regulations together with all future amendments shall be known as the City of Commerce City Engineering Construction Standards and Specifications, hereinafter called Standards and Specifications. These Standards and Specifications replace the City of Commerce City Engineering Construction Standards and Specifications, originally adopted in 1988, and amended in 1994, which are hereby repealed.

1.01 PURPOSE

The Standards and Specifications are provided pursuant to the Commerce City Land Development Code. The purpose of the Standards and Specifications is to provide minimum standards to safeguard the health, property and public welfare by regulating the design, construction, quality of materials, use, location, and maintenance of all public improvements and common facilities including, but not limited to public and private streets and trails, open space, parking lots, storm drainage improvements, and appurtenances thereto.

These Standards and Specifications are intended to provide for adequate and coordinated facilities in order to serve and protect the people who use and pay to maintain these facilities.

1.02 SCOPE

The Standards and Specifications contained in this document provide adopted standards for the more frequent construction and development issues. It is impossible to provide standards for every issue; therefore, good engineering judgment will be required when issues arise that are not addressed in these Standards and Specifications and shall be approved by the City Engineer.

The criteria to be considered by the designer and the reviewer when encountering these situations shall be:

1. The health, safety, and welfare of the users of the proposed facilities.
2. That the intended purposes for the proposed improvement are being provided for.
3. Operating and maintenance costs will be minimized.
4. The proposed construction will be compatible with existing and proposed improvements on adjacent properties.

These Standards and Specifications represent **minimum** requirements and design values. The City Engineer may impose additional requirements or higher design values, if, in the City Engineer's judgement, site conditions or other circumstances warrant.

It is recognized that certain projects financed wholly or in part with county, state, Urban Drainage and Flood Control District (UDFCD), or federal funds may be subject to standards prescribed by those agencies. The more stringent standards shall apply in those cases, as determined by the City Engineer.

When development occurs adjacent to State Highways within the City of Commerce City, if the Colorado Department of Transportation (CDOT) and/or the State Highway Access Code exceed the standards contained in this ordinance, then the State's standards will take precedence.

1.03 DEVIATIONS FROM THE STANDARDS

Whenever there are practical difficulties involved in carrying out the provisions of these Standards and Specifications, the City Engineer may grant deviations for individual cases. The City Engineer shall first determine special circumstances, which make these procedures impractical and that the deviation is in conformance with the intent and purpose of these Standards and Specifications. These deviations must not lessen the intent of the design requirement, or the level of safety, service, and quality intended by the Standards and Specification's minimum requirements.

The City Engineer shall require that sufficient evidence or proof be submitted to substantiate any deviation request.

1.04 DEFINITIONS

Whenever the following terms are used in these Standards and Specifications, they shall be defined as follows:

Bonds - Performance, labor and material payment bonds, irrevocable letters of credit, and other instruments of security furnished to the City by the responsible party as surety in accordance with the Development Agreement and the Municipal Code of the City of Commerce City.

City - The City of Commerce City, Colorado, its agents, representatives, and employees acting on its behalf.

City Engineer - The City of Commerce City, City Engineer or authorized representative.

Common Facilities - Facilities intended to serve and protect the users and the owners of property developed in Commerce City and covered by these Standards and Specifications.

Contractor - A person, partnership, corporation, or other legal entity who undertakes to; construct, install, alter, move, remove, trim, demolish, repair, replace, excavate, or add to any improvements covered by these Standards and Specifications, or any utility or any other facility that requires work, workers, and/or equipment to be in the public right-of-way in the process of performing these operations.

Developer - The person, partnership, corporation, or other legal entity who is improving a parcel of land within the City, and who is legally responsible to the City for the construction of improvements within a subdivision.

Final Acceptance - The date on which the City agrees to accept the improvements after the one-year warranty period.

In-fill Development – Development or redevelopment on vacant or under-utilized land within existing urban areas.

Holidays - New Year's Day, Martin Luther King Jr. Day, President's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving and the Friday after Thanksgiving, and Christmas Day.

Initial Acceptance - The date on which the City agrees to accept the work under contract. This date usually follows the final walk-through and completion of all "punchlist" items. The warranty period begins on this date.

Inspector - The authorized representative of the City Engineer assigned to make detailed inspection of construction work to assure compliance with these Standards and Specifications and the plans approved by the City.

May - To be interpreted as can or able, or more permissive than the use of "shall" in these Standards and Specifications.

Normal Work Hours - 8:00 a.m. to 5:00 p.m., Monday through Friday, except holidays.

Owner - Any individual, corporation, partnership, or other legal entity holding controlling title on property, which is in some way impacted or involved by development or improving the property.

Public Improvements - Improvements in the public right-of-way, or in easements that are either in the control of or ownership by the City. Improvements include sidewalk, curb, gutter, and any portion of City streets.

Right-of-Way - (ROW) - An area dedicated to public use for pedestrians, equestrian or vehicular movement, railroads, public utilities, storm drainage and runoff.

Responsible Party - Any individual, corporation, partnership, or other legal entity involved in developing improvements covered by these Standards and Specifications. Includes subcontractors, contractors, developers, and owners, as applicable in the development process.

Shall - An obligation or necessity to be interpreted as mandatory.

Should - An advisory or recommendation, but not mandatory.

Specifications - Applicable specifications of agencies or organizations identified and shall mean the latest edition or as revised.

Standards and Specifications - The "Engineering and Construction Standards and Specifications" of the City of Commerce City.

Substantial Completion - The degree of completion of a construction project, or a portion of the project that is sufficient to provide the City or the general public the use of the project for the purposes for which it was intended, as determined by the City Engineer.

Warranty Period - Time frame during which the responsible party is held liable for all work performed and materials utilized prior to final acceptance of improvements by the City.

1.05 ABBREVIATIONS

A The algebraic difference in grades in a vertical curve or the area of a basin, subbasin or orifice.

AASHTO	American Association of State Highway and Transportation Officials.
ACI	American Concrete Institute
ADT	Average Daily Traffic
AISC	American Institute of Steel Construction
ANSI	American National Standards Institute
APWA	American Public Works Association
ASTM	American Society for Testing and Materials
ATSSA	American Traffic Safety Services Association
Auto-CAD	Computer aided drafting software
BMP	Best Management Practices
CDOT	Colorado Department of Transportation
CMP	Corrugated Metal Pipe
CMPA	Corrugated Metal Pipe Arch
DIP	Ductile Iron Pipe
DTN	Design Traffic Number (DTN = EDLA)
DRCOG	Denver Regional Council of Governments
EDLA	Equivalent Daily Load Application. A load application is a single axle load of 18,000 pounds. (DTN = EDLA)
GIS	Geographical Information System
HERCP	Horizontal Elliptical Reinforced Concrete Pipe
HBP	Hot Bituminous Pavement
HGL	Hydraulic Grade Line
ITE	Institute of Transportation Engineers

K	The factor in vertical curve design that is equal to the length of the curve divided by the algebraic difference in grades (L/A).
L	Length of a vertical curve or travel distance of flow in a time of concentration formula
PLS	Professional Licensed Land Surveyor in the State of Colorado
MGPEC	Metropolitan Government Pavement Engineers Council
MUTCD	Manual on Uniform Traffic Control Devices
OSHA	Occupational Safety and Health Administration
PC	Point of curvature
PCR	Point on curb return, where tangent and radius meet at the intersection of two streets.
PE	Professional Engineer licensed in the State of Colorado
PI	Point of Intersection
PRV	Pressure Reducing Valve
psf	Pounds per square foot
psi	Pounds per square inch
PT	Point of Tangency
PVC	Polyvinyl Chloride
R	Subgrade support value
RI	Reliability Index in pavement design
RCP	Reinforced Concrete Pipe
ROW	Right-of-Way
SI	Serviceability Index in pavement design
SN	Structural Number in pavement design

SPPA	Structural Plate Pipe Arch
SWMP	Stormwater Management Plan
UDFCD	Urban Drainage and Flood Control District
USGS	United States Geological Survey
VMA	Voids in the Mineral Aggregate
vpd	Vehicles Per Day

2.00 DRAWING SUBMITTAL PROCEDURE

2.01 GENERAL

2.02 SUBMITTALS

2.03 APPROVED PLANS

2.04 CONSTRUCTION PLAN REQUIREMENTS

2.05 CONSTRUCTION PLAN CHECKLISTS

- 2.05.1 GRADING PLANS
- 2.05.2 STREET CONSTRUCTION PLANS

2.06 RECORD DRAWING REQUIREMENTS

- 2.06.1 RECORD DRAWING INFORMATION

2.00 DRAWING SUBMITTAL PROCEDURE

2.01 GENERAL

The Engineering Division has developed and the City Council has adopted construction standards and engineering regulations for development. Plans, engineering calculations, diagrams, traffic reports, drainage reports and other data as required shall be submitted, as required by the City Engineer, with each development proposal or application for building permit. The engineer for the developer is encouraged to meet with the Engineering Division so that the technical aspects of the project can be discussed prior to preparation and submittal of plans and reports.

These submittals are reviewed by the Engineering Division in conjunction with other City department staff to ensure conformance with City standards. The City of Commerce City is not responsible for the correctness of design, dimensions, details, or quantities. All submittals are to be prepared by a registered professional engineer licensed in the State of Colorado.

2.02 SUBMITTALS

Two copies of plans and two copies of reports are required for each initial submittal. If additional copies are required for agency referrals, the applicant will be notified.

Drawing submittals should include but are not limited to: drainage plans, storm sewer plans and profiles, storm sewer construction details, an overlot grading plan, street construction plans and profiles, and street construction details. A cost estimate should also be submitted with the drawing set. An overall utility plan with storm sewer, water, irrigation, and sanitary sewer should also be submitted.

A drainage report may be required, in accordance with the requirements listed in the Commerce City Storm Drainage Design and Technical Criteria Manual, which is available online on the City's website. The drainage report and construction plans should be submitted concurrently. Approval of the drainage report is required prior to approval of street and storm sewer construction plans.

2.03 APPROVED PLANS

Plans must be approved by the City Engineer prior to initiation of any construction activities.

The City requires two full size paper copies of plans and reports that contain the professional engineer's original wet stamp and signature. A copy of the

approved plans shall be kept on the jobsite at all times during construction of the public improvements.

A right-of-way permit is required for all work in the public right-of-way, which includes all storm sewer, streets, sidewalks, and curb and gutter. The contractor must be licensed with the City of Commerce City, and can obtain the permit at the Department of Public Works. For new infrastructure, the permit fee is based on 2% of the cost estimate for the public improvements included in the project. All other permit fees will be per the current rate schedule. A traffic control plan for work in the public right-of-way shall be submitted as part of the construction plans, or when the right-of-way permit is obtained. Use tax is also charged on all right-of-way permits in the amount of 4.5% of 60% of the cost estimate.

If construction of any public improvements is not initiated within 180-days from the approval date on the plans, they will be subject to re-approval by the City.

Should circumstances warrant changes to the approved plans and specifications, a written approval must be obtained from the City Engineer. Copies shall be given to the responsible party, and the project design engineer. It shall be the responsibility of the engineer, land surveyor, or the design engineer to record any changes on record drawings at the completion of the project. One full set of mylars shall be furnished to the City at the time of application for acceptance. Once the record drawings have been approved, the design engineer shall submit Auto-CAD files to the City.

2.04 CONSTRUCTION PLAN REQUIREMENTS

Construction plans shall be drawn to scale and shall have sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that the proposed improvements conform to the provisions of these Standards and Specifications.

Street construction plans shall contain the following items:

1. Flowline or centerline profile elevations.
2. Curb return profiles with flowline elevations at all corners and intersections.
3. Centerline stations and elevations at all intersecting streets.
4. Storm water surface flow direction arrows, particularly at intersections, and at high and low points including spot elevations.
5. Handicap ramps at all intersections and mid-block ramps at all “T” intersections.
6. Typical street cross sections shall be included as appropriate on each sheet.

A benchmark and basis of bearing for the plans must tie and be rotated to an established point in the Commerce City Control Point System. Benchmark locations, elevations and bearings may be obtained from the Engineering Division at the Department of Public Works.

Streetlights shall conform to the requirements set forth in Section 5.04, Street Lighting, of these Standards and Specifications.

If construction plans include new streets or substantial modification, or widening of an existing street, a signage and striping plan shall be submitted as part of the construction plan set. All signage and striping shall follow the guidelines in the Manual on Uniform Traffic Control Devices (MUTCD).

All reports submitted for review must be typewritten. All drawings shall be on 24" x 36" plan sheets.

Horizontal and vertical alignment continuity shall be provided between new and existing streets to provide safe and aesthetically pleasing transitions. Sufficient information shall be provided on the plans to assure that the desired continuity is achieved.

2.05 CONSTRUCTION PLAN CHECKLISTS

The following checklists are provided to assist in developing plans that will meet City requirements for specific submittals:

TABLE 2-1 GRADING PLAN CHECKLIST

Subdivision		**Acceptable?**			**Date**
Filing					**Submittal Number**
Consultant					**Reviewed By**
		Yes	**No**	**N/A**	**Comments**
A.	**PLAN SHEET FORMAT**				
1	Vicinity Map				
2	North Arrow				
3	Title Block				
4	Contour Lines (2' Maximum intervals)				
5	24" x 36" Plan Sheets				
6	Original and Revision Dates				
7	Dated, Checked, Sealed, and Signature of P.E.				
8	Legend				
9	Street names, dimensions, and grades				
10	Match lines and sheet numbers				
11	Bench mark description and elevation (Must be tied to City Datum)				
12	Baseline or control line				
B	**PRESENT SITE CONDITIONS**				
1	Existing site topography extending a minimum of 50 feet past property limits.				
2	Existing Features				
3	Easements and rights-of-way				

TABLE 2-1 GRADING PLAN CHECKLIST					
Subdivision		**Acceptable?**			**Date**
4	All utilities				
5	Drainageways with 100-year floodplain and floodway limits				
6	Irrigation ditches or laterals				
7	Buildings, fences, retaining walls, trees, and other physical features				
C	**PROPOSED SITE CONDITIONS**				
1	Proposed contours with match to existing contours				
2	Drainage flow arrows				
3	Grade breaks and slopes 3:1 or greater indicated on the plan				
4	Elevations and grades of all proposed drainage swales				
5	Elevations and locations of all high points				
6	Cut and fill areas and quantities shown				
7	Proposed Improvements				
8	Sidewalks, bike paths, and other public improvements				
9	Driveway grades and dimensions				
10	Storm drainage structures and channels				
11	Fences, retaining walls, and site improvements				
12	Typical cross sections				
13	Finished floor elevations for all buildings				
D	**EROSION PROTECTION**				
1	Erosion control plan details				
E	**STANDARD NOTES**				
F	**CONSULTANT SIGN-OFF**				
	"I have reviewed the attached plans with this checklist, and all the required items have been included except as noted above."				Professional Engineer

2.05.1 GRADING PLANS

The contractor shall notify the City 48 hours prior to commencing grading. The following general notes should be included on the grading plans when applicable:

1. GRADING PLAN IS FOR ROUGH GRADING ONLY. CHANGES MAY BE NECESSARY TO BRING PLANS INTO CONFORMANCE WITH APPROVED DRAINAGE AND SITE PLAN.

2. A WATER TRUCK SHALL BE KEPT ON-SITE TO CONTROL WIND EROSION AND DUST.

3. ANY SETTLEMENT OR SOIL ACCUMULATIONS BEYOND THE PROPERTY LIMITS DUE TO GRADING OR EROSION SHALL BE REPARIED IMMEDIATELY BY THE CONTRACTOR.

4. NO GRADING SHALL TAKE PLACE IN ANY DELINEATED FLOOD HAZARD AREA UNTIL THE FINAL DRAINAGE PLAN HAS BEEN APPROVED AND ALL APPROPRIATE PERMITS HAVE BEEN OBTAINED.

5. ANY CONSTRUCTION DEBRIS OR MUD TRACKING IN THE PUBLIC RIGHT-OF-WAY RESULTING FROM THIS DEVELOPMENT WILL BE REMOVED IMMEDIATELY BY THE

CONTRACTOR. UPON WRITTEN NOTICE BY THE CITY, FAILURE TO REMOVE THE MUD OR DEBRIS BY THE CONTRACTOR WITHIN 24 HOURS SHALL CAUSE THE CITY TO STOP ALL WORK UNTIL THE SITUATION IS RESOLVED.

6. WHEN REQUIRED, A COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT (CDPHE), WATER QUALITY DIVISION, STORMWATER DISCHARGE PERMIT SHALL BE OBTAINED AND A COPY SHALL BE SUBMITTED TO THE CITY OF COMMERCE CITY DEPARTMENT OF PUBLIC WORKS.

7. AREAS DISTURBED BY GRADING SHALL BE MULCHED AND RESEEDED WITH NATIVE VEGETATION OR AS APPROVED ON THE PLAN.

8. THE CONTRACTOR SHALL BE SOLELY AND COMPLETELY RESPONSIBLE FOR SAFETY CONDITIONS ON AND ADJACENT TO THE SITE 24 HOURS A DAY, SEVEN DAYS A WEEK.

9. CONTRACTOR SHALL CONTACT UTILITY NOTIFICATION CENTER FOR THE LOCATION OF UNDERGROUND UTILITIES AT LEAST 48 HOURS PRIOR TO COMMENCEMENT OF CONSTRUCTION. (811 or 1-800-922-1987)

10. THE CITY ENGINEER'S SIGNATURE AFFIXED TO THIS DOCUMENT INDICATES THE CITY OF COMMERCE CITY PUBLIC WORKS DEPARTMENT, ENGINEERING DIVISION, HAS REVIEWED THE DOCUMENT AND FOUND IT IN GENERAL COMPLIANCE WITH THE CITY'S STORMWATER QUALITY CONTROL CRITERIA. THE CITY ENGINEER, THROUGH ACCEPTANCE OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY (OTHER THAN AS STATED ABOVE) FOR THE COMPLETENESS AND/OR ACCURACY OF THESE DOCUMENTS.

11. THE ADEQUACY OF THIS ESC PLAN LIES WITH THE ORIGINAL DESIGN ENGINEER.

12. ALL MATERIALS AND WORKMANSHIP SHALL BE SUBJECT TO INSPECTION BY THE CITY. COMMERCE CITY RESERVES THE RIGHT TO ACCEPT OR REJECT ANY SUCH MATERIALS AND WORKMANSHIP THAT DOES NOT CONFORM TO THE APPROVED PLANS.

13. THE PLACEMENT OF EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICES (BMP’s) SHALL BE IN ACCORDANCE WITH THE CITY APPROVED PLANS.

14. ANY VARIATION IN MATERIAL, TYPE OR LOCATION OF EROSION AND SEDIMENT CONTROL BMP’s FROM THE CITY APPROVED PLANS WILL REQUIRE APPROVAL FROM AN ACCOUNTABLE REPRESENTATIVE OF THE CITY OF COMMERCE CITY ENGINEERING DIVISION.

15. AFTER THE ESC PLAN HAS BEEN APPROVED, THE CONTRACTOR MAY INSTALL THE INITIAL-STAGE EROSION AND SEDIMENT CONTROL BMPS INDICATED ON THE ACCEPTED ESC PLAN.

16. THE FIRST BMP TO BE INSTALLED ON THE SITE SHALL BE CONSTRUCTION FENCE, MARKERS, OR OTHER APPROVED MEANS OF DEFINING THE LIMITS OF CONSTRUCTION, INCLUDING CONSTRUCTION LIMITS ADJACENT TO STREAM CORRIDORS AND OTHER AREAS TO BE PRESERVED.

17. AFTER INSTALLATION OF THE INITIAL-STAGE EROSION AND SEDIMENT CONTROL BMPs, THE PERMITTEE SHALL CALL THE PUBLIC WORKS AT 303-289-8150 TO SCHEDULE A PRECONSTRUCTION MEETING AT THE PROJECT SITE. THE REQUEST SHALL BE MADE A MINIMUM OF THREE BUSINESS DAYS PRIOR TO THE

REQUESTED MEETING TIME. NO CONSTRUCTION ACTIVITIES SHALL BE PLANNED WITHIN 24 HOURS AFTER THE PRECONSTRUCTION MEETING.

18. THE ESC MANAGER SHALL BE CERTIFIED IN STORMWATER MANAGEMENT AND EROSION CONTROL AND DOCUMENTATION SHALL BE PROVIDED TO THE CITY.

19. THE OWNER OR OWNER'S REPRESENTATIVE, THE ESC MANAGER, THE GENERAL CONTRACTOR, AND THE GRADING SUBCONTRACTOR, IF DIFFERENT FROM THE GENERAL CONTRACTOR, MUST ATTEND THE PRECONSTRUCTION MEETING. IF ANY OF THE REQUIRED PARTICIPANTS FAIL TO ATTEND THE PRECONSTRUCTION MEETING, OR IF THE INSTALLATION OF THE INITIAL BMP's ARE NOT APPROVED BY THE CITY ESC INSPECTOR, THE APPLICANT WILL HAVE TO PAY A REINSPECTION FEE, ADDRESS ANY PROBLEMS WITH BMP INSTALLATION, AND CALL TO RESCHEDULE THE MEETING, WITH A CORRESPONDING DELAY IN THE START OF CONSTRUCTION. THE CITY STRONGLY ENCOURAGES THE APPLICANT TO HAVE THE ENGINEER OF RECORD AT THE PRECONSTRUCTION MEETING.

20. CONSTRUCTION SHALL NOT BEGIN UNTIL THE CITY ESC INSPECTOR APPROVES THE INSTALLATION OF THE INITIAL BMP's AND THE GRADING PERMIT IS OBTAINED FROM PUBLIC WORKS.

21. THE ESC MANAGER SHALL STRICTLY ADHERE TO THE APPROVED LIMITS OF CONSTRUCTION AT ALL TIMES. THE CITY OF COMMERCE CITY ENGINEERING DIVISION MUST APPROVE ANY CHANGES TO THE LIMITS OF CONSTRUCTION AND, AT THE DISCRETION OF THE ENGINEERING DIVISION, ADDITIONAL EROSION/SEDIMENT CONTROLS MAY BE REQUIRED IN ANY ADDITIONAL AREAS OF CONSTRUCTION.

22. NATURAL VEGETATION SHALL BE RETAINED AND PROTECTED WHEREVER POSSIBLE. EXPOSURE OF SOIL TO EROSION BY REMOVAL OR DISTURBANCE OF VEGETATION SHALL BE LIMITED TO THE AREA REQUIRED FOR IMMEDIATE CONSTRUCTION OPERATIONS.

23. A COPY OF THE GRADING PERMIT AND APPROVED PLANS SHALL BE ON SITE AT ALL TIMES.

24. THE ESC MANAGER SHALL BE RESPONSIBLE FOR ENSURING THAT THE SITE REMAINS IN COMPLIANCE AND SHALL BE THE PERMITTEE'S CONTACT PERSON WITH THE CITY FOR ALL MATTERS PERTAINING TO THE GRADING PERMIT. THE ESC MANAGER SHALL BE PRESENT AT THE SITE THE MAJORITY OF THE TIME AND SHALL BE AVAILABLE THROUGH A 24-HOUR CONTACT NUMBER.

25. THE ESC MANAGER IS RESPONSIBLE FOR CLEANUP OF SEDIMENT OR CONSTRUCTION DEBRIS TRACKED ONTO ADJACENT PAVED AREAS. PAVED AREAS, INCLUDING STREETS, ARE TO BE KEPT CLEAN THROUGHOUT BUILD-OUT AND SHALL BE CLEANED WITH A STREET SWEEPER OR SIMILAR DEVICE AT FIRST NOTICE OF ACCIDENTAL TRACKING OR AT THE DISCRETION OF THE CITY'S ESC INSPECTOR. STREET WASHING IS NOT ALLOWED. THE CITY RESERVES THE RIGHT TO REQUIRE ADDITIONAL MEASURES TO ENSURE AREA STREETS ARE KEPT FREE OF SEDIMENT AND/OR CONSTRUCTION DEBRIS.

26. THE APPROVED PLANS MAY REQUIRE CHANGES OR ALTERATIONS AFTER APPROVAL TO MEET CHANGING SITE OR PROJECT CONDITIONS OR TO ADDRESS INEFFICIENCIES IN DESIGN OR INSTALLATION. ALL CONSTRUCTION TRAFFIC MUST ENTER/EXIT THE SITE THROUGH THE CITY APPROVED ACCESS POINTS. A VEHICLE TRACKING CONTROL PAD IS REQUIRED AT ALL ACCESS POINTS ON THE

SITE. ADDITIONAL STABILIZED CONSTRUCTION ENTRANCES MAY BE ADDED WITH AUTHORIZATION FROM THE COMMERCE CITY ENGINEERING DIVISION.

27. THE ESC MANAGER SHALL OBTAIN PRIOR APPROVAL FROM THE DESIGN ENGINEER AND COMMERCE CITY ENGINEERING DIVISION FOR ANY PROPOSED CHANGES.

28. NO PERMANENT EARTH SLOPES GREATER THAN 3:1 SHALL BE ALLOWED.

29. ANY SETTLEMENT OR SOIL ACCUMULATIONS BEYOND THE LIMITS OF CONSTRUCTION DUE TO GRADING OR EROSION SHALL BE REPAIRED IMMEDIATELY BY THE ESC MANAGER. THE ESC MANAGER SHALL BE HELD RESPONSIBLE FOR OBTAINING ACCESS RIGHTS TO ADJACENT PROPERTY, IF NEEDED, AND REMEDIATING ANY ADVERSE IMPACTS TO ADJACENT WATERWAYS, WETLANDS, PROPERTIES, ETC. RESULTING FROM WORK DONE AS PART OF THIS PROJECT.

30. SOILS THAT WILL BE STOCKPILED FOR MORE THAN THIRTY (30) DAYS SHALL BE SEEDED AND MULCHED WITHIN FOURTEEN (14) DAYS OF STOCKPILE CONSTRUCTION. NO STOCKPILES SHALL BE PLACED WITHIN ONE HUNDRED (100) FEET OF A DRAINAGE WAY UNLESS APPROVED BY THE COMMERCE CITY ENGINEERING DIVISION.

31. ALL CHEMICAL OR HAZARDOUS MATERIAL SPILLS WHICH MAY ENTER WATERS OF THE STATE OF COLORADO, WHICH INCLUDE BUT ARE NOT LIMITED TO, SURFACE WATER, GROUND WATER AND DRY GULLIES OR STORM SEWER LEADING TO SURFACE WATER, SHALL BE IMMEDIATELY REPORTED TO THE CDPHE PER CRS 25-8-601, AND COMMERCE CITY. RELEASES OF PETROLEUM PRODUCTS AND CERTAIN HAZARDOUS SUBSTANCES LISTED UNDER THE FEDERAL CLEAN WATER ACT (40 CFR PART 116) MUST BE REPORTED TO THE NATIONAL RESPONSE CENTER, SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT AS WELL AS THE CDPHE. SPILLS THAT POSE AN IMMEDIATE RISK TO HUMAN LIFE SHALL BE REPORTED TO 911. FAILURE TO REPORT AND CLEAN UP ANY SPILL SHALL RESULT IN ISSUANCE OF A STOP WORK ORDER.

32. THE CLEANING OF CONCRETE DELIVERY TRUCK CHUTES IS RESTRICTED TO APPROVED CONCRETE WASH OUT LOCATIONS ON THE JOB SITE. THE DISCHARGE OF WATER CONTAINING WASTE CONCRETE TO THE STORM SEWER SYSTEM IS PROHIBITED. ALL CONCRETE WASTE SHALL BE PROPERLY CLEANED UP AND DISPOSED AT AN APPROPRIATE LOCATION.

33. COMMERCE CITY DOES NOT ALLOW HAY BALES AS A FORM OF EROSION AND SEDIMENT CONTROL.

34. ONCE THE SITE HAS REACHED FINAL STABILIZATION, A FINAL INSPECTION SHALL BE SCHEDULED WITH THE CITY'S ESC INSPECTOR. A CERTIFICATE OF OCCUPANCY WILL NOT BE ISSUED AND/OR THE GRADING BOND WILL NOT BE RELEASED UNTIL THE CITY'S ESC INSPECTOR APPROVES FINAL STABILIZATION

2.05.2 STREET CONSTRUCTION PLANS

The following general notes should be included on the street construction plans when applicable:

1. A construction (street cut) permit from the City of Commerce City Department of Public Works is required prior to commencing work within the City Right-of Way.

2. Any work within State Highway right-of-way will require a CDOT construction permit in addition to a City permit.

3. The contractor shall notify the City of Commerce City Department of Public Works at least 24 hours prior to starting construction within the right-of-way at telephone number (303) 289-8150.

4. The contractor shall provide all signs, barricades, flag men, lights or other devices necessary for safe traffic control in accordance with the current edition of the *Manual on Uniform Traffic Control Devices* and as modified by the *Colorado Supplement to the MUTCD.* A traffic control plan shall be submitted to and approved by the City of Commerce City Department of Public Works prior to the issuance of any construction permit for work within City right-of-way.

5. The contractor shall contact the Utility Notification Center of Colorado at least 48 hours prior to construction. Call 1-(800) 922-1987 or 811.

6. Construction Specifications: Current edition of the *Colorado Department of Transportation Standard Specifications for Road and Bridge Construction* hereafter referred to as Standard Specifications. Special provisions and revisions thereto and the City of Commerce City Department of Public Works *Engineering Construction Standards and Specifications.*

7. The subgrade material shall be scarified or removed to a depth required by the City of Commerce City according to information obtained from laboratory tests and/or as required in the pavement design report. Additives or approved material may be required if the native material is unsatisfactory. The subgrade shall be compacted to a minimum density determined in accordance with AASHTO designation T180 or T99 and in accordance with the Standard Specifications *Section 203.07* (1991 edition or newer).

8. Service trenches and utility main trenches shall be compacted throughout the depth of trench as specified in above note. Exact extent of new pavement to be installed for a street cut patch shall be determined by the City Construction Inspector upon completion of roadway excavation. New pavement shall conform to existing sound structural section.

9. Class 6 aggregate base course for shoulders shall be placed and compacted to 100% standard proctor after placement of asphalt.

10. Existing asphalt pavement shall be straight saw cut when adjoining with new asphalt pavement. CSS-1H tack coat shall be applied to all exposed surfaces, including saw cuts, potholes, trenches and asphalt overlay.

11. Structural sections shall be as approved by the City of Commerce City Department of Public Works, with pavement design in accordance with the City of Commerce City Department of Public Works *Engineering Construction Standards and Specifications*.

12. Concrete may be placed by machine methods provided that all finish lines are within 1/8" ± tolerance of the lines shown on the plans. The flowline must be free draining.

13. One half (1/2) inch expansion joint material shall be installed when abutting any existing concrete or a fixed structure.

14. Sidewalks and driveways shall have the name of the Contractor and the year of construction impressed therein using block letters not less than (1) inch high and three-eighths (3/8) inch deep in each driveway and each end of construction, or a minimum of every 150 lineal feet of sidewalk.

15. A reflective City of Commerce City logo shall be added to each street sign. Street name sign plates shall be provided and installed by the Developer prior to issuance of a Certificate of Occupancy. Coordinate with City of Commerce City Traffic Engineering at (303) 289-8150.

16. The Contractor shall guarantee all work for a period of one year after the date of acceptance of the work by the City and shall repair or replace any or all such work, together with any other work which may be displaced in so doing, that may prove defective in workmanship and/or materials within the one year period from date of acceptance without expense whatsoever to the City, ordinary wear and tear, unusual abuse or neglect excepted. Prior to initial acceptance of public improvements, the City may require the applicant or his contractor to file a maintenance bond with the City in the amount of fifteen (15) percent of the estimated cost of construction or an amount adequate to ensure the satisfactory maintenance and condition of the required public improvements for a period of one (1) year after the date of their final acceptance and dedication to the City.

17. No portion of any street shall be paved with the final lift of asphalt until all utilities have been relocated, installed or stubbed to the back of sidewalk and all street lights relocated as necessary.

18. Angle points in the curb and gutter and all points of grade change not within a vertical curve shall be rounded in the field to produce a smooth gradual curve for proper appearance.

19. Survey Monuments. The standard Survey Monument as shown in design standard detail No. 300-24 or 300-25 will be installed at all section and quarter section corners. Survey monuments shall be set in accordance with the Colorado Revised Statues, and as required by the Bylaws and Rules of Procedure of the Colorado State Board of Registration for Professional Engineers and Professional Land Surveyors. All monuments shall be set within 60 days of completion of streets. If the monuments are not installed, the City shall have the work performed by a registered land surveyor and make a claim against the collateral for all costs including administration and legal fees.

20. Mylar copies of "AS BUILT" plans shall be submitted to the Engineering Division prior to initial acceptance of improvements.

21. No revisions to these plans shall be made without the approval of both the City Engineer and the Design Engineer. Any revisions or changes thereto shall be approved by the City Engineer prior to any requests for inspection.

22. Benchmark. All elevations shown on these plans for improvements or noted elsewhere are referenced to the benchmark. The Contractor shall be responsible for any monument or benchmark which is destroyed or disturbed. Damaged monument shall be re-established and replaced by a licensed land surveyor and a monument record filed as required.

23. The Contractor agrees that he shall assume sole and complete responsibility for job site conditions during the course of construction of the Project, including safety of all persons and property; that this requirement shall apply continuously and not be limited to normal working hours; and that the Contractor shall defend, indemnify and hold the Owner, the Engineer, and the City of Commerce City harmless from any and all liability, real or alleged, in connection with the performance of work on this Project, excepting for liability arising from the sole negligence of the Owner, the Engineer, or the City of Commerce City.

24. It shall be the responsibility of the Contractor to coordinate all necessary utility relocations with the appropriate utility company.

25. Adjust rim of all clean-outs, manholes, valve covers and survey monument covers to finish grade.

26. The Contractor shall provide for ingress and egress for private property adjacent to the work throughout period of construction.

27. It shall be the Contractor's responsibility to notify the Design Engineer of any problem in conforming to the approved line and grade for any element of the proposed improvements prior to its construction.

28. It shall be the Design Engineer's responsibility to resolve construction problems due to changed conditions or design errors encountered by the Contractor during the progress of any portion of the proposed work. If, in the opinion of the Construction Inspector, proposed alterations to the approved plans involve significant changes to the character of the work or to future contiguous public or private improvements, the Design Engineer shall be responsible for submitting revised plans to the City of Commerce City for approval prior to any further construction related to that portion of the work.

29. Location of underground utilities was taken from the records of the controlling agencies. No responsibility for their accuracy is assumed by the Engineer. It shall be the responsibility of the Contractor to verify the existence and/or location of all underground utilities prior to the commencement of construction.

30. The Contractor is responsible for the prevention of damage to adjacent property. No person shall excavate on land so close to the property line as to endanger any adjoining improvements, sidewalk, alley or utility without supporting and protecting such property from settling, or other damage that might result from the work prescribed on this plan. The local agency will hold the Contractor responsible for correction of damage to adjacent property, public or private.

If the construction plan set contains storm sewer that is located in public right-of-way or will be maintained by the City, the following storm sewer notes should also be added:

1. All storm sewer construction, including manholes, inlets and pipe trenches, shall be governed by the Commerce City *Storm Drainage Design and Technical Criteria Manual and Standards Specifications*, and the *Colorado Department of Highways Standards Specifications*, latest edition. In the event of conflict the Commerce City standards will govern.

2. All storm sewer pipe shall be ASTM C76 Class III reinforced concrete pipe (RCP) unless otherwise specified in these plans.

3. For construction in the City of Commerce City, the following modifications have been made to the CDOT standard type R inlet:

a. The 5-foot Type R Inlet shall have one manhole ring and lid.
b. The 10-foot Type R Inlet shall have two manhole rings and lids.
c. The 15-foot Type R Inlet shall have three manhole rings and lids, with on manhole ring and lid being located at the center of the inlet.

d. The 20-foot Type R Inlet shall have four manhole rings and lids. A hanging center wall shall be built with a bottom opening depth sufficient to handle design water flows. The center two manholes shall be located one each, on both sides of the center wall.

4. All storm sewer manholes shall be 1/4 inch low to flush with final paved surface.

5. Prior to initial acceptance of public improvements, the City may require the applicant or his contractor to file a maintenance bond with the City in the amount of fifteen (15) percent of the estimated cost of construction or an amount adequate to ensure the satisfactory maintenance and condition of the required public improvements for a period of one (1) year after the date of their final acceptance and dedication to the City.

6. The Contractor shall furnish and install, per specifications, the appropriate buried utility warning and identification tape above all public sewer lines, including sewer laterals located in public rights-of-way.

7. After completion of pipe laying, all main line sewers, service laterals and structures shall be tested in the presence of the Inspector. It will be the Permittee's responsibility to pay for the cost of this work.

8. Compaction tests shall be supplied by Contractor for all trenches.

9. Bedding for the RCP pipe shall be AG7122 No. 57/67 crushed rock. Squeegee or mixtures containing squeegee shall not be used. Bedding shall be six to eight inches deep under the pipe and backfilled to the spring line.

10. Request for an inspection of reinforcement and subgrade must be called 24 hours prior to placement of concrete at manholes and inlets. Storm sewer installation shall be subjected to additional periodic inspection by the Engineer. For storm sewer in the roadway area, trench compaction shall be in accordance with AASHTO T99 or T180 as required in Section 203.11 of the CDOT Standard Specifications. Compaction tests must be performed by a Geotechnical Engineer and shall be a minimum of every 250 feet along the trench. Testing intervals may be increased at the discretion of the City Inspector.

TABLE 2-2 STREET CONSTRUCTION PLAN CHECKLIST

Subdivision:					**Date:**
Filing:					Submittal Number:
Consultant:					Reviewed by:
		Acceptable?			
A.	**Plan Sheet Format**	**Yes**	**No**	**N/A**	**Comments**
1	Scale: Horizontal: 1" =50' or larger Vertical: 1" =5' or larger				
2	North Arrow				
3	Title Block				
4	Vicinity Map (1" = 2000')				
5	24" x 36" Plan Sheets				
6	Date of Plan and Revisions				
7	Checked, Sealed, Dated, and Signature of P.E.				
8	Legend				
9	Key map on each sheet				
10	Street Names, Dimensions, and Grades				
11	Existing Conditions depicted by Dashed Lines, Proposed Improvements by Solid Lines.				
12	Match Lines and Sheet Numbers				
B.	**Control Standards**				
1	Field Bench Mark Description (Must be tied to Commerce City Datum)				
2	Control Line and Referenced and Tied to Section Corner				
3	Control Line Stationed				
4	Size and Location of Proposed and Existing Property, ROW, Easements, Tied and Referenced to Control Line				
5	Beginning Station Tied and Referenced				
6	Centerline Elevations on All Intersecting Streets				
7	Control Line Ties to Adjacent Street				
8	Complete Curve Data				
	a) Radius				
	b) Chord				
	c) Delta				
	d) Elevations on Curb Returns				
	e) Length of Curve				
9	Spot Elevations				
	a) High Points				
	b) Low Points				
	c) Flow Direction				
10	Centerline Tied and Referenced to Control or Section Line				
11	Existing Centerline Grades on Plans				
12	Limits of Construction				
13	Existing and/or Future Construction Dashed				
14	Standard Notes per Commerce City Construction Specifications (Section 2.05.1)				
C.	**Plan Design and Detail**				
1	Typical cross section for each differing street section				
2	Easements for all off-site grading				
3	Elevations 100' each direction from all intersections				
4	Stations and Proposed Utilities				
	a) Manholes and Inlets				
	b) Light and Power Poles				
	c) Hydrants and water valves				
	d) Gas lines				
	e) Traffic Signs and Poles				

TABLE 2-2 STREET CONSTRUCTION PLAN CHECKLIST – continued					
C.	**Plan Design and Detail (con't)**	**Yes**	**No**	**N/A**	**Comments**
5	Location of Fixed Objects				
	a) Trees				
	b) Poles				
	c) Fences				
	d) Retaining Walls				
	e) Building Setbacks				
	f) Guardrails				
	g) Railroads				
	h) Utilities				
6	Curb Return Profiles				
7	Storm Sewer (Proposed and Existing)				
	a) Clearance with other utilities				
	b) Size				
	c) Type				
	d) Location				
	e) Invert				
	f) Profile grades and percent				
	g) Bedding details				
8	Station, Elevation, Size, and Detail of Existing and Proposed Improvements				
	a) Sidewalks				
	b) Bike paths				
	c) Handicap Ramps				
	d) Drive Cuts				
	e) Cross Pans with flowline intersection elevations				
	f) Bus Pads				
9	Drainage Appurtenances – Station, Elevation, Size, Slope, and Detail of Existing and Proposed				
	a) Manholes				
	b) Inlets				
	c) Sidewalk Chase Sections				
	d) Rip-rap				
	e) Swale				
	f) Drainage Channel				
	g) Bedding details				
	h) Bearing on Mainlines				
	i) Underdrains				
	j) Utility Crossings				
10	Curb and Gutter – Existing and Proposed				
	a) Type				
	b) Size				
	c) Location				
	d) Flowline elevation				
	e) Match Existing Improvements				
	f) Profile grades and percent				
11	Vertical Curves				
	a) VPC				
	b) VPI				
	c) VPT				
	d) Profile Grades and Percent				
	e) High and Low Points				
	f) Vertical Curve Design Speed				
12	Sight Distance				
	a) Intersection – Horizontal				
	b) Intersection – Vertical				
	c) Driveways – Horizontal				
	d) Driveways – Vertical				
13	Geotechnical Test Locations				

TABLE 2-2 STREET CONSTRUCTION PLAN CHECKLIST – continued					
		Yes	**No**	**N/A**	**Comments**
14	Erosion Control Plan Detail				
15	Advanced Warning Signs				
16	Matching Existing Improvements				
17	Details Provided for Non-standard or Modified Construction Items				
18	Pavement Transitions Back to Existing				
19	Include Appropriate City or CDOT Details.				
D	**Consultants Sign-Off**				
"I have reviewed the attached plans with this checklist, and all the required items have been included except as noted above"		Professional Engineer			

2.06 RECORD DRAWING REQUIREMENTS

It is the duty of the responsible party to record and document the physical dimensions and any changes on a set of record drawings and to certify as to their accuracy. The certification shall be by a professional engineer (P.E.).

Record drawings may be field verified and approved by the City prior to initial acceptance as defined in Section 7. Once the record plans have been approved, the responsible party shall submit a full size mylar plan of the record drawing improvements, and submit AutoCad files to the City.

2.06.1 RECORD DRAWING INFORMATION

A. Streets
1. Elevation checks at a maximum of one hundred fifty (150) foot intervals in both flowlines of all streets, at the point of curb return of each radii, and at the center of each cross-pan.
2. Elevations at flowline at each side of storm inlets.
3. Elevations at the PCs, radius points of all cul-de-sacs along the flowline, and high and low points in the cul-de-sac bulb.
4. Pavement evaluation and deflection testing report as provided in Section 4.05.

B. Storm Sewers
1. Elevation, size, and material of all inverts (in/out) at manholes, inlets, and outlets.
2. Pipe lengths, pipe diameters, stations, and manholes.
3. Rim elevations and slope on all manholes and drainage inlet structures.
4. Elevation check every 100 feet in the thalweg of all drainage channels, including elevations at the top and bottom of all drop structures.
5. Final detention pond volume and the final release rates.

C. Water Mains and Sanitary Sewers

1. Horizontal verification of water valves, fire hydrants, and manholes.

D. Certification Statement:

"I hereby certify that the public improvements for (Name of Subdivision or project) have been constructed in substantial compliance with the construction plans approved by the City of Commerce City."

_____ _____
PE Name Date

_____
PE Number

3.00 ROADWAY AND PARKING ENGINEERING CRITERIA

3.01 GENERAL

3.02 DEFINITIONS

3.03 ACCESS
- 3.03.1 ACCESS POINTS
- 3.03.2 DRIVEWAY OFFSETS
- 3.03.3 CHANGE IN USE
- 3.03.4 SPEED CHANGE LANES
- 3.03.5 ACCESS ALIGNMENT
- 3.03.6 SITE ACCESS DESIGN

3.04 MINIMUM DESIGN CRITERIA
- 3.04.1 AUXILIARY LANES
- 3.04.2 STORAGE LENGTH
- 3.04.3 TRANSITION TAPERS
- 3.04.4 MEDIAN DESIGN

3.05 VERTICAL ALIGNMENT

3.06 SIGHT DISTANCE

3.07 UNIQUE INTERSECTIONS AND CUL-DE-SACS
- 3.07.1 TYPICAL STREET SECTION
- 3.07.2 RIGHT IN-RIGHT OUT
- 3.07.3 EYEBROW TREATMENT
- 3.07.4 CUL-DE-SAC
- 3.07.5 ROUNDABOUTS
- 3.07.6 TRAFFIC CALMING

3.08 CONCRETE
- 3.08.1 DRIVE CURB CUT
- 3.08.2 VALLEY PAN
- 3.08.3 CURB RAMPS
- 3.08.4 CHASE DRAIN
- 3.08.5 CURB, GUTTER, AND SIDEWALK
- 3.08.6 JOINTS

3.09 MAJOR STRUCTURES

3.10 DRAINAGE

3.11 SURVEY MONUMENTS

3.12 UTILITY LOCATIONS

3.01 GENERAL

This section sets forth the minimum criteria to be met on all newly designed and constructed public and private streets and parking lots in the City of Commerce City.

3.02 DEFINITIONS

Principal Arterial: Roadways with up to six (6) through lanes designed to provide intra-city and inter-community connections, for moderate speeds and moderate traffic volumes. Access needs to be controlled in order to preserve the traffic carrying capacity of the roadway.

Minor Arterial: Roadways consisting of four (4) through lanes designed to provide intra-city and inter-community connections, for moderate speeds and moderate traffic volumes. Access needs to be controlled, but can be more frequent than principal arterials.

Multimodal Arterial: Roadways consisting of two (2) through lanes and two (2) bike lanes designed to provide intra-city and inter-community connections, for moderate speeds and moderate traffic volumes. Access is the same as minor arterials.

Major Collector: Roadways designed to handle traffic volumes generally greater than 7,000 vehicles per day. These streets collect and distribute traffic between arterials and local streets and serve as main connectors within communities.

Minor Collector: Roadways designed to handle traffic volumes generally less than 7,000 vehicles per day. These streets collect and distribute traffic between arterials and local streets and serve as main connectors within communities.

Local Industrial: Roadways that provide direct access to public right-of-way from abutting industrial developments. Traffic volumes are to be less than 2,500 vehicles per day. These developments create higher volumes of large trucks, which require larger turning radii and greater room to maneuver.

Local Commercial: Roadways that provide direct access to public right-of-way from abutting commercial and high-density residential developments. Traffic volumes are to be less than 2,500 vehicles per day.

Local Residential: Roadways that provide direct access to public right-of-way from abutting single-family residential lots. Traffic volumes are to be less than 2,500 vehicles per day, and are designed to accommodate pedestrians and bicyclists, as well as passenger cars, trucks, and emergency vehicles.

3.03 ACCESS

Every roadway in a transportation network serves two functions to differing degrees: mobility and access. Conflict between safe and efficient movement of traffic and access to abutting properties have long been recognized as a major limiting constraint in traffic operations and transportation systems management. To obtain maximum through traffic movement efficiency, direct access needs to be limited. The purpose of these regulations is to provide a balanced program that provides reasonable access, while maintaining safety and efficiency in traffic movement.

3.03.1 ACCESS POINTS

Whenever the use of any property subject to review and approval, denial, or revision of its access operation is changed, the City Engineer must approve the number of access points and location(s). In addition, the City Engineer must approve any proposed changes or modifications of existing driveways or accesses, and the necessary Public Way Permit must be obtained.

Access will not be approved for parking or loading areas that require backing maneuvers in a public street right-of-way, except for single-family or duplex residential uses on local streets.

If a property has frontage on more than one street, access will be permitted only on those street frontages where these standards can be met. If a property cannot be served by any access point meeting these standards, the City will designate a revocable access point based on traffic safety, operational needs, and conformance with these guidelines. Once an alternate access is provided to the parcel, the revocable access may be removed.

If a property has frontage on a State Highway, access must be approved and obtained from CDOT.

Where necessary for the safe and efficient movement of traffic, the City Engineer may require access points to provide only limited turning movements.

One access point per common property ownership will be permitted unless a site plan or traffic study proves that additional access points are required to adequately handle driveway volumes and will not be detrimental to traffic flow. Multiple accesses must also be approved by the City Engineer. Table 3-1 outlines the general guidelines to be followed when designing a site for access.

TABLE 3-1 ACCESS GUIDELINES⊗

Functional Classification	TYPES OF ACCESS			
	Major Signalized (Full Movement)	**Unsignalized Full Movement**	**3/4 Movement**	**Right-in / Right-out Movement**
Principal Arterial	1/2 Mile Spacing	1/4 Mile Spacing or Alternative Spacing if supported by a traffic study	± 660 feet∗ if supported by a traffic study	±660 feet∗ if supported by a traffic study
Minor/ Multimodal Arterial	1/4 Mile Spacing	Approximately 660 feet∗ from signalized intersection if supported by a traffic study	Approx. 660 feet∗ from signalized intersection if supported by a traffic study	±250 feet• if supported by traffic study
Major Collector	1/2 Mile Spacing	Approximately 450 feet• from signalized intersections, 300 feet• from major intersections, 150 feet◊ spacing otherwise	Generally not applicable	Approx. 200 feet• from signalized intersection, 150 feet◊ spacing otherwise
Minor Collector	1/2 Mile Spacing	Approximately 300 feet• from major intersections♦, 150 feet◊ spacing otherwise	Generally not applicable	Generally not applicable
Industrial Local	Not Applicable	150 feet◊ spacing	Generally not applicable	Generally not applicable
Commercial Local	Not Applicable	150 feet◊ spacing	Generally not applicable	Generally not applicable
Single Family Local	Not Applicable	Streets shall be 150 feet∗ Driveways shall be 55 feet• from intersections, 25 feet◊ spacing otherwise	Generally not applicable	Generally not applicable

⊗ The above driveway spacing requirements are minimums, except at potential signalized intersections, where spacing requirements provide optimum signal progression and maintain the functional quality of the roadway.

∗ Measured from centerline of intersection to centerline of drive access.

• Measured from near side flowline to centerline of drive access.

◊ Measured from centerline of drive access to centerline of drive access.

♦ Major intersections are any functional classification above a collector.

3.03.2 DRIVEWAY OFFSETS

Where lots on undivided roadways are not large enough to allow accesses on opposite sides of the street to be aligned, the center of driveways not in alignment will be offset by a minimum of 150 feet (as measured from centerline to centerline of accesses) on all collector and commercial local streets, and 300 feet on arterial roadways. Greater distances may be required if left-turn storage lengths require such. Accesses must intersect a public street at 90^{o}; if physical constraints make this impractical, up to a 10^{o} variance may be permitted with review and approval of the City Engineer.

3.03.3 CHANGE IN USE

A change in use is defined below:

1. The use of the access increases in actual or proposed vehicular volume by 20% or more.
2. A particular directional characteristic (such as left turns) increases by 20% or more.
3. The change in use of the property or modifications to the property causes the flow of vehicles entering the property to be restricted, to queue or hesitate on the City Street, creating a hazard.
4. The use of the access by vehicles exceeding 30,000 pounds gross vehicle weight increases by 20% or by 10 vehicles per day, whichever is less.
5. If a parcel of land with direct access has been in a state of non-use for more than 4 years, resuming use of the access will be considered a change in use.

Change in property use may include but is not limited to: structural modifications, remodeling, change in type of business, expansion of an existing business, or a change in zoning or subdivision to create new parcels. It does not include modifications to advertising, landscaping, general maintenance, or aesthetic improvements that do not affect internal or external traffic safety or flow.

3.03.4 SPEED CHANGE LANES

The City may require speed change lanes as a condition of access approval on collector and arterial streets where it is necessary for public safety and traffic operations based on site-specific conditions.

3.03.5 ACCESS ALIGNMENT

When lots are not large enough to allow accesses on opposite sides of the street to be aligned, the center of driveways not in alignment will be offset by a minimum of 150 feet (as measured from centerline to centerline of accesses) on all collector and commercial local streets; 300 feet on arterial roadways. Greater distances may be required if left-turn storage lanes require such. Accesses must intersect a public street at 90°; if physical constraints make this impractical, up to a 10° deviation may be permitted with review and approval of the City Engineer.

3.03.6 SITE ACCESS DESIGN

A. Vehicle Storage

When a development is located adjacent to a public street, the parking features must have full, internal vehicular circulation and storage. Vehicular circulation must be located completely within the property, and vehicles within one portion of the development must have access to all other portions without using the adjacent street system.

If a proposed development includes a truck loading operation and has access to a public street, adequate space shall be provided such that all truck maneuvering is performed off City streets.

Parking stalls shall not be provided along the entrance aisles to parking lots of sites adjacent to roadways classified as Major Collector and higher.

Required distances from the right-of-way line of the street to the first parking stall or drive aisle shall be based upon peak hour exit trips from the development(s) within the site using Table 3-2.

TABLE 3-2 SITE ACCESS VEHICLE STORAGE REQUIREMENTS[⊗]

Peak Hour Exit Trips	Local (Feet)	Collector (Feet)	Arterial (Feet)
Less than 30	20	40	40
Between 30 and 120	40	40	80
Between 120 and 240	40	60	120
Greater than 240	60	80	180

[⊗] The recommended vehicle storage as needed for the entire site, may be spread over several accesses if more than one access serves the site. The distribution must be proportional to the traffic volumes at each access.

B. Spacing

Access spacing standards are shown in Table 3-1 Access Guidelines. If accesses are in closer proximity than the distances shown in Table 3-1, revocable access permits may be issued until joint access can be provided at the proper location, or median improvements are completed to make the access a right-in/right-out movement.

Vehicle storage area for drive-in/drive-through facilities should meet the requirements in Article 7 of the Land Development Code.

C. Access Radii and Width Criteria

Site access points shall be designed to meet the criteria summarized in Table 3-4.

TABLE 3-4 ACCESS RADII AND WIDTH CRITERIA

Roadway Classification	Residential Single-Family	Residential Multi-Family	Service Commercial	Shopping Center	Industrial
Single-Family Local	Curb Cut or Mountable Curb	Curb Cut❶ Radius Returns❷	Curb Cut❶ Radius Returns❷	Curb Cut❶ Radius Returns❷	Radius Returns❸
Commercial Local	Curb Cut	Curb Cut❶ Radius Returns❷	Curb Cut❶ Radius Returns❷	Curb Cut❶ Radius Returns❷	Radius Returns❸
Industrial Local	Curb Cut	Curb Cut❶ Radius Returns❷	Curb Cut❶ Radius Returns❷	Curb Cut❶ Radius Returns❷	Radius Returns❸
Minor Collector	Not Allowed	Not Allowed	Curb Cut❶ Radius Returns❷	Radius Returns❷	Radius Returns❸
Major Collector	Not Allowed	Not Allowed	Curb Cut❶ Radius Returns❷	Radius Returns❷	Radius Returns❸
Arterial w/ Full Deceleration Lane	Not Allowed	Not Allowed	Curb Cut❶ Radius Returns❷	Radius Returns❷	Radius Returns❸
Arterial with 3rd Travel Lane	Not Allowed	Not Allowed	Radius Returns❷	Radius Returns❷	Radius Returns❸
Arterial with 1 or 2 Lanes and no Deceleration Lane	Not Allowed	Not Allowed	Radius Returns❷	Radius Returns❷	Radius Returns❸
Minimum Width❹	12 feet	24 feet	24 feet	24 feet	24 feet
Maximum Width	20 feet for 2-car garage; 24 feet for 3-car garage	36 feet	36 feet	45 feet	50 feet

❶ Standard curb cuts must be used if the anticipated ADT for access is less than 500 vpd. (Except as noted above)

❷ 20-foot radii if ADT for access is between 500 and 1,000 vpd. 25-foot radii if ADT for access is between 1,000 and 1,500 vpd. 30-foot radii if ADT for access is greater than 1,500 vpd.

❸ 25-foot radii unless longer wheel combinations or single unit vehicles exceeding 30 feet in length are proposed, then a 40- to 50-foot radii should be provided.

❹ One way accesses, or accesses with median divider, must be at least 14-feet wide.

3.04 MINIMUM DESIGN CRITERIA

Street design, construction, and ROW requirements shall conform to the provisions contained in these Standards and Specifications, as listed in the tables and illustrated in the design standards.

TABLE 3-5 ROADWAY DESIGN CRITERIA

Design Element	Principal Arterial	Minor / Multimodal Arterial	Major Collector	Minor Collector	Industrial Local	Commercial Local	Single-Family Local
Right-of-Way Width	150’	120’	80’	64’	80’	60’	54’ or 58’
Design Speed (mph)	55	50	45	40	30	30	25
Posted Speed Limit (mph)	45	40	35	30	25	25	25
Min. Centerline Radius	1200’	950’	450’	300’	200’	200’	150’❶
Min. Reverse Curve Tangent	300’	300’	250’	100’	25’	25’	0’
Min. Approach Tangent @ Intersections	300’	300’	200’	200’	100’	100’	100’
Min. Tangent Between Vertical Curves	50’						
Min. Curb Return Radii❷	35’	35’	30’	30’	35’	30’	25’
Property Line Curb Return Radii	Case by Case Design	Case by Case Design	20	20	20	20	10
Maximum Superelevation	4%						
Maximum Longitudinal Grade	6%						
Minimum Longitudinal Grade	0.5%						
Min. Grade Around Curb Return	0.75%						
Min. Pavement Cross Slope❸	1.5% Optimal is 2%						
Max. Cross Slope❸	4%						

❶ Note: May be reduced to 72 feet on minor local streets with a minimum of through traffic and appropriate eyebrow treatment provided.

❷ Note: When two categories of streets intersect, the flowline radius shall be the greater radius. Curb return radii to be designed in accordance with Design Vehicle Type use in that area. Design to be approved in coordination with Public Works Department staff.

❸ Note: Does not apply on super-elevated sections of roadway.

3.04.1 AUXILIARY LANES

Auxiliary lanes provide for the acceleration or deceleration of turning traffic onto or off of a major roadway. Auxiliary lanes improve the safety at intersections by reducing the accident potential between turning traffic and through traffic.

3.04.1.1 DECELERATION LANES

Deceleration lanes provide vehicles a safe area in which to slow prior to turning into an intersection. Deceleration lengths are based off of calculations that provide for 20 mph speed differential between turning and through traffic and a deceleration rate of 6 ft/s^2.

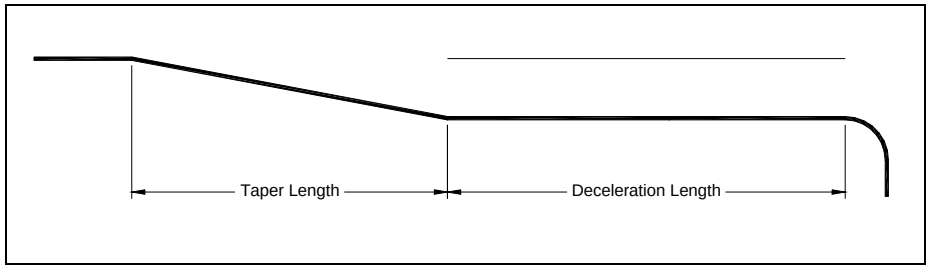
Right-Turn Deceleration Lanes

Right-turn deceleration lanes consist of two components: the deceleration length and the taper length. The criteria and the geometric requirements for right-turn deceleration lanes are shown in Table 3-6. For clarification, Figure 3-1 shows the geometric components of right-turn deceleration lanes.

TABLE 3-6 RIGHT-TURN DECELERATION LANES

	Minimum # of Major Street Right Turns to Require Right-Turn Deceleration Lane on Major Street (vph)	Deceleration Lane Length (ft)	Taper Rate	Taper Length (ft) for 12' Lane
Principal Arterial	15	185	18.5:1	222
Minor/Multimodal Arterial	20	135	15:1	180
Major Collector	25	90	13.5:1	162
Minor Collector	30	50	12:1	144

FIGURE 3-1: GEOMETRIC COMPONENTS OF RIGHT-TURN DECELERATION LANES



Left-Turn Deceleration Lanes

Left-turn deceleration lanes consist of three components:

- deceleration length
- taper length
- storage length

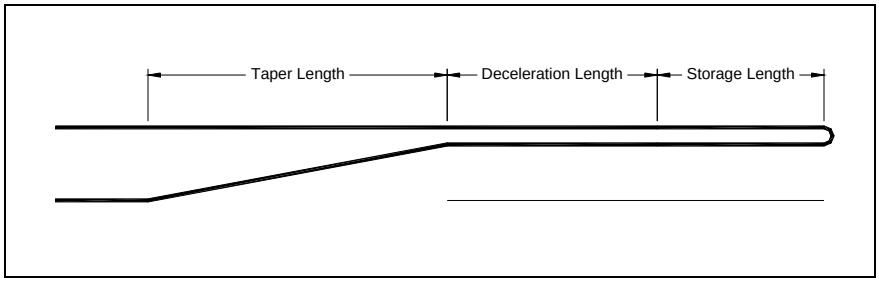
The criteria and the geometric requirements for left-turn deceleration lanes are shown in Table 3-7. Storage length criteria is discussed in Section 3.04.2. For clarification, Figure 3-2 shows the geometric components of left-turn deceleration lanes.

TABLE 3-7 LEFT-TURN DECELERATION LANES

Description	Minimum # of Major Street Left Turns to Require Left-Turn Decel Lane on Major Street (vph)	Deceleration Lane Length (ft)	Taper Rate	Taper Length (ft) for 12' Lane
Principal Arterial	Always	185	18.5:1	222
Minor/Multimodal Arterial	Always	135	15:1	180
Major Collector	Always	90	13.5:1	162
Minor Collector	**	50	12:1	144

** The need for a left-turn deceleration lane on a minor collector shall be determined by the City Engineer on an individual basis.

FIGURE 3-2: GEOMETRIC COMPONENTS OF LEFT-TURN DECELERATION LANES



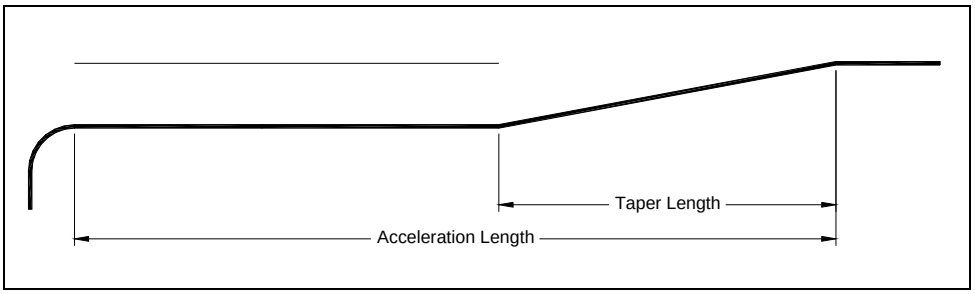
3.04.1.2 Acceleration Lanes

Acceleration lanes are required to provide distance for vehicles to accelerate up to reasonable speeds before merging into the flow of traffic on a major street when turning from minor roadways or private properties. Acceleration lengths are calculated based on speed differentials of 10 mph between turning and through traffic. Table 3-8 shows acceleration lane requirements. Figure 3-3 shows the geometric components of acceleration lanes.

TABLE 3-8 ACCELERATION LANE REQUIREMENTS

Description	Minimum # of Minor Street Right Turns to Require Accel Lane on Major Street	Acceleration Lane Length (Including taper) (ft)	Taper Rate	Taper Length (ft) for 12' Lane
Principal Arterial	85	730	18.5:1	222
Minor/Multimodal Arterial	24	575	15:1	180
Major Collector	10	440	13.5:1	162
Minor Collector	35	325	12:1	144

FIGURE 3-3: GEOMETRIC COMPONENTS OF ACCELERATION LANES



3.04.2 STORAGE LENGTH

The auxiliary lane should be sufficiently long in order to store the number of vehicles that accumulate during a critical period. Sufficient storage length should be provided such that the queue length does not compromise the deceleration length provided. Additionally, the storage length shall be sufficiently long so that the entrance to the auxiliary lane is not blocked by vehicles queued in the through lanes at a signal.

Storage lengths for signalized intersections may be determined from capacity nomographs in the Highway Capacity Manual (HCM) or the traffic impact study. The minimum storage length for left-turn lanes at signalized intersections shall be 100 feet.

At unsignalized intersections, the storage length, exclusive of taper and deceleration length, may be based on the number of turning vehicles likely to arrive in an average 2-minute period within the peak hour. The 2-minute waiting time may need to be adjusted based on the volume of opposing traffic. The required storage length for an unsignalized intersection is presented in Table 3-9.

TABLE 3-9 STORAGE LENGTHS FOR AUXILIARY LANES AT UNSIGNALIZED INTERSECTIONS

Left-Turning Vehicles per Hour (peak hour)	0-30	31-60	61-100	101-200	201+
Required Storage Length (feet)	40*	50	100	175	250
*50 feet when trucks equal or exceed 10% of turning traffic					

3.04.3 TRANSITION TAPERS

Transition tapers are necessary to redirect traffic when the roadway is widened to accommodate auxiliary lanes (left- and right-turn lanes, lane drops, median transitions, etc.). Table 3-10 shows the required taper ratios by design speed.

TABLE 3-10 REDIRECT TAPERS FOR THROUGH LANES

Speed (mph)	Taper Ratio
25	10:1
30	15:1
35	20:1
40	30:1
45	45:1
50	50:1
55	55:1
60	60:1

3.04.4 MEDIAN DESIGN

Median lanes are necessary for the installation of left-turn lanes, providing a lane for deceleration and storage of vehicles making left turns from the roadway. Acceleration lanes for vehicles turning left onto the roadway may utilize the median as well. The minimum width for a painted or raised median is 4 feet. The minimum width for left-turn lanes is shown in Table 3-11.

TABLE 3-11 MINIMUM MEDIAN WIDTHS FOR LEFT-TURN LANES

Single Left-Turn Lanes	16 feet
Dual Left-Turn Lanes	28 feet
Triple Left-Turn Lanes	40 feet
Two-Way Left-Turn Lanes	14 feet (max)

A. Median Openings

Median openings are necessary to accommodate left turning and cross traffic. A semicircular median may be used on medians of less than 10 feet in width. All medians that are 10 feet or wider in width must use a bullet nose median end for a median opening at a crossroad, or a parabolic curve at a "T" intersection.

Median openings should be designed in accordance with Chapter IX, Intersections, of the current edition of *A Policy on Geometric Design of Highways and Streets*. In addition, all median openings should be verified using the appropriate design vehicle and *Auto-turn* or equivalent software.

3.05 VERTICAL ALIGNMENT

All vertical curves shall be symmetrical. When the algebraic difference in grade exceeds 0.5%, a vertical curve shall be used. All vertical curves shall be labeled in the profile with length of curve (L) and (K) where K = L/A (A = algebraic grade difference).

Vertical curves that have flat sections near the high or low point should be evaluated for drainage where curbed roadways are proposed. Values of K=167 or greater should be checked for adequate drainage.

TABLE 3-12 MINIMUM VERTICAL CURVE DESIGN CRITERIA

Design Speed MPH	Stopping Sight Distance Minimum in feet	Minimum K Values
15	80	3
20	115	7
25	155	12
30	200	19
35	250	29
40	305	44
45	360	61
50	425	84
55	495	114

Length of curve = "K" Times Algebraic Difference In Grades

TABLE 3-13 MAXIMUM GRADES AND LENGTHS OF GRADES AT INTERSECTION APPROACHES

Intersection of:	Local	Collector	Arterial	Maximum Grade
Non-residential Driveways with	65'	65'	75'	4%
Local with	35'	100'	125'	3%
Collector with	100'	120'	200'	3%
Arterial with	125'	200'	200'	2%

3.06 SIGHT DISTANCE

The sight distances listed in Table 3-14 enable vehicles to turn right or left in order to accelerate to the operating speed of the street without causing approaching traffic to reduce speed by more than 10 mph.

The distance requirements are based upon a driver's eye height of 3.5 feet and an object height of 4.35 feet. Operating speed shall be based upon the design speed as listed in Table 3-14 for new roads.

When the sight distance criteria cannot be met, the City will prohibit turns by exiting vehicles, or require additional speed change lane lengths.

Within the sight distance triangle, no shrubs, groundcover, boulders, berms, fences, walls, or other materials constituting visual obstructions shall exceed a height of 36 inches from the gutter flowline. Trees planted within the sight

distance triangles, at sufficient maturity, shall be trimmed to a height of 8 feet above the gutter flowline. See Section 21-43 of the Commerce City Development Standards.

TABLE 3-14 MINIMUM SIGHT DISTANCES⊕

Speed (mph)	Passenger Cars Turning Left Out∗	Passenger Cars Turning Right Out∗	Semi Trailers Turning Left Out∗	Semi Trailers Turning Right Out∗	Passenger Cars Turning Left Into Access•	Semi Trailers Turning Left Into Access•
20	150	130	300	200	150	260
25	240	200	400	320	190	330
30	350	260	500	400	230	400
35	430	350	680	640	300	480
40	530	440	850	850	370	570
45	610	570	1160	1160	450	680
50	740	700	1600	1600	520	810
55	830	860	2000	2000	600	910
60	950	1050	2500	2500	700	1000

∗ Measured from the driver's eye, 14.5 feet back of the flowline or pavement edge.

• Measured from the point where a left-turning vehicle stops to the vehicle approaching in the outside lane.

⊕ The sight distances in Table 3-14 apply when roadway grades are between 0% and 3%. Sight distances are based on traffic entering or crossing up to two-lane roadways. For roadways with more than two (2) lanes, follow current AASHTO requirements. Adjustments must be made to compensate for the acceleration and deceleration rates that are affected by roadway grades greater than 3% in Table 3-15.

TABLE 3-15 FACTORS FOR GRADE EFFECT ON SIGHT DISTANCE

Grade	Downgrade Factor∗	Upgrade Factor•
0 to 3%	1.0	1.0
3.1 to 5%	0.6	1.4
Greater than 5%	0.5	1.7

∗ Downgrade factors are used when a vehicle leaving the access is accelerating downhill.

• Upgrade factors are used when a vehicle leaving the access is accelerating uphill.

3.07 UNIQUE INTERSECTIONS AND CUL-DE-SACS

Intersections of unique interest and cul-de-sacs shall conform to these Standards and Specifications, and be approved by the City Engineer.

3.07.1 TYPICAL STREET SECTION

Typical street sections shall be designed in accordance with Detail Drawings No. 307-01 through No. 307-09. Deviations from the typical street sections shall be approved by the City Engineer.

3.07.2 RIGHT IN-RIGHT OUT

The use of Right In-Right Out shall only be used to eliminate left-turn lanes at intersections where it is needed, at the discretion of the City Engineer. Right In-Right Outs shall conform to Detail Drawing No. 307-10.

3.07.3 EYEBROW TREATMENT

Eyebrow Treatments shall be used only at right angle intersections of local streets. If a valley pan is needed, the entire eyebrow shall be paved in concrete. Eyebrow Treatments shall conform to Detail Drawing No. 307-11 and be approved by the City Engineer.

3.07.4 CUL-DE-SAC

Cul-de-sacs shall conform to Detail Drawing No. 307-12. Loop-de-lanes shall conform to Detail Drawing No. 307-13. Hammerhead cul-de-sacs shall conform to Detail Drawing No. 307-14 and require the approval of the City Engineer. Cul-de-sacs in commercial and industrial developments will need to be specifically designed to meet the turning radius requirements for tractor/trailer units that are typically found in that type of development.

Lengths of cul-de-sacs are recommended to be no greater than 500 feet. Cul-de-sacs that are proposed greater than 500 feet must be fully justified, and the following considerations must be addressed:

1. The intersection traffic capacity.
2. Emergency vehicle response time.
3. Utility systems, drainage, and open space access.
4. The water supply system for fire protection must be approved by the fire protection district.

Surface drainage shall be directed toward the intersection. If this is not practical, drainage improvements and the necessary easements shall be provided at a collection point to convey these flows to the storm collection system.

3.07.5 ROUNDABOUTS

Roundabouts located on local streets shall conform to Detail Drawing No. 307-15. If a roundabout is located on a collector or arterial roadway the roundabout shall be designed according to Roundabouts: An Informational Guide, Publication No. FHWA-RD-00-067.

3.07.6 TRAFFIC CALMING

Traffic calming should be considered on local streets which have the potential for speeding, cut-through traffic, or high pedestrian activity. Detail 307-16 gives an example of traffic calming using neckdowns and islands. Other traffic calming devices will be considered but must be approved by the City Engineer before implementation.

3.08 CONCRETE

Design of all concrete flatwork shall be in accordance with City Standards and Specifications, and shall be approved by the City Engineer. All concrete work in the public right of way shall be Class B 4500 psi, have 5-8% air entrainment, and a max slump of 4".

3.08.1 DRIVE CURB CUT

Curb cuts in 6-inch vertical curbs will be provided at all driveway locations. Construction of curb cuts will be as shown on Detail Drawing No. 308-01.

Driveways with detached sidewalks shall have expansion joints at the following locations:

1. Between the back of curb and drive apron
2. Between the drive apron and sidewalk
3. Between the sidewalk and driveway

The apron and sidewalk must be a separate pour from the driveway. The drive apron and the sidewalk through the driveway must be 6" thick for residential and at least 8" thick for all others.

3.08.2 VALLEY PAN

Valley pans, crosspans, and curb return fillets will be constructed at a minimum of 8-inches thick in residential, commercial, and industrial areas. A typical cross section of a valley pan is shown on Detail Drawing No. 308-02. A curb ramp with a crosspan is shown on Detail Drawing No. 308-03.

3.08.3 CURB RAMPS

Curb ramps are required at all intersection curb returns and at mid-block locations associated with T-intersections. Curb ramps shall be constructed in accordance with Detail Drawing No. 308-04.

3.08.4 CHASE DRAIN

Chase drains shall be placed as required per the approved drainage study, and at the discretion of the City Engineer. Chase drains shall be designed and constructed as shown on Detail Drawing No. 308-05.

3.08.5 CURB, GUTTER AND SIDEWALK

Detail Drawing No. 308-06 shows typical mountable curb, gutter, and sidewalk design requirements.

Vertical curb design and construction is shown on Detail Drawing No. 308-07.

3.08.6 JOINTS

All cold joints shall be doweled with 18" long #4 epoxy coated rebar (green bar). Dowels should be placed 6-inches from the edge of concrete and shall be spaced at a minimum of 12".

Joint Materials shall conform to AASHTO Specifications according to type as follows:

Concrete joint sealer, hot-poured elastic	M 173
Preformed expansion joint filler (Bituminous Type)	M 33
Preformed sponge rubber and cork expansion joint fillers	M 153
Preformed expansion joint fillers non-extruding & resilient bitum	M 213

Non-bituminous joint types shall be placed in widths shown on the approved plans or at a width of 3/8 inch when not specified. Bituminous type joints shall be used for concrete paving and structural construction where joint sealers are not called for.

Expansion joint material shall be placed at the following locations and will be in place prior to the placing of concrete:

1. At each end of curb return
2. At both edges of driveway
3. Between back of sidewalk and driveway slab or service walk
4. Between new concrete and existing masonry buildings
5. As shown on approved drawings
6. As directed by the City Engineer
7. Between new and existing concrete
8. Intervals of not more than 500 feet

Expansion joint construction shall follow Detail Drawing No. 308-08.

Contraction or transverse joints will be placed at maximum intervals of 10 feet to control random cracking. Joints shall be formed, sawed, or tooled to a minimum depth of 1/3 the total depth with a minimum depth of 2 inches. If divider plates are used, the maximum depth of plates shall not be greater than half of the concrete depth at the finished surface and shall be no less than 15/16-inch thick. Contraction joint construction shall follow Detail Drawing No. 308-09.

3.09 MAJOR STRUCTURES

Major structures that are appurtenant to the proposed improvements such as retaining walls, box culverts, and bridges, shall conform to the structural and loading requirements of CDOT and geometry and drainage requirements of the City Engineer. Bridge and roadway guardrails shall be designed and constructed in accordance with current AASHTO Standards. Plans and supporting calculations for major structures shall be prepared and stamped by a registered Professional Engineer.

3.10 DRAINAGE

Drainage system design shall be in accordance with the City of Commerce City Storm Drainage Design and Technical Criteria Manual. A drainage report must be submitted for concurrent review with the roadway design, and shall be considered as a part of the roadway design. All public roadways shall be crowned according to Table 3-6. Private drives and streets may have an inverted crown, provided a concrete valley pan is provided to convey the nuisance flows.

Nuisance flows and minor storm event flows shall not be permitted to flow over sidewalks. With the use of sidewalk chase sections, flow shall be taken into the street curb and gutter. Sidewalk chase sections shall not be permitted at driveways or within the curb cut aprons. Direct connection to storm manholes is not permitted. Sidewalk chases, when permitted, are to be used to allow surface drainage to enter into the street gutter, and not to avoid the use of a standard inlet.

Crosspans will only be permitted across streets at intersections that will be controlled with a stop sign. Crosspans shall not be permitted at intersections that have the potential for being signalized when warrants are met. Crosspans may be installed at midblock locations on local residential streets if, and only if, the crosspan is desired to provide traffic calming in addition to drainage conveyance at the direction of the City Engineer.

3.11 SURVEY MONUMENTS

A permanent survey monument as shown in Detail No. 311-01 and No. 311-02 shall be installed at all section and quarter section corners. Survey monuments shall be set in accordance with the Colorado Revised Statutes, and as required by the Bylaws and Rules of Procedure of the Colorado State Board of Registration for Professional Engineers and Professional Land Surveyors.

All monuments shall be set within 60 days of completion of the streets. If the monuments are not installed, the City shall have the work performed by a registered land surveyor and make a claim against the collateral for all costs, including administration and legal fees.

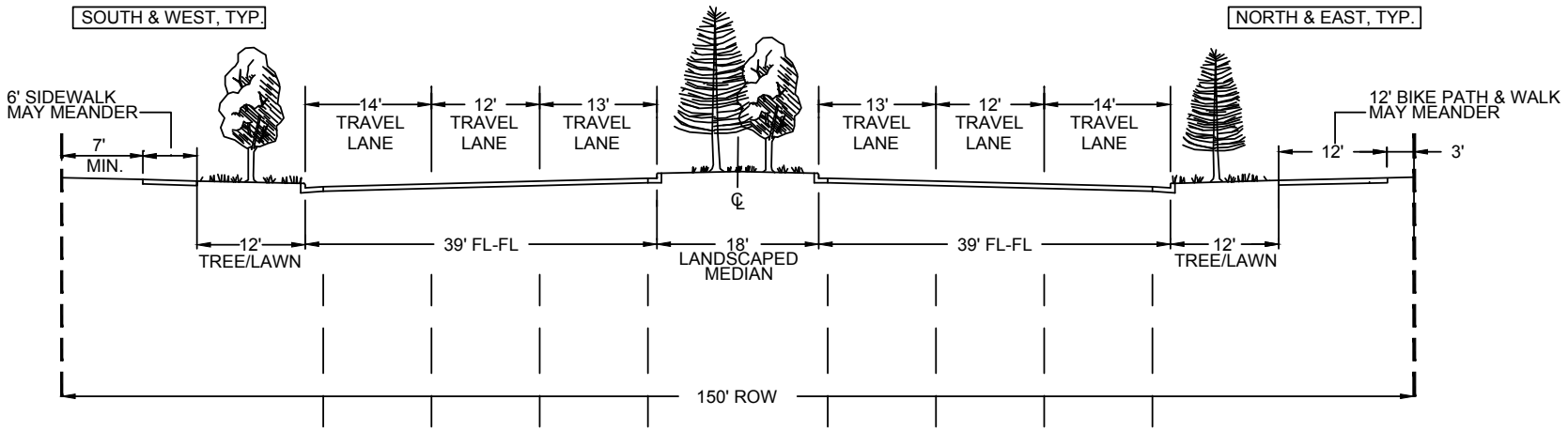
3.12 UTILITY LOCATIONS

All new subdivisions in the northern range require a dual water system to be installed. The typical utility locations are shown on Detail 312-01. The locations and design of the sanitary sewer, potable, and non-potable water lines are to be reviewed and approved by South Adams County Water and Sanitation District.

DETAIL DESCRIPTION	DETAIL NUMBER
Principal Arterial	307-01
Intersection for Principal Arterial	307-02
Minor Arterial	307-03
Multimodal Arterial	307-04
Minor Collector, Major Collector/Local Industrial	307-05
Local Residential with Detached Walks	307-06
Optional Local Residential with Detached Walks	307-07
Local Residential with Attached Walks/Local Commercial	307-08
Residential and Commercial Alley, Local Rural	307-09
Right-In, Right-Out	307-10
Eyebrow Treatment	307-11
Cul-de-sac	307-12
Loop-de-lane	307-13
Hammerhead Cul-de-sac	307-14
Roundabout	307-15
Traffic Calming Island with Neckdown	307-16
Curb Cut	308-01
Valley Pan	308-02
Curb Ramps	308-03a
Curb Ramps	308-03b
Curb Ramps	308-03c
Curb Ramps	308-03d
Typical Sidewalk Transitions to Curb Ramp Landing	308-03e
Curb Ramp with Cross-pan	308-04
Chase Drain	308-05
Mountable Curb Sections	308-06
Vertical Curb Sections	308-07
Expansion Joint Details	308-08
Contraction Joint Details	308-09
Curb Detail with Sump Pipe Outlet	308-10
Survey Monuments	311-01
Survey Monument Box	311-02
Typical Utility Locations	312-01
Pipe Stabilization	312-02
Concrete Panel Replacement	399-01

NOTES:

1. AUXILIARY LANES SHALL BE 12' WIDE, INCLUDING GUTTER PANS
2. EASEMENTS MAY BE DEDICATED AS RIGHT-OF-WAY IF SETBACKS ARE NOT AN ISSUE
3. SIDEWALKS MAY MEANDER
4. DUAL LEFT TURNS SHALL BE PROVIDED WHERE TRAFFIC VOLUMES DICTATE
5. SEE PRINCIPAL & REGIONAL ARTERIAL INTERSECTION DETAILS FOR TURN LANE AND ROW CONFIGURATOINS.

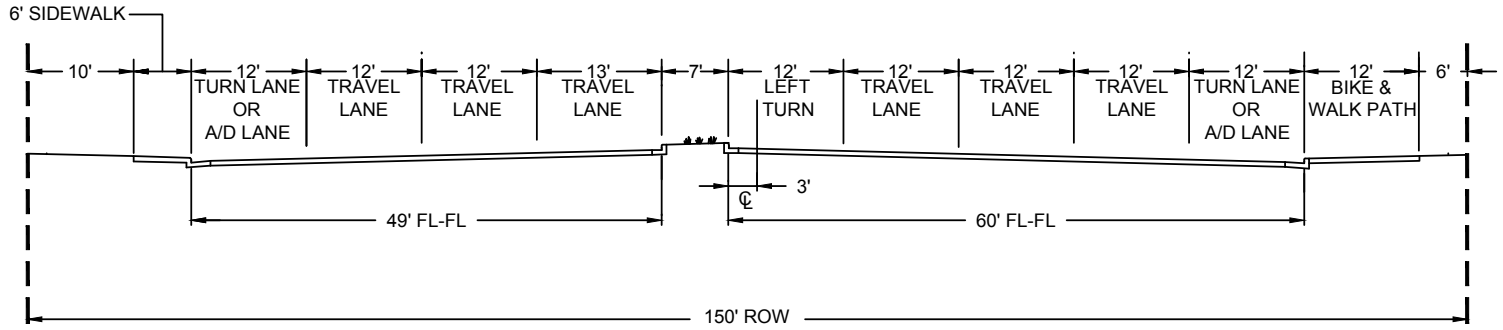


PRINCIPAL ARTERIAL

NOT TO SCALE

COMMERCE CITY DEPARTMENT OF PUBLIC WORKS ENGINEERING CONSTRUCTION STANDARDS	APPROVAL: CITY ENGINEER 12-15-17 DATE
ROADWAY AND PARKING DETAILS TYPICAL STREET SECTIONS	DETAIL NO. 307-01

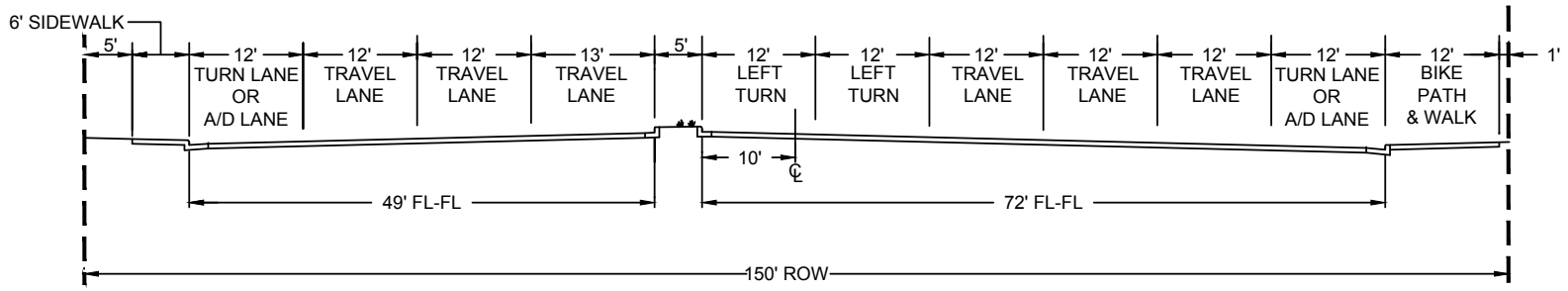
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SINGLE LEFT TURN LANE

SOUTH & WEST, TYP.

NORTH & EAST, TYP.



DUAL LEFT TURN LANES

INTERSECTION DETAILS
PRINCIPAL ARTERIAL
NOT TO SCALE

NOTES:
1. AUXILIARY LANES SHALL BE 12' WIDE, INCLUDING GUTTER PANS
2. EASEMENTS MAY BE DEDICATED AS RIGHT-OF-WAY IF SETBACKS ARE NOT AN ISSUE
3. SIDEWALKS MAY MEANDER

COMMERCE CITY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING CONSTRUCTION STANDARDS

APPROVAL:

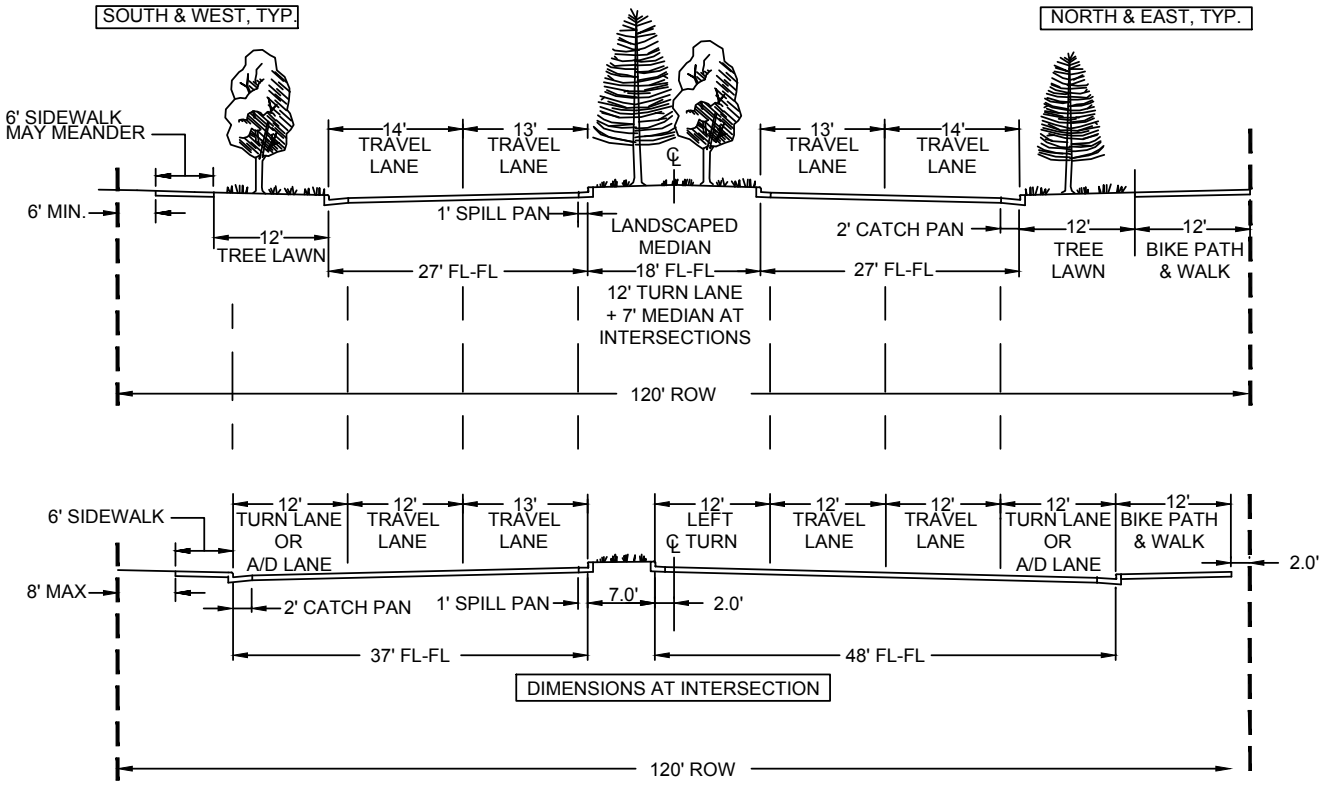
CITY ENGINEER — DATE: 12-15-17

ROADWAY AND PARKING DETAILS
TYPICAL STREET SECTIONS

DETAIL NO.
307-02

O:\Division Information\Engineering\Documents\Engineering and Construction\COMMERCE CITY\CAD files\2016 Updated Files\307-01 thru 307-09 (Roadway & Parking Typical Sections).dwg

NOTES:
1. AUXILIARY LANES SHALL BE 12' WIDE, INCLUDING GUTTER PANS
2. EASEMENTS MAY BE DEDICATED AS ROW IF SETBACKS ARE NOT AN ISSUE



MINOR ARTERIAL
NOT TO SCALE

COMMERCE CITY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING CONSTRUCTION STANDARDS

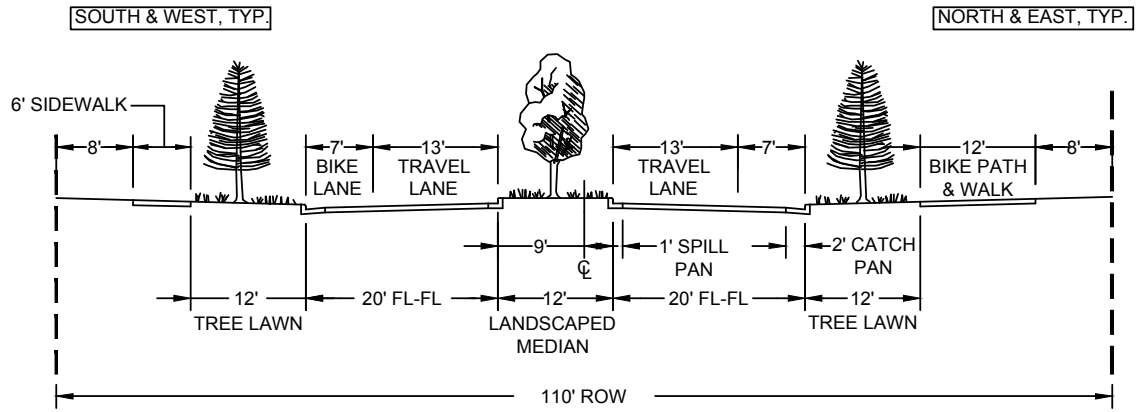
APPROVAL:
CITY ENGINEER 12-15-17 DATE

ROADWAY AND PARKING DETAILS
TYPICAL STREET SECTIONS

DETAIL NO.
307-03

O:\Division Information\Engineering\Documents\Engineering and Construction\COMMERCE CITY\CAD files\2016 Updated Files\307-01 thru 307-09 (Roadway & Parking Typical Sections).dwg

NOTES:
1. AUXILIARY LANES SHALL BE 12' WIDE, INCLUDING GUTTER PANS
2. EASEMENTS MAY BE DEDICATED AS ROW IF SETBACKS ARE NOT AN ISSUE
3. SIDEWALKS MAY MEANDER



MULTIMODAL ARTERIAL
NOT TO SCALE

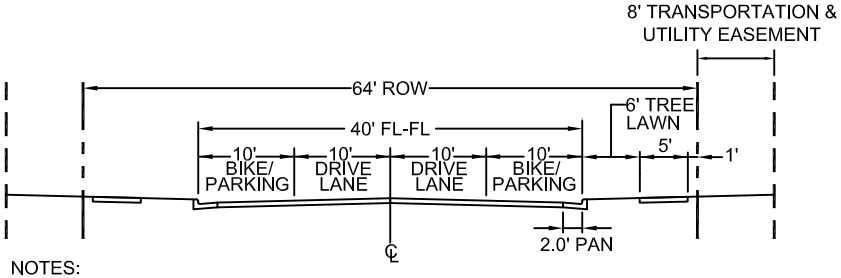
COMMERCE CITY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING CONSTRUCTION STANDARDS

APPROVAL:
CITY ENGINEER
12-15-17
DATE

ROADWAY AND PARKING DETAILS
TYPICAL STREET SECTIONS

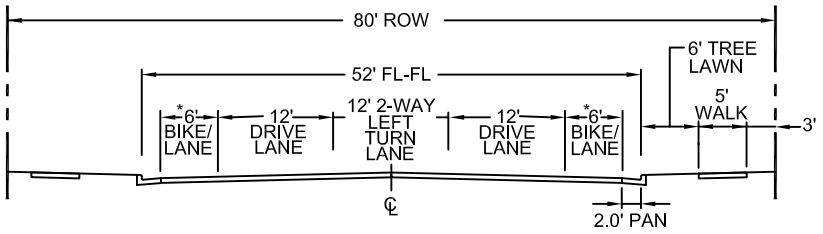
DETAIL NO.
307-04

O:\Division Information\Engineering\Documents\Engineering and Construction\COMMERCE CITY\CAD files\2016 Updated Files\307-01 thru 307-09 (Roadway & Parking Typical Sections).dwg



NOTES:
1. CENTER LINE STRIPE REQUIRED
2. THIS SECTION FOR STREETS WITH "BACK OUT" DRIVEWAYS IN RESIDENTIAL SUBDIVISIONS

MINOR COLLECTOR
NOT TO SCALE



NOTES:
1. MAJOR COLLECTOR LANEAGE SHOWN
2. CITY ENGINEER TO DETERMINE STRIPING REQUIREMENTS FOR LOCAL INDUSTRIAL STREETS ON A CASE BY CASE BASIS
*3. OMIT BIKE PATHS ON INDUSTRIAL STREETS (STILL 52' FL-FL)
4. NO ON STREET PARKING

MAJOR COLLECTOR / LOCAL INDUSTRIAL
NOT TO SCALE

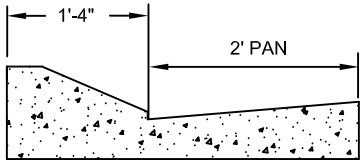
COMMERCE CITY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING CONSTRUCTION STANDARDS

APPROVAL:
CITY ENGINEER — DATE: 05-27-16

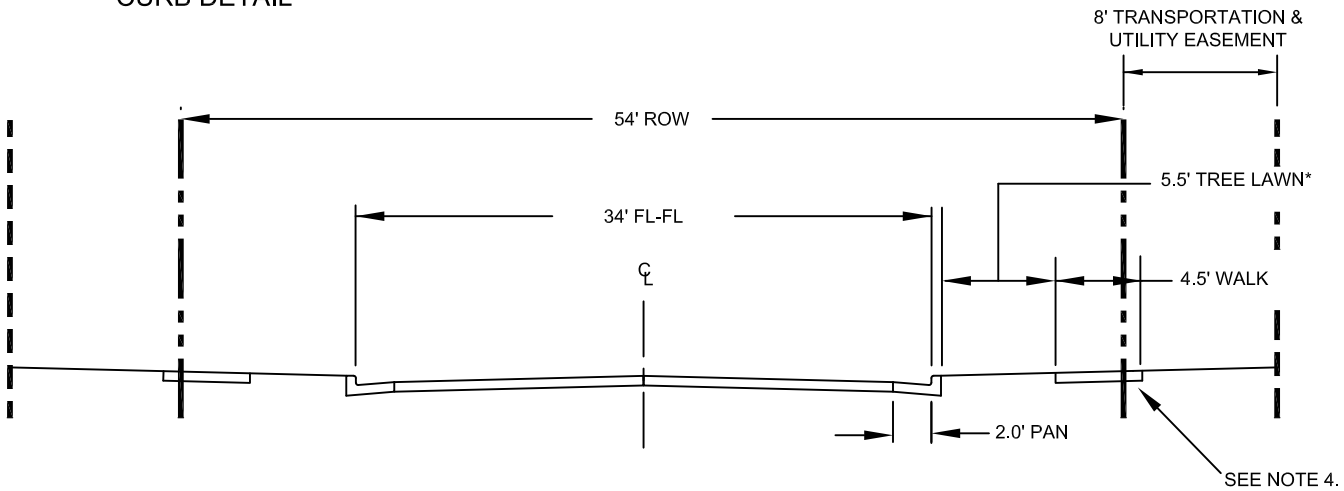
ROADWAY AND PARKING DETAILS
TYPICAL STREET SECTIONS

DETAIL NO.
307-05

O:\Division Information\Engineering\Documents\Engineering and Construction\COMMERCE CITY\CAD files\2016 Updated Files\300-01 thru 300-07 (Roadway & Parking Typical Sections).dwg



MOUNTABLE
CURB DETAIL



NOTE:
1. STRIPING NOT REQUIRED
2. ON STREET PARKING ALLOWED
*3. IRRIGATED & UNIFORMLY LANDSCAPED TREE LAWN TO BE INSTALLED BY DEVELOPER
4. IF MOUNTABLE CURB IS USED, SIDEWALK WILL ENCROACH 1'-4" INTO TRANSPORTATION EASEMENT

LOCAL RESIDENTIAL WITH DETACHED WALKS (NO ALLEY)
NOT TO SCALE

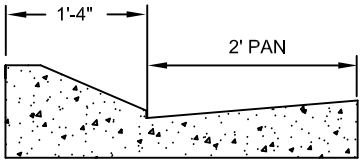
COMMERCE CITY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING CONSTRUCTION STANDARDS

APPROVAL:
CITY ENGINEER — DATE: 05-27-16

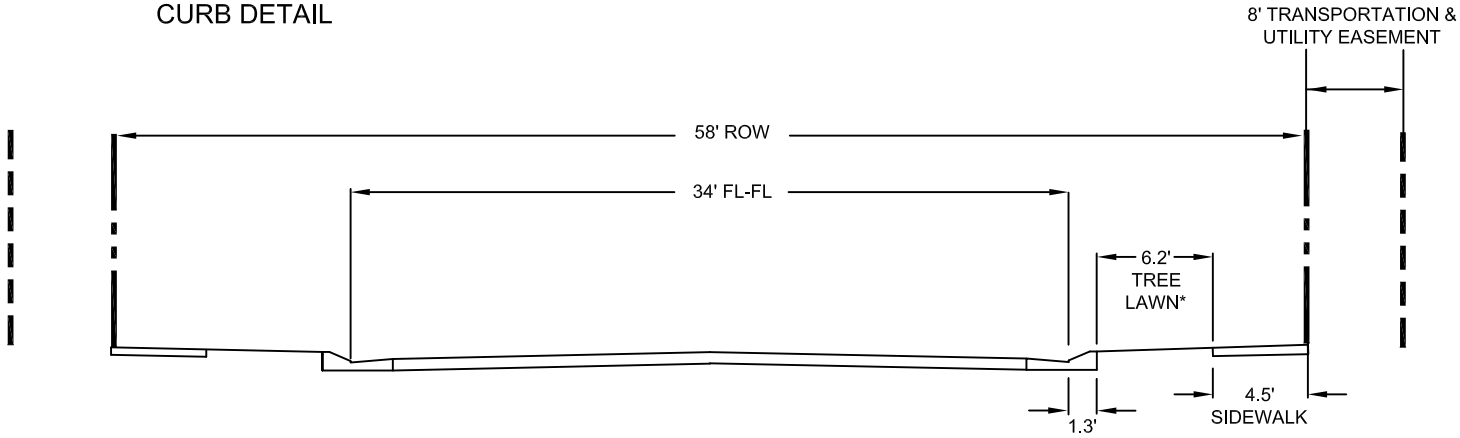
ROADWAY AND PARKING DETAILS
TYPICAL STREET SECTIONS

DETAIL NO.
307-06

S:\Tranproj\100049520 - Commerce City Engineering Standards\Design\Drawings\Reference_Files\CCC DWGs\300-01 thru 300-07 (Roadway & Parking Typical Sections).dwg



MOUNTABLE
CURB DETAIL



NOTE:
1. STRIPING NOT REQUIRED
2. ON STREET PARKING ALLOWED
*3. IRRIGATED & UNIFORMLY LANDSCAPED TREE LAWN TO BE INSTALLED BY DEVELOPER

LOCAL RESIDENTIAL WITH DETACHED WALKS (NO ALLEY)

NOT TO SCALE

COMMERCE CITY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING CONSTRUCTION STANDARDS

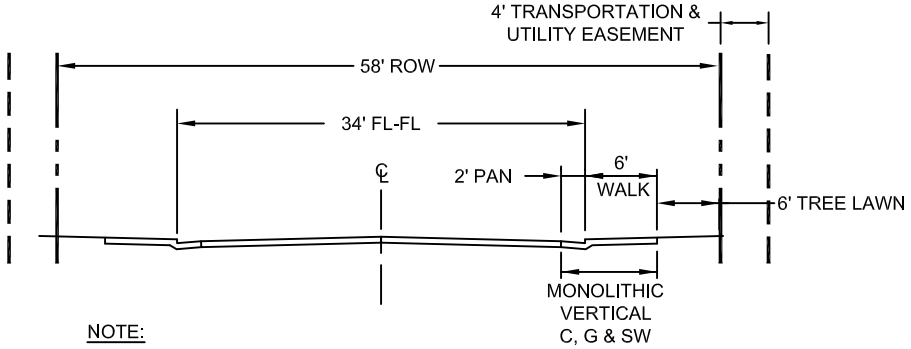
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CITY ENGINEER — DATE: 05-27-16

ROADWAY AND PARKING DETAILS
TYPICAL STREET SECTIONS

DETAIL NO.
307-07

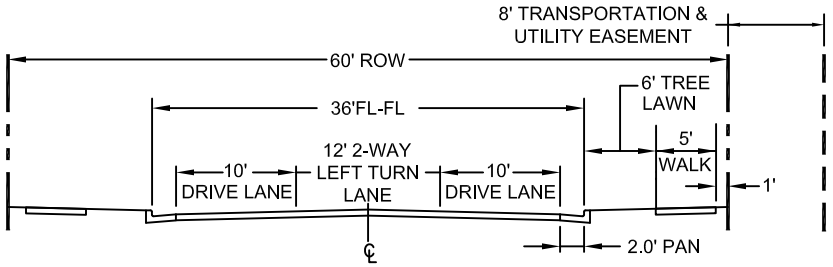
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NOTE:
1. STRIPING NOT REQUIRED
2. ON STREET PARKING ALLOWED

LOCAL RESIDENTIAL WITH ATTACHED WALKS (NO ALLEY)

NOT TO SCALE



NOTES:
1. NO ON STREET PARKING
2. STRIPE 2-WAY LEFT TURN LANE
3. FOR COMMERCIAL OR HIGH DENSITY RESIDENTIAL STREETS

LOCAL COMMERCIAL

NOT TO SCALE

COMMERCE CITY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING CONSTRUCTION STANDARDS

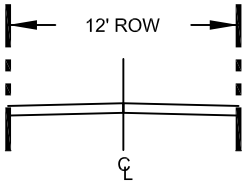
APPROVAL:

CITY ENGINEER — DATE: 05-27-16

ROADWAY AND PARKING DETAILS
TYPICAL STREET SECTIONS

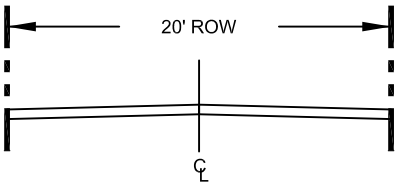
DETAIL NO.
307-08

S:\Tranproj\100049520 - Commerce City Engineering Standards\Design\Drawings\Reference_Files\CCC DWGs\300-01 thru 300-07 (Roadway & Parking Typical Sections).dwg



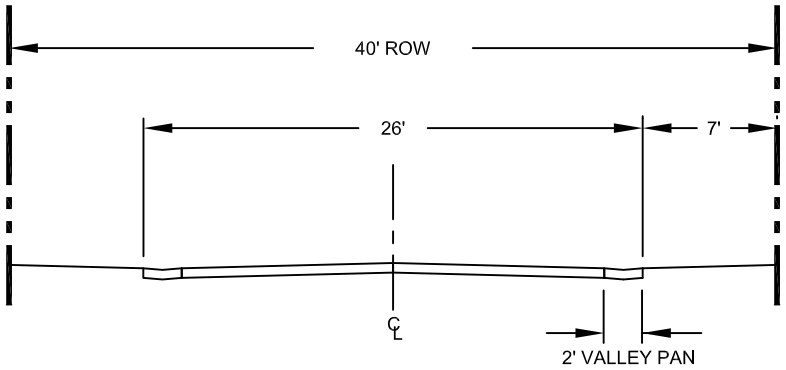
RESIDENTIAL ALLEY

1"=10'



COMMERCIAL ALLEY

1"=10'



NOTES:
1. NO ON STREET PARKING
2. STRIPING NOT REQUIRED
3. FOR ACCESS TO 1/2 ACRE OR LARGER LOTS

LOCAL RURAL

1”=10’

SEE THE PAVEMENT DESIGN SECTION OF THE ENGINEERING CONSTRUCTION STANDARDS AND SPECIFICATIONS FOR REQUIRED PAVEMENT SECTIONS.

COMMERCE CITY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING CONSTRUCTION STANDARDS

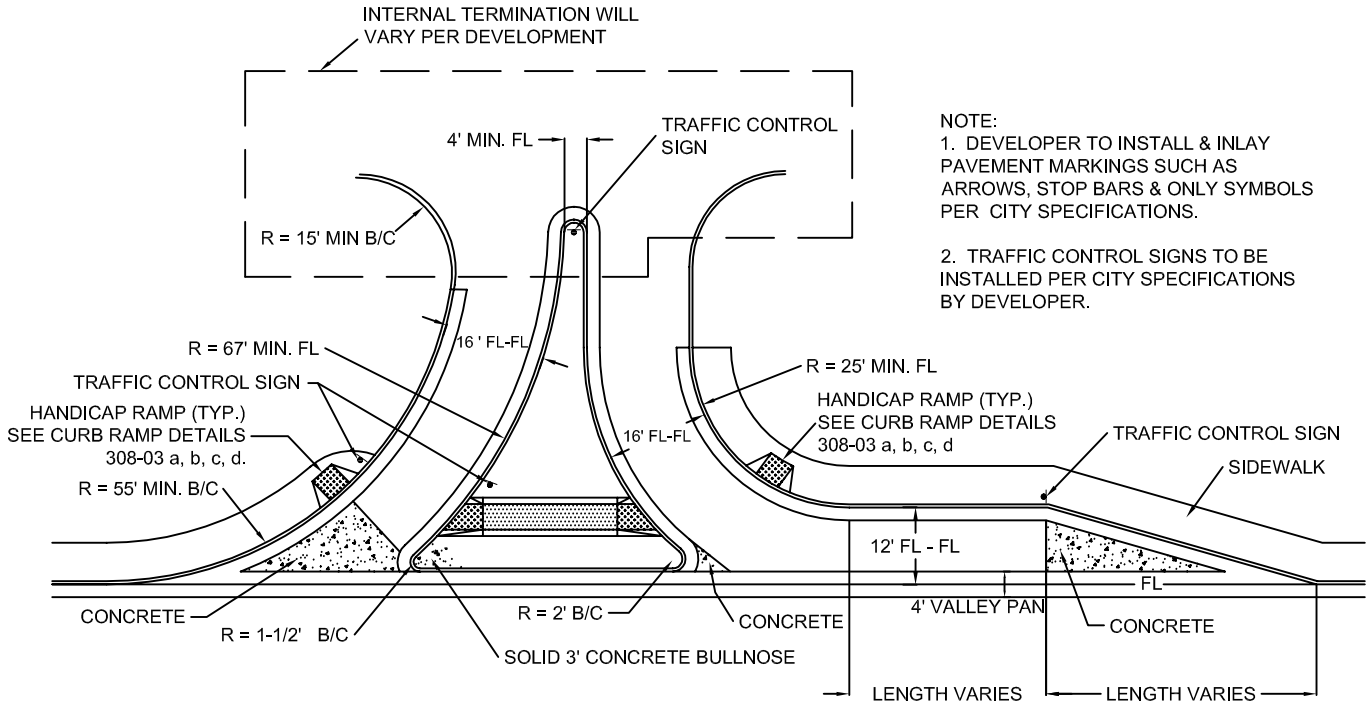
APPROVAL:

CITY ENGINEER — DATE: 05-27-16

ROADWAY AND PARKING DETAILS
TYPICAL STREET SECTIONS

DETAIL NO.
307-09

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NOTE:
1. DEVELOPER TO INSTALL & INLAY PAVEMENT MARKINGS SUCH AS ARROWS, STOP BARS & ONLY SYMBOLS PER CITY SPECIFICATIONS.

2. TRAFFIC CONTROL SIGNS TO BE INSTALLED PER CITY SPECIFICATIONS BY DEVELOPER.

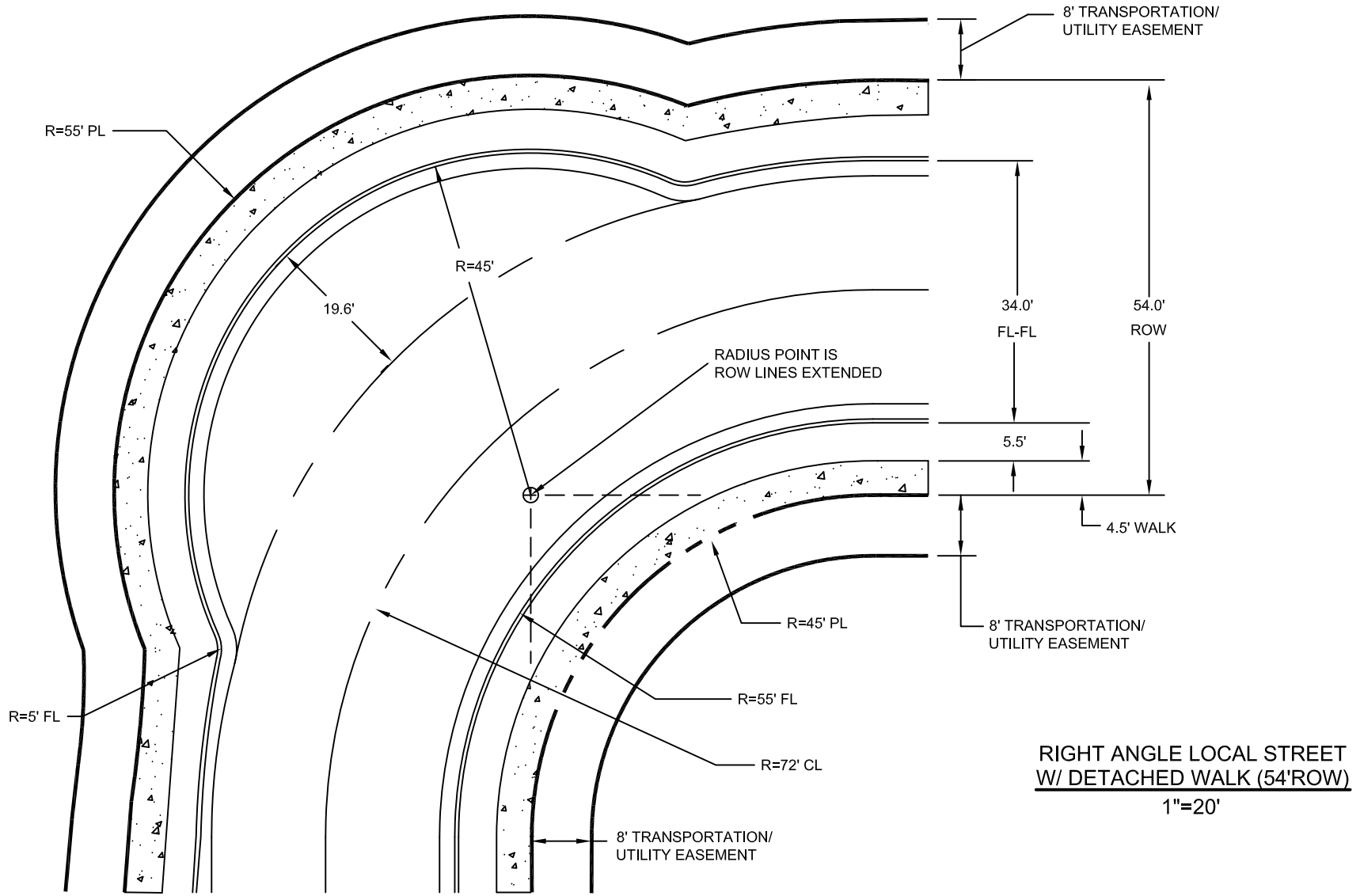
COMMERCE CITY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING CONSTRUCTION STANDARDS

APPROVAL:
CITY ENGINEER — DATE: 11-14-16

TYPICAL RIGHT IN - RIGHT OUT

DETAIL NO.
307-10

W:\Design\Drawings\Reference_Files\CCC DWGs\307-10 (Right In - Right Out).dwg



RIGHT ANGLE LOCAL STREET
W/ DETACHED WALK (54'ROW)
1"=20'

COMMERCE CITY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING CONSTRUCTION STANDARDS

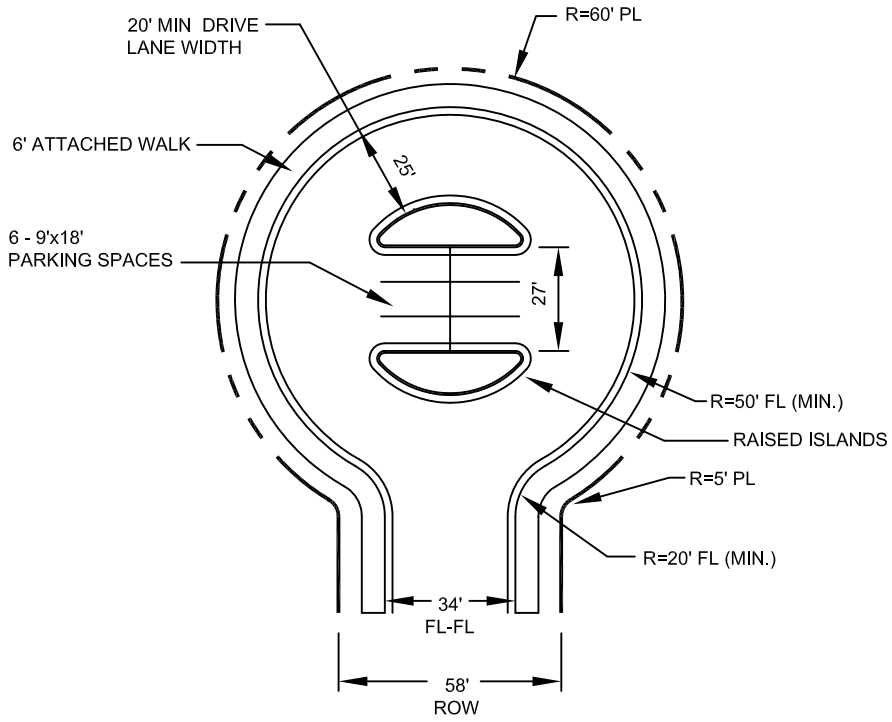
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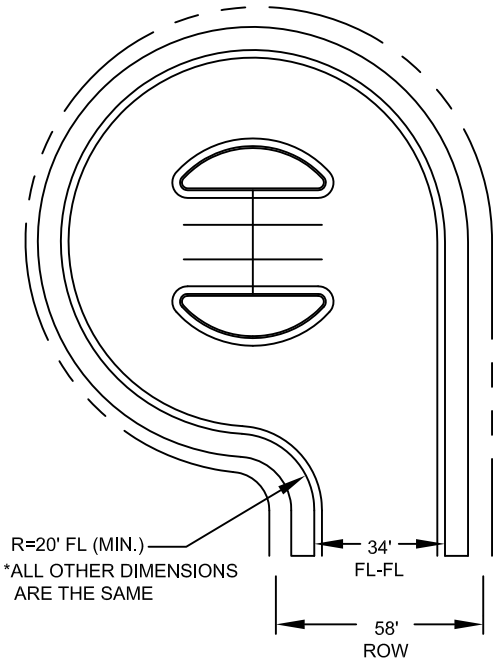
CITY ENGINEER — DATE: 05-27-16

EYEBROW TREATMENT

DETAIL NO.
307-11

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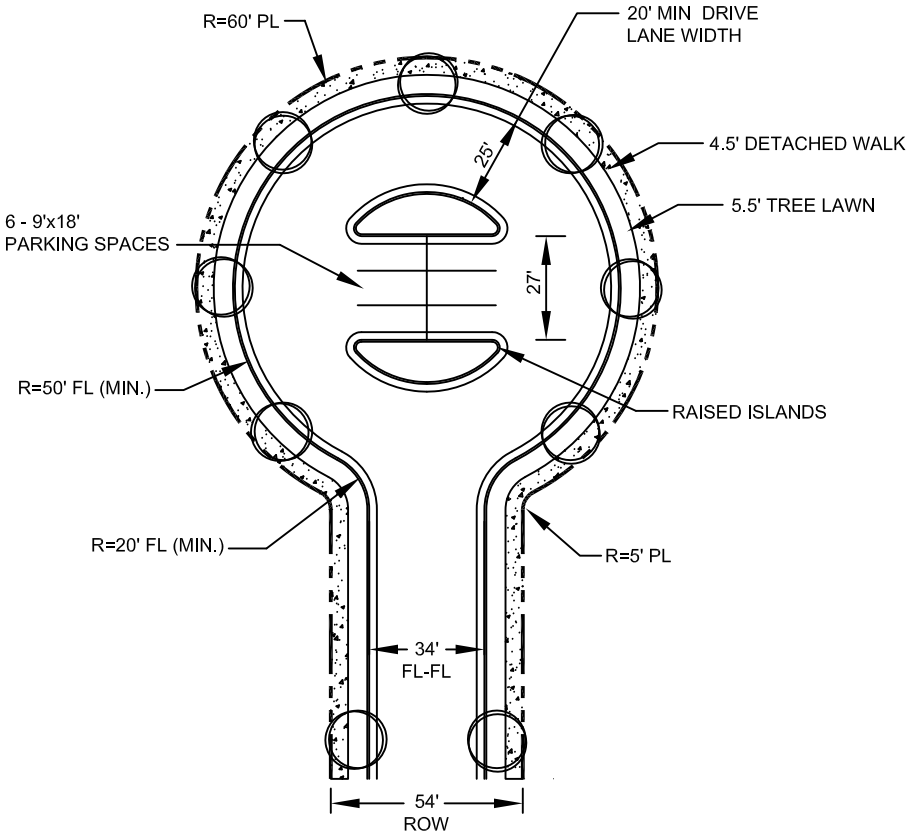


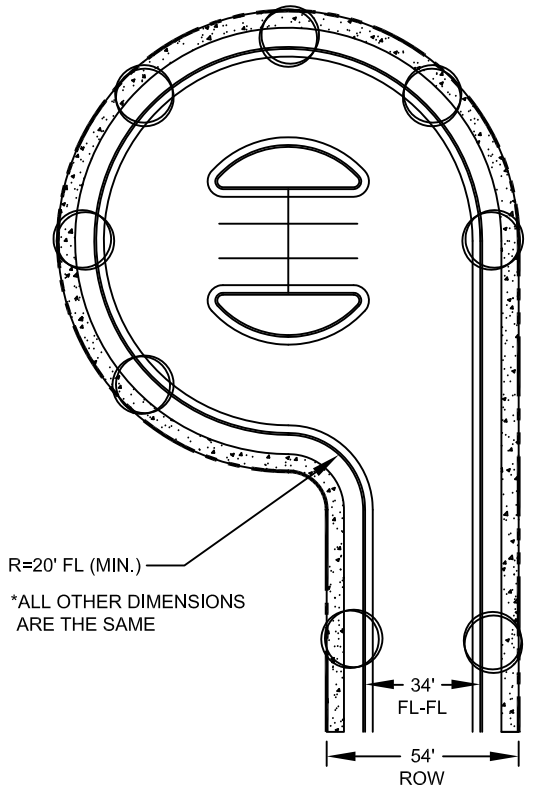


CUL-DE-SAC
WITH ATTACHED SIDEWALK
NOT TO SCALE

COMMERCE CITY DEPARTMENT OF PUBLIC WORKS ENGINEERING CONSTRUCTION STANDARDS	APPROVAL: CITY ENGINEER 05-27-16 DATE
CUL-DE-SAC W/ATTACHED SIDEWALK (1 OF 2)	DETAIL NO. 307-12

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CUL-DE-SAC
WITH DETACHED SIDEWALK
NOT TO SCALE

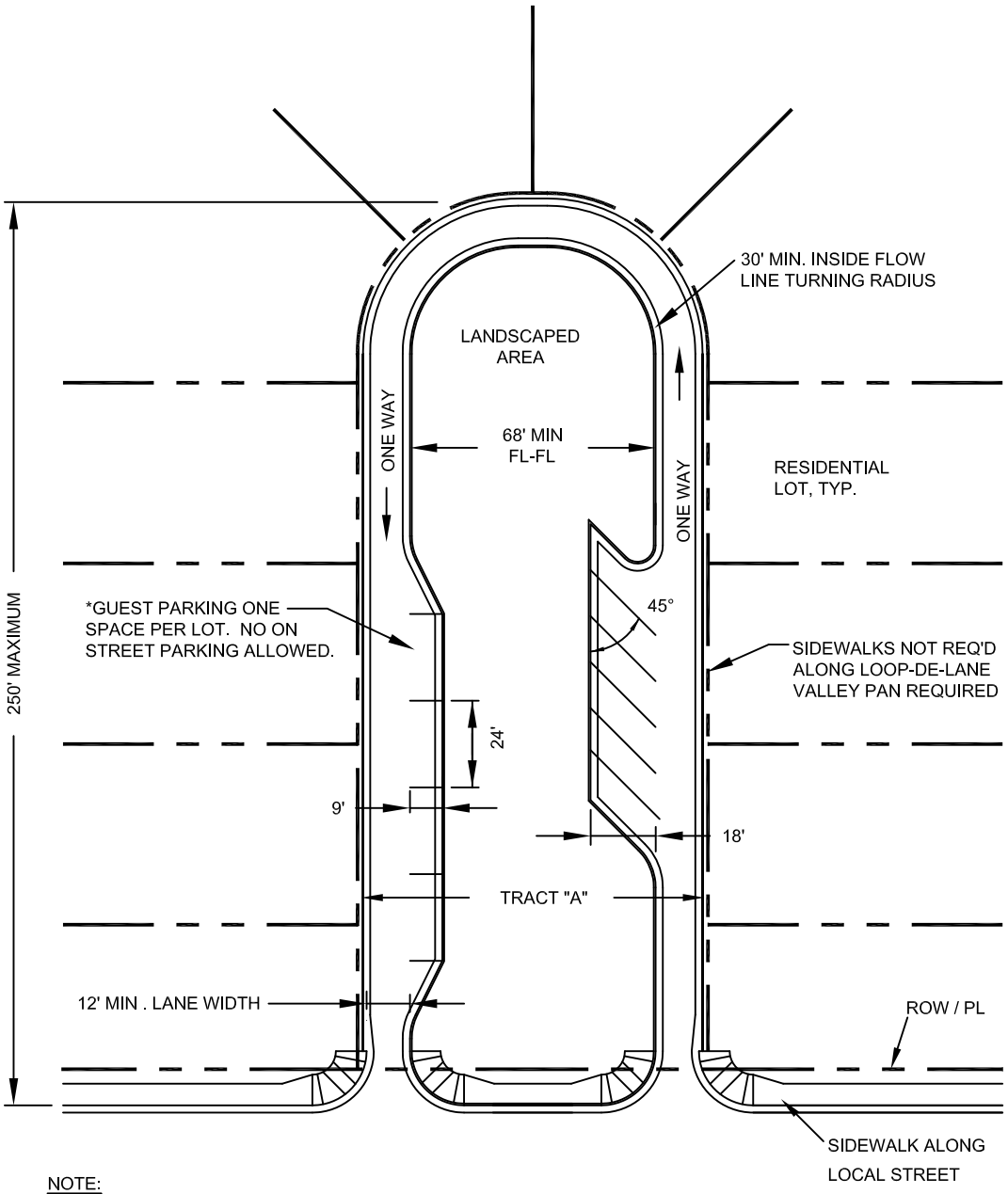
COMMERCE CITY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING CONSTRUCTION STANDARDS

APPROVAL:
05-27-16
CITY ENGINEER DATE

CUL-DE-SAC W/ATTACHED SIDEWALK (2 OF 2)

DETAIL NO.
307-12

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NOTE:
*1. EITHER ANGLED OR PARALLEL PARKING IS ALLOWED.
BOTH ARE SHOWN FOR ILLUSTRATION PURPOSES ONLY.

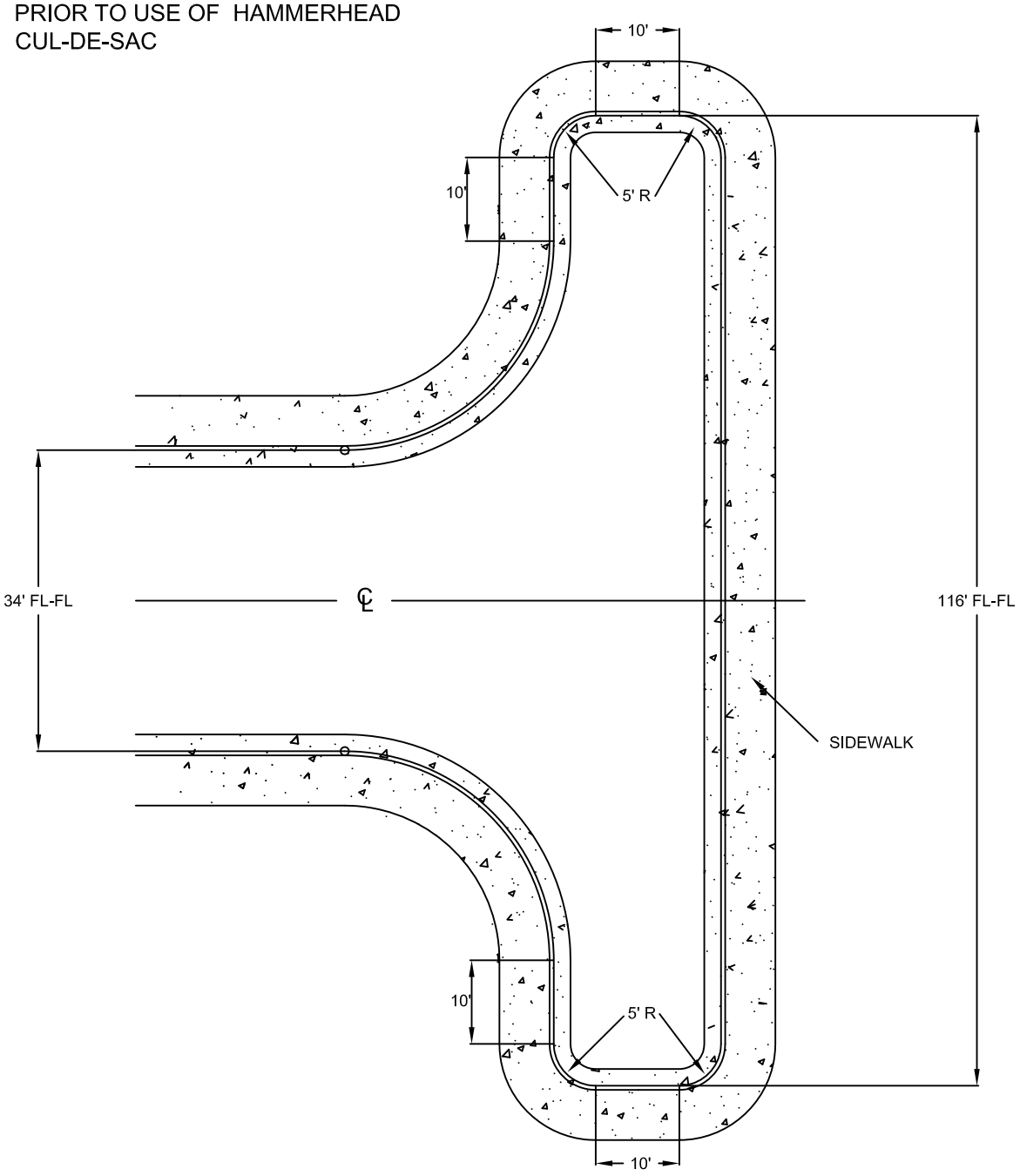
LOOP-DE-LANE

1"=50'

COMMERCE CITY DEPARTMENT OF PUBLIC WORKS ENGINEERING CONSTRUCTION STANDARDS	APPROVAL: CITY ENGINEER 05-27-16 DATE
LOOP-DE-LANE	DETAIL NO. 307-13

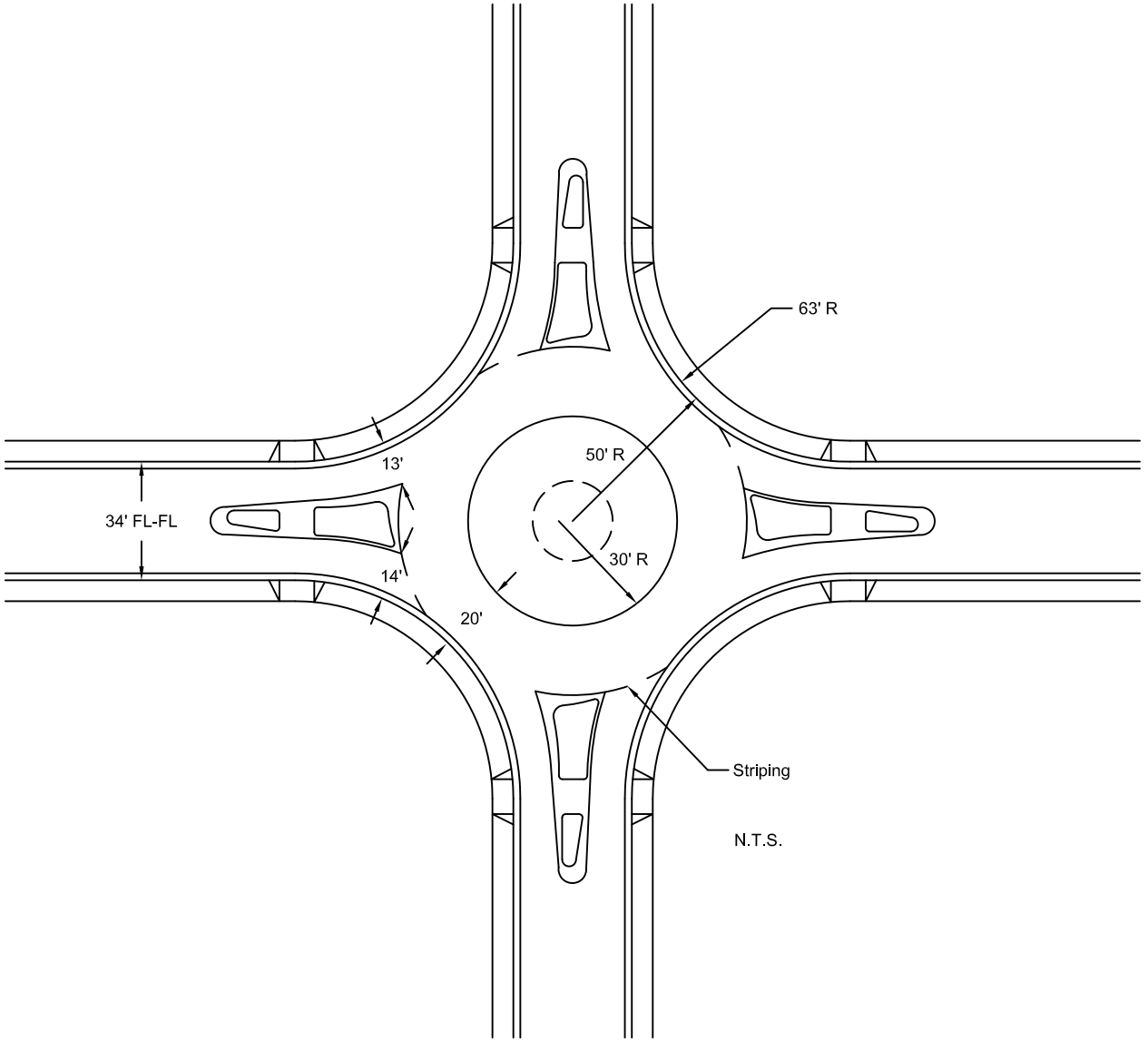
S:\Tranproj\100049520 - Commerce City Engineering Standards\Design\Drawings\Reference_Files\CCC DWGs\307-13 (Loop-de-lane).dwg

CITY ENGINEER AND EMERGENCY
ACCESS APPROVAL REQUIRED
PRIOR TO USE OF HAMMERHEAD
CUL-DE-SAC



COMMERCE CITY DEPARTMENT OF PUBLIC WORKS ENGINEERING CONSTRUCTION STANDARDS	APPROVAL: CITY ENGINEER 05-27-16 DATE
TYPICAL HAMMERHEAD CUL-DE-SAC	DETAIL NO. 307-14

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COMMERCE CITY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING CONSTRUCTION STANDARDS

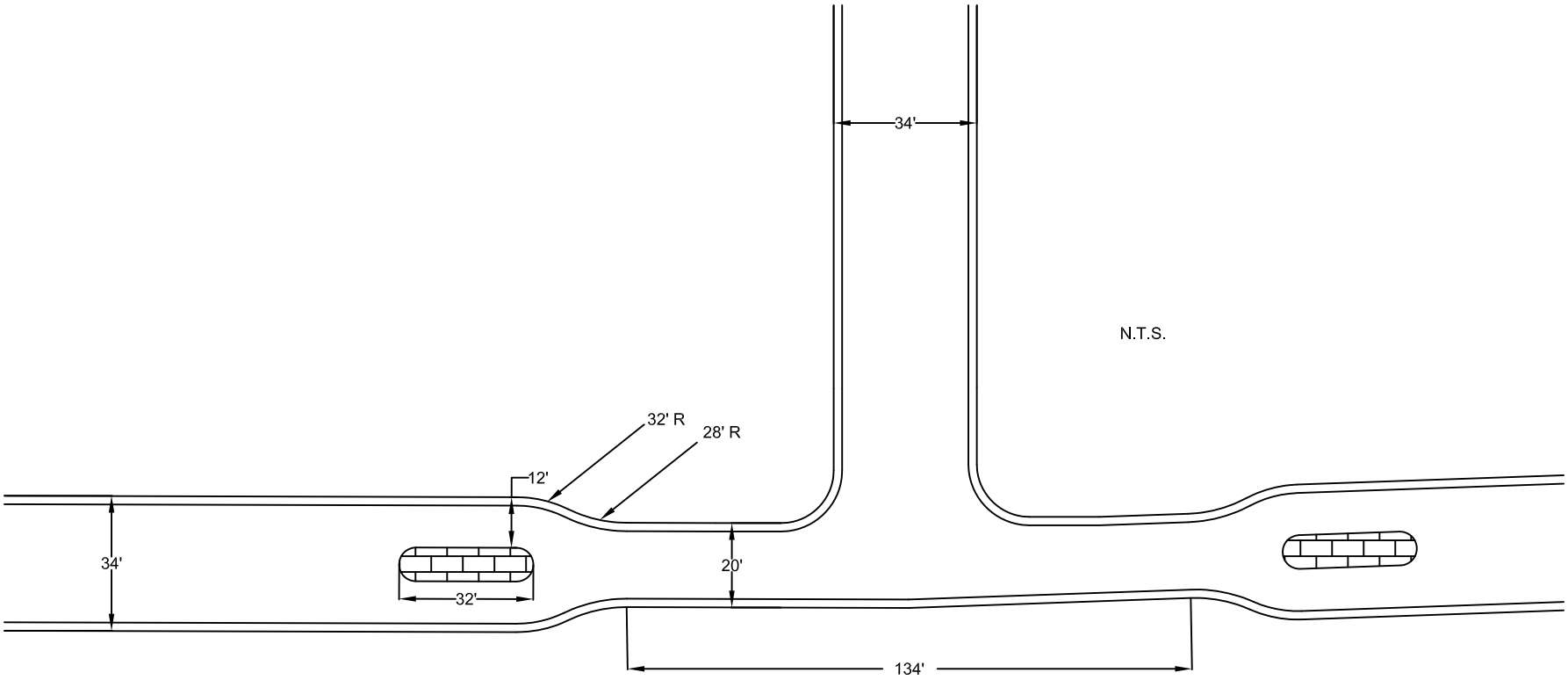
APPROVAL:

CITY ENGINEER — DATE: 05-27-16

ROUNDABOUT

DETAIL NO.
307-15

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COMMERCE CITY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING CONSTRUCTION STANDARDS

APPROVAL:

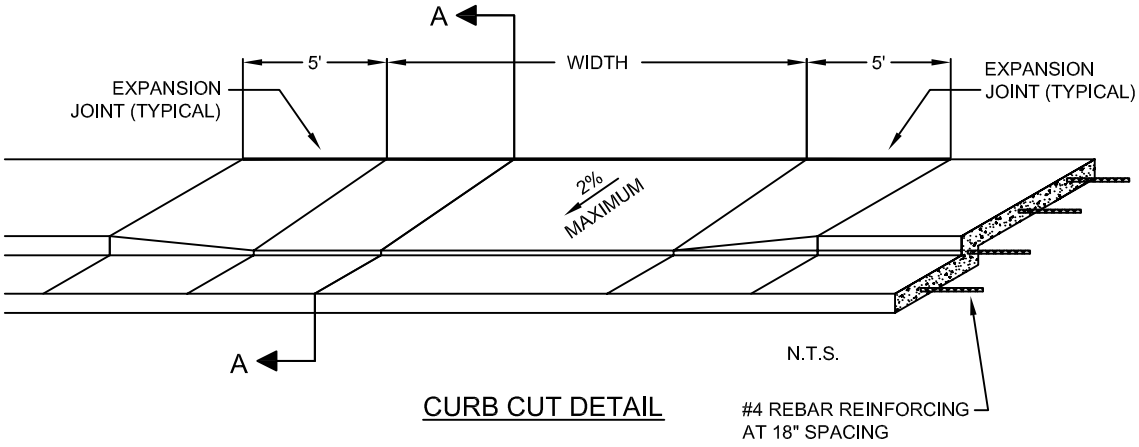
CITY ENGINEER

05-27-16
DATE

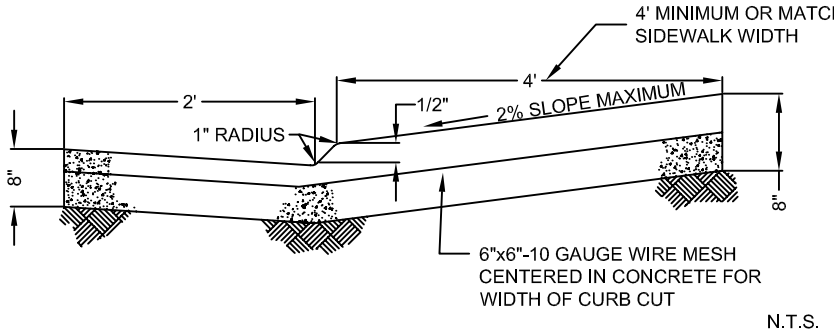
TRAFFIC CALMING ISLAND WITH NECKDOWN

DETAIL NO.
307-16

S:\Tranproj\100049520 - Commerce City Engineering Standards\Design\Drawings\Reference_Files\CCC DWGs\307-16 (Traffic Calming Island with Neckdown).dwg



CURB CUT DETAIL



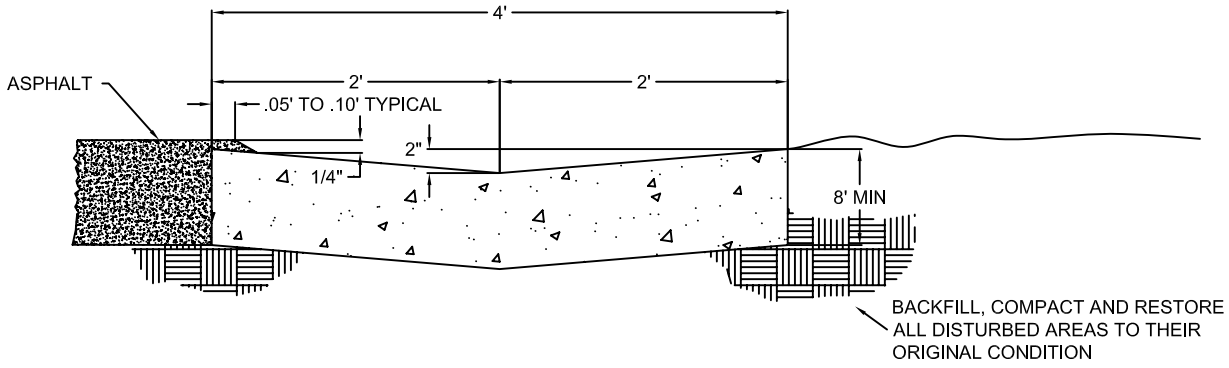
SECTION A-A

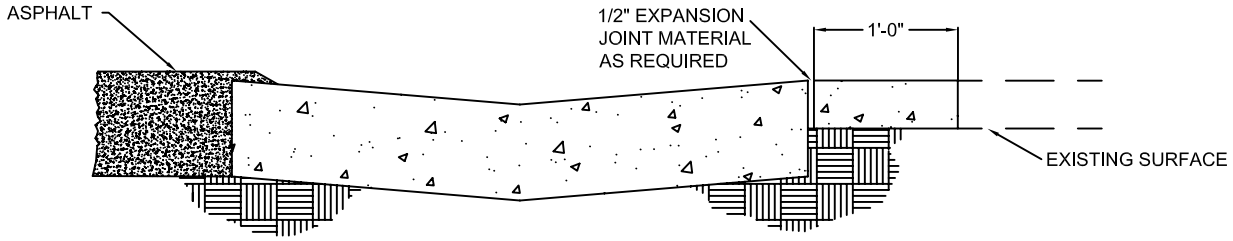
NOTES:

1. REINFORCEMENT IS REQUIRED FOR INDUSTRIAL AND HEAVY COMMERCIAL DRIVE CUTS.
2. EXPANSION JOINTS SHALL BE INSTALLED WHEN ABUTTING EXISTING CONCRETE OR FIXED STRUCTURE. EXPANSION JOINT MATERIAL SHALL BE 1/2" THICK AND SHALL EXTEND THE FULL DEPTH OF THE CONTACT SURFACE.
3. CONCRETE THICKNESS SHALL BE 6" FOR RESIDENTIAL AREAS AND 8" FOR ALL OTHERS.
4. 18" LONG #4 EPOXY COATED REBAR REINFORCING SHALL BE USED TO PIN NEW CONCRETE TO EXISTING CONCRETE. SPACING SHALL BE 18-INCHES.
5. IF 2% MAXIMUM SLOPE CANNOT BE MET, A MOUNTABLE CURB WILL BE REQUIRED AND A 2% MAXIMUM SLOPE SHALL BE MAINTAINED. SEE DETAIL 308-06

COMMERCE CITY DEPARTMENT OF PUBLIC WORKS ENGINEERING CONSTRUCTION STANDARDS	APPROVAL: CITY ENGINEER 11-14-16 DATE	
CURB CUT DETAIL	DETAIL NO. 308-01	

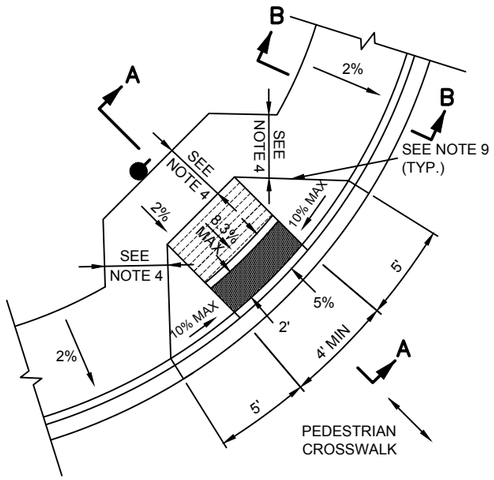
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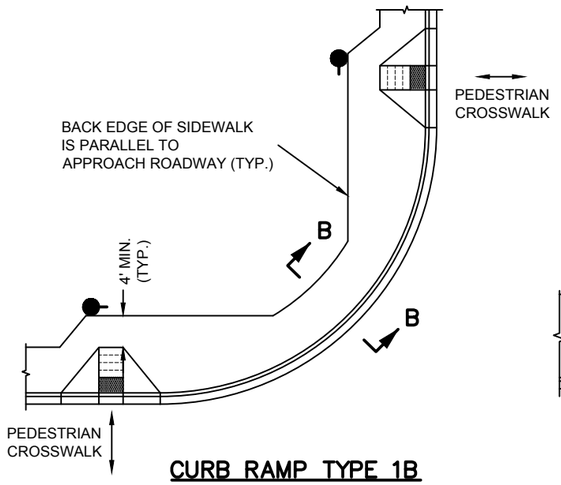
COMMERCE CITY DEPARTMENT OF PUBLIC WORKS ENGINEERING CONSTRUCTION STANDARDS	APPROVAL: CITY ENGINEER 05-27-16 DATE
VALLEY PAN	DETAIL NO. 308-02

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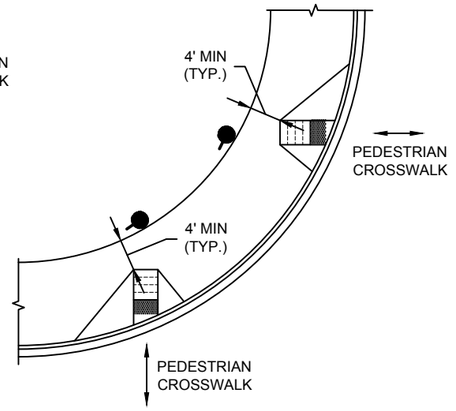
CURB RAMP TYPE 1A

SEE NOTE 11



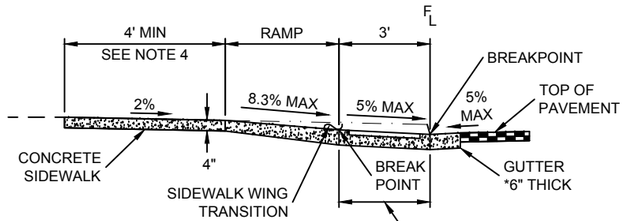
CURB RAMP TYPE 1B

SEE NOTE 11



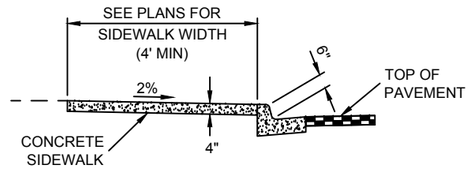
CURB RAMP TYPE 1B MODIFIED

USE ONLY IF EXISTING ROW DICTATES.
GRADE BREAK SHALL NOT BE PERMITTED ON THE SURFACE OF THE RAMP RUNS AND TURNING SPACES. SURFACE THAT MEET AT GRADE BREAKS SHALL BE FLUSH.
SEE NOTE 11.

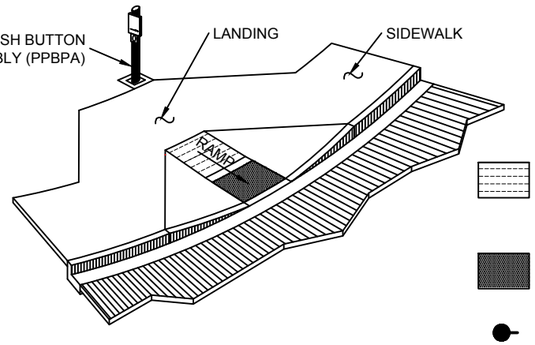


SECTION A–A

* INCREASE TO 8" FOR BRICK PAVERS.

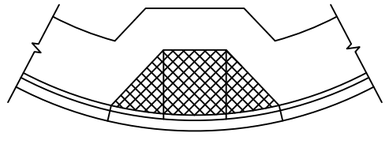


SECTION B–B



ISOMETRIC VIEW

SHOWN WITH PEDESTRIAN PUSH BUTTON POST ASSEMBLY (PPBPA)



RAMP PAY AREA

FOR CURB RAMPS TYPE 1A AND 1B

RAMP SURFACE SHALL BE TEXTURED WITH A COARSE BROOMED FINISH AND SCORED WITH GROOVES (," BY ,") SPACED 6" INCHES ON CENTER

ADA DETECTABLE WARNING DEVICE
CAST IRON TRUNCATED DOMES.
BRICK AND STAMPED CONCRETE ARE NOT ALLOWED

PEDESTRIAN PUSH BUTTON PUSH ASSEMBLY (PPBPA).
SEE NOTE 8.
SEE STANDARD PLAN S-614-9 FOR PPBPA DETAILS.
SEE PLANS FOR LOCATIONS
THE SIGN FACE SHALL BE PARALLEL TO THE CROSSWALK.

MFG'S:
EAST JORDAN IRON WORKS, INC. 1-800-874-4100
NEENAH FOUNDRY CO. 1-800-694-4660

GENERAL NOTES

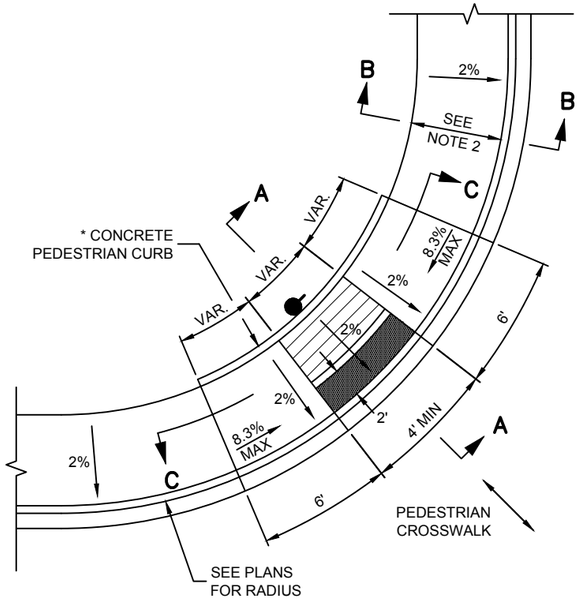
1. THE DETECTABLE WARNINGS SHALL BE INSTALLED AT SIDEWALK TO STREET TRANSITIONS. THEY SHALL HAVE A TRUNCATED DOME SURFACE. THE DOMES SHALL BE IN A SQUARE GRID PATTERN AND ALIGNED WITH PEDESTRIAN TRAFFIC.
2. ALL DETECTABLE WARNING AREAS SHALL START A MINIMUM OF 6 IN. FROM THE FLOW LINE OF THE CURB AND NOT BE MORE THAN A MAXIMUM OF 8 IN. (WITH EXCEPTION FOR THE TYPE 1B MODIFIED AND TYPE 3B MODIFIED AS THIS DIMENSION MAY BE GREATER THAN 8 INCHES ON ONE SIDE OF THE RADIUS) FROM ANY POINT ON THE FLOW LINE OF THE CURB. ALL DETECTABLE WARNING AREAS SHALL BE 2 FT. IN LENGTH AND COVER THE COMPLETE WIDTH OF THE RAMP AREA ONLY.
3. RAMP SLOPES SHALL BE 8.3% OR FLATTER. THE DETECTABLE WARNING SLOPES SHALL BE 5% OR FLATTER.
4. MINIMUM SIDEWALK WIDTH IS 4 FT.
5. DO NOT INSTALL DRAINAGE STRUCTURES, TRAFFIC SIGNAL EQUIPMENT, JUNCTION BOXES, AND OTHER OBSTRUCTIONS IN FRONT OF THE RAMP ACCESS AREAS.
6. CONSTRUCTION OF THE CONCRETE PEDESTRIAN CURB ADJACENT TO THE RAMP AREAS SHALL BE INCLUDED IN THE BID PRICE OF THE CONCRETE CURB RAMP.
7. DETECTABLE WARNINGS SHALL MEET SECTION 705 OF THE USDOT ADA STANDARDS FOR TRANSPORTATION FACILITIES.
8. IF THE PLACEMENT OF A PEDESTRIAN PUSH BUTTON ASSEMBLY ON A TRAFFIC SIGNAL MAST POLE WILL NOT BE WITHIN EASY REACH (10" OR LESS AND UNOBSTRUCTED) OF PEDESTRIANS (IN ACCORDANCE WITH THE AMERICANS WITH DISABILITIES ACT), THEN A SEPARATE PEDESTRIAN PUSH BUTTON POST ASSEMBLY (PPBPA) SHALL BE INSTALLED WITHIN EASY REACH. THE PPBPA SHALL MEET THE PROVISIONS FOUND IN "SECTION 4E.08 THROUGH 4E.13 - PEDESTRIAN DETECTORS" OF THE 2009 MUTCD MANUAL WITH REVISIONS 1 AND 2.
9. WHERE SPACE IS LIMITED OR GRADE IS AN ISSUE, A 10% SLOPE MAY BE USED ON FLARED SIDES.
10. THE SLOPES CAN BE LOWER THAN WHAT IS SHOWN BUT THEY SHALL NOT EXCEED THESE VALUES.
11. CURB RAMP TYPE 1A DIAGONAL (ON THE APEX) IS UNACCEPTABLE IN NEW CONSTRUCTION. TYPICALLY, TWO CURB RAMPS AS IN TYPE 1B, MUST BE PROVIDED AT EACH STREET CORNER.

    ADA TITLE II 28 C.F.R. SECTION 35.151(B) STATES:
    ALTERATIONS HAVE TO BE MADE READILY ACCESSIBLE, WITHIN THE IMPACTING PROJECT, TO THE MAXIMUM EXTENT FEASIBLE (MEF).

    THEREFORE, A SINGLE, DIAGONAL CURB RAMP TYPE 1A WILL ONLY BE PERMITTED ON ALTERATION PROJECTS WITH MEF JUSTIFICATION DOCUMENTATION.
12. THE CURB RAMP (EXCLUDING ANY FLARED SIDES) OR BLENDED TRANSITION SHALL BE CONTAINED WHOLLY WITHIN THE WIDTH OF THE CROSSWALK AND/OR PEDESTRIAN STREET CROSSING THE RAMP SERVES.
13. WING SURFACES SHALL BE TEXTURED WITH A COARSE BROOMED SURFACE ONLY.

COMPUTER FILE INFORMATION		APPROVAL	CITY OF COMMERCE CITY	DETAIL NO.
Creation Date: 03/10/2016	Initials: CJC		Department of Public Works 8602 Rosemary St. Commerce City, CO 80022 Ph: 303-289-8150	CURB RAMPS
Last Modification Date: 5/26/2016	Initials: CJC			
Full Path: WWW.C3GOV.COM				ENGINEERING CONSTRUCTION STANDARDS
Drawing Name: $FILES$				
Scale: $SCALESHORT$	Units: ENGLISH	CITY ENGINEER 12-15-17 DATE		308-03a

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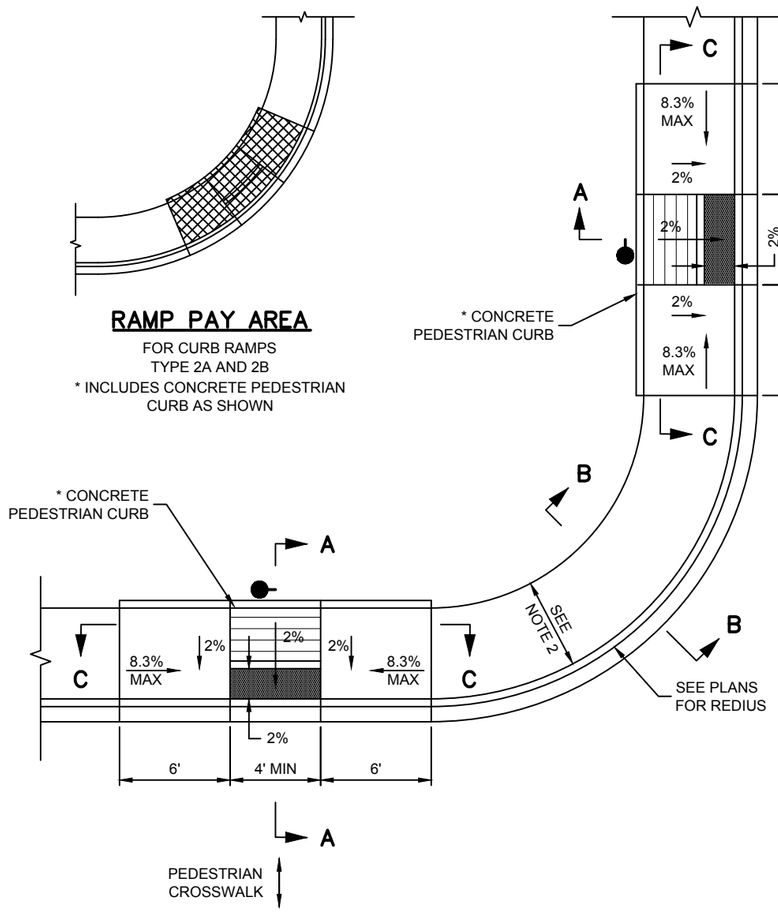


CURB RAMP TYPE 2A

SEE NOTE 3

RAMP PAY AREA

FOR CURB RAMPS
TYPE 2A AND 2B
* INCLUDES CONCRETE PEDESTRIAN CURB AS SHOWN



CURB RAMP TYPE 2B

SEE NOTE 3

GENERAL NOTES

1. CURB RAMP TYPE 2B MAY BE USED IN MID–BLOCK.
2. MINIMUM SIDEWALK WIDTH IS 4 FT.
3. CURB RAMP TYPE 2A DIAGONAL (ON THE APEX) IS UNACCEPTABLE IN NEW CONSTRUCTION. TYPICALLY, TWO CURB RAMPS AS IN TYPE 2B, MUST BE PROVIDED AT EACH STREET CORNER.
   ADA TITLE II 28 C.F.R. SECTION 35.151(B) STATES:
   ALTERATIONS HAVE TO BE MADE READILY ACCESSIBLE, WITHIN THE IMPACTING PROJECT, TO THE MAXIMUM EXTENT FEASIBLE (MEF).

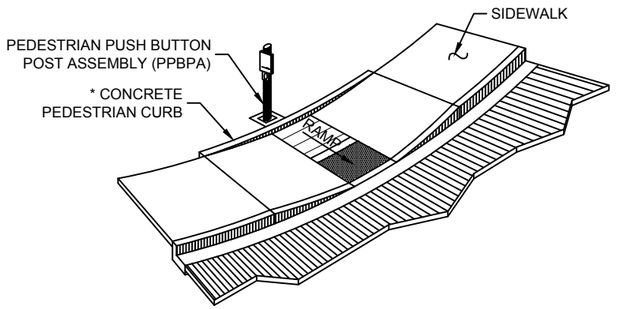
   THEREFORE, A SINGLE, DIAGONAL CURB RAMP TYPE 2A WILL ONLY BE PERMITTED ON ALTERATION PROJECTS WITH MEF JUSTIFICATION DOCUMENTATION.

RAMP SURFACE SHALL BE TEXTURED WITH A COARSE BROOMED FINISH AND SCORED WITH GROOVES (," BY ,") SPACED 6" INCHES ON CENTER

ADA DETECTABLE WARNING DEVICE
CAST IRON TRUNCATED DOMES.
BRICK AND STAMPED CONCRETE ARE NOT ALLOWED

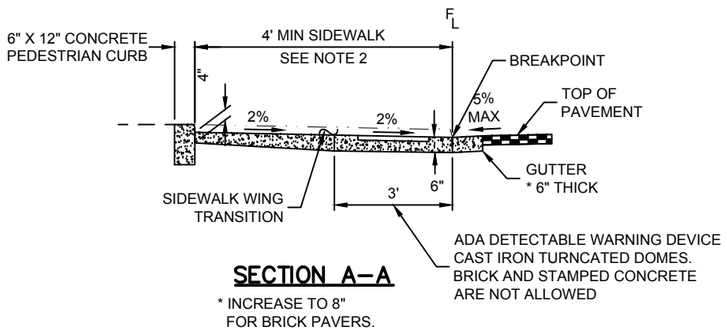
PEDESTRIAN PUSH BUTTON PUSH ASSEMBLY (PPBPA).
SEE NOTE 8.
SEE STANDARD PLAN S-614-9 FOR PPBPA DETAILS.
SEE PLANS FOR LOCATIONS
THE SIGN FACE SHALL BE PARALLEL TO THE CROSSWALK.

MFG'S:
EAST JORDAN IRON WORKS, INC. 1-800-874-4100
NEENAH FOUNDRY CO. 1-800-694-4660



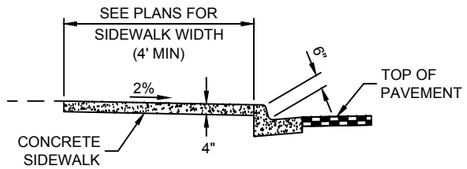
ISOMETRIC VIEW

SHOWN WITH PEDESTRIAN PUSH BUTTON POST ASSEMBLY (PPBPA)

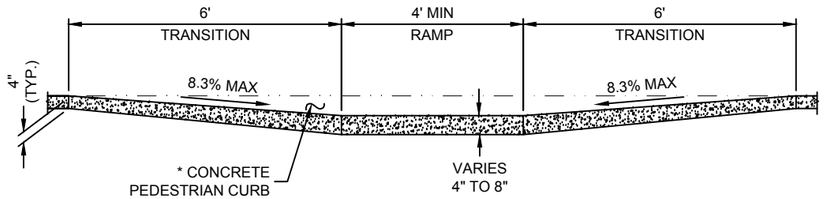


SECTION A–A

* INCREASE TO 8" FOR BRICK PAVERS.



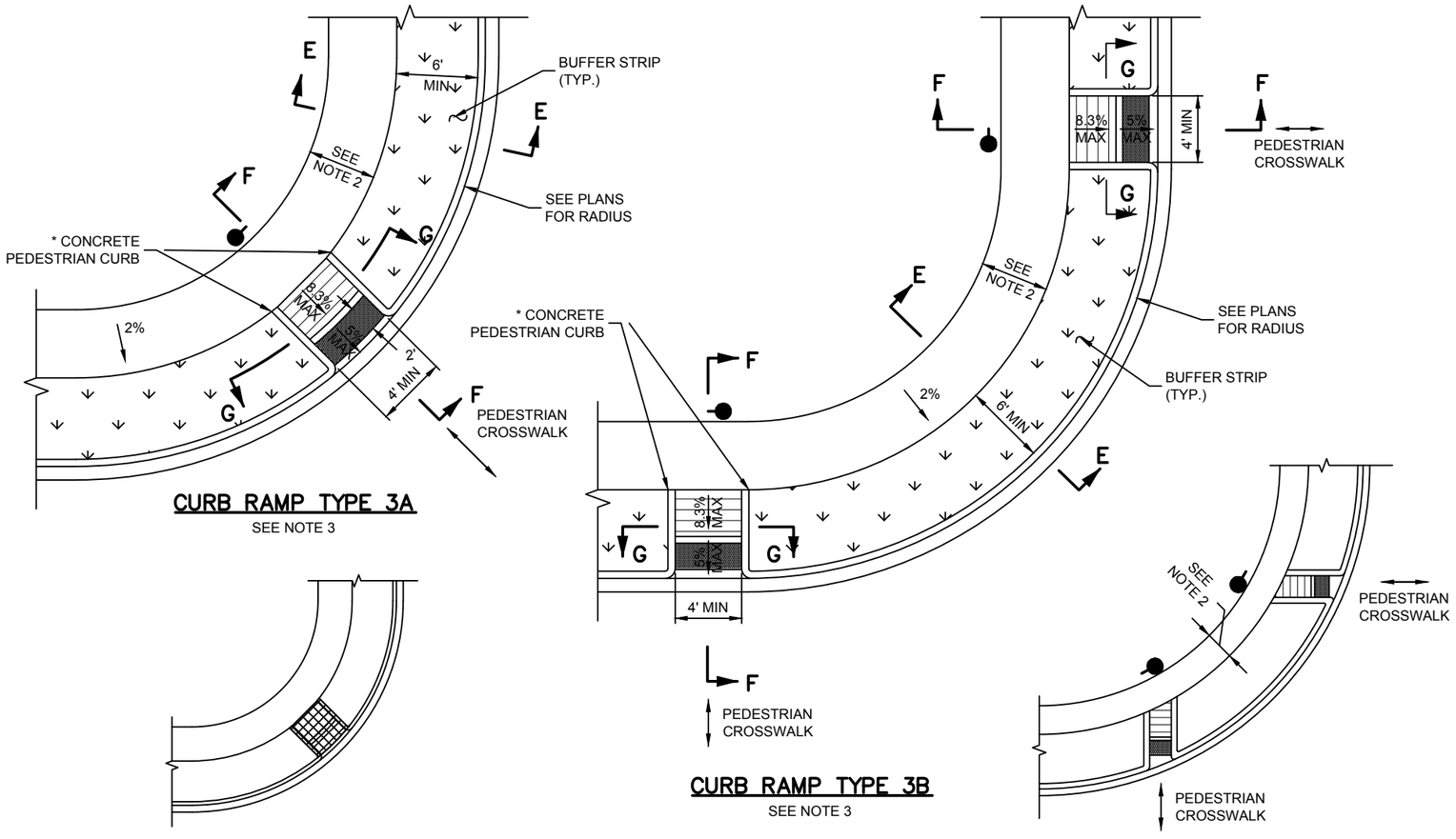
SECTION B–B



SECTION C–C

COMPUTER FILE INFORMATION		APPROVAL	CITY OF COMMERCE CITY	DETAIL NO.
Creation Date: 03/10/2016	Initials: CJC		Department of Public Works	CURB RAMPS
Last Modification Date: 5/26/2016	Initials: CJC	CITY ENGINEER 12-15-17 DATE	8602 Rosemary St.	308-03b
Full Path: WWW.C3GOV.COM			Commerce City, CO 80022	
Drawing Name: $FILES$			Ph: 303-289-8150	ENGINEERING CONSTRUCTION STANDARDS
Scale: $SCALESHORT$	Units: ENGLISH			

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CURB RAMP TYPE 3A

SEE NOTE 3

CURB RAMP TYPE 3B

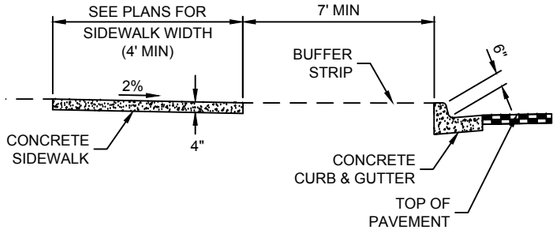
SEE NOTE 3

CURB RAMP TYPE 3B MODIFIED

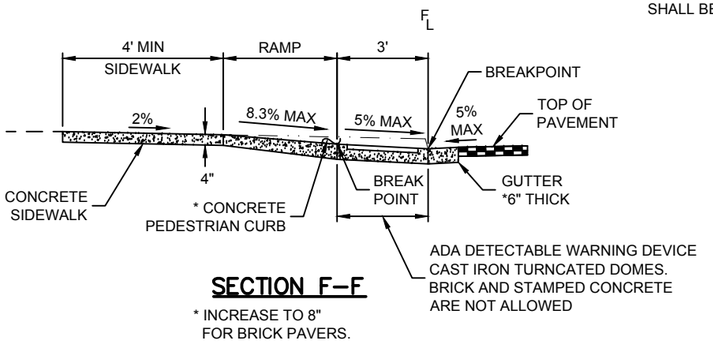
USE ONLY IF EXISTING ROW DICTATES.
GRADE BREAKS SHALL NOT BE PERMITTED ON THE SURFACE OF THE RAMP RUNS AND TURNING SPACES.
SURFACE SLOPES THAT MEET AT GRADE BREAKS SHALL BE FLUSH. SEE NOTE 3.

RAMP PAY AREA

FOR CURB RAMPS
TYPE 3A AND 3B
* INCLUDES CONCRETE PEDESTRIAN CURB AS SHOWN



SECTION E–E



SECTION F–F

* INCREASE TO 8"
FOR BRICK PAVERS.

GENERAL NOTES

1. CURB RAMP TYPE 3B MAY BE USED IN MID–BLOCK.
2. MINIMUM SIDEWALK WIDTH IS 4 FT.
3. CURB RAMP TYPE 3A DIAGONAL (ON THE APEX) IS UNACCEPTABLE IN NEW CONSTRUCTION. TYPICALLY, TWO CURB RAMPS AS IN TYPE 3B, MUST BE PROVIDED AT EACH STREET CORNER.
   ADA TITLE II 28 C.F.R. SECTION 35.151(B) STATES:
   ALTERATIONS HAVE TO BE MADE READILY ACCESSIBLE, WITHIN THE IMPACTING PROJECT, TO THE MAXIMUM EXTENT FEASIBLE (MEF).

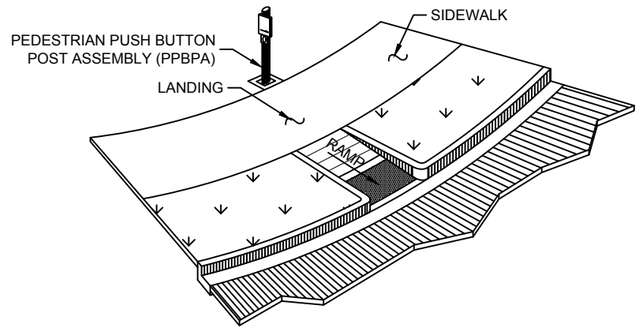
   THEREFORE, A SINGLE, DIAGONAL CURB RAMP TYPE 3A WILL ONLY BE PERMITTED ON ALTERATION PROJECTS WITH MEF JUSTIFICATION DOCUMENTATION.

RAMP SURFACE SHALL BE TEXTURED WITH A COARSE BROOMED FINISH AND SCORED WITH GROOVES (," BY ,") SPACED 6" INCHES ON CENTER

ADA DETECTABLE WARNING DEVICE
CAST IRON TRUNCATED DOMES.
BRICK AND STAMPED CONCRETE ARE NOT ALLOWED

PEDESTRIAN PUSH BUTTON PUSH ASSEMBLY (PPBPA).
SEE NOTE 8.
SEE STANDARD PLAN S-614-9 FOR PPBPA DETAILS.
SEE PLANS FOR LOCATIONS
THE SIGN FACE SHALL BE PARALLEL TO THE CROSSWALK.

MFG'S:
EAST JORDAN IRON WORKS, INC. 1-800-874-4100
NEENAH FOUNDRY CO. 1-800-694-4660



ISOMETRIC VIEW

SHOWN WITH PEDESTRIAN PUSH BUTTON POST ASSEMBLY (PPBPA)

COMPUTER FILE INFORMATION	
Creation Date: 03/10/2016	Initials: CJC
Last Modification Date: 5/26/2016	Initials: CJC
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APPROVAL

CITY ENGINEER — 12-15-17 DATE

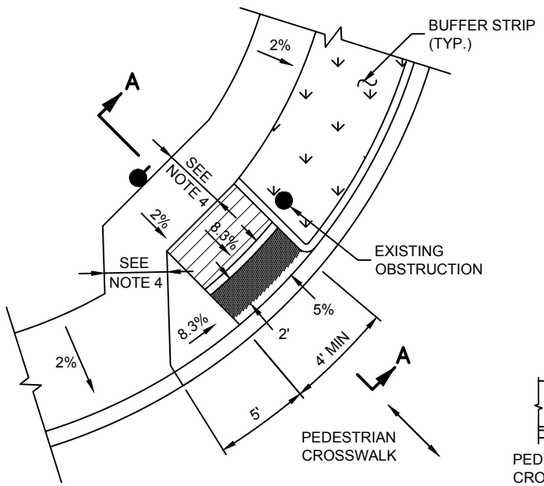
CITY OF COMMERCE CITY
Department of Public Works
8602 Rosemary St.
Commerce City, CO 80022
Ph: 303-289-8150

CURB RAMPS

ENGINEERING CONSTRUCTION STANDARDS

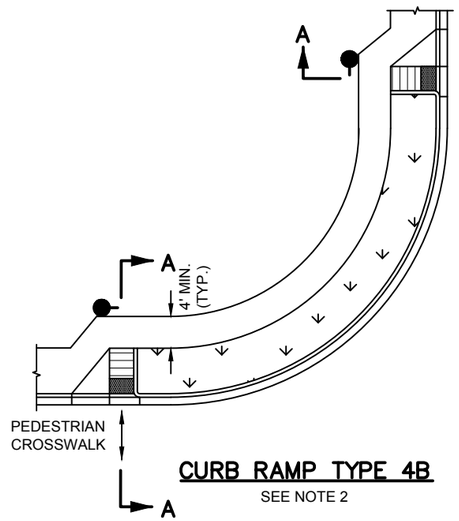
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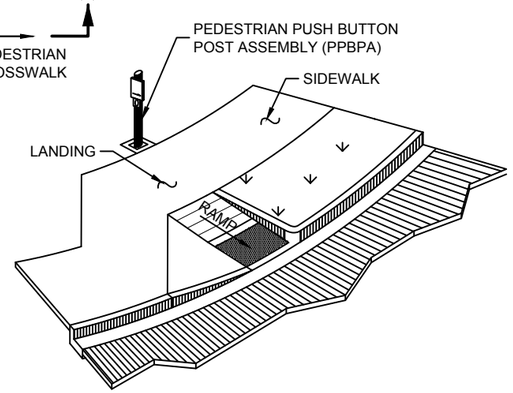
CURB RAMP TYPE 4A

SEE NOTE 2



CURB RAMP TYPE 4B

SEE NOTE 2



ISOMETRIC VIEW

SHOWN WITH PEDESTRIAN PUSH
BUTTON POST ASSEMBLY (PPBPA)

GENERAL NOTES

1. MINIMUM SIDEWALK WIDTH IS 4 FT.
2. CURB RAMP TYPE 4A DIAGONAL (ON THE APEX) IS UNACCEPTABLE IN NEW CONSTRUCTION. TYPICALLY, TWO CURB RAMPS AS IN TYPE 4B, MUST BE PROVIDED AT EACH STREET CORNER.
   ADA TITLE II 28 C.F.R. SECTION 35.151(B) STATES:
   ALTERATIONS HAVE TO BE MADE READILY ACCESSIBLE, WITHIN THE IMPACTING PROJECT, TO THE MAXIMUM EXTENT FEASIBLE (MEF).

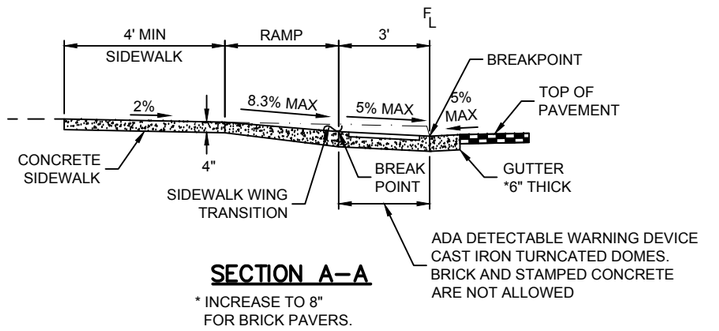
   THEREFORE, A SINGLE, DIAGONAL CURB RAMP TYPE 4A WILL ONLY BE PERMITTED ON ALTERATION PROJECTS WITH MEF JUSTIFICATION DOCUMENTATION.
3. WING SURFACES SHALL BE TEXTURED WITH A COARSE BROOMED SURFACE ONLY.

RAMP SURFACE SHALL BE TEXTURED WITH
A COARSE BROOMED FINISH AND SCORED
WITH GROOVES (," BY ,")
SPACED 6" INCHES ON CENTER

ADA DETECTABLE WARNING DEVICE
CAST IRON TRUNCATED DOMES.
BRICK AND STAMPED CONCRETE ARE NOT ALLOWED

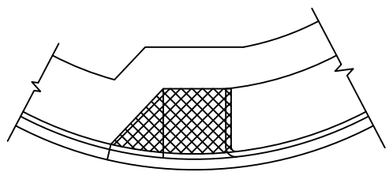
PEDESTRIAN PUSH BUTTON PUSH ASSEMBLY (PPBPA).
SEE NOTE 8.
SEE STANDARD PLAN S-614-9 FOR PPBPA DETAILS.
SEE PLANS FOR LOCATIONS
THE SIGN FACE SHALL BE PARALLEL TO THE CROSSWALK.

MFG'S:
EAST JORDAN IRON WORKS, INC. 1-800-874-4100
NEENAH FOUNDRY CO. 1-800-694-4660



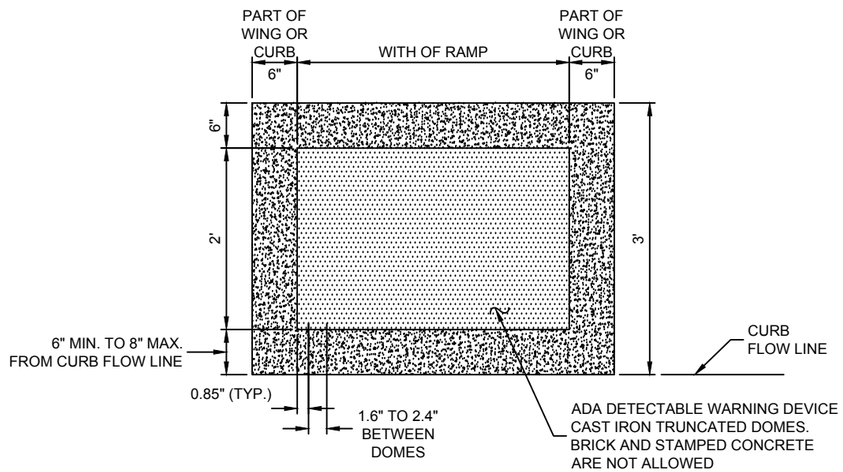
SECTION A–A

* INCREASE TO 8"
FOR BRICK PAVERS.



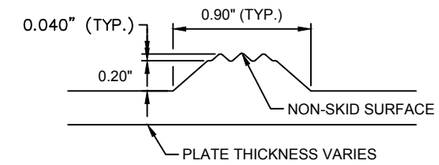
RAMP PAY AREA

FOR CURB RAMPS
TYPE 4A AND 4B



PLAN VIEW OF DETECTABLE WARNING PLATE

FOR CURB RAMPS



ELEVATION VIEW OF DETECTABLE WARNING PLATE

FOR CURB RAMPS

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COMPUTER FILE INFORMATION	
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Last Modification Date: 5/26/2016	Initials: CJC
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APPROVAL

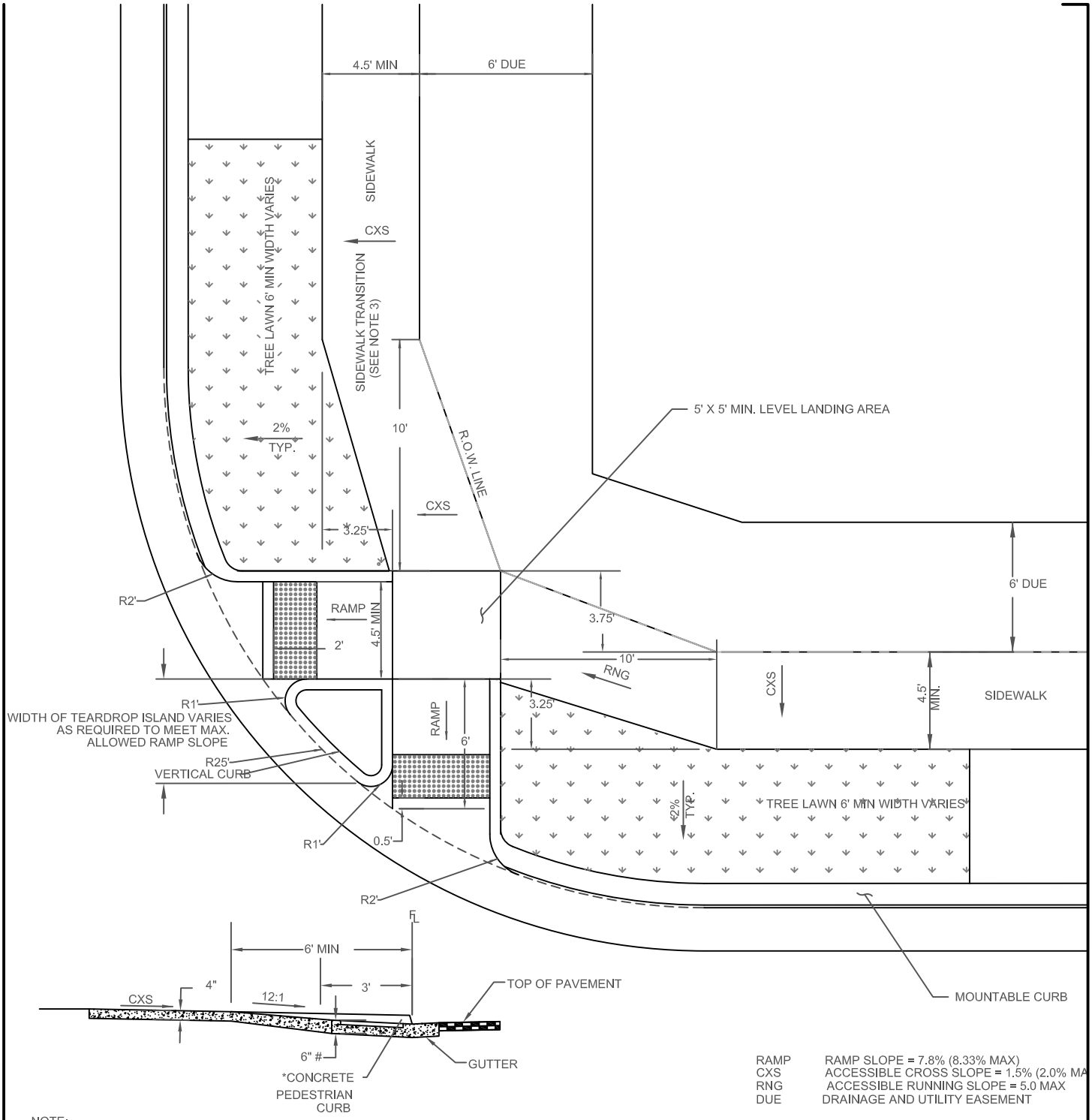
CITY ENGINEER — 12-15-17 DATE

CITY OF COMMERCE CITY
Department of Public Works
8602 Rosemary St.
Commerce City, CO 80022
Ph: 303-289-8150

CURB RAMPS

ENGINEERING CONSTRUCTION STANDARDS

DETAIL NO.
308-03d



RAMP	RAMP SLOPE = 7.8% (8.33% MAX)
CXS	ACCESSIBLE CROSS SLOPE = 1.5% (2.0% MA
RNG	ACCESSIBLE RUNNING SLOPE = 5.0 MAX
DUE	DRAINAGE AND UTILITY EASEMENT

NOTE:
1. TO ALLOW REQUIRED RAMP LENGTH TO MEET MAXIMUM ALLOWED SLOPES, SIDEWALKS LEADING UP TO CURB RAMPS MAY BE OFFSET AS SHOWN.
2. SIDEWALK TRANSITION LENGTH NEED NOT EXCEED 15', BUT LONG SLOPE MUST BE UNIFORM.
3. SEE 308-03A CURB RAMP DETAIL GENERAL NOTES.
4. SEE 308-03D CURB RAMP DETAIL FOR DETECTABLE WARNING PLATE.
5. THIS TRANSITION TO RAMP CONFIGURATION TO BE USED WITH NEW RESIDENTIAL AND COMMERCIAL DEVELOPMENTS ALONG LOCAL AND COMMERCIAL LOCAL AND COLLECTOR ROADWAYS.

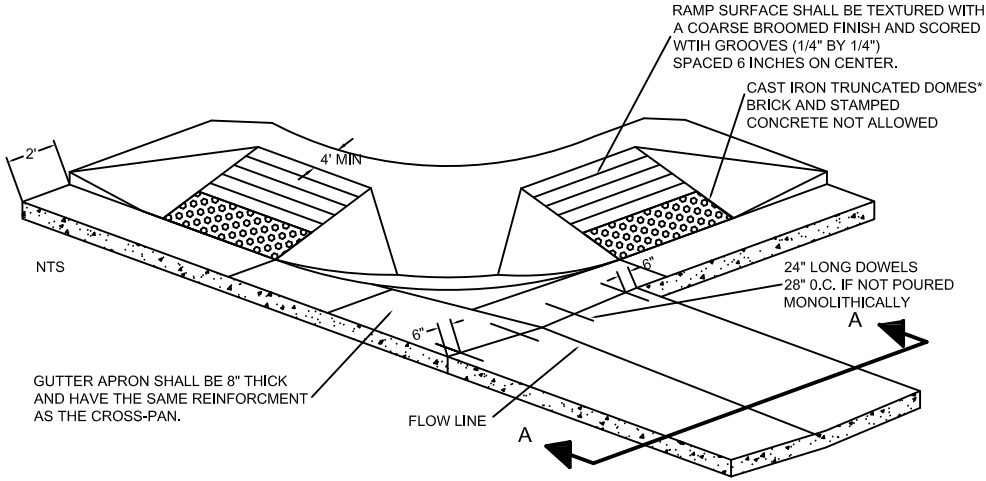
COMMERCE CITY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING CONSTRUCTION STANDARDS

APPROVAL:
Brent Soderlin 10-05-21
CITY ENGINEER DATE

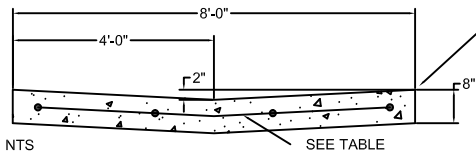
TYPICAL SIDEWALK TRANSITIONS TO CURB RAMP LANDING

DETAIL NO.
308-03E

O:\Division Information\Engineering\Documents\Engineering and Construction\COMMERCE CITY\CAD files\Ramp Detail 2021.dwg



*MFG'S: EAST JORDAN IRON WORKS, INC. - 1-800-874-4100
NEENAH FOUNDRY CO. - 1-800-694-4660



SECTION A-A

NOTE:
THIS DETAIL IS GENERALIZED. ANY PARTICULAR INSTALLATION MAY INCLUDE ALL OR PART OF THE DETAIL ELEMENTS AS PART OF THE CONSTRUCTION. ANY GIVEN INSTALLATION MAY INCLUDE REQUIREMENTS OF OTHER DETAILS. EXISTING CONDITIONS AND CONFIGURATIONS OF LOCATION WILL AFFECT ACTUAL CONSTRUCTION OF RAMPS.

PAN LENGTH	WIRE MESH CALLED FOR	REPLACE WITH REBAR HAVING END AREA OF
36"	6x6 - 4,4	0.10 SQ IN PER FT
46"	6x6 - 2,2	0.13 SQ IN PER FT
64"	6x6 - 0,0	0.20 SQ IN PER FT
84"	Two 6x6 - 2,2	0.26 SQ IN PER FT

NOTE:
SQUARE RETURNS AND PANS SHALL USE WIRE MESH AS SHOWN IN THE TABLE ABOVE. WHEN WIRE MESH IS NOT AVAILABLE, STEEL REINFORCING BAR MAY BE SUBSTITUTED.

COMMERCE CITY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING CONSTRUCTION STANDARDS

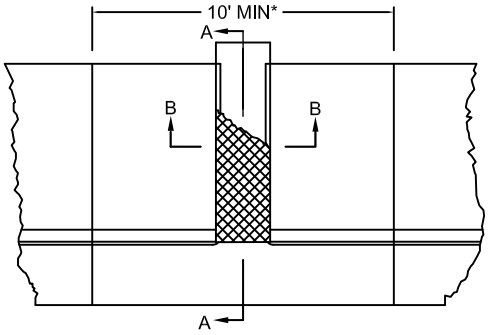
APPROVAL:
CITY ENGINEER — DATE: 12-15-17

CURB RAMP WITH CROSSPAN

DETAIL NO.
308-04

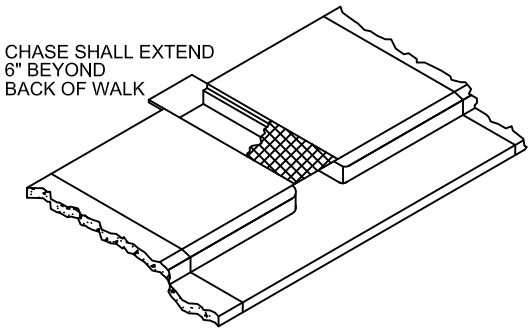
C:\Computer Tips\AutoCAD\Standard Details\308-04 (Curb Ramp with Crosspan).dwg

ATTACHED SIDEWALK



PLAN VIEW

*A MINIMUM OF 10 FEET OF NEW CONCRETE IS REQUIRED.

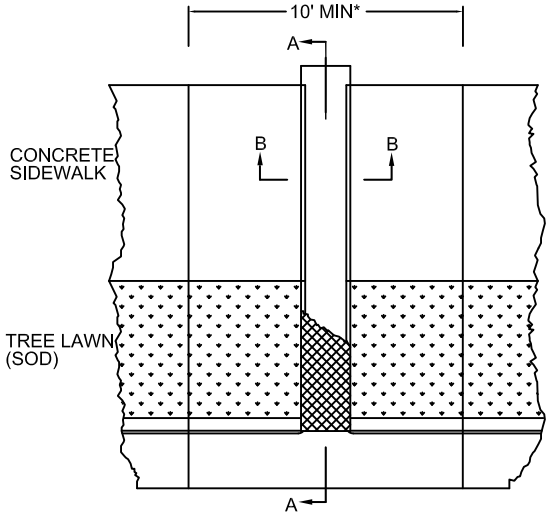


ISOMETRIC VIEW

NOTE: 1/2" EXPANSION JOINT MATERIAL REQUIRED ABUTTING EXISTING CONCRETE.

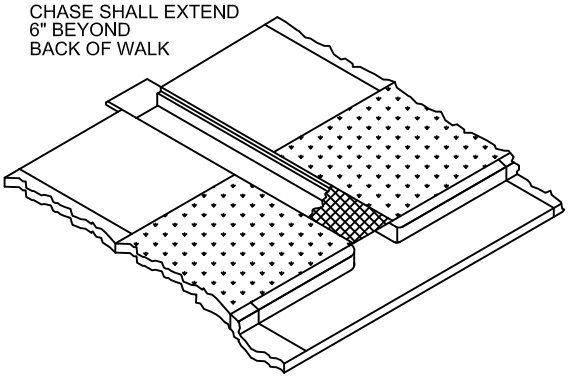
SECTION VIEWS ARE SHOWN ON DETAIL 300-19 (2)

DETACHED SIDEWALK



PLAN VIEW

*A MINIMUM OF 10 FEET OF NEW CONCRETE IS REQUIRED.
A CONCRETE CHANNEL IS REQUIRED TO BE EXTENDED THROUGH THE TREE LAWN TO THE FLOWLINE OF THE GUTTER.

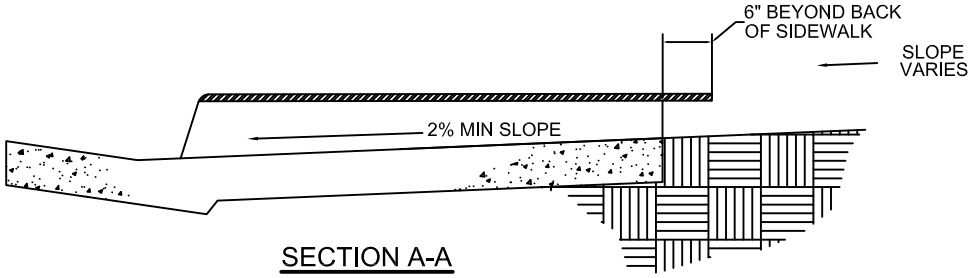


ISOMETRIC VIEW

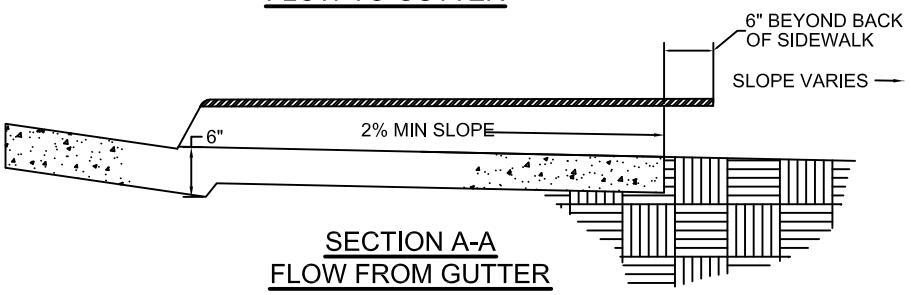
NOTE: 1/2" EXPANSION JOINT MATERIAL REQUIRED ABUTTING EXISTING CONCRETE.

COMMERCE CITY DEPARTMENT OF PUBLIC WORKS ENGINEERING CONSTRUCTION STANDARDS	APPROVAL: CITY ENGINEER 05-27-16 DATE
CHASE DRAIN (1 OF 2)	DETAIL NO. 308-05

S:\Tranproj\100049520 - Commerce City Engineering Standards\Design\Drawings\Reference_Files\CCC DWGs\308-05 (Chase Drain).dwg

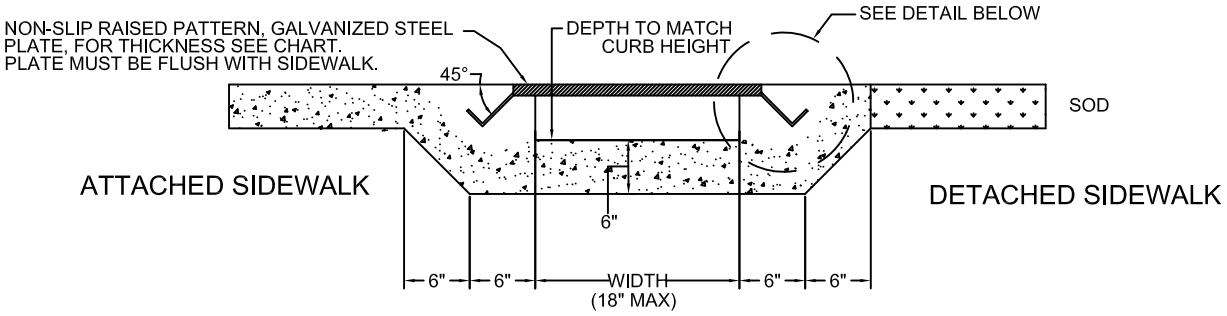


SECTION A-A
FLOW TO GUTTER

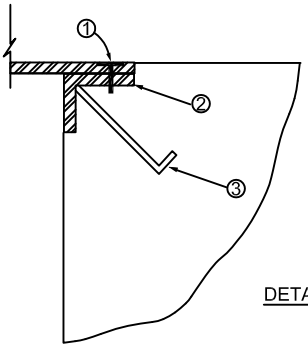


SECTION A-A
FLOW FROM GUTTER

SECTION B-B



WIDTH OF OPENING	THICKNESS OF PLATE
6-12"	1/2"
12-18"	9/16"

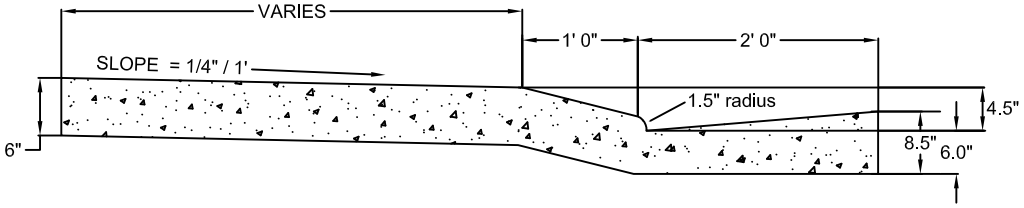


DETAIL

NOTES:
1. 3/8" GALV. BOLT. LUBRICATE BOLT PRIOR TO SETTING PLATE.
2. 2"x 1"x1/4" ANGLE IRON.
3. 1/4" DIA x 3" STUDS AT 1'-0" O.C.

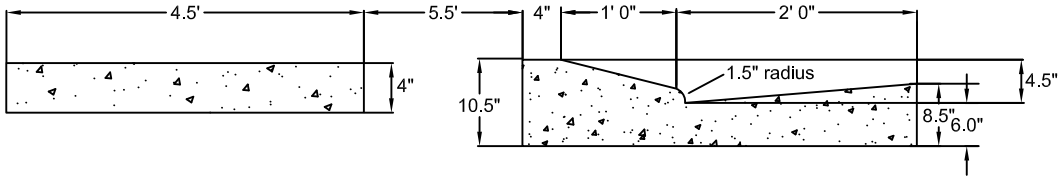
COMMERCE CITY DEPARTMENT OF PUBLIC WORKS ENGINEERING CONSTRUCTION STANDARDS	APPROVAL: CITY ENGINEER 05-27-16 DATE
CHASE DRAIN (2 OF 2)	DETAIL NO. 308-05

S:\Tranproj\100049520 - Commerce City Engineering Standards\Design\Drawings\Reference_Files\CCC DWGs\308-05 (Chase Drain).dwg



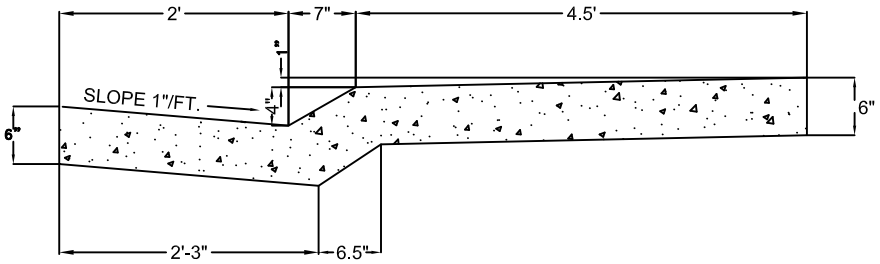
COMBINATION CURB, GUTTER AND SIDEWALK

NOT TO SCALE



DETACHED CURB, GUTTER AND SIDEWALK

NOT TO SCALE



COMBINATION CURB, GUTTER AND SIDEWALK

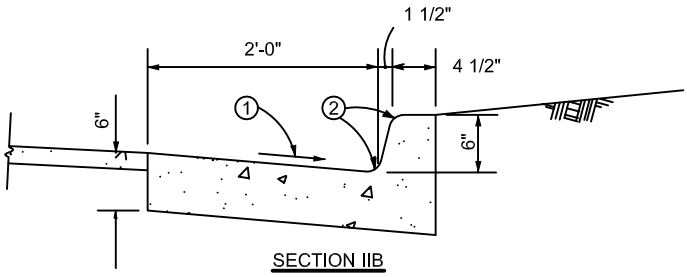
NOT TO SCALE

COMMERCE CITY DEPARTMENT OF PUBLIC WORKS ENGINEERING CONSTRUCTION STANDARDS	APPROVAL: CITY ENGINEER 05-27-16 DATE
MOUNTABLE CURB SECTIONS	DETAIL NO. 308-06

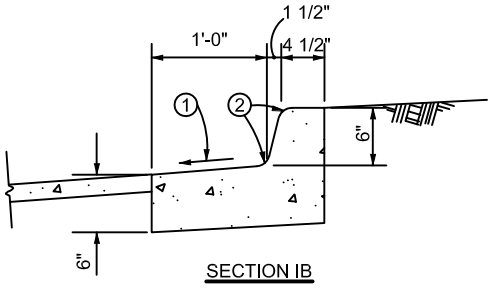
S:\Tranproj\100049520 - Commerce City Engineering Standards\Design\Drawings\Reference_Files\CCC DWGs\308-06 (Mountable Curb Sections).dwg

6" VERTICAL CURB AND GUTTER (TYPE 2)

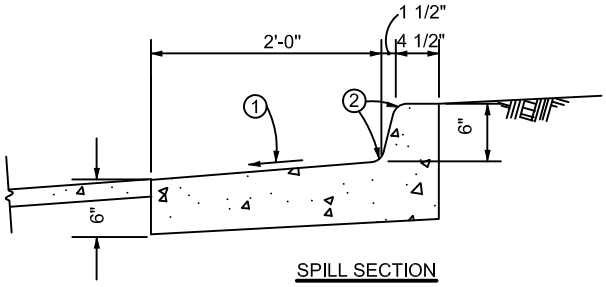
DRAWING NOT TO SCALE



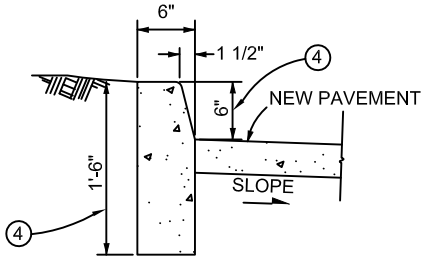
SECTION IIB



SECTION IB



SPILL SECTION



SECTION B

NOTES:

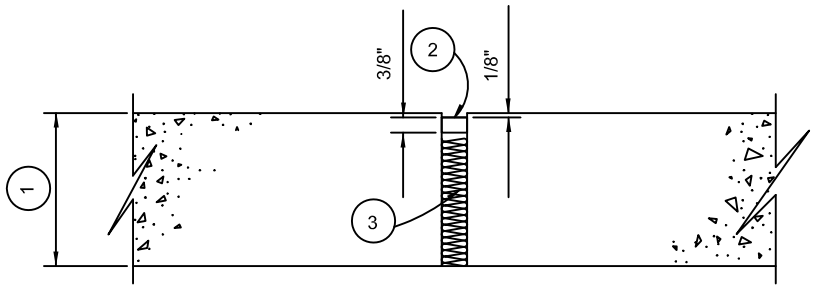
1. GUTTER CROSS SLOPES SHALL BE 1/2" / FT WHEN DRAINING AWAY FROM CURB AND 1" / FT WHEN DRAINING TOWARD CURB
2. 1 1/2" RADIUS TYPICAL
3. 3/4" Ø x 12" DEFORMED REINFORCING BARS AT 6 FT. SPACING. BARS TO BE GROUTED IN 1-1/2" Ø HOLES IN EXISTING CONCRETE. GROUT TO CONSIST OF 2 PARTS CLEAN SAND AND 1 PART CEMENT.
4. 9" CURB HEIGHT, 1'-9" OVERALL HEIGHT FOR MEDIAN.

COMMERCE CITY DEPARTMENT OF PUBLIC WORKS ENGINEERING CONSTRUCTION STANDARDS	APPROVAL: CITY ENGINEER 05-27-16 DATE
VERTICAL CURB SECTIONS	DETAIL NO. 308-07

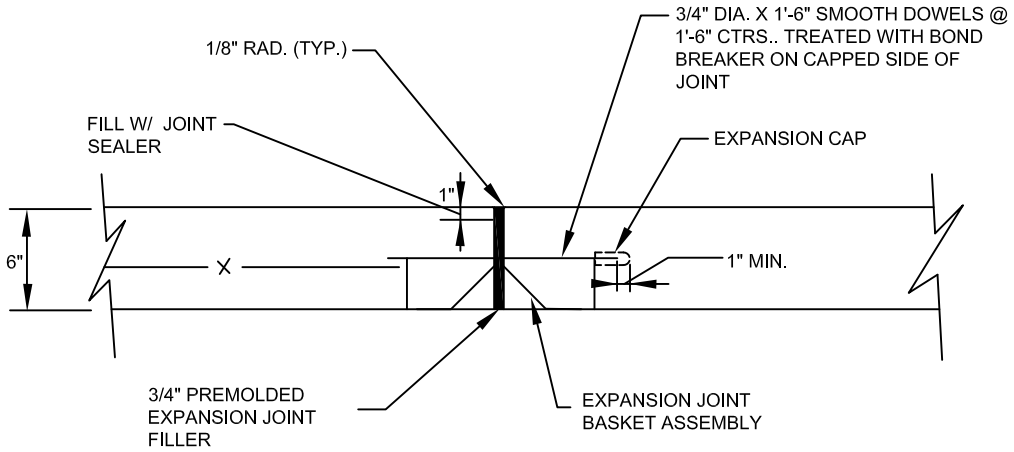
S:\Tranproj\100049520 - Commerce City Engineering Standards\Design\Drawings\Reference_Files\CCC DWGs\308-07 (Vertical Curb Sections).dwg

EXPANSION JOINT

N.T.S.



NOTES:
1. (T) THICKNESS OF PAVEMENT, SEE TYPICAL PAVEMENT SECTION.
2. POURED JOINT MATERIAL.
3. 1/2" PREFORMED JOINT MATERIAL. INSTALL EXPANSION JOINT MATERIAL BETWEEN NEW SIDEWALK AND EXISTING CONCRETE SLABS, POLES, FIRE HYDRANTS, BUILDINGS, ETC. SET EXPANSION JOINT MATERIAL VERTICAL AND WITH THE TOP EDGE BELOW FINISHED SURFACE OF CONCRETE. PROVIDE EXPANSION JOINTS EVERY 100' TO 120'.



SECTION

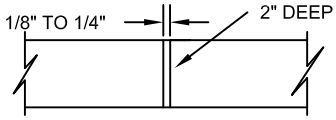
NOTE:
THIS DETAIL DOES NOT APPLY TO EXPANSION JOINT WHERE PAVEMENT ABUTS A STRUCTURE. USE ONLY JOINT FILLER AGAINST STRUCTURE.

COMMERCE CITY DEPARTMENT OF PUBLIC WORKS ENGINEERING CONSTRUCTION STANDARDS	APPROVAL: CITY ENGINEER 05-27-16 DATE
EXPANSION JOINT DETAILS	DETAIL NO. 308-08

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CONTRACTION JOINT

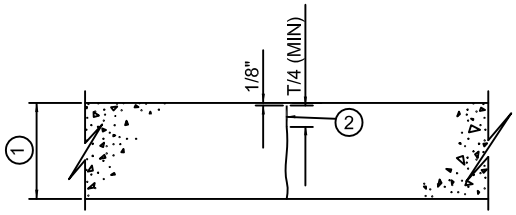
N.T.S.



CONTRACTION JOINTS SHALL BE PLACED EVERY 10 FEET OR AS DIRECTED BY THE ENGINEER.

ALTERNATE TRANSVERSE CONTRACTION JOINT

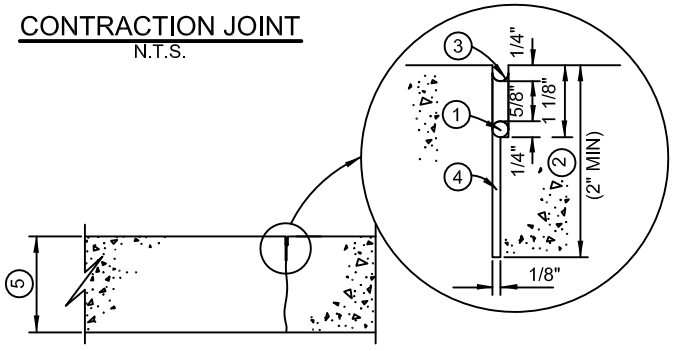
N.T.S.



NOTES:
1. (T) THICKNESS OF PAVEMENT, SEE TYPICAL PAVEMENT SECTION.
2. 20 MILL POLYURETHANE PLASTIC PARTING STRIP. SPLICE WITH ENDS BUTTED.

CONTRACTION JOINT

N.T.S.



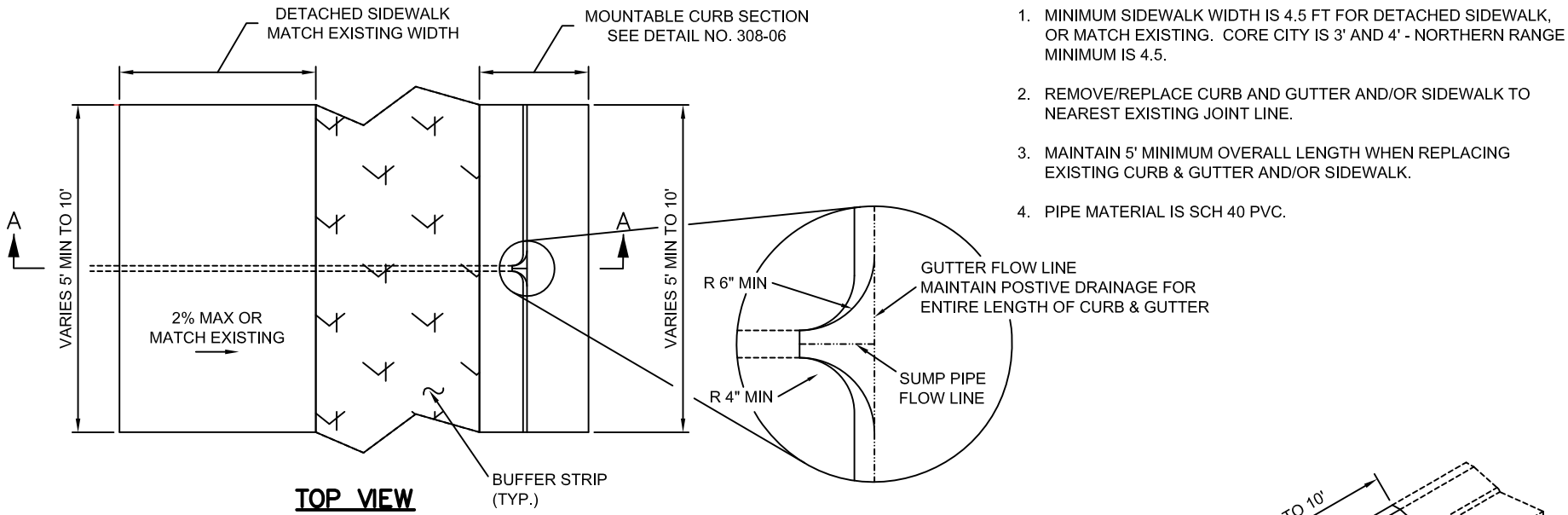
NOTES:
1. BACKER ROD OF OPEN OR CLOSED CELL POLYURETHANE STRAND AS APPROVED.
2. T/4+1/2" LONGITUDINAL,T/4 TRANSVERSE.
   MAY BE 1/4" SAWCUT FOR ITS FULL DEPTH WITH JOINT MATERIAL AND BACKER ROD AT SAME DEPTH.
3. POURED JOINT MATERIAL.
4. AIR
5. (T) THICKNESS OF PAVEMENT, SEE TYPICAL PAVEMENT SECTION.

COMMERCE CITY DEPARTMENT OF PUBLIC WORKS ENGINEERING CONSTRUCTION STANDARDS	APPROVAL: CITY ENGINEER 05-27-16 DATE	
CONTRACTION JOINT DETAILS	DETAIL NO. 308-09	

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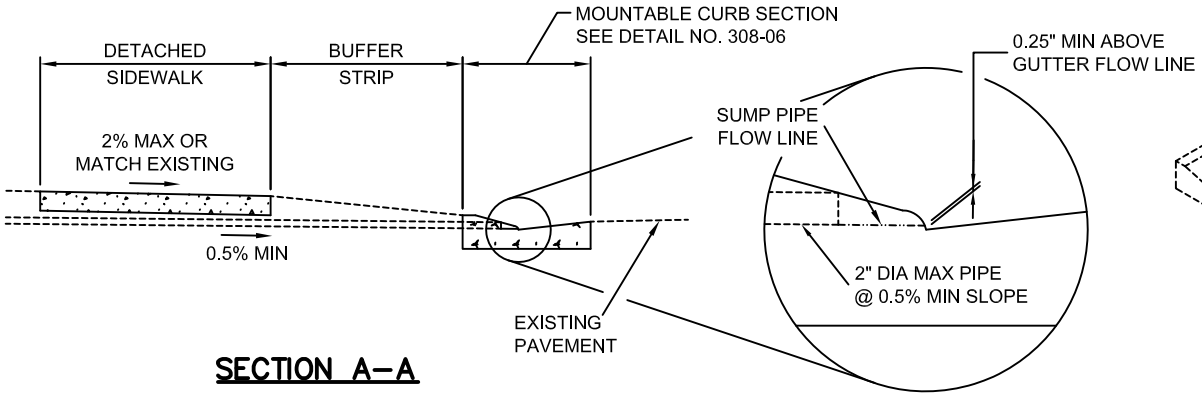
GENERAL NOTES

1. MINIMUM SIDEWALK WIDTH IS 4.5 FT FOR DETACHED SIDEWALK, OR MATCH EXISTING. CORE CITY IS 3' AND 4' - NORTHERN RANGE MINIMUM IS 4.5.
2. REMOVE/REPLACE CURB AND GUTTER AND/OR SIDEWALK TO NEAREST EXISTING JOINT LINE.
3. MAINTAIN 5' MINIMUM OVERALL LENGTH WHEN REPLACING EXISTING CURB & GUTTER AND/OR SIDEWALK.
4. PIPE MATERIAL IS SCH 40 PVC.



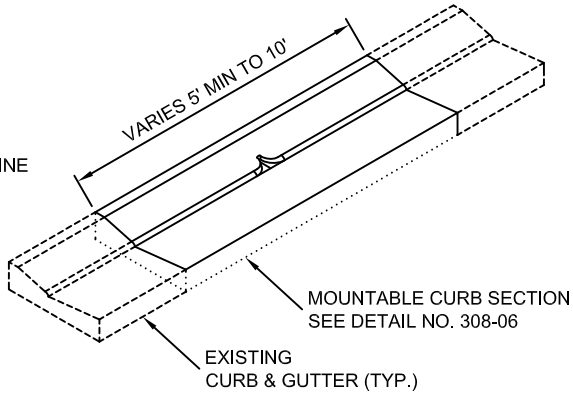
TOP VIEW

SHOWN WITH DETACHED SIDEWALK



SECTION A–A

SHOWN WITH DETACHED SIDEWALK



ISOMETRIC VIEW

SHOWN WITH MOUNTABLE CURB

COMMERCE CITY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING CONSTRUCTION STANDARDS

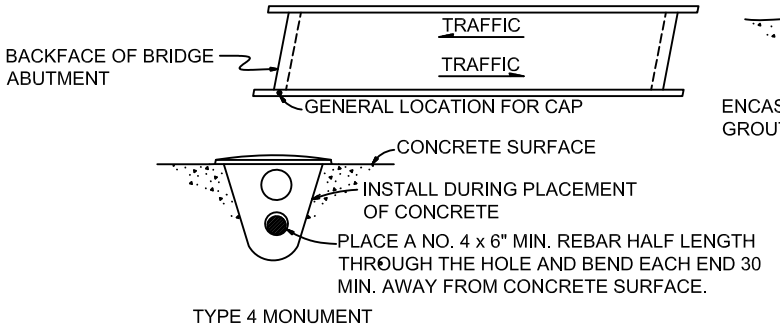
APPROVAL:

CITY ENGINEER — DATE: 05-27-16

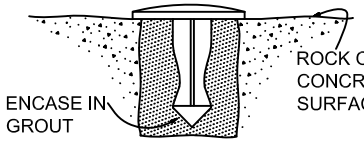
CURB DETAIL WITH SUMP PIPE

DETAIL NO.
308-10

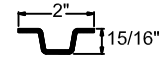
S:\Tranproj\100049520 - Commerce City Engineering Standards\Design\Drawings\Reference_Files\CCC DWGs\308-10 (Curb Detail with Sump Pipe).dwg



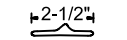
TYPE 4 MONUMENT



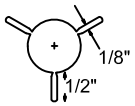
TYPE 5 MONUMENT



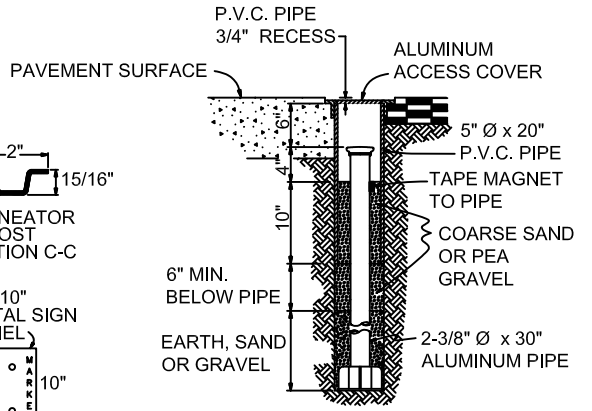
DELINEATOR POST SECTION C-C



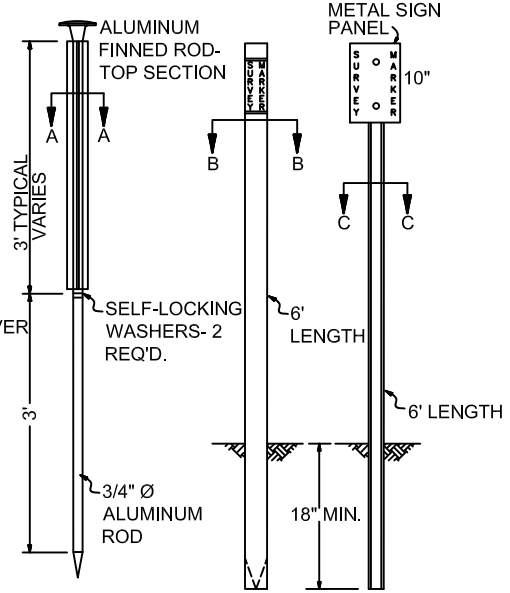
SECTION B-B



SECTION A-A

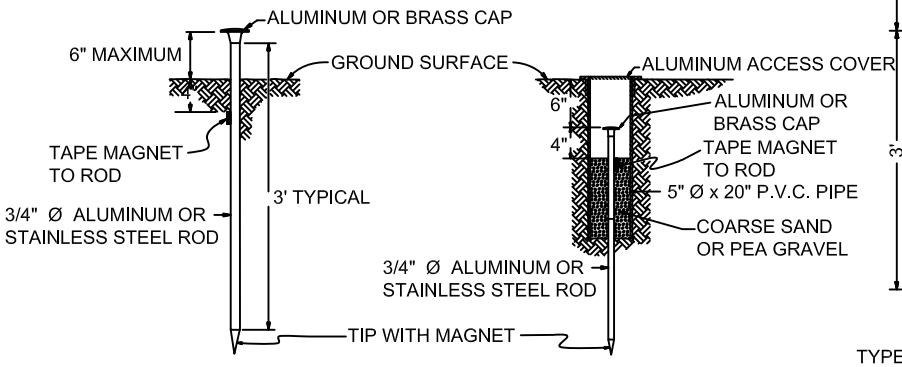


TYPE 3A MONUMENT, ROADWAY INSTALLATION



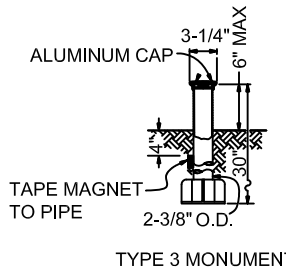
TYPE 2 MONUMENT

WITNESS POSTS



TYPE 1 MONUMENT

TYPE 1A MONUMENT & TYPE 2A MONUMENT INCLUDES MONUMENT BOX



TYPE 3 MONUMENT

DIMENSIONS ARE INCHES (") UNLESS OTHERWISE NOTED.

COMMERCE CITY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING CONSTRUCTION STANDARDS

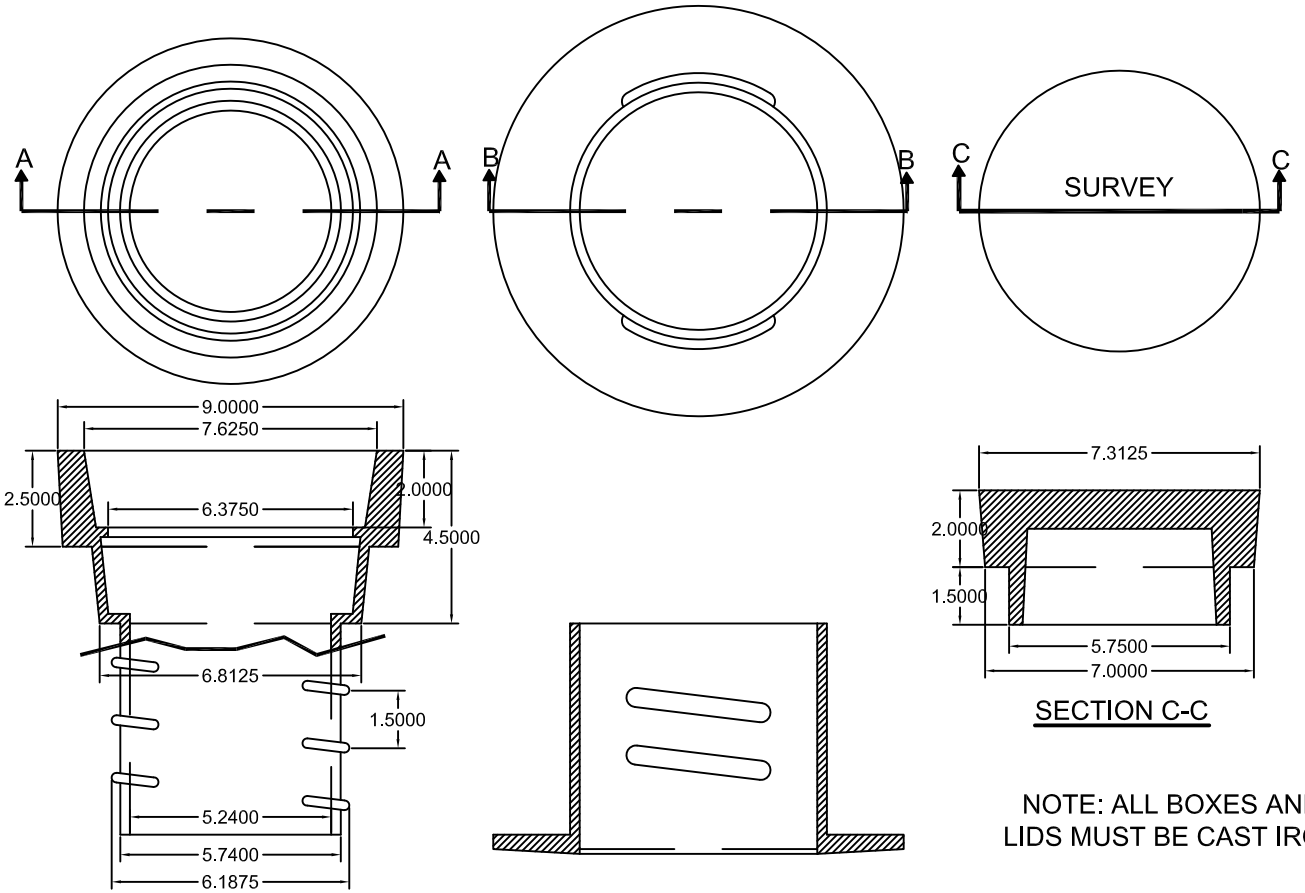
APPROVAL:

CITY ENGINEER — DATE: 05-27-16

SURVEY MONUMENTS

DETAIL NO.
311-01

S:\Tranproj\100049520 - Commerce City Engineering Standards\Design\Drawings\Reference_Files\CCC DWGs\311-01 (Survey Monuments).dwg



SECTION A-A

SECTION B-B

SECTION C-C

NOTE: ALL BOXES AND
LIDS MUST BE CAST IRON

COMMERCE CITY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING CONSTRUCTION STANDARDS

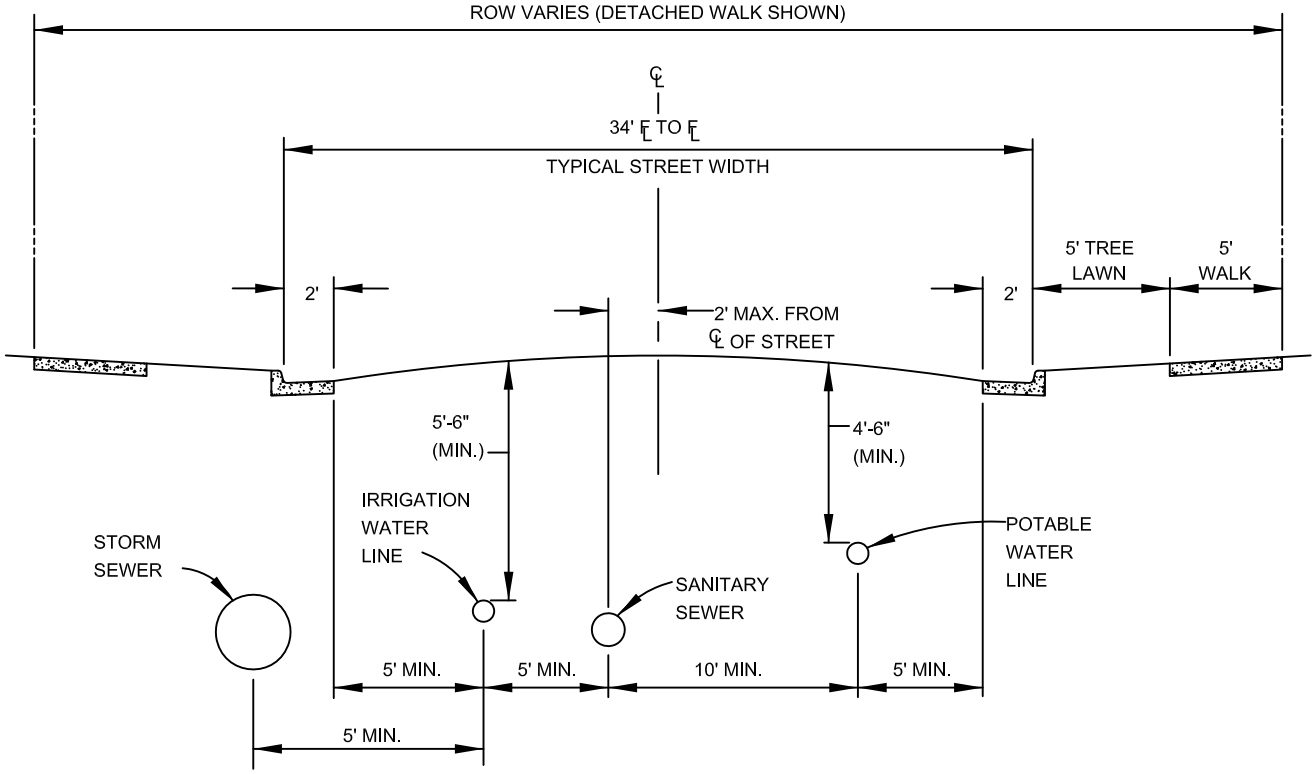
APPROVAL:

CITY ENGINEER — DATE: 05-27-16

SCREW TYPE ADJUSTABLE MONUMENT BOX

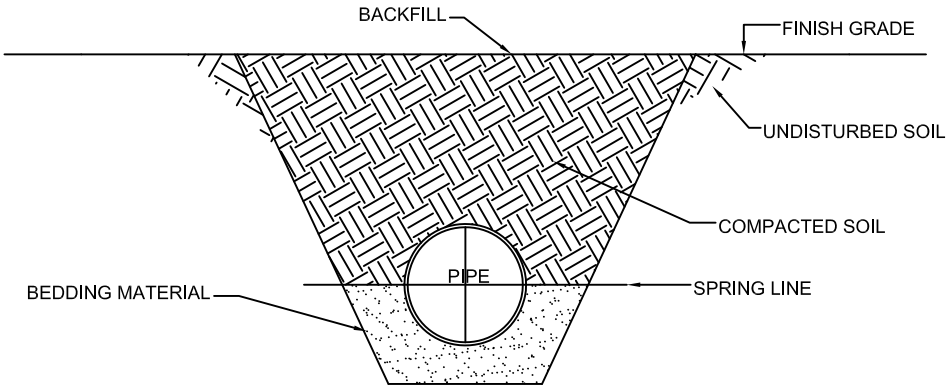
DETAIL NO.
311-02

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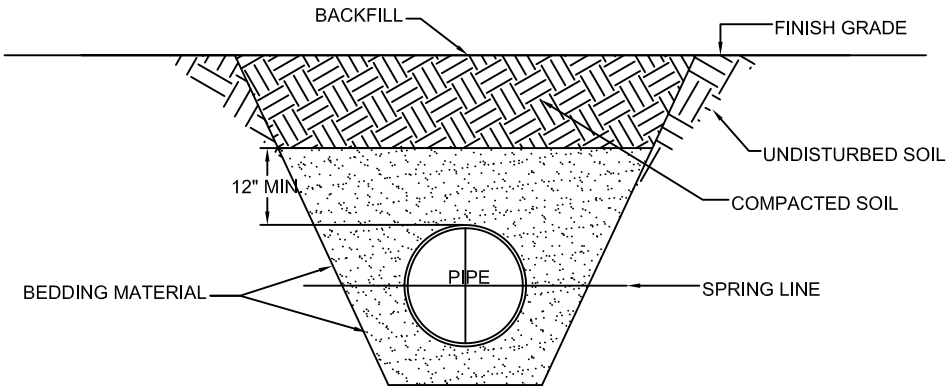


COMMERCE CITY DEPARTMENT OF PUBLIC WORKS ENGINEERING CONSTRUCTION STANDARDS	APPROVAL: CITY ENGINEER 05-27-16 DATE
TYPICAL UTILITY LOCATIONS	DETAIL NO. 312-01

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REINFORCED CONCRETE PIPE



P.V.C PIPE & DUCTILE IRON PIPE

NOTE:

FOR SOILS WITH 50% OR MORE BY WEIGHT RETAINED ON THE #40 SIEVE
BEDDING SHALL BE CDOT CLASS A FILTER MATERIAL (ASTM C-33 NO. 67 AGGREGATE GRADATION) OR EQUIVALENT
FOR SOILS WITH LESS THAN 50% BY WEIGHT RETAINED ON THE #40 SIEVE
BEDDING SHALL BE CDOT CONCRETE SAND, AASHTO M6 BEDDING, OR EQUIVALENT

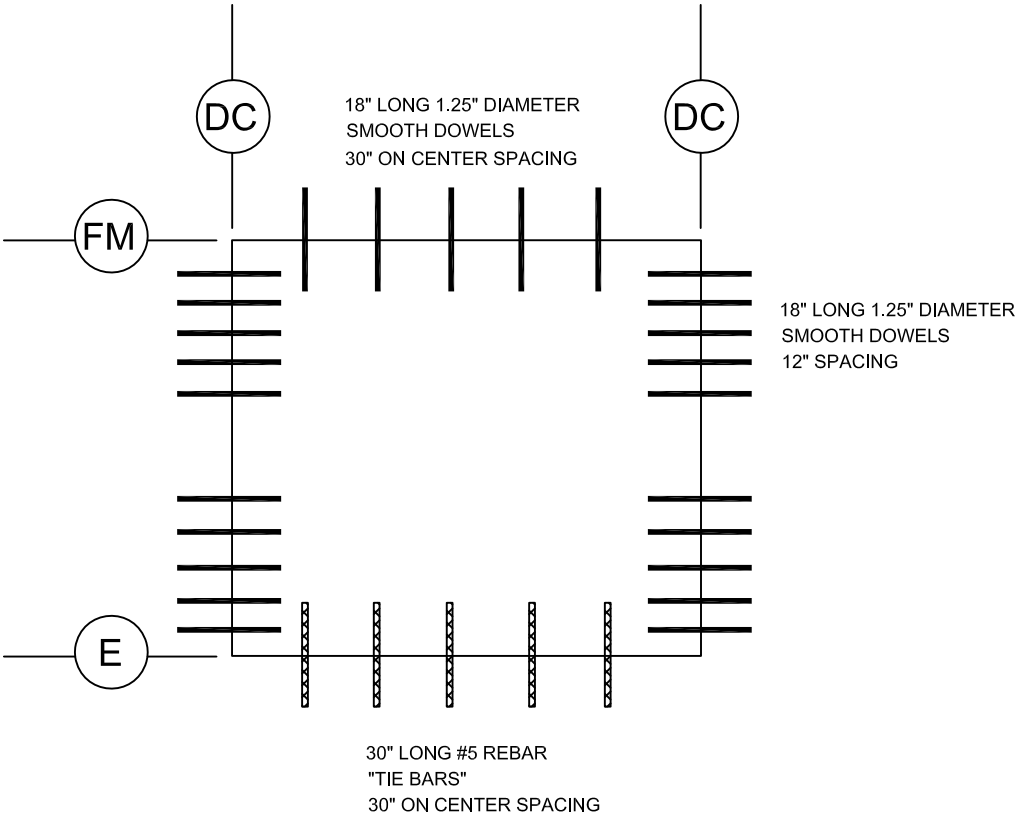
COMMERCE CITY DEPARTMENT OF PUBLIC WORKS ENGINEERING CONSTRUCTION STANDARDS	APPROVAL: CITY ENGINEER 05-27-16 DATE
PIPE STABILIZATION	DETAIL NO. 312-02

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FM DOWELED LONGITUDINAL CONSTRUCTION JOINT

DC DOWELED TRANSVERSE CONTRACTION JOINT
CDOT DETAIL M-412-1

E LONGITUDINAL CONTRACTION OR CONSTRUCTION JOINT
CDOT DETAIL M-412-1



TRAFFIC DIRECTION

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COMMERCE CITY DEPARTMENT OF PUBLIC WORKS ENGINEERING CONSTRUCTION STANDARDS	APPROVAL: CITY ENGINEER 05-27-16 DATE
CONCRETE PANEL REPLACEMENT	DETAIL NO. 399-01

4.00 PAVEMENT DESIGN

4.01 GENERAL

4.02 MIX DESIGN CRITERIA FOR FLEXIBLE PAVEMENTS

4.03 PAVEMENT DESIGN REPORT
- 4.03.1 SUBGRADE INVESTIGATION
- 4.03.2 PAVEMENT DESIGN REPORT REQUIREMENTS
- 4.03.3 FLEXIBLE PAVEMENT DESIGN PROCEDURE
- 4.03.4 EQUIVALENT DAILY LOAD APPLICATION
- 4.03.5 FLEXIBLE PAVEMENT STRENGTH COEFFICIENTS
- 4.03.6 MINIMUM PAVEMENT SECTIONS

4.04 MATERIALS SPECIFICATIONS
- 4.04.1 BASE COURSE
- 4.04.2 HOT BITUMINOUS PAVEMENT
- 4.04.3 CONCRETE PAVEMENT
- 4.04.4 TESTING

4.05 INITIAL STREET ACCEPTANCE

4.06 FINAL STREET ACCEPTANCE

4.00 PAVEMENT DESIGN

4.01 GENERAL

This Section contains minimum criteria to be met on all newly designed and constructed, resurfaced, or widened public and private (open to the general public) streets and parking lots in the City.

4.02 MIX DESIGN CRITERIA FOR FLEXIBLE PAVEMENTS

All designs are to be based upon Colorado Department of Transportation, AASHTO, and Superpave methodology. The Contractor shall submit a proposed design job mix for each mixture required. The design shall be determined using Colorado Procedure CP-L 5115 for the Superpave Method of Mixture Design. Additional guidance is provided in Superpave Level 1 Mix Design SP-2 published by the Asphalt Institute. Some standardization of criteria has been made in the design procedures for Commerce City.

4.03 PAVEMENT DESIGN REPORT

Flexible pavement design shall be based on a soils report signed and stamped by a Professional Engineer who is licensed in Colorado.

4.03.1 SUBGRADE INVESTIGATION

A. Field Investigation

The geotechnical investigation shall consist of borings or other suitable methods of sampling subgrade soils to a depth of at least five (5) feet below proposed subgrade elevation, at spacings of no more than two hundred fifty (250) feet unless otherwise accepted by the City Engineer. Samples shall be taken after grading is completed and subgrade is rough cut.

B. Classification Testing

Subgrade samples shall be tested to determine liquid limit, plastic limit, plasticity index, and the percentage passing the US Standard No. 200 sieve. Samples of sands and gravels may require gradation analysis for classification determination. These data shall be determined using the following methods:

1. Liquid Limit - AASHTO T 89
2. Plastic Limit - AASHTO T 90
3. Percent Passing No. 200 - AASHTO T II

4. Gradation - AASHTO T 27
5. Swell/Consolidation Testing (Denver Swell Method) where appropriate, under a 200 psf surcharge

The results of these tests shall be used to calculate the AASHTO Classification and Group Index using AASHTO M 145.

C. Subgrade Support Testing

Soil samples shall be taken at the proposed subgrade elevation and shall represent the soil of the subgrade. Individual subgrade samples shall be tested to determine the subgrade support value (R-value) using Hveem Stabilometer testing. These values shall be used in the design of pavement sections in accordance with the procedures outlined below.

R-value Tests - Hveem Stabilometer tests shall be conducted in accordance with AASHTO T 190. The design R-value shall be a three hundred (300) psi exudation pressure. The reported data shall consist of:

1. Dry density and moisture content for each sample.
2. Expansion pressure for each sample.
3. Exudation Pressure - corrected R-value curve showing the 300 psi design R-value.

Resilient Modulus of subgrade soils should be determined by either direct measurement or by representative correlation to the R-value. Typically, the results of the R-value are correlated to a Resilient Modulus value. However, due to the variability in these correlations, subjecting representative samples of the subgrade to the actual Resilient Modulus testing is the most accurate way to determine soil support characteristics for use in pavement design. Therefore, the use of Resilient Modulus testing is both highly encouraged and preferred.

4.03.2 PAVEMENT DESIGN REPORT REQUIREMENTS

A. Sketch Plan with location and depth of test holes(minimum depth is 60 inches);
B. Ground water elevations, if encountered;
C. Grading analysis curves;
D. Atterberg limits;
E. AASHTO soil classification;
F. Moisture-density curves (Proctor values);
G. Depth of bore holes or test pits;
H. Approximate location or limits of different soil types on the sketch plan;

I. Pavement design recommendations with all supporting data and calculations.

In addition, the Geotechnical Engineer shall investigate and recommend solutions to the following problems, if encountered during the investigation:

1. Expansive clay soils including recommendations for any overexcavation and moisture-density replacement where deemed appropriate;
2. Frost heave in silty soils;
3. Potential ground water problems or instability;
4. Any other matters which may adversely affect the design life of the pavement.

TABLE 4-1--PAVEMENT DESIGN REPORT CHECK LIST

Subdivision				Date
Filing				Submittal Number
Consultant		Acceptable?		Reviewed By
		Yes	No	Comments
A.	PLAN SHEET FORMAT			
1	Vicinity Map			
2	Drawing(s) Showing:			
3	Location of Borings			
4	Depth of Borings			
5	Soil Type Locations and Limits			
6	EDLA Locations and Limits			
7	Potential Problem Locations			
B	PAVEMENTDESIGN REQUIREMENTS			
1	Atterberg Limits			
2	Percent Passing 200 Sieve			
3	Correct Soil Classifications			
4	Resilient Modulus Determination			
5	Swell/Consolidation Test (Denver Swell) Performed Under a 200 psf Surcharge			
6	Correct EDLA			
7	Design Calculations for Each Pavement Section			
8	Correct Design Coefficients			
9	Minimum Pavement Sections for Street Classifications			
10	Special Problems Addressed:			
11	Expansion			
12	Frost Heave			
13	Groundwater			
14	If Swell Test is greater than 2%, Are the Proposed Mitigation Measures Acceptable?			
C	CONSULTANT SIGN-OFF "I have reviewed the attached report with this checklist and all the required items have been included except as noted above."			_____ Professional Engineer

4.03.3 FLEXIBLE PAVEMENT DESIGN PROCEDURE

Determine the Structural Number (SN) using the following procedure:

A. Determine the roadway classification and the corresponding EDLA (Table 4-2)
B. Determine the Serviceability Index (SI) of the roadway classification (Table 4-3)
C. Determine the Reliability Index (RI) of the roadway classification (Table 4-3)
D. For the case where the variance of projected future traffic is not considered, use the AASHTO Design Guide recommended value of 0.44. In situations where the variance of projected future traffic is considered, use 0.49.
E. Use the AASHTO Design Equations to determine the SN, using the subgrade Resilient Modulus values from the laboratory test results. Indicate method or correlation used to determine Resilient Modulus (M_r) value(s).
F. Determine minimum pavement section using the strength coefficients from Table 4-4.
    a. Total thickness selected cannot be less than the minimum specified in Table 4-5 for the roadway classification.
    b. All pavement section calculations shall be rounded up to the nearest 0.5-inch increment.

4.03.4 EQUIVALENT DAILY LOAD APPLICATION (EDLA)

The design traffic number (DTN) is defined as the equivalent daily load application (DTN = EDLA) for the design lane during a design period. The design period is a minimum of 20 years. A load application is a single axle load of 18,000 pounds. Minimum EDLA's are listed in Table 4-2. All subdivision, zoning, and other site developments shall provide a Traffic Impact Study using the ITE Information Manual and Report to determine the projected traffic volumes and truck traffic for the proposed streets within or adjacent to the proposed development.

When possible, the traffic impact study should identify the number of "Truck" types per day utilizing a listing similar to that as presented in the Metropolitan Government Pavement Engineers Council Design Standards(MGPEC).

TABLE 4-2--MINIMUM EQUIVALENT DAILY LOAD APPLICATION

(EDLA VALUES) (18 KIP)				
	Residential	Multi-Family Residential	Commercial & Business	Industrial
Local Streets & Alleys				
(Cul-de-sacs)				
10 or less D.U.*	5	5		
11 to 80 D.U.*	10	10		
All Others	20	20	30	100
Collectors				
Minor	50	50	75	125
Major	130	130	130	130
Arterials				
Minor	225	225	225	225
Principal	250-300	250-300	250-300	250-300

Notes:
1. The values for the local streets should be treated as base values and increased by 0.3 for each undeveloped lot as a New Construction Factor to account for the significant loading that occurs during new construction.
2. Higher EDLA values may be increased if traffic conditions warrant such an increase upon traffic projections and truck traffic.
3. When different land uses occur along a street, the higher category of use shall apply.
4. EDLA values for major arterial roadways shall be set on a case-by-case basis; two hundred fifty (250) is the minimum for planning purposes.

*D.U. = Dwelling Units

Table 4-3 contains the standard values of the Serviceability Index (SI) and Reliability Index (RI) for various roadways. These values are required in the determination of the Structural Number (SN).

TABLE 4-3--SERVICEABILITY INDEX (SI) AND RELIABILITY INDEX (RI)

Roadway Designation	Serviceability Index (SI)	Reliability Index (RI)
Arterials – All Categories	2.5	90
Major Collector, Commercial, Business, and Industrial Locals	2.5	85
Minor Collector – Residential	2.0	85
Local – Residential and Alleys	2.0	75

4.03.5 FLEXIBLE PAVEMENT STRENGTH COEFIECIENTS

Table 4-4 contains the standard design coefficients for various pavement materials. Non-standard design coefficients may only be used if approved by the City Engineer.

TABLE 4-4--STRENGTH COEFFICIENTS

Strength Coefficients	
Component	Coefficient
Hot Bituminous Pavement (HBP)	0.40
Existing Bituminous Pavement** (<9 years old)	0.30
Existing Bituminous Pavement** (9-15 years old)	0.25
Existing Bituminous Pavement** (>15 years old)	0.20
Plant Mix Bituminous Base	0.30
Aggregate Base Course (Class 6)	0.12
Existing Aggregate Base Course (R 75+)	0.10
Emulsified Asphalt Treated Base	0.15
Concrete (3500 psi minimum)	0.50
Treated Materials Cement Treated Aggregate Base (7 day 650-1000 psi)	0.23
Lime Treated Subgrade (5 day accelerated cure in moist oven, 100°F, 160 psi, PI <6)	0.11

**The structural (strength or Resilient Modulus) coefficient of existing pavement shall be determined utilizing the Falling Weight Deflectometer (FWD) or an actual laboratory Resilient Modulus test results, in cases where overlay design is being considered.

4.03.6 MINIMUM PAVEMENT SECTIONS

Table 4-5 provides the minimum acceptable pavement sections for each roadway classification. These pavement sections may be used for public improvements cost estimate requirements for developer agreements. Final pavement designs must be based on actual subgrade testing and geotechnical analysis.

TABLE 4-5--MINIMUM PAVEMENT SECTIONS

Roadway Classification	Full Depth Asphalt (inches)	Asphalt + Base (inches)	Portland Cement Concrete (inches)
Parking Lots	5.0	3.0 + 6.0	4.5
Local Streets, Alleys and Private Streets	6.0	Allowed*	5.5
Minor Collectors (Residential)	6.5	Allowed*	6.0
Minor Collectors (Commercial)	7.0	Allowed*	6.5
Major Collectors	7.0	Allowed*	6.5
Minor Arterials	7.5	Allowed*	7.0
Major Arterials	8.0	Allowed*	7.5

*Per approved pavement design report

Using the strength coefficients from Table 4-4, calculate the thickness of the various pavement layers by the following formula for Structural Number (SN). Note that minimum pavement sections govern if lighter sections are calculated. (See 4.03.6 above, composite sections are not allowed except for private streets and parking lots)

$SN = a_1(D_1) + a_2(D_1) = \ldots$

a_1, a_2 = strength coefficients (Table 4.4)

D_1, D_2 = thickness of pavement layers in inches

Example: For a trial calculation to meet or exceed the nomograph determined SN, try a three inch thickness of HBP placed on six inches of compacted Class 6 road base, the SN = (0.40)(3) + (0.12)(6); SN = 1.92. If, in the AASHTO equation determined solution for Structural Number, that number was greater than the 1.92 SN calculated, then other trial formula calculations must be performed.
Several types of computer software have been developed for use in solving the AASHTO pavement design equations. Utilization of this software is acceptable.

4.04 MATERIALS SPECIFICATIONS

The intent of this section is to specify the materials to be used for construction, overlaying, seal coating, and pavement rejuvenating of streets, parking lots, walks, and other miscellaneous work requiring the use of aggregates. All materials and workmanship shall be in accordance with the requirements of these Standards and Specifications and in

conformance with the lines, grades, depths, and cross sections shown on the approved plans, or as directed by the City Engineer.

4.04.1 BASE COURSE

This item consists of the foundation course composed of crushed gravel or crushed stone and filler, constructed on the prepared subgrade or subbase course. Materials and construction shall be in accordance with the requirements of the CDOT 1999 or current Standard Specifications for Road and Bridge Construction, or latest revisions, hereinafter referred to as CDOT Standard Specifications. Gradation shall be Class 5 (1-1/2" maximum) or Class 6 (3/4" maximum).

The base course material shall be placed on the previously prepared subgrade at the locations and in the proper quantities to conform to the typical cross sections as shown on the plans and as directed by the City Engineer. The material shall be placed without segregation. Any segregated areas shall be removed and replaced with uniformly graded material at the responsible party's expense.

The base material may be placed in lifts up to six (6) inches, providing that after compaction, uniform density is obtained throughout the entire depth of the lift. If the required depth exceeds six (6) inches, it shall be placed in two (2) or more lifts of approximate equal thickness.

Base material shall not be placed on a foundation that is soft, spongy, frozen, or one that is covered by ice or snow. Base material shall not be placed on a dry or dusty foundation where the existing conditions would cause rapid dissipation of moisture from the base material and hinder or preclude its proper compaction. Such dry foundations shall have water applied to them and shall be reworked and recompacted.

Rolling shall be continuous until the base material has been compacted thoroughly in accordance with Section 304 of the CDOT Standard Specifications. Water shall be uniformly applied as needed during compaction to obtain optimum moisture content and to aid in consolidation. The surface of each layer shall be maintained during the compaction operation in such a manner that a uniform texture is produced and the aggregates are firmly placed.

The finished base course surface shall be smooth and free of ruts and irregularities, and shall be true to grade and crown as shown on the plans, or as directed by the City Engineer. The base course shall be maintained in this condition by watering, drying, rolling, or blading, or as the City Engineer may direct until the surfacing is placed.

4.04.2 HOT BITUMINOUS PAVEMENT

All pavement shall be hot bituminous pavement of the plant mix type unless otherwise approved in writing by the City Engineer. Materials and construction shall be in accordance with the CDOT Standard Specifications, Section 403, and the following requirements:

1. The asphalt cement shall have a performance grade (PG) of 76-28 or 58-28. The content of the asphalt cement shall be as determined by the mix design.
2. The gradation of the mineral aggregate shall be grading SG (1-1/2 inch maximum) for the lower lifts of construction for new street construction. The top lift shall be grading S (3/4-inch maximum).
3. The mix shall conform to the job mix formula specified by the City Engineer for the pit supplied materials, if a current job mix formula is available, and shall meet the requirements as shown in Tables 4-6, 4-6a, and 4-7. A copy of the mix formula shall be submitted to the City Engineer for review and approval at least seven (7) days prior to starting paving work.
4. The use of the automatic control system specified in the Standard Specifications, Section 401, Paragraph 401.10, "Bituminous Pavers", shall not be required. A "Box Paver" shall not be allowed without a written request, submitted and approved by the City Engineer. The request must stipulate all conditions and limitations.

TABLE 4-6--SUPERPAVE MIXTURE PROPERTIES

Roadway Classification	Residential (Parking Lot)	Minor Collector	Major Collector	Minor Arterial	Principal Arterial		Industrial	Commercial
Traffic Level	1	2	3	3	4	5	5	5
Traffic Loading **Total 18 Kip ESALs Over Design Life (Usually 20 Years)**	Less than 300,000	300,000 - 1,000,000	1,000,000 to 3,000,000	1,000,000 to 3,000,000	3.0 to 10.0 million	> 10.0 million	> 10.0 million	> 10.0 million
Design Gyrations N_{design} (Air Void: See Note 1, and Table 4.6a)	75	75	75	75	100	100	100	100
Max Gyrations N_{max} (Air Void > 2.0%)	104	117	134	134	152	174	174	174
Hveem Stability (100 mm Plugs) See Note 2 (minimums)	28	28	28	28	30	30	30	30
Voids filled with Asphalt, %, MS-2	65-80	65-80	65-80	65-80	65-75	65-75	65-75	65-75
Lottman, Tensile Strength Ratio, % Retained, CP-L 5109, Method B	80 Min.	80 Min.	80 Min.	80 Min.	80 Min.	80 Min.	80 Min.	80 Min.
Lottman, CP-L 5109 **Dry Tensile Strength**, Min. psi	30 Min.	30 Min.	30 Min.	30 Min.	30 Min.	30 Min.	30 Min.	30 Min.
Asphalt Binder	PG 58-28		PG 76-28					

Note 1: ->Air Void of production mixes to be within 1.0 percent of design mix Air Void at optimum Asphalt Content, Air Void determination for N_{design} should be made from samples compacted at N_{design}.
->Maximum Theoretical Specific Gravity of mix by CP-51.

Note 2: Further investigation or corrective action is required where production stability is below the mix design stability.

TABLE 4-6a--MINIMUM VMA REQUIREMENTS

	Design Air Voids [2]		
Nominal Maximum Size[1] mm (in)	**3.5%**	**4.0%**	**4.0 – 5.0%**
37.5 (1-1/2)	11.5	12.0	12.5
25.0 (1)	12.5	13.0	13.5
19.0 (3/4)	13.5	14.0	14.5
12.5 (1/2)	14.5	15.0	15.5
9.5 (3/8)	15.5	16.0	16.5

[1] The Nominal Maximum size is defined as one size larger than the first sieve to retain more than 10%.
[2] Interpolate specified VMA values for design air voids between those listed.

TABLE 4-7--PROPERTIES OF SUPERPAVE PERFORMANCE GRADED BINDERS

Property	PG 58-28	PG 76-28
Traffic Level	1 or 2	3 to 5
Flash Point Temperature, °C AASHTO T 48	230 Min.	230 Min.
Viscosity at 135 °C, Pas, ASTM D 4402	3 Max.	3 Max.
Dynamic Shear, Temperature °C, where C/Sin δ @ 10 rad/sec. $\geq$1.00 Kpa, AASHTO TP 5	58	76
Rolling Thin Film Over Residue Properties, AASHTO T 240		
Mass Loss, %, AASHTO T 240	1.00 Max.	1.00 Max.
Dynamic Shear, Temperature °C, where G/Sin δ @ 10 rad/sec. $\geq$2.20 Kpa, AASHTO TP 5	58	76
Elastic Recovery[1], 25°C, % Min.	N/A	50 Min.
Pressure Aging Vessel Residue Properties, Aging Temperature 100° C AASHTO PP1		
Dynamic Shear, Temperature °C, where G/Sin δ @ 10 rad/sec. $\leq$ 5,000 Kpa, AASHTO TP 5	28	28
Creep Stiffness, @60 sec. Test Temperature in °C, AASHTO TP 1	-12	-18
S, Mpa, AASHTO TP 1	300 Min.	300 Min.
m-value, AASHTO TP 1	0.300 Max.	0.300 Max.
Direct Tension Temperature in °C, @1.0 mm/min., Where Failure Strain > 1.0 %, AASHTO TP 3	-12	-18

4.04.3 CONCRETE PAVEMENT

All concrete pavement materials and construction shall be in accordance with the current CDOT Standards Specifications for Road and Bridge Construction Manual. Concrete pavement is only allowed on arterial roadways.

4.04.4 TESTING

A. Proof Rolling

Proof rolling shall be required to determine whether certain areas of subgrade meet compaction requirements. Proof rolling shall be carried out with a pneumatic-tired water truck/similar vehicle loaded to a minimum of 36,000 pounds within 8 to 10 hours prior to paving.

Areas of subgrade that are found to be weak and/or fail the proof roll shall be investigated, and a determination shall be made to solve the failure condition by the contractor or his consultant. The area of failure shall be brought up to the requirements for density and moisture prior to paving.

B. Materials and Methods Testing

Determination of the effect of water on the cohesion of the bituminous mixture shall be made in accordance with AASHTO TO-165. Retained strength shall be a minimum of seventy-five (75). The use of "anti-stripping" admixture to improve the retained strength characteristics shall be permitted only by written permission of the City Engineer.
All commercial testing and laboratory work necessary to establish the job mix formula, and all testing necessary to assure conformance of materials and workmanship to the requirements of the specifications throughout the construction period, shall be performed at the responsible party's expense. Two (2) copies of all test reports shall be submitted directly to the City Engineer.

4.05 INITIAL STREET ACCEPTANCE

A pavement evaluation shall be performed in accordance with good engineering practices prior to initial acceptance. The report shall evaluate the existing condition of the base and binder course by performance of deflection tests utilizing a Falling Weight Deflectometer at one hundred (100) foot spacing per traffic lane. The report shall determine whether or not the pavement section will develop a twenty (20) year design life or greater. (Deflection testing that is done between November 1 and April 1 will not be accepted).

If the pavement section is not projected to meet a design life of twenty (20) years or more based on the deflection test results, a detailed report outlining the deficiencies, and/or causes for the deficiencies shall be developed. In addition, the report shall outline the projected design life and remedial measures to develop a twenty (20) year design life. The City Engineer shall evaluate the results of the report and inform the responsible party of the required pavement operation of the section.

4.06 FINAL STREET ACCEPTANCE

Non-destructive deflection testing (NDT) shall be conducted at the end of the warranty period on all streets. The testing shall be at two hundred (200) foot spacings per traffic lane. A report on test findings shall then be supplied to the City Engineer. (Deflection testing that is done between November 1 and April 1 will not be accepted).

5.00 TRAFFIC ENGINEERING DESIGN

5.01 GENERAL

5.02 TRAFFIC STUDIES

- 5.02.1 TRAFFIC STUDY FORMAT
- 5.02.2 TRAFFIC STUDY CHECKLIST

5.03 TRAFFIC CONTROL DEVICES

- 5.03.1 GENERAL
- 5.03.2 SIGNS
- 5.03.3 SIGN POSTS
- 5.03.4 STREET STRIPING

5.04 STREET LIGHTING

- 5.04.1 GENERAL
- 5.04.2 RESIDENTIAL STREET LIGHTING
- 5.04.3 ARTERIAL AND COLLECTOR STREET LIGHTING
- 5.04.4 FINAL ACCEPTANCE

5.00 TRAFFIC ENGINEERING DESIGN

5.01 GENERAL

The Traffic Engineering Design policies contained in these Standards and Specifications are aimed at ensuring consistent Traffic Engineering Design practices in new development or with redevelopment of land in Commerce City.

Failure to meet minimum standards creates deficiencies that may result in unnecessary capacity losses in the roadway network, safety, liability problems, or higher maintenance costs.

5.02 TRAFFIC STUDIES

Traffic studies may be required by the City in order to adequately assess the impact of a proposed development on the existing and/or planned street system. The developer shall have the primary responsibility for assessing the traffic impacts associated with a proposed development, subject to City review and approval.

The traffic study shall be prepared by a registered professional engineer. The City Engineer must approve all studies.

Traffic studies will be required in the following situations:

1. A rezoning application or for an application for annexation into the City.
2. A final plat if the property has already been rezoned for the proposed use and no traffic study was required for the rezoning.
3. Prior to issuance of a building permit, if the property has already been zoned/platted and no previous traffic study less than two years old exists.
4. Site access is required from a State Highway prior to issuing a building permit.
5. Additional access from a State Highway to an existing use is being requested.
6. Change of use affecting access from a State Highway.

The applicant will be required to submit a new traffic study if one of the following has occurred:

1. All previous traffic studies relating to the development are more than two years old, unless conditions are determined not to have changed significantly by the City Engineer.

2. After submitting the original traffic study, the land use intensity and traffic generation is increased by more than 15%.
3. Where access points are not defined or a site plan is not available at the time the traffic study is prepared, additional traffic analysis may be required when a site plan becomes available or the access points are defined.

5.02.1 TRAFFIC STUDY FORMAT

Traffic consultants are encouraged to discuss projects with the City prior to starting the study. Important issues to review include directional distribution of traffic, definition of the study area, intersections requiring critical lane analysis, and methods for projecting build-out volume. This should provide a firm base of cooperation and communication between the City, the owner or developer and their consultant in creating a traffic study that best addresses the issues and provides the most accurate description of existing and future conditions. Specific requirements will vary depending on the site location. However, all traffic studies shall contain at a minimum, the following information:

A. Introduction

1. Land Use, Site and Study Area Boundaries
   A brief description of the size of the land parcel, general terrain features, the location within the jurisdiction and the region should be included in this section. In addition, the roadways that afford access to the site, and are included in the study area, should be identified.

   The limits of the study area should be based on engineering judgment and an understanding of existing traffic conditions at the site. In all instances, however, the study area limits shall be mutually agreed upon by the developer, the developer's engineer, and City staff. A vicinity map that shows the site, in relation to the surrounding transportation system, should be included.

2. Existing and Proposed Site Uses
   The existing and proposed uses of the site should be identified in terms of the various zoning categories of the City. In addition, the specific use for which the request is made should be identified if known.

3. Existing and Proposed Uses in Vicinity of Site
   A complete description of the existing land uses in the vicinity of the site, as well as the current zoning and use, should be included.

The applicant should also state the proposed uses for vacant adjacent land in order that any proposed transitions in uses are identified. This latter item is especially important where large tracts of undeveloped land are in the vicinity of the site, and within the prescribed study area.

4. Existing and Proposed Roadways and Intersections
   Within the study area, the applicant must describe existing roadways and intersections (geometry and traffic signal control) and future improvements proposed by government agencies.

B. Existing and Projected Traffic Volume Scenarios

The following scenarios shall be analyzed to properly evaluate the effects of the site traffic on the study roadways and intersections:

1. Existing Year, Without Project (Background Traffic)
2. Project Opening Year(s), Without Project (Background Traffic)
3. Project Opening Year(s), With Project
4. Project Opening Year(s), With Project and Proposed Mitigation Improvements, if necessary
5. Horizon Year, Without Project (Background Traffic)
6. Horizon Year, With Project
7. Horizon Year, With Project and Proposed Mitigation, if necessary

The horizon year shall be approximately 20 years following construction of the proposed development, or as determined by the City Engineer.

Note: If portions of a development are scheduled to open in separate phases, a traffic scenario for each phase that is anticipated to open separated by more than 1 year from the previous phase shall be analyzed for each of the Project Opening Years as noted above.

C. Presentation of Data and Results

In general, tables and graphics should be included to aid in the presentation of information in the report. If data lends itself well to

a table or an exhibit, the data should be prepared in that format. At a minimum the tables and graphics listed below shall be included in the report.

Tables that present the following information shall be included:

1. Trip generation rates and calculations.
2. Level of service and delay results at each study intersection for each scenario shown in 5.02.1 B: Existing and Projected Traffic Volume Scenarios.

The following graphical exhibits shall be included:

1. Vicinity map.
2. Site map including proposed access locations and types (signalized, ¾ movement, right-in/right-out, etc.) with distances between adjacent accesses.
3. Proposed conceptual site plan.
4. Trip distribution at each study intersection for all study scenarios shown in 5.02.1 B: Existing and Projected Traffic Volume Scenarios in which the project is open.
5. Trip Assignment at each study intersection for all study scenarios shown in 5.02.1 B: Existing and Projected Traffic Volume Scenarios in which the project is open.
6. AM/PM peak hour turning volumes at each study intersection for each of the scenarios shown in 5.02.1 B: Existing and Projected Traffic Volume Scenarios.
7. ADT for streets adjacent to the development for each of the scenarios shown in 5.02.1 B: Existing and Projected Traffic Volume Scenarios.
8. Level Of Service for each study intersection for each of the scenarios shown in 5.02.1 B: Existing and Projected Traffic Volume Scenarios.

When possible, each graphic should follow its corresponding discussion in the report. If necessary, graphics may be inserted in the Appendix of the report.

Raw traffic count data (including hourly ADT and peak hour turning movements), analysis worksheets, and any additional support material shall be provided in the appendices of the traffic study.

Build-out projections shall include major vacant properties around the proposed development as defined by the City. The City will provide volume projections for background traffic growth, or a method for determining their volume will be recommended by the City.

All total daily traffic counts shall be actual traffic counts, and not be based on factored peak hour sampling. Latest available traffic counts from the Colorado Department of Transportation, the City, or other agencies may be acceptable if not more than two years old.

All traffic shall be assigned to existing and planned facilities in a manner consistent with existing traffic patterns and approved by the City.

D. Trip Generation and Design Hour Volumes

A summary table listing each type of land use, acreage, average trip generation rates used (total daily traffic and a.m./p.m. peaks), and resultant total trips generated should be provided.

Trip generation shall be calculated from the latest data contained within the Institute of Transportation Engineers' Trip Generation Guide. In the event that data is not available for the proposed land use, the City must approve estimated rates prior to acceptance.

Site design hour volumes approximating the peak hour volume used to determine public improvements shall be estimated by one of the following methods that are listed in order of preference:

1. Traffic volume counts for existing uses.
2. Peak hour trip generation rates as published in the ITE Trip Generation Guide.
3. By the formula:
   DHV=59.13 + (0.133 x AADT)
   Where: DHV=Estimated design hour volume
   AADT=Estimated annual average daily traffic.

E. Trip Distribution

The directional analysis for the site-generated traffic shall be presented in this section. The methods and assumptions used for this task shall be clearly stated.

F. Trip Assignment

This section shall describe the utilization of the study area roadways by site-generated traffic. The anticipated site traffic volume scenarios in Section B describe mainline and turning movement volumes for future conditions with the site developed as proposed. Internal trips in excess of 10% will require analytical support to demonstrate how the higher figures were derived. Non-generated passerby traffic reductions in generation volumes may

be considered if applicable. All estimates of trip distribution, assignment, and modal split are subject to review and approval by the City. It is suggested that City approval of the Trip Generation, Trip Distribution, and Trip Assignment be received prior to further analysis.

G. Critical Lane Capacity and Level of Service Analysis

A critical lane capacity analysis shall be conducted for the street intersections at driveways for the proposed development. Within the limits of the previously defined study area, capacity analysis shall also be conducted for any affected street intersections. The A.M., P.M., and any other possible peak period shall be tested to determine which will be analyzed. Pedestrian movements should also be considered in the evaluation. Capacity and level of service analyses shall be conducted for each of the volume scenarios listed in 5.02.1 B.

Level of service “D” shall be the design objective for each scenario. Levels of service are as defined in the latest edition of the Highway Capacity Manual.

H. Traffic Signals

The need for new traffic signals shall be evaluated using the warrants in the latest edition of the Manual on Uniform Traffic Control Devices. Traffic progression is of paramount importance. Generally, a spacing of one-half mile for all signalized intersections should be maintained. This spacing is used to achieve optimum signal progression, travel speed, and capacity.

To provide flexibility for existing conditions and to ensure optimum two-way signal progression, an approved traffic engineering report is required to ensure proper location of all access approaches that may require signalization. An optimum two-way progression pattern will be established between two public intersections that bracket the proposed approach as approved by the City Engineer. These bracketing intersections should be approximately one mile apart, and be considered acceptable, existing, or possible future signal locations.

The progression pattern calculation shall use a cycle length between 60 and 120 seconds, and a travel speed equal to the existing posted speed limit or the proposed posted speed limits as defined in Table 3-7. A minimum efficiency of 30% shall be

achieved. Efficiency for each direction of travel shall be defined with the following formula:

$$e = \frac{BW}{C} \times 100$$

Where: e = Efficiency (%)
BW = Bandwidth in that direction (seconds)
C = Cycle Length (seconds)

Where intersections have no signals presently, but are expected to have signals, a 60% mainline, 40% cross street cycle split should be assumed, unless projected traffic volumes dictate otherwise. The green time allowed to the cross street shall be considered no less than the time that is required for a pedestrian to cross the mainline at four feet per second. Those intersections, which would reduce the progression efficiency to below 30% if a traffic signal were installed, shall remain unsignalized and have turning movements limited by driveway design or median islands.

I. Traffic Accidents

Traffic accident data for affected street corridors may be required for the study. The study period shall be approximately three years. Where this is necessary, estimates of increased or decreased accident potential shall be evaluated for the development. If the proposed development might negatively impact existing traffic safety in the study area, then recommended mitigations to improve safety shall be required.

J. Reciprocal Parking

Traffic studies for planning applications where reciprocal parking is contemplated will be required to include parking accumulation studies for existing facilities similar to the proposed and surrounding uses with which parking is being reciprocated.

K. Recommendations

In the event that the analysis indicates unsatisfactory levels of service (LOS D or less) for the study area roadways, a description of proposed improvements to mitigate deficiencies shall be included. Mitigations should maintain an acceptable level of service in the horizon year. If projected background conditions for the horizon year are already less than LOS C, the engineer preparing the report shall contact the city for direction as to what LOS the

roadway should be mitigated. These mitigations could include projects by the City or CDOT for which funds have been appropriated and obligated. The use of all future roads in an analysis will require approval from the City. In general, the recommendation section should include:

1. Proposed Recommended Improvements - The location, nature, and extent of proposed improvements are to ensure sufficient roadway capacity. Accompanying the list of improvements are preliminary cost estimates, source of funding, timing, and likelihood of implementation. Depending upon the problems that exist, possible improvements might include:
   a. Noise Attenuation – If a residential development is planned adjacent to a freeway or arterial roadway, the need for noise attenuation measures shall be assessed as part of the impact analysis.
   b. Joint Access – Joint access shall be considered when a proposed new access will not meet the spacing requirements set fourth in Table 3.4.
   c. Speed Change Lanes – Speed change lanes for both left turns in and out, as well as right turns in and out, shall be considered when traffic volumes and speeds dictate.
   d. Access Turn Restrictions – Right-in and right-out access or three-quarter movement restrictions at the proposed access where high accident rates, sight distance concerns, inadequate gaps, or long delays are found.

2. Volume/Capacity Analysis at Critical Points - Another iteration of the volume/capacity analysis shall be described, which demonstrates the anticipated results of making these improvements.

3. Levels of Service at Critical Points - As a result of the reviewed volume/capacity analysis presented in the previous section, levels of service for the highway system with improvements shall be presented.

L. Conclusion

The last chapter of the report must be a clear, concise description of the study findings. It is anticipated that the concluding chapter will serve as an executive summary.

5.02.2 TRAFFIC STUDY CHECKLIST

Subdivision	Date
Filing	Submittal Number
Consultant	Reviewed By

REQUIRED DISCUSSIONS

	Acceptable? Yes	No	Comments
INTRODUCTION			
Existing & proposed site uses			
Existing & proposed uses in vicinity of site			
Existing & proposed roadways and intersections (Map provided)			
Original & revision dates			
Dated, checked, sealed, and signature of P.E.			
TRIP GENERATION AND DESIGN HOUR VOLUMES			
Background growth rate – state assumptions			
Justification for reduction in trips due to internal circulation			
Justification for pass-by trips			
TRAFFIC SIGNAL ANALYSIS, WARRANT & PROGRESSION ANALYSIS WITH EXISTING AND PROPOSED SIGNAL LOCATIONS			
TRAFFIC ACCIDENT ANALYSIS			
RECOMMENDATIONS			
Proposed recommended improvements (provide sketches of improvements)			
Volume/Capacity analysis at critical points			
Recommendations on phasing improvements			
Traffic signage and striping recommendations			

REQUIRED FIGURES AND TABLES

		Existing Year	**Project Opening Year(s)**			**Horizon Year**			
Indicate in each box Whether indicated item Is acceptable or not (Yes or No)	Acceptable? **Yes/No**	Without Project (Back-ground Traffic)	Without Project (Back-ground Traffic)	With Project	With Project & Proposed Mitigation Improvements	Without Project (Back-ground Traffic)	With Project	With Project & Proposed Mitigation Improvements	Other scenario that may be necessary
TABLES		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Trip generation rates and calculations									
Level of service and delay results									
FIGURES									
Vicinity Map		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Site map including proposed access locations and types (signalized, 3/4 movement, right-in/right-out, etc.) with distances between adjacent accesses		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Proposed conceptual site plan		**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Am/PM peak hour turning volumes by each study intersection									
ADT for streets adjacent to the development									
Trip distribution at each study intersection		**NA**							
Trip assignment at each study intersection		**NA**							
Level of Service for each study intersection									
CONCLUSIONS									

"I have reviewed the attached report with this checklist and all the required items have been included except as noted above."

Signature of Professional Engineer

5.03 TRAFFIC CONTROL DEVICES.

5.03.1 GENERAL

The installation of traffic control devices shall comply with all applicable portions of the CDOT Standard Specifications for Road and Bridge Construction, the Manual on Uniform Traffic Control Devices, and the accepted plans. These Standards and Specifications and any other requirements determined by the City Engineer will apply to all materials supplied, methods, and procedures of work.

Traffic control devices shall be installed on all new streets accepted by the City for maintenance as set in these Standards and Specifications.

5.03.2 SIGNS

All signage shall be in accordance with the following design criteria:

1. All signs shall conform to current M.U.T.C.D. Standards and Colorado Supplements.
2. All signs shall be installed on Unistrut Telespar type perforated posts with anchors at proper heights as per current M.U.T.C.D. Standards.
3. Sign backings shall be as follows:
   a. Less than 36” x 36” shall be 0.080 aluminum.
   b. 36” x 36” or larger shall be 0.100 aluminum.
4. Street and avenue signs shall be extruded aluminum, 6” x 30” (minimum) in length. At signalized intersections, these signs shall be 18” x 48” (minimum) with 8” letters. City of Commerce City standard, reflective green background with white letters and numbers, with block numbers and arrows. All overhead street and avenue signs shall have a white border of width 0.75 inches.
5. All signs shall be mounted with City approved vandal proof bolts or rivets.
6. Unistrut Telespar type bolts shall meet or exceed the following:
   a. Posts—1.75” x 1.75”, 12 gauge, ASTM Specification No. A446, Grade A, drilled on 1” centers.
   b. Anchors—2” x 2”, 12 gauge, ASTM Specification No. A446, drilled on 1” centers.
   c. All posts and anchors shall be galvanized to ASTM Specification A525 coating designation G90.
7. All signs shall be minimum engineer grade reflective sheeting, seven-year guarantee, or approved equal.
8. Signing dimensions and lettering shall conform in accordance with Details No. 503-01. Illuminated street name signs and regulatory warning signs are covered in Chapter 9.

5.03.3 SIGN POSTS

All sign posts and their foundations and sign mounting shall be so constructed as to hold signs in a proper and permanent position, in order to resist swaying in the wind or displacement by vandalism.

In areas where ground mounted sign supports cannot be sufficiently offset from the pavement edge, sign supports should be of a suitable breakaway or yielding design. When used, concrete basins shall be flush with ground level.

5.03.4 STREET STRIPING

A striping plan shall be submitted for review and approval as part of the construction plans. The striping plan shall meet the requirements for such work as outlined in the M.U.T.C.D. Yellow centerline and lane line markings shall be applied to streets designated by the City as through streets. Standard 12" wide stop bars shall be provided at all stop locations and intersections adjacent to schools, parks, commercial, and other areas as determined by the City. Crosswalks shall be marked with two foot by eight foot (2' x 8') bars spread four feet apart. Markings shall consist of pre-formed thermoplastic material conforming to Section 713 of the CDOT Standard Specifications for Road and Bridge Construction.

Where construction is final, all pavement markings shall be hot extruded thermoplastic for striping and preformed for arrows and lettering. Where construction is not in final form, all striping shall be painted with arrows and lettering being pre-formed thermoplastic.

5.04 STREET LIGHTING

5.04.1 GENERAL

This section contains requirements and guidelines to be met on all newly designed and constructed public and private (open to the general public) streets and parking lots in the City.

Street lights (luminaries) shall be installed when development occurs and shall be funded by the Developer.

The Developer will provide either Xcel Energy or United Power, Inc. with a copy of the City approved street lighting plan with the required number, style, and placement of the streetlights.

Luminaries shall be high pressure sodium flat lens, on fiberglass or metal poles which are underground fed, and at a minimum of 300 feet spacing on alternating sides of the street. The City Engineer is authorized to modify these standards for particular, special, or unique situations.

5.04.2 RESIDENTIAL STREET LIGHTING

Residential lighting shall be 150-watt high pressure sodium on metal or fiberglass poles, 25 feet in height unless otherwise approved by the City. The poles shall be spaced 300 feet apart on alternating sides of the street. All intersections and cul-de-sac bulbs shall have a minimum of one light. If a segment of street between intersections is greater than 450 feet and less than 600 feet, a light shall be installed at the center of the segment. The type and style of light within the subdivision are up to the developer to choose the character they want to create for the neighborhood, subject to availability from the serving electric utility.

5.04.3 ARTERIAL AND COLLECTOR STREET LIGHTING

Arterial lighting shall be 250-watt high pressure sodium on metal or fiberglass poles, 35 feet in height. The light fixture shall be the round (hockey puck) style with a flat lens on 10-foot long mast arms unless otherwise approved by the City. The poles shall be dark in color and shall be spaced 300 feet apart on alternating sides of the street. A minimum of two lights shall be placed on diagonal corners at all intersections and signalized locations.

Collector lighting shall be 250 watt high pressure sodium on metal or fiberglass poles 25 feet in height. The light fixture shall be the round (hockey puck) style or with a flat lens unless otherwise approved by the City. The poles shall be dark in color and shall be spaced 300 feet apart on alternating sides of the street. A minimum of two lights shall be placed on diagonal corners at all intersections and signalized locations.

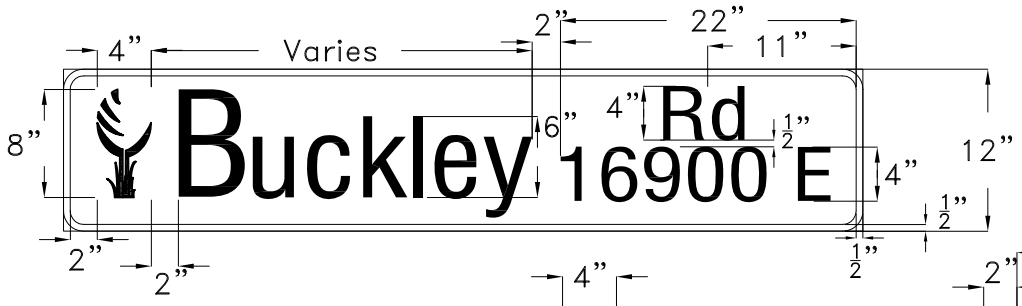
Lighting at arterial/arterial signalized intersections shall be 400 watt. Lighting at arterial/collector and collector/collector signalized intersections shall be 250 watt. When a developer has control of both sides of a collector street, the lighting style may be changed to reflect the character of the neighborhood, subject to availability from the serving electric utility.

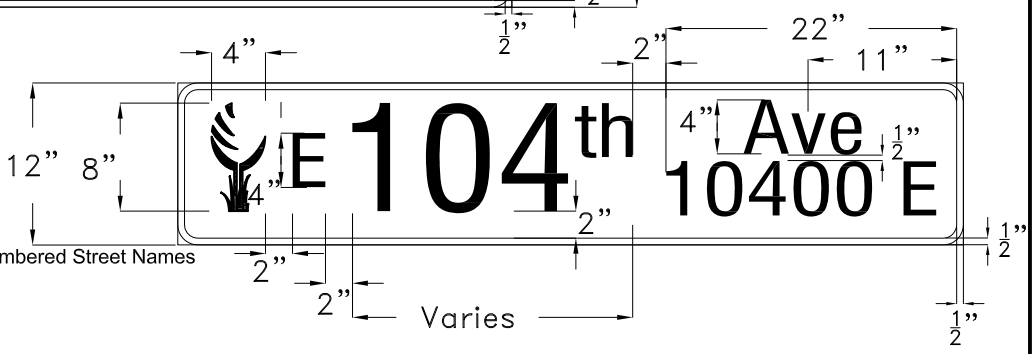
Lighting on East 104th Avenue, East 120th Avenue, Tower Road (except Tower Road north of the Tower/Buckley intersection), Buckley Road, and the Tower/Buckley connection shall be a City approved style light.

5.04.4 FINAL ACCEPTANCE

Final acceptance of the public improvements will not be issued until all street lighting has been installed and is functional.

DETAIL DESCRIPTION	DETAIL NUMBER
Typical Street Signs	503-01
Sign Post and Base	503-02
Speed Hump Installation Standards	503-03A
Speed Hump Installation Standards	503-03B

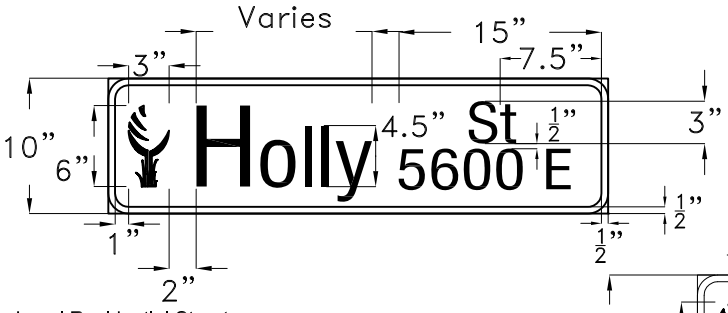


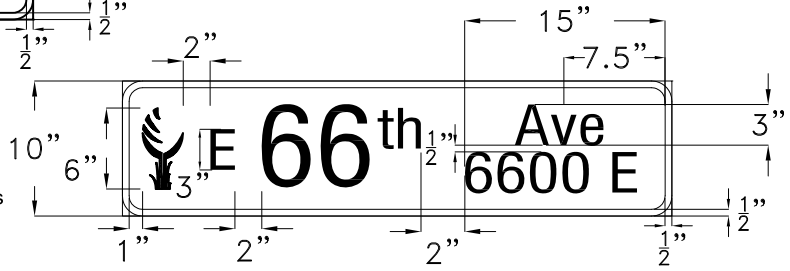


Collector and Arterial Streets

12" x Varies x .08" Aluminum Blank
8" Initial Upper-Case Text Lettering & Numbered Street Names
6" Lower-Case Text Lettering
4" Secondary Text
Text Font is FHWA Series D
1/2" White Border as shown
High Intensity Background (White 3M #2870)
Transparent Green Overlay (3M #1177)
8" Reflective City Logo as shown, centered vertically

City logo is available from:
Commerce City
Communications Division
303-289-3612





Local Residential Streets

10" x Varies x .08" Aluminum Blank
6" Initial Upper-Case Text Lettering & Numbered Street Names
4.5" Lower-Case Text Lettering
3" Secondary Text
Text Font is FHWA Series D
1/2" White Border as shown
High Intensity Background (White 3M #2870)
Transparent Green (3M #1177)
6" Reflective City Logo as shown, centered vertically

LOCAL RESIDENTIAL STREETS REQUIRE 10" SIGNS
COLLECTOR AND ARTERIAL STREETS REQUIRE 12" SIGNS

ALL NUMBERED STREETS MUST HAVE "E" IN FRONT OF THE STREET NAME, CENTERED VERTICALLY

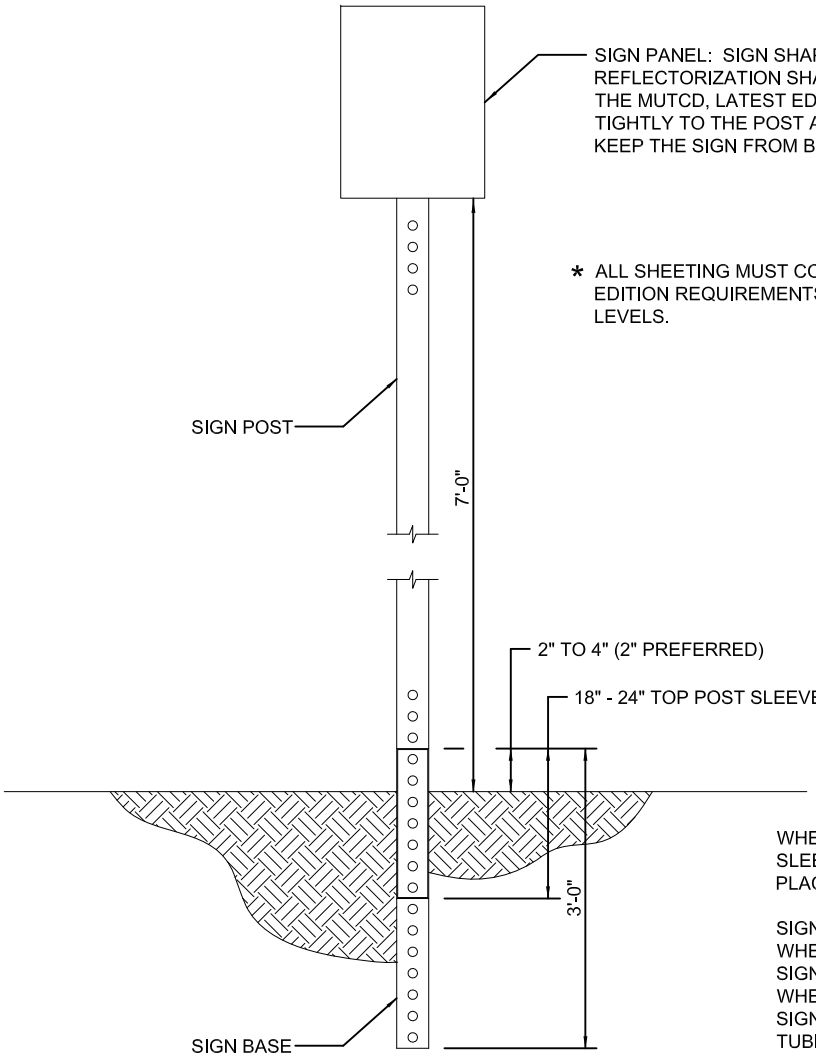
STREET SUFFIXES ARE TO BE CENTERED ABOVE STREET NUMBER AS SHOWN

LOCAL RESIDENTIAL STREETS REQUIRE A CITY LOGO
COLLECTOR AND ARTERIAL STREETS REQUIRE A CITY LOGO

PRIVATE STREETS REQUIRE A BLUE SIGN BACKGROUND WITHOUT A LOGO

SIGNS AT SIGNALS MUST BE ILLUMINATED STREETS NAME SIGNS
SEE DETAIL 900-01

COMMERCE CITY DEPARTMENT OF PUBLIC WORKS ENGINEERING CONSTRUCTION STANDARDS	APPROVAL: CITY ENGINEER 07-14-17 DATE	
TYPICAL STREET SIGNS	DETAIL NO. 503-01	



SIGN PANEL: SIGN SHAPE AND SIZES, LEGEND AND REFLECTORIZATION SHALL BE IN CONFORMANCE WITH THE MUTCD, LATEST EDITION. ATTACH THE SIGN PANELS TIGHTLY TO THE POST AND USE OVERSIZED WASHERS TO KEEP THE SIGN FROM BREAKING LOOSE FROM THE POST.

* ALL SHEETING MUST COMFORM TO THE CURRENT MUTCD EDITION REQUIREMENTS FOR RETRO-REFLECTIVITY LEVELS.

WHEN A SIGN BASE FALLS WITHIN A HARDSCAPE AREA, A 3" PVC SLEEVE SHALL BE INSTALLED AT THE SIGN LOCATION PRIOR TO PLACEMENT OF THE CONCRETE.

SIGN POSTS SHALL 1.75" X 1.75". SIGN BASES SHALL BE 2" X 2" WHEN SIGNS ARE SMALLER THAN 36" X 36".
SIGN POSTS SHALL BE 2" X 2", SIGN BASES SHALL BE 2.25" X 2.25" WHEN SIGNS ARE 36" X 36" OR BIGGER.
SIGN POSTS AND BASES SHALL BE STEEL PERFORATED SQUARE TUBING AS SUPPLIED BY UNISTRUT, OR APPROVED EQUAL.

COMMERCE CITY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING CONSTRUCTION STANDARDS

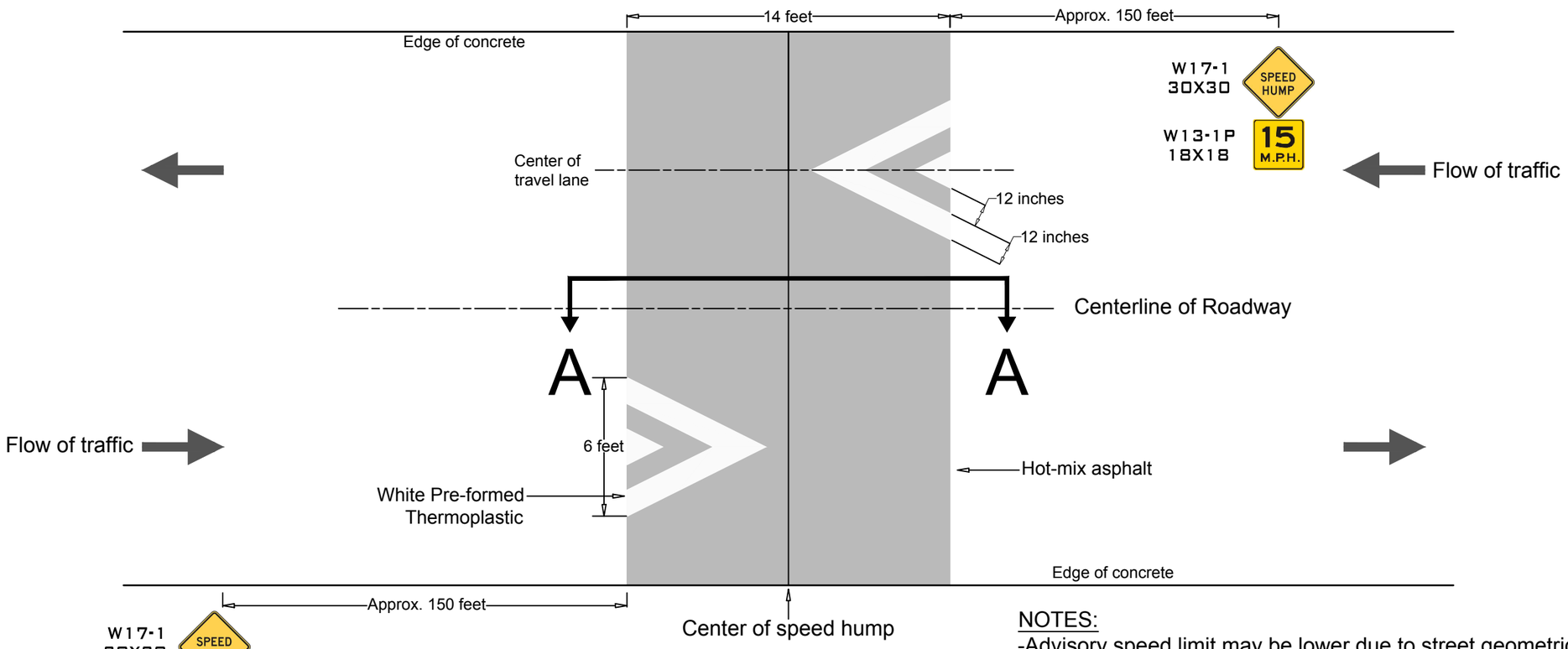
APPROVAL:

CITY ENGINEER — DATE: 05-27-16

SIGN POST & BASE

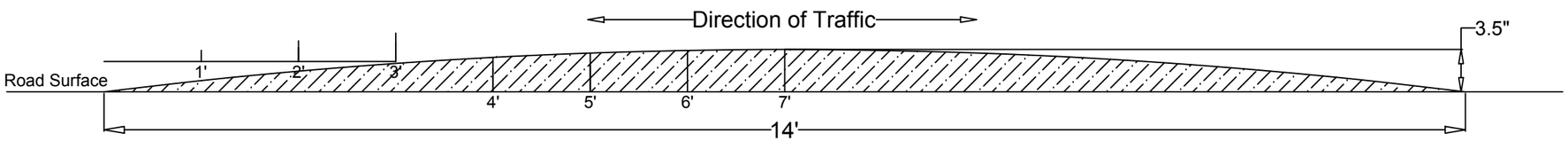
DETAIL NO.
503-02

S:\Tranproj\100049520 - Commerce City Engineering Standards\Design\Drawings\Reference_Files\CCC DWGs\503-02 (Sign Post & Base).dwg



NOTES:
-Advisory speed limit may be lower due to street geometrics
-For Advance Warning Markings, reference MUTCD: Figure 3B-31

SECTION A-A



14 Foot Parabolic Speed Hump Development in U.S. Customary Units

Distance (feet)	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0
Finished height (inches)	0.0	0.9	1.7	2.4	2.9	3.2	3.4	3.5

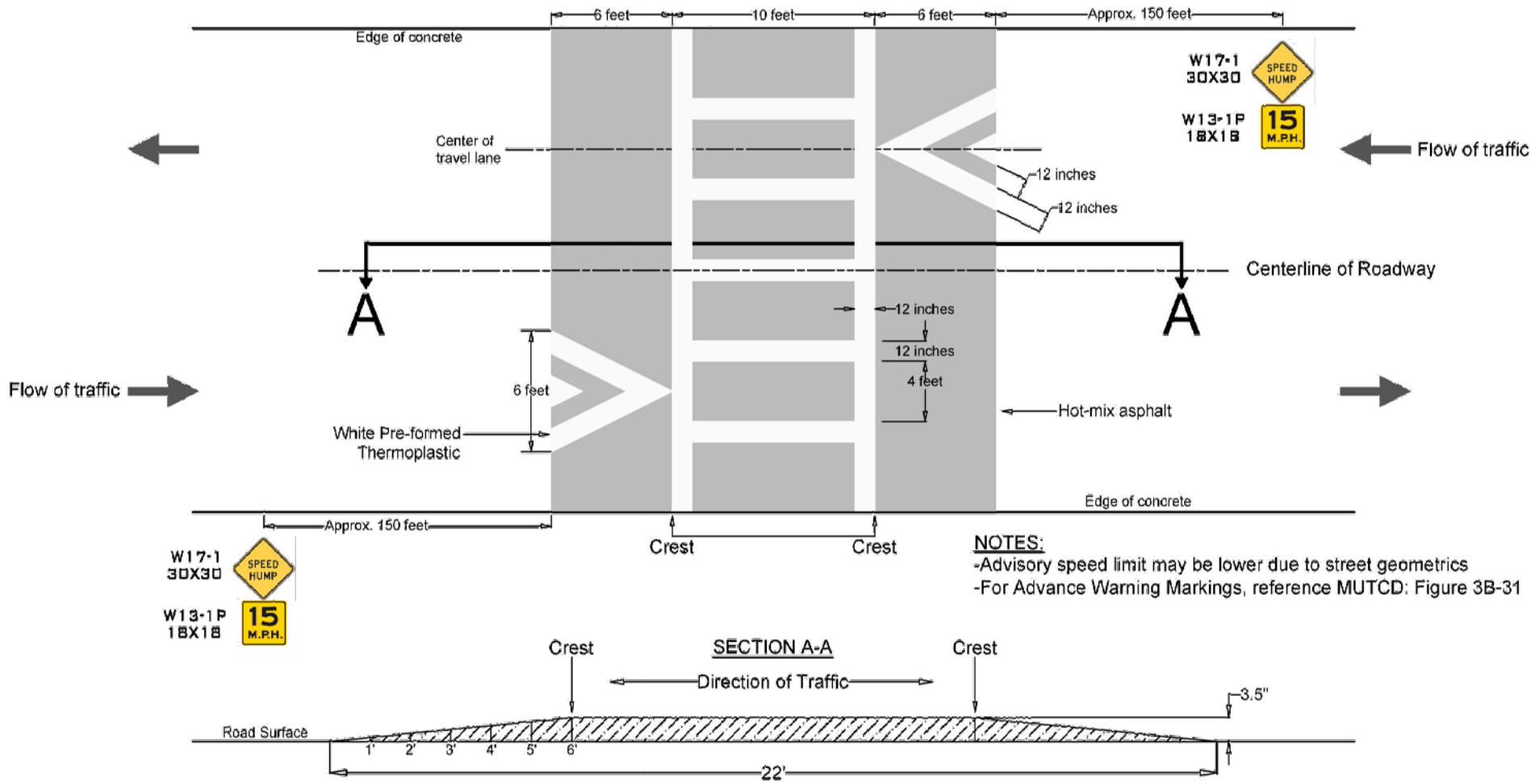
COMMERCE CITY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING CONSTRUCTION STANDARDS

APPROVAL:

CITY ENGINEER — DATE: 12-15-17

Speed Hump Installation Standards

DETAIL NO.
503-03A



22 Foot Speed Table Development in U.S. Customary Units

Distance (feet)	0.0	1.0	2.0	3.0	4.0	5.0	6.0
Finished height (inches)	0.0	0.6	1.2	1.8	2.3	2.9	3.5

COMMERCE CITY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING CONSTRUCTION STANDARDS

APPROVAL:

CITY ENGINEER — DATE: 12-15-17

Speed Hump Installation Standards

DETAIL NO.
503-03b

6.00 STORM SEWERS

6.01 GENERAL

6.02 STORM SEWER MATERIALS
- 6.02.1 PIPE
- 6.02.2 INLETS
- 6.02.3 MANHOLES

6.03 MAINTENANCE BONDS

6.04 TESTING AND INSPECTION

6.01 GENERAL

All storm sewer construction, including manholes, inlets and pipe trenches, shall be governed by the Commerce City Storm Drainage Design and Technical Criteria Manual (CCSDDTC). Any specifications or requirements not listed in the CCSDDTC shall refer to CDOT standards or follow the manufacturer's recommendations.

6.02 STORM SEWER MATERIALS

6.02.1 PIPE

All storm sewer pipe shall be ASTM C76 Class III reinforced concrete pipe (RCP) unless otherwise specified in the approved plans. Bedding for the RCP pipe should be AG7122, No.57/67 crushed rock. **Squeegee or mixtures containing squeegee shall not be used.** Bedding should be six to eight inches deep under the pipe and backfilled to the spring line.

Section tie-in collars to inlet boxes should have 1' x 1' x 1' collar with #4 epoxy coated rebar (green bar).

6.02.2 INLETS

For construction in the City of Commerce City, the following modifications are to be made to the CDOT standard type R Inlet:

- The 5' Type R Inlet shall have one manhole ring and lid (no change).
- The 10' Type R Inlet shall have two manhole rings and lids (no change)
- The 15' Type R Inlet shall have three manhole rings and lids, with one manhole ring and lid being located at the center of the inlet. The 20' Type R Inlet shall have four manhole rings and lids, a hanging center wall shall be built with a bottom opening depth sufficient to handle design water flows. The center two manholes shall be located one each, on both sides of the center wall.

6.02.3 VALVE BOXES AND MANHOLES

All manholes and valve boxes within public right-of-way shall be ¼ inch low to flush with final paved surface.

Cast in place manholes must have cage with #4 epoxy coated rebar (green bar).

6.03 MAINTENANCE BONDS

Prior to initial acceptance of public improvements, the City may require the applicant or his contractor to file a maintenance bond with the City in the amount of 15% of the estimated cost of construction, or an adequate amount. This bond ensures the satisfactory maintenance and condition of the required public improvements for a period of one year after the date of the initial acceptance and dedication to the City.

6.04 TESTING AND INSPECTION

Request for an inspection of reinforcement and sub-grade must be called 24 hours prior to placement of concrete at manholes and inlets. Storm sewer installation shall be subjected to additional periodic inspection by the Engineer. For storm sewer in the roadway area, trench compaction shall be in accordance with AASHTO T99 or T180 as required in Section 203.07 of the CDOT Standard Specifications. Compaction tests must be performed by a Geotechnical Engineer and shall be a minimum of every 250 feet along the trench. Testing intervals may be increased at the discretion of the City Inspector.

7.00 PERMITS, LICENSES, AND CONSTRUCTION INSPECTION

7.01 GENERAL

7.02 PERMITS

- 7.02.1 STREET CUT PERMITS
- 7.02.2 CONSTRUCTION REQUIREMENTS

7.03 RELATED CONSTRUCTION AND SPECIFICATIONS

- 7.03.1 TRENCHLESS TECHNOLOGY (BORING)
- 7.03.2 LOCATION OF EXISTING UTILITIES
- 7.03.3 SIZE AND ALIGNMENT OF BORES
- 7.03.4 SIZE OF BORES
- 7.03.5 ALIGNMENT AND DEPTH OF BORES
- 7.03.6 DRILLING OPERATIONS
- 7.03.7 MUD CONTAINMENT AND CLEANUP
- 7.03.8 RESTORATION AND MISCELLANEOUS
- 7.03.9 ASPHALT PAVEMENT REPAIRS

7.04 LICENSES

7.05 CONSTRUCTION INSPECTION

- 7.05.1 WORK HOURS
- 7.05.2 AUTHORITY OF THE CITY ENGINEER
- 7.05.3 AUTHORITY OF THE PUBLIC WORKS INSPECTOR
- 7.05.4 DEFECTIVE MATERIALS AND WORK
- 7.05.5 PROTESTS
- 7.05.6 INSPECTION FACILITIES

7.06 TESTING AND MATERIALS STANDARDS

7.07 INITIAL ACCEPTANCE

7.08 WARRANTY PERIOD

7.09 FINAL ACCEPTANCE

7.00 PERMITS, LICENSES, AND CONSTRUCTION INSPECTION

7.01 GENERAL

This section specifies the requirements for permits, licenses, and construction observation (inspections) required for public improvement construction work, and designated private construction work. Requirements stated in this section shall be supplemented by, and be in compliance with, any additional requirements or conditions required by City Codes, Specifications, or Administrative Requirements.

City Engineering Offices
8602 Rosemary Street, Commerce City, Colorado 80022

City Contacts	Phone Number
Street Cut Inspection	(303) 289-8150
Street Cut Permits	(303) 289-8150
Oversize Moving Permits	(303) 289-8150
General Engineering Questions	(303) 289-8150

Civic Center
7887 E 60th Avenue, Commerce City, Colorado 80022

City Contacts	Phone Number
Contractor's License	(303) 289-3790
Building Inspection	(303) 289-3790
Building Permits	(303) 289-3790
Building Permit Inspections	(303) 289-3790
Electrical Permit Inspections	(303) 289-3790

7.02 PERMITS

Permits are required for new public improvement construction or any other work in the public right-of-way, for any overlot grading of private property, for any construction or repair of any utilities including storm drainage, sanitary sewer and water service lines and fire suppression lines located in the public right-of-way.

Permits shall be obtained prior to commencing work. Permits will be issued only to the contractor performing the work who is required to be licensed and bonded for the type of work. Work may be performed under the general contractor's permit when the contractor and subcontractors are in compliance with licensing requirements described in Section 7.04, Licenses.

The type of work being performed shall be limited to that stated on the issued permit. Any additional work will require a new permit.

Permits will be issued only after the following items have been completed:

1. The Engineering Division has approved the plans for the specific improvements to be constructed.
2. All applicable fees have been paid in full.
3. Traffic control plan and street closure have been approved, if applicable.

A complete set of approved drawings, specifications, and a valid permit shall be on the job site and available to the Public Works Inspector at all times.

7.02.1 STREET CUT PERMITS

All street cuts being performed within the City of Commerce City shall conform to the following specifications for materials, methods, and standards.

The work may consist of, but not be limited to: excavating, backfilling, compacting, asphalt patching, placing of forms, placing of concrete, earthwork, coordinating with involved agencies, traffic control, and any other work incidental to construction in the City's right-of-way. Street cut permit costs will be at the expense of the Contractor unless otherwise designated by the City Engineer. A Street Cut Permit and a valid Contractor's License with the City of Commerce City are required prior to any work within the City of Commerce City's right-of-way, except as otherwise provided.

Prior to any excavation work, the Contractor shall contact the Utility Notification Center of Colorado (1-800-922-1987 or 811) and all agencies as instructed by the Utility Notification Center. The Contractor shall protect all existing facilities and utilities in the vicinity of the Contractor's operations and shall be liable for all damages to existing utilities due to negligence by the Contractor. The location of the utility service lines for homes and businesses are the responsibility of the Contractor.

Prior to the start of work, the Contractor may request an inspection of the work site with the City Engineer to determine and note the pre-existing condition of the public improvements in the work area. The Contractor shall be responsible for any damage to existing public improvements not previously identified prior to the start of work.

During the work, representatives from the City of Commerce City and owners and agencies of other existing utilities may be present on site. The Contractor shall provide notification, and coordinate operations with any agency representative required to be present during the work. The representatives of these agencies shall be permitted full access to the Contractor's work area to perform inspections, tests, and other operations that may be required. The Contractor shall provide the City of Commerce City a minimum of 24 hours notice prior to the starting work on any street cut permit and shall coordinate all sub-grade, form, concrete, and asphalt paving inspections and tests with the City Engineer or his representative.

7.02.2 CONSTRUCTION REQUIREMENTS:

A. Traffic Control

Prior to any roadway lane closure, a traffic control plan needs to be approved by the City Engineer or his representative. The traffic control plan shall conform to the *Manual on Uniform Traffic Control Devices* (MUTCD) latest edition, for traffic control within a construction zone. The Contractor shall also notify local police, fire, and emergency services of the roadway lane closure prior to starting work each day for the duration of the lane closure. Once the work has started, the Contractor shall not deviate from the approved traffic control plan unless approved by the City Engineer, and shall notify local fire, police and emergency services when construction operations are completed and the road is reopened to traffic.

B. Excavation

When a street cut is required in a paved street, all pavement shall be removed from the site at the Contractor's expense. The Contractor shall perform all necessary excavation to the depth required to sufficiently expose or install the utility. During excavation, material suitable for backfilling shall be stored on-site at a sufficient distance from the open cut or hole to avoid surcharge from falling into the open hole or trench. All excavated materials not suitable for backfilling shall be removed from the site at the Contractor's expense.

Any section of curb, gutter, or sidewalk which has had its sub-grade disturbed by tunneling or horizontal excavation by the

contractor shall be removed for its entire length and replaced at the contractor's expense.

During excavation, sheeting or shoring shall be provided by the Contractor for the safety and health of personnel when required by health and safety (OSHA) regulations. When notified by the City of a dangerous condition, the Contractor shall immediately stop all work until the dangerous condition is corrected.

C. Backfill and Compaction

Backfill material shall consist of material that has been excavated except for rubbish, broken pavement, frozen material, debris, and stones larger than three (3) inches in diameter, organic material, or other materials considered unsuitable for backfill as determined by the City Engineer. When a material is unsuitable for backfill, as determined by the City Engineer, or an appointed representative, the Contractor shall furnish a material suitable for backfill and dispose of the unsuitable material at his expense.

Compaction of the backfill shall be subject to City inspection. Compaction of the backfill material shall be conducted in 12-inch lifts of loose material, and testing by a nuclear probe shall be completed every two (2) lifts. The Contractor shall furnish all testing and provide copies of the test results to the City Engineer. All compacted backfill material shall have a minimum relative compaction of 95% as determined by AASHTO T99 or AASHTO T180 for the classified soil. If the specified percentage of compaction is not obtained, the Contractor shall re-compact the backfill material. The Contractor shall be responsible for backfilling to grade and maintaining all excavations until permanently repaired.

Controlled density backfill materials such as flash-fill and flow-fill may be used by the Contractor with prior approval by the City Engineer.

Trenches with fifty (50) feet or more of their length within the wheel path of any street shall be backfilled with a controlled density material and approved by the City Engineer prior to patching.

D. Asphalt Patching

Asphalt patching of all streets shall be accomplished on the same day as the excavation whenever possible. All street cuts are to be patched within 10 working days of the completion of the backfill, unless otherwise approved by the City Engineer. Pavement, curb, gutter, sidewalk, or other improvements that are destroyed, removed, or damaged during construction shall be replaced in-kind with the same type material, shape, and size as that which was damaged and shall be equal to the undisturbed portions of the improvements that existed prior to excavation. The cost of replacement work and the removal of debris from the work site shall be at the Contractor's expense. Immediately prior to patching, the Contractor shall saw cut the pavement two (2) feet beyond the limits of damage done during the excavation. The pavement shall be cut to lines perpendicular and parallel with the edge of pavement using a saw or wheel cutter. Whenever unfavorable weather conditions exist, the City Engineer may require the placement of a temporary bituminous cold-mix street surfacing that is four (4) inches thick. The cold-mix surfacing shall be removed by the Contractor, and replaced with permanent hot-mix bituminous pavement within ten (10) working days.

The permanent paving work shall not commence until favorable weather conditions exist (according the *Colorado Department of Transportation Standards and Specifications)*. Permanent street surfacing shall consist of hot bituminous pavement, CDOT's Grade S (3/4-inch stone) placed in lifts (3-inch maximum) one inch greater than the existing thickness of the asphalt surfacing. In no case shall the patch material be less than six (6) inches thick. All exposed asphalt surfaces to be patched shall first be evenly coated with tack oil as per the CDOT standards and specifications referenced herein.

Depending on the size, location, and condition of the area to be patched the Engineer may require the contractor to perform a proof roll on the sub-grade to determine the stability of the backfill and its ability to permanently support the patch.

All manhole lids, handhole lids, and valve boxes within the area to be patched shall be adjust to flush to ¼" below the final elevation of the surface of the permanent patch.

E. Concrete Pavement Patching

The patching of concrete pavement shall be completed on the same day as the excavation whenever possible. All street cuts in concrete pavement are to be patched within 10 working days of the completion of the backfill, unless otherwise approved by the City Engineer. Immediately prior to patching, the contractor shall saw cut the concrete pavement to the nearest existing joint. Concrete pavement patches shall replace the existing full pavement panel. The pavement shall be cut with a saw parallel or perpendicular with the edge of the existing pavement. Whenever unfavorable weather conditions exist, the City Engineer may require the placement of a temporary bituminous cold-mix street surfacing that is six (6) inches in thickness. The cold-mix surfacing shall be removed by the Contractor and replaced with concrete pavement within ten (10) working days.

F. Concrete Paving Work

The permanent concrete paving work shall not commence until favorable conditions exist (according to the *Colorado Department of Transportation Standards and Specifications*). Reinforcing dowels shall be #7 rebar, eighteen (18) inches in length (nine (9) inches placed in existing concrete), and spaced thirty (30) inches on centers for sides of existing concrete pavement. Reinforcing dowels shall not be placed within twelve (12) inches of any corner. The concrete pavement shall be a 4500 psi pavement mix placed to a thickness of one inch greater than the existing concrete pavement. A white curing compound shall be placed on the concrete pavement as soon as the finishing is complete. The concrete pavement shall be cured under blankets whenever freezing temperatures are possible.

G. Concrete Curb, Gutter & Sidewalk Replacement

All damaged concrete curb, gutter & sidewalk must be replaced from joint to joint. No patching or grouting is allowed. No partial stone replacements will be allowed.

7.03 RELATED CONSTRUCTION AND SPECIFICATIONS

7.03.1 TRENCH-LESS TECHNOLOGY (BORING)

Trench-less technology refers to subsurface, horizontal excavation used as an alternative to trenching for installation of utility lines. Pipes, conduits, sleeves, cables, and wires will be collectively

referred to as utility lines in this section. This section applies primarily to directional boring. It also applies to pneumatic missiling, micro tunneling, augering and pipe ramming, or jacking. A street cut permit is required for all utility companies, contractors, and others using trench-less technology in City rights-of-way or other City properties such as parks, drainage ways, parking lots, etc.

7.03.2 LOCATION OF EXISTING UTILITIES

Prior to construction, all existing underground utilities shall be physically located. It is advised to obtain design locates when planning bore alignments. It may not be allowable to waive clearance and depth requirements solely due to unknown conflicts if design locates were not performed.

All underground utilities shall be marked on the surface five feet on both sides of the proposed bore alignment by the utility owners. Utility locate requests are required by contacting the Utility Notification Center of Colorado at 1-800-922-1987 or 811. The South Adams County Water and Sanitation District is responsible for water and sanitary sewer locates. Commerce City Public Works Department for traffic signal locates, storm sewer locates, and the Commerce City Parks Department for irrigation system locates. Contact adjacent property owners for locating private water service lines, sanitary service lines, and sprinkler systems. Depth determination of existing utilities shall be done by potholing.

7.03.3 SIZE AND ALIGNMENT OF BORES

Borehole diameter and the amount of void space remaining around the utility line shall be minimized to prevent surface subsidence. Alignment and depth of bores shall be designed to accommodate the many different underground utilities which use relatively narrow corridors and cross each other.

7.03.4 SIZE OF BORES

Borehole diameter shall not exceed 1-1/2 times the utility line diameter for utilities less than seven inches in diameter. For larger utility lines and multiple lines using the same borehole, approval of construction methods and bore diameter by the City Engineer shall be required.

7.03.5 ALIGNMENT AND DEPTH OF BORES

Borehole alignment shall be parallel for longitudinal street bores and perpendicular for street crossings. A borehole shall not meander

more than one foot to either side of the approved proposed alignment. A borehole shall not encroach within one foot, horizontally or vertically, of another utility. The minimum depth of private utility lines (gas, electric, communication) shall be 30 inches.

Longitudinal bores cannot be located under City sidewalk, curb, or gutter.

7.03.6 DRILLING OPERATIONS

Water used for the drilling operation shall not be obtained from City fire hydrants without a meter. A meter can be obtained from South Adams County Water and Sanitation District located at 6595 E. 70th Avenue (phone 303-288-2646) to be used on hydrants. The Water District's personnel will provide direction on use and proper methods for filling tanks so as not to cause a cross connection that could contaminate the City's water supply.

Whenever a drill damages gas or electric lines, the fire department shall be notified immediately (phone 911). The utility owner and the Public Works Inspector should be notified whenever any utility line is damaged. Failure to make these notifications may be cause to revoke the Contractor's license and permit.

7.03.7 MUD CONTAINMENT AND CLEAN UP

Drilling mud shall be ponded or contained in a manner which prevents it from flowing onto sidewalks, into traveled lanes, down the gutter, or across driveways and cross pans. Mud tracking onto City streets is not allowed and must be removed immediately. Washing drilling mud or allowing it to flow into storm sewer inlets is strictly prohibited. Citations will be issued for these violations. The Public Works Inspector may temporarily allow the Contractor to pond mud in the gutter with the use of sand bags, as long as it is barricaded and does not impede traffic. In the event drilling mud should leak from the borehole to the surface, the area shall be barricaded from vehicular and pedestrian travel immediately before resuming drilling operation. Complete clean up of drilling mud with hydro-vacuum equipment is required at the end of each day.

7.03.8 RESTORATION AND MISCELLANEOUS

Pavement, sidewalk, other items of infrastructure, and landscaping that is damaged during construction shall be replaced or repaired to its original condition or better.

Surface improvements undermined from adjacent bore/splice pits more than one foot horizontally shall be replaced or repaired.

Boreholes greater than three (3) inches in diameter that are abandoned without conduit shall be filled with an approved grout or flowing backfill material.

Conduit that is wasted between the borehole collar at grade and the splice pit at depth shall be removed, not abandoned in place.

Lids and covers on hand holes, pull/splice/junction boxes, and other below-grade utility vaults shall be adjusted to grade prior to backfilling. Buried facilities with concealed covers are prohibited.

7.03.9 ASPHALT PAVEMENT REPAIRS

Damage to any roadway will require the Contractor to repair the roadway to as good or better condition than existed prior to their work. The pavement shall be saw-cut a minimum of two (2) feet in both directions from the damaged section and replaced. All patching shall comply with the requirements of the street cut permit and these Standards. A pre-construction walk-through to determine existing roadway conditions will be required prior to any trench-less work.

7.04 LICENSES

Any company, contractor, or firm performing construction of public improvements or working in City right-of-way shall have a current contractor's license. The contractor's license shall be applicable to all public improvement construction work and designated private construction work.

7.05 CONSTRUCTION INSPECTION

The contractor shall obtain the Public Works Inspector's approval of any material prior to placement. The contractor shall call for inspection with a minimum of 24 hours notice and give notification when the work is complete. Inspections may be requested from the Public Works Department at (303) 289-8150. In the event that any of the work or material fails to meet any of the requirements of these Standards, written notice of the rejection shall be given to the Contractor, and work shall be halted until corrective action is taken. Periodic construction observations will be conducted to aid and observe the contractor regarding quality control. The contractor must comply with all applicable portions of these Standards to obtain acceptance of the work, or any part thereof, by the City.

7.05.1 WORK HOURS

Public Works Inspectors' normal work hours are from 8:00 a.m. to 5:00 p.m. Monday through Friday. When the Public Works Inspector or other City personnel are required to work overtime or on legal holidays, (New Year's Day, Martin Luther King Jr. Day, President's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving and the Friday after Thanksgiving, and Christmas Day) it shall be at the contractor's expense. Other days or hours will be considered overtime and will be at the contractor's expense. A minimum charge of four hours will be charged for any overtime work requested and performed on weekends and legal holidays. The contractor's payment for all overtime work shall be made by check to the City of Commerce City. Night work may be authorized by the Public Works Inspector if adequate lighting is available, and noise will not disturb nearby residents or businesses.

7.05.2 AUTHORITY OF THE CITY ENGINEER

The City Engineer shall exercise authority on behalf of the City to ascertain that all construction of facilities is equal to or better than the minimum construction requirements set forth in the project specifications. The City Engineer may be represented by a Public Works Inspector who will observe work performed under a permit issued for construction, including all materials to be incorporated in the work, excavation, bedding, backfill, and all construction methods and practices. The City Engineer shall have the authority to issue, in writing, deviations from the provisions of the project specifications or changes to previously approved drawings.

7.05.3 AUTHORITY OF THE PUBLIC WORKS INSPECTOR

Public Works Inspectors are assigned by the City Engineer to assist the contractor in complying with the approved project specifications. Public Works Inspectors have the authority to reject inferior materials or defective workmanship, and to suspend work not in accordance with these Standards until corrections are made and approved. The Public Works Inspectors are not authorized to alter any provisions or to issue instructions contrary to the project specifications, or to make any changes to approved drawings.

7.05.4 DEFECTIVE MATERIALS AND WORK

Whenever materials and/or work are found defective, the contractor, at his expense, shall promptly remove such defective materials and construction from the job site and replace all defective portions to the satisfaction of the City Engineer. If the contractor fails to remove defective items from the job site within 10 days of written notice, the City

Engineer may arrange for such removal at the expense of the contractor. Work performed or covered without observation is subject to rejection.

7.05.5 PROTESTS

If the contractor considers any work demanded of him by the Public Works Inspector to be outside the requirements of the approved specifications, he will immediately ask for a written decision or instructions, and shall proceed to perform the work to conform with the Public Works Inspector's ruling. If the contractor considers such instructions unsatisfactory, he will, within 24 hours after their receipt, file a written protest with the City Engineer stating his objections and the reasons therefore. Unless protests or objections are made in the manner specified, and within the time limits stated herein, the contractor hereby waives all grounds for protests.

7.05.6 INSPECTION FACILITIES

The contractor shall furnish all reasonable facilities and shall assist the Public Works Inspector as necessary for the proper inspection of materials to be used and workmanship involved in construction.

7.06 TESTING AND MATERIALS STANDARDS

Standard testing procedures shall conform to CDOT Standard Specifications for Road and Bridge Construction. All materials used in construction shall conform to CDOT requirements. If a material or test is not specified, it shall be directed to the discretion of the City Engineer.

7.07 INITIAL ACCEPTANCE

For new public improvement construction, the contractor will notify the Public Works Inspector that all work has been completed, and request an initial acceptance inspection. The Public Works Inspector will perform all necessary inspections and notify the contractor of any noted defects. Until the NOTICE OF INITIAL ACCEPTANCE is issued, the City Engineer may direct that the newly constructed public improvements shall be barricaded to prevent public use of the improvements.

The NOTICE OF INITIAL ACCEPTANCE, which begins the one-year warranty period, will be issued when the following items are completed:

1. All major work elements have been accepted by the Public Works Inspector.

2. Warranty bonds have been provided to the City as defined in the developer's agreement.

3. As-built information in both signed and stamped mylars and AutoCAD drawings has been deemed satisfactory by the Engineering Division.

7.08 WARRANTY PERIOD

The warranty period is for one year from the date of initial acceptance, or substantial completion unless otherwise specified or mutually agreed upon in writing. During the warranty period, the developer or owner shall be responsible for maintenance, snow removal and replacement of any damaged infrastructure.

7.09 FINAL ACCEPTANCE

One year after initial acceptance has been granted, the developer or other entity may request a final acceptance walk-through with the Public Works Inspector. All items that the Public Works Inspector notes as damaged or defective shall be noted and sent in writing to the developer. The developer shall make all corrections requested by the Public Works Inspector and request a final walkthrough to inspect the items from the punchlist. The Public Works Inspector shall notify the developer in writing that final acceptance has been granted, and the City will begin maintenance of all sidewalk, storm sewer and street improvements. The warranty bonds or letter of credit shall be released to the developer at this time.

8.00 STORMWATER QUALITY CONTROL CRITERIA

8.01 GENERAL

8.02 DEFINITIONS

8.03 EROSION AND SEDIMENT CONTROL PLAN

- 8.03.1 GENERAL SUBMITTAL REQUIREMENTS AND PROCEDURES
- 8.03.2 PRECONSTRUCTION MEETING
- 8.03.3 CONSTRUCTION SITE INSPECTIONS
- 8.03.4 EXECUTED PERMIT AND DURATION
- 8.03.5 GUARANTEE
- 8.03.6 EXEMPTIONS
- 8.03.7 FINAL STABILIZATION
- 8.03.8 BMP COST/ISSUES
- 8.03.9 CONSTRUCTION ENFORCEMENT STRATEGY

8.04 TEMPORARY CONTROLS, INSTALLATION AND MAINTENANCE PROCEDURES

8.05 BMP PLANNING FOR NEW DEVELOMENT

- 8.05.1 APPLICABILITY
- 8.05.2 PERMANENT BMP PLANNING
- 8.05.3 MAINTENANCE OF PERMANENT BMP’S

8.06 REFERENCES

8.01 GENERAL

This section sets forth the minimum criteria to be met on all construction sites in the City of Commerce City.

8.02 DEFINITIONS

Best management practices (BMPs) - Schedules of activities, prohibitions of practice, maintenance procedures, and other management practices to prevent or reduce the pollution of Waters of the US. BMP's also include treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, waste disposal, or drainage from material storage.

Commerce City ESC Inspector - Assigned City representative responsible for inspecting grading/construction activities for compliance with Erosion and Sedimentation Control Plan.

Earth Disturbance / Earth Disturbing Activity - man-made alteration or disturbance of the ambient land surface, natural cover or topography of land, including all grading, cut and fill, stockpiling of imported fill, building, paving, landscaping and other activities which may result in, or contribute to, soil erosion or sedimentation of the Waters of the US.

Erosion - The wearing away of the land surface by water, wind, ice or other geological agents, including the detachment and movement of soil or rock fragments by water, wind, ice, gravity, or any combination thereof.

Erosion Control Measures - Practices, either operational or structural, that slow or stop erosion.

ESC Manager - The ESC Manager is responsible for communicating with the City and submitting the required Permit and ESC Plan materials as outlined in this Chapter. Failure to meet the necessary schedule and submittal requirements is the ultimate responsibility of the ESC Manager.

Municipal Separate Storm Sewer System - A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains), designed or used for collection or conveying stormwater.

Sedimentation - A process by which solid materials, inorganic (mineral) and organic, come to rest on the earth's surface either above or below sea level.

Sediment - Particulate solid material, either inorganic or organic, that will settle or be deposited in a liquid under the force of gravity.

Temporary Controls - Installation of erosion or sediment control measures, either structural or nonstructural, that are planned to be removed or inactivated after a period of time.
Water Quality Capture Volume - The volume of stormwater produced from an 80th percentile storm event.

Waters of the State - Any and all surface and subsurface waters which are contained in or flow through the State of Colorado; does not include waters in sewage systems, waters in treatment works of disposal systems, waters in potable water distribution systems, and all water withdrawn for use until use and treatment have been completed.

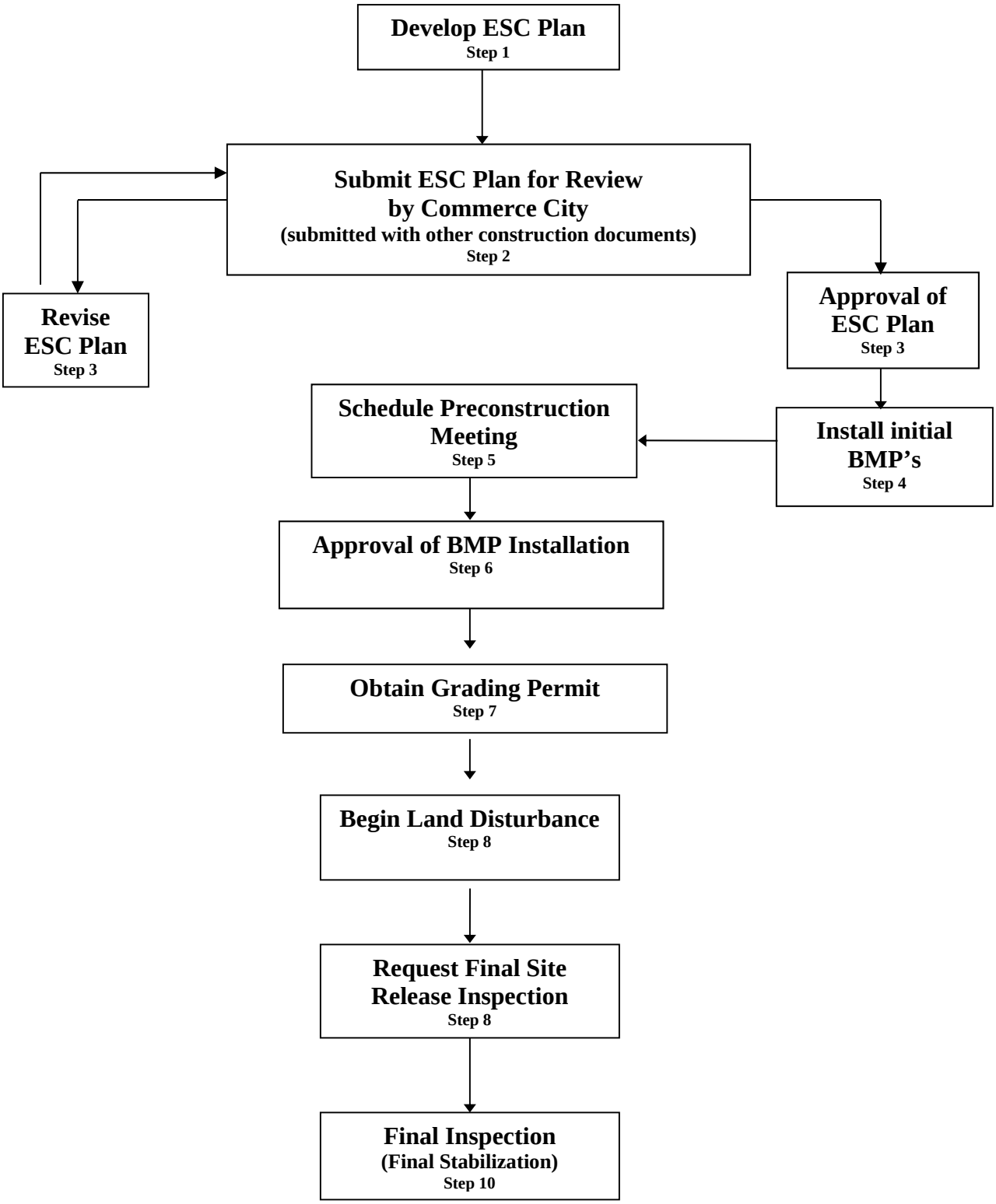
8.03 EROSION AND SEDIMENT CONTROL PLAN

Under the Colorado Discharge Permit System (CDPS) Phase II regulations, Commerce City is required to administer a stormwater discharge permit system for construction activities. The method by which the City will ensure that all construction activities are complying with the CDPS requirements is the requirement that an ESC Plan needs to be submitted and approved by the City Engineer prior to obtaining a Grading Permit. A Grading Permit is required under the City's Land Development Code for any activities disturbing and/or modifying greater than 5,000 square feet of property within the City limits. Construction or site grading permits will not be issued prior to the ESC Plan being approved by the City. Approval of the ESC Plan does not imply acceptance or approval of Drainage Plans, Utility Plans, Street or Road Plans, Design of Retaining Walls, or any other aspect of site development. Specific ESC Plan submittal requirements are presented in Section 8.03.1.1. Applicants are encouraged to prepare the required submittals with as much detail as possible to minimize confusion and cut down on overall processing time.

Information regarding erosion and sediment control and design including details on temporary erosion and sediment control BMP's can be found in Section 8.2 and Appendix C, respectively.

8.03.1 GENERAL SUBMITTAL REQUIREMENTS AND PROCEDURES

This section outlines the general submittal requirements and procedures to obtain and comply with the Commerce City ESC Permit.



8.03.1.1 ESC SUBMITTAL REQUIREMENTS

The following items are required for all ESC Submittals.

ESC Drawing Cover Sheet

Since the ESC drawings are normally part of a comprehensive set of construction drawings for development, one cover sheet may suffice for the entire set of drawings. It shall include the following information related to the ESC portion of the plan set. Additional requirements shall be required for the other portions of the construction drawings. Contact the Public Works Department for a complete list of cover sheet requirements.

1. Project name
2. Project address (if applicable)
3. Owner address
4. Design firm's name and address
5. Plan sheet index
6. Design Engineer's signature block with name, date and Professional Engineer registration number. Signature block shall include the following note:
    - THE **EROSION AND SEDIMENT CONTROL PLAN** INCLUDED HEREIN HAS BEEN PREPARED UNDER MY DIRECT SUPERVISION IN ACCORDANCE WITH THE REQUIREMENTS OF CHAPTER 8 OF THE CITY OF COMMERCE CITY ENGINEERING CONSTRUCTION STANDARDS AND SPECIFICATIONS MANUAL.
7. The Erosion and Sediment Control General Notes found on Detail No. 800-01 in Appendix C.
8. General Location Map at a Scale of 1-inch to 2000 – feet indicating:
    - General vicinity of the site location
    - Major roadway names
    - North arrow and scale

ESC Drawing Index Sheet

For projects that require multiple plan-view sheets to adequately show the project area (based on the specified scale ranges), a single plan-view sheet shall be provided at a scale appropriate to show the entire site on one sheet. Areas of coverage of the multiple blow-up sheets are to be indicated as rectangles on the index sheet.

ESC Drawing

This plan sheet shall provide erosion and sediment controls for the initial clearing, grubbing and grading of a project. At a minimum, it shall contain:

1. Title Block – Include name and address of proposed project/development, submittal date, title of drawing, and sheet number.

2. Project Site Plan – Existing and proposed right-of-way and easements.

3. Professional Engineer's Seal – Include signature and date.

4. Drawing Information:
   - North arrow indicator
   - Section-Township-Range
   - Drawing Scale
   - Symbol Legend

5. Limits of construction encompassing all areas of work, access points, storage and staging areas etc. All other areas outside the limits of construction shall be lightly shaded to clearly show area not to be disturbed.

6. Existing topography at 1' - 2' maximum contour intervals, extending a minimum of 100 feet beyond the property line (insufficient extension of contours will be cause for non-compliance).

7. Water Features – Include locations of springs, streams, wetlands and other surface waters and the boundaries of 100-year flood plains (if determined).

8. Storm Drainage Structures – Include locations of all existing and proposed channels, swales or drainage pipes which either convey off-site stormwater through or route stormwater around the construction area.

9. Erosion and Sediment Control Structures – Include locations of all proposed erosion and sediment control facilities. In addition, develop typical or specific details of all proposed facilities.

10. Material Storage Areas – Include all areas used for storage of building materials, soils, or wastes.

11. Batch Plants – Identify the location of any dedicated asphalt or concrete batch plants.

12. Construction Site – Provide construction site boundaries and limits of soil disturbance (include area). Stockpile areas shall be presented as well as areas of cut and fill.

13. Construction Phasing - Phasing of any erosion and sediment control work shall be clearly indicated on the Plan.

14. Re-vegetation – Include details and notes for mulching and re-vegetation. Plans shall also include detailed planting procedures, seed/plant specifications, and plant maintenance specifications.

15. Receiving Waters – The name of the receiving water(s) and the size, type and location of any site outfall(s). If the discharge is to an existing storm sewer system, this should be stated, along with the name of the ultimate receiving water(s).

8.03.2 PRECONSTRUCTION MEETING

Installation of Initial BMP's. The Initial BMP's shown on the ESC Drawings shall be installed prior to the on-site Preconstruction Meeting. The Initial BMP's include, but are not limited to, silt fence, construction fence, and vehicle tracking control.

Scheduling the Preconstruction Meeting. The Permittee(s) shall contact Public Works to schedule the on-site Preconstruction Meeting. Three day notice (business days, not including Saturday, Sundays and holidays) shall be provided to schedule the meeting.

Attendees at the Preconstruction Meeting. The on-site Preconstruction Meeting is required prior to the start of construction. In addition to the City Engineer or his/her representatives the following should be present:

1. **Owner or Owner's Representative** (the Contractor may **NOT** be the owner's representative).

2. **General Contractor**.

3. **ESC Manager** and **Alternate ESC Manager** (one or both may be the same as the Owner and/or General Contractor Representatives).

4. **Grading Sub-Contractor**, if different than the General Contractor.

5. **Design Engineer** (the Design Engineer's attendance is not mandatory; however, it is strongly recommended that the Design Engineer attend, to avoid possible delays if the City or the Permittee(s) determine that modifications to the ESC Plan are necessary).

General Meeting Agenda. The following agenda items are addressed at the Preconstruction meeting.

1. **Review of ESC Field Manual.** The City ESC Inspector or engineer will confirm the Permittee's understanding of the ESC Field Manual.

2. **Field Review of ESC Drawings.** The ESC Drawing for all stages and phases will be reviewed to confirm the attendees' understanding of the ESC Plan and to discuss any modifications to the plan. If modifications to the ESC Plan are thought to be advantageous, input will be sought from the Design Engineer and final acceptance of changes will be as determined by the engineer. Limits of construction and topsoil stripping limits shall be confirmed.

3. **Inspection of Initial BMP's.** A visual inspection of all of the Initial BMP's that have been installed will take place. The ESC Inspector will confirm if any corrections are required.

4. **Acceptance of Initial BMP's.** If the Initial BMP's are accepted by the ESC Inspector, as is or with minor corrections, the ESC Inspector will inform the Permittee(s). Construction shall not start until a Grading Permit is obtained from the City.

5. **Corrections to the BMP's.** If the ESC Inspector determines that significant modifications or corrections to the BMP's are necessary, the ESC Inspector will inform the Permittee(s) that such corrections shall be made, that a follow-up inspection shall be scheduled with the City, and that acceptance of the corrected BMP's by the ESC Inspector shall take place prior to the signing of the Grading Permit or prior to any additional inspections. Modifications to the ESC Plan will, in most cases, require acceptance of the Design Engineer who signed and stamped the ESC Drawings. The re-inspection requires one-day notice (by 3:30 p.m. the weekday prior to the inspection) and shall be scheduled with Public Works (contact information is listed in Appendix A).

6. **Grading Permit.** No grading can occur until a grading permit is obtained from Public Works. If the Permittee(s) think that modifications to the Initial BMP's shown on the ESC Drawings should be made to provide for a more effective plan, the Permittee(s) shall contact the Design Engineer and Commerce City Engineering to obtain acceptance of the proposed modifications prior to installing the BMP's.

8.03.3 CONSTRUCTION SITE INSPECTIONS

The overall effectiveness of the ESC Plan depends upon the correct installation and maintenance of BMP's. Appendix C provides Standard Notes and Details, and Section 8.2 identifies correct installation and maintenance procedures ("Do's" and "Don'ts").

All construction activities that are required to submit an ESC Plan must be inspected every 7 calendar days and post-precipitation events to ensure compliance with the approved ESC Plan. The focus of the inspections is to verify that structural BMP's are installed and maintained properly and that temporary control BMP's are being implemented appropriately. Once the site has completed all necessary final stabilization measures, the ESC Manager will notify the Commerce City Department of Public Works and schedule an inspection. The Commerce City Department of Public Works will provide guidance to the owner and the owner's representatives in complying with the requirements of the ESC Plan and the Grading Permit.

8.03.3.1 RIGHT TO ENTRY AND INFORMATION

Upon the presentation of credentials, the owner shall allow the City (ESC Inspector, Commerce City Director of Public Works, or their authorized representatives):

- To enter upon the owner's premises where a regulated facility or activity is located or in which any records are required to be kept under the terms and conditions of this permit;
- At reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit and to inspect any monitoring equipment or monitoring method required in the permit; and
- To enter upon the owner's premises to investigate, within reason, any actual, suspected, or potential source of water pollution, or any violation of the Colorado Water Quality Control Act. The investigation may include, but is not limited to, the following: sampling of any discharge and/or process waters, the taking of photographs, interviewing owner's staff on alleged violation, and access to any and all facilities or areas within the owner's premises that may have any affect on the discharge, permit, or alleged violation.

The owner shall furnish to the City, within reasonable time, any information which the City may request to determine whether cause exists for modifying, revoking and reissuing, or inactivating coverage under this permit, or to determine compliance with this permit. The owner shall also furnish to the City, upon request, copies of records required to be kept by this permit.

8.03.3.2 CORRECTION OF DEFICIENCIES AND ESC PLAN MODIFICATIONS

If the approved or implemented ESC Plan is observed to be inadequate, as determined by the ESC Inspector, modifications to correct the deficiencies shall be made immediately or within the timeframe specified by the ESC Inspector. It shall be understood that additional or revised BMP's may be required should construction site observation indicate that the ESC Plan is not adequately controlling erosion, sedimentation, or stormwater runoff from equipment fueling/maintenance and materials storage areas.

The ESC Inspector may approve minor field modifications to the ESC Plan. Such modifications would include minor adjustments to BMP field locations to better correspond with actual site conditions or to improve BMP performance. No plan changes or formal written approval will be required. If the modification is not acceptable the ESC inspector will notify the contractor/owner. All other modifications to the ESC Plan proposed by the contractor/owner shall be in writing (including revised plans) and submitted to Commerce City Public Works at least 10 working days prior to the desired date of implementation. Public Works will re-approve the ESC Plan if the proposed modifications are acceptable.

8.03.4 EXECUTED PERMIT AND DURATION

The Grading Permit expires if construction has not commenced within 80 days of the City's issuance of the Grading Permit. If construction stops for longer than six months, the contractor needs to schedule a pre-construction meeting and re-new the Grading Permit. The ESC Plan may be required to be resubmitted and approved by the City. Previously accepted ESC Plans must also be resubmitted to the City for approval if any of the following occur:

1. Proposed development changes to the site, or

2. Proposed grading revisions.

8.03.5 GUARANTEE

The applicant may be required to file with the City of Commerce City's Public Works Department a faithful performance bond, letter of credit, or other improvement security approved by the City in an amount of $3000 per disturbed acre with a minimum of $5000 prior to issuance of the Grading Permit to cover all costs of BMP's and re-vegetation for such period as specified by the City.

8.03.6 EXEMPTIONS

Exemptions from the erosion control planning process may be considered for any of the following; however, exempting the owner from preparing an ESC Plan and applying for a Grading Permit does not exempt the owner from controlling erosion of soil at each construction site through the use of the techniques described herein:

1. Any emergency activity that is immediately necessary for the protection of life, property, or natural resources.

2. Existing nursery and agricultural operations conducted as a main or permitted use.

3. Underground utility construction including the installation, maintenance, and repair of all utilities under hard-surfaced roads, streets, or sidewalks provided such land-disturbing activity is confined to the area which is hard-surfaced and provided that runoff and erosion from soil stockpiles are confined and will not enter the drainage system.

4. Gravel, sand, dirt or topsoil removal as authorized pursuant to approval of the Colorado Mined Land Reclamation Board, provided said approval includes an ESC Plan that meets the minimum specifications.

8.03.7 FINAL STABILIZATION

The ESC Plan shall include a description of all measures used to achieve final stabilization and all permanent measures used to control the long-term discharge of pollutants in stormwater after construction operations have been completed. Final stabilization is achieved when:

1. All soil disturbing activities at the site have been completed;

2. Uniform vegetative cover has been established with a density of at least 70 percent of pre-disturbance levels; and,

3. The vegetative cover is adequate to control soil erosion, as determined by the Director of Public Works.

If permanent, physical erosion reduction methods have been employed at the site that are equivalent to items two (2) and three (3) above, the site can be considered in a state of final stabilization. Determination of vegetative density shall be estimated by visual inspection of several areas throughout the site. Prior to final acceptance or Certificate of Occupancy for a development, it shall be the responsibility of the Owner to provide the City with all documentation necessary to demonstrate that

the site has achieved final stabilization. The City may, after consultation with the Owner and upon good cause, amend the final stabilization criteria for specific operations.

8.03.7.1 EROSION CONTROL

Erosion controls are surface treatments that stabilize soil exposed by excavation or grading. Erosion control measures, or Best Management Practices (BMP's), provide the best means of managing sediment from disturbed lands by preventing soil movement. These BMP's are variously referred to as source controls, vegetative controls, or non-structural controls. Some typical BMP's used to control erosion are as follows:

- Surface Roughening – Provides temporary stabilization of disturbed areas by creating depressions in the soil surface. The depressions reduce the quantity of stormwater runoff by increasing infiltration. Surface roughening also reduces runoff velocity and provides for sediment trapping.
- Mulching – Temporarily stabilizes soils by securely applying materials such as grass, hay, woodchips or wood fibers to the soil's surface. Mulching protects the soil from raindrop impact and reduces the velocity of overland runoff. Mulch also aids in the growth of temporary seeding by holding seeds and topsoil in place, retaining moisture, and insulating against extreme temperatures.
- Temporary Revegetation – The use of quickly germinating vegetative cover on disturbed areas to stabilize soils and control erosion in the short term.
- Permanent Revegetation – The use of perennial vegetation on disturbed areas to provide long term stabilization of soils and erosion control.
- Erosion Control Blankets – Installation of geotextiles that are used to stabilize soils, steep slopes, and drainage channels. The geotextiles effectively shield the soil from the effects of wind and rain and enhance the growth of vegetation through the geotextile.
- Construction Phasing – Consists of properly planning and scheduling land disturbing activities for the purpose of minimizing the total amount of disturbed area at any one time during the construction process.

Section 8.2 provides additional design parameters for selected BMP's. In addition, Appendix C provides Standard ESC Plan Drawing Requirements. Other BMP's may be

considered, provided that sufficient documentation, to include field installation performance evaluation, is submitted to Commerce City Public Works for review and approval.

8.03.7.2 SEDIMENT CONTROL

Sediment controls capture soil that has been eroded. Soil particles suspended in runoff can be filtered through a porous media or deposited by slowing the flow and allowing the natural process of sedimentation to occur. Sediment controls (or BMP's) are facilities built to perform this function, and are also referred to as structural controls. Some typical BMP's used for sediment control include:

- Vehicle Tracking – Refers to the stabilization of construction site access locations and staging areas to prevent the tracking of sediment from the construction site.
- Slope Protection – Used to capture and divert runoff from the faces of cut and fill slopes. Temporary diversion dikes and temporary slope drains are common BMP's used for this purpose.
- Rough Cut Street Control – Temporary sediment barriers that are placed on alternate sides of a rough cut street to divert runoff from the rough cut street and to slow the runoff velocity.
- Silt Fence – A temporary sediment barrier constructed of filter fabric stretched between supporting posts and entrenched into the ground. Runoff is filtered through the filter fabric while sediment is deposited on the upstream side of the barrier.
- Sediment Basin – A temporary sediment entrapment facility that captures and detains sediment-laden runoff long enough to allow sediment to settle out. Sediment basins are formed by excavation or construction of an embankment of compacted soil.

Section 4.0 of the Construction Best Management Practices chapter of VOLUME III provides design guidance for sediment control measures. Other BMP's may be considered, provided that sufficient documentation, to include field installation performance evaluation, is submitted to Commerce City Public Works for review and approval. In the event that conflicts exist between the design guidance provided in this document and VOLUME III (including future revisions), the more stringent BMP design standards will apply.

8.03.7.3 DRAINAGEWAY PROTECTION

Drainageway control measures protect channels and/or storm sewers during site construction. This can be accomplished by limiting equipment travel across a stream, constructing a temporary channel crossing, or diverting a stream into a temporary channel while work is done on the permanent channel. Where storm sewers are used, sediment can be filtered prior to entry of runoff into the storm drainage system. Some typical (structural) BMP's used for drainageway protection include:

- Temporary Stream Crossing – A temporary structural span or at-grade crossing installed across a watercourse for use by construction traffic. This BMP stabilizes stream crossings and reduces erosion caused by construction traffic.
- Check Dam – A small temporary dam constructed across a swale or drainage ditch to reduce the velocity of stormwater flows and erosion of the swale or ditch.
- Outlet Protection – Structurally lined aprons or other acceptable energy dissipating devices placed at the outlets of pipes or paved channel sections. This BMP prevents scour at stormwater outlets and reduces the velocity of concentrated stormwater flows to protect downstream channels from erosion.
- Inlet Protection – Sediment control barrier formed around a storm drain inlet. Runoff is filtered through the barrier while sediment is deposited on the upstream side of the barrier. Several options exist for the construction of the barrier ranging from gravel bags to a multitude of commercially available geotextile products.

Section 5.0 of the Construction Best Management Practices chapter of VOLUME III provides design guidance for drainageway protection measures. Other BMP's may be considered, provided that sufficient documentation, to include field installation performance evaluation, is submitted to Commerce City Public Works for review and approval.

Freeboard Above the 100-year Floodplain. Floodplain elevations can rise over time due to the following:

- Increased baseflows and runoff from development can promote increased growth of wetland and riparian vegetation, making drainageways hydraulically rough and leading to higher flow depths.

- Stream stabilization work can raise the bed of the drainageway at the crests of drop structures and flatten the channel slope, leading to higher flow depths.
- Upstream bank erosion or watershed erosion, flatter slopes, or increased channel vegetation can lead to sediment deposition and channel aggradation, raising the streambed and floodplain elevations.

All of these conditions are generally healthy and positive, since they slow flow velocities, improve stream stability, and enhance water quality through sediment trapping. For these conditions to occur over time without jeopardizing properties during floods, freeboard should be provided at the outset of development.

Existing Drainageways Shall be Stabilized. It may be impossible, or undesirable, to avoid all construction in an existing drainageway. Most natural channels cannot be left alone in their predevelopment condition. Increased runoff from development can shift the natural balance of a stream over time, tending toward degradation and bank erosion as the stream tries to flatten its grade.

Drop structures and other grade control features are usually necessary to reduce the channel slope to future equilibrium conditions and to control flow velocity. Bank or toe protection may also be necessary to reinforce weak, unstable channel banks. Grade control structures and other channel stabilization improvements shall be designed according to the criteria shown in the *Storm Drainage Design and Technical Criteria* (Commerce City, 1888), as amended. Under no circumstance shall broken up concrete or asphalt be used for bank stabilization.

Disturbance to Existing Drainageways Shall be Minimized and Quickly Restored. In addition to the construction of grade control and bank stabilization improvements, there may be other unavoidable instances where construction must occur in existing drainageways. Examples include bridges and culverts for road crossings, utility crossings, storm sewer outfalls, and temporary stream crossings for construction access. However, it is critical that construction disturbance within drainageways be minimized and quickly restored. When construction within a drainageway is unavoidable, the Design Engineer shall delineate construction limits that restrict activities to the smallest area possible. Construction Fence (CF) or Construction Markers (CM) shall be indicated on the ESC Drawing within the drainageway corridor to indicate the allowable limits of disturbance. In the same manner, construction fence or construction markers shall be shown throughout the site to identify all limits of construction (along all

perimeters of the site, along all stream corridors to be preserved, and around any other preservation zones). Coordinates or other information shall be provided to establish the location of the fence.

If disturbance to a drainageway is significant, such that excessive amounts of sediment may be transported downstream, a Check Dam (CD), reinforced or nonreinforced, shall be installed immediately downstream of the disturbed area in the drainageway. If several areas of disturbance are located in close proximity, one check dam at the downstream end of the construction may be appropriate (in general, BMP's shall be configured to control erosion and trap sediment outside of the limits of drainageways to enable check dams to be used infrequently). Sizing criteria for check dams is provided in Appendix C.

Crossing drainageways may require a floodplain permit, conditional use permit and other federal or state permits. Temporary stream crossings shall be limited to one per 2000 linear feet of drainageway unless otherwise approved by the City.

All disturbed areas within streams and drainage channels shall be revegetated with topsoil (at least 6-inches in depth), seeded and mulched, and unless otherwise approved, protected with an Erosion Control Blanket (ECB). Additional plantings, such as willows or other riparian species, shall be considered to enhance channel stability, habitat, and aesthetics. Erosion control blankets shall be required for the disturbed channel bed and banks and all slopes steeper than 4:1. The Design Engineer shall indicate approximate limits of erosion control blankets on the ESC Drawing. These limits shall extend to the top of the banks. Additional design information for erosion control blankets is provided in Appendix C.

8.03.7.4 SENSITIVE AREAS

In addition to protecting drainageways, other sensitive areas may exist on construction sites. These could include:

- Protected habitat for threatened or endangered species.
- Wetlands.
- Nesting bird habitat.
- Riparian corridors.
- Mature cottonwood stands.
- Steep slopes.
- Potential stormwater infiltration areas.
- Historic, cultural, or archeological resources.
- Areas of unique or pristine vegetation, habitat, or landform.

A resource inventory should be conducted for the site and include any sensitive areas such as those listed above. The location, aerial extent, and type of resource, including stream floodplains shall be shown on the Initial ESC Drawing.
Disturbance to sensitive resource areas shall be avoided or minimized. Destroying or disturbing wetlands, nesting bird habitat, and protected habitat for threatened or endangered species is sharply restricted; these restrictions shall be addressed through the appropriate Federal or State agency permitting process.

A Design Engineer can go farther than preserving critical resource areas; other open space areas can be left undisturbed and exempt from clearing and grading operations. The technique of mapping out areas of the site that can be left undisturbed, termed "fingerprinting," can reduce grading costs and contribute to the ultimate value of the development. The ESC Drawings shall clearly show limits of construction and shall call out Construction Fence (CF) or other means to protect resources that are to be preserved.

8.03.8 CONSTRUCTION ENFORCEMENT STRATEGY

The following policies and procedures will be used by Commerce City to ensure compliance with the ESC Plan and the Grading Permit.

8.03.8.1 ENFORCEMENT POLICIES

The following policies apply to enforcement at construction sites within Commerce City:

1. It is the policy of Commerce City to encourage compliance with grading, erosion and stormwater quality control requirements by cooperating with engineers and developers during the design and implementation phases of a project to incorporate proper construction BMP's. The City will inform and educate contractors on the proper implementation and maintenance of construction BMP's.

2. The City will require an Owner to bring a construction site into compliance with its approved ESC Plan prior to formal enforcement. This will be accomplished by working with the owner, developer, and contractor. The intent will be to allow them reasonable opportunity to take the necessary measures before more formal action, such as a Stop Work Order, is taken.

3. The City considers the owner of the land the ultimate responsible party for all construction activities. It is the responsibility of the owner to take all necessary measures to ensure that the site is in compliance with City ordinances, the ESC Plan, and the Grading Permit.

4. The City has, to the maximum extent practicable, made its requirements consistent with State requirements for construction activities (CDPS General Permit-Stormwater Discharges Associated with Construction Activities). In the event of conflicting requirements, the most restrictive requirement shall govern.

5. Whenever a Stop Work Order is issued, it is the City's policy to stop any or all City activities or further approvals relative to the site until the necessary measures are taken to address the concerns, as stipulated in the Stop Work Order.

8.03.8.2 ENFORCEMENT PROCEDURES

The enforcement of a construction site's approved ESC Plan begins and ends with the inspection process. The Self-Monitoring Inspection is the only type of inspection that is conducted solely by the owner or his/her representatives. The self-monitoring inspection requires the owner to identify areas of noncompliance and take corrective actions. The contractor shall implement the corrective actions immediately. It is at the discretion of the ESC Inspector to conduct a Follow-Up Inspection to further verify if the corrective actions have been taken.

The ESC Inspector also conducts inspections and identifies areas of noncompliance and the corrective actions that will be taken to bring the site into compliance with its ESC Plan and Grading Permit. A time frame for addressing any noncompliance is included in the inspection checklist as a required follow-up action. The site contact shall implement corrective action immediately after notification of noncompliance. The ESC Inspector will determine if a Follow-Up Inspection is needed or if submission of information that verifies that the necessary actions were taken is adequate.

In the event that a Final Inspection reveals corrective actions that need to be taken, a Certificate of Occupancy will not be issued and/or the financial assurances will not be released

until the corrective actions have been implemented to the satisfaction of the ESC Inspector.

Certain situations may require the City to take more aggressive actions to get a site into compliance with its ESC Plan and Grading Permit. Table 8.1 summarizes some of these actions. The City may take other action as deemed appropriate.

It is expected that under normal conditions the progression of enforcement actions is a Verbal Warning, Notice of Violation, Letter of Noncompliance, and then a Stop Work Order. The City may impose additional requirements and/or conditions for re-issuance of the Grading Permit. A Municipal Summons may be issued for noncompliance with a Stop Work Order or other situations as outlined in the Erosion and Sediment Control Ordinance.

Table 8.1 – Enforcement Options

Enforcement Option	Description	Typical Applications
Verbal Warning	The ESC Inspector will inform the ESC Manager of items that need corrective action.	No immediate danger to the public safety, property or water resources. Items must be corrected immediately.
Notice of Violation	The ESC Inspector will document the items that were not corrected from the verbal warning. A copy of the inspection form will be provided to the ESC Manager.	No immediate danger to the public safety, property or water resources. Items must be corrected immediately.
Letter of Noncompliance	This is a letter written to the owner and contractor. It contains a description of the problem, the measures required to bring the site into compliance and a timeframe for completion of those measures.	No immediate danger to the public safety, property or water resources. Compliance has not been achieved while working with the owner/representative or contractor. When the City wants to document ongoing problems and agreed upon follow-up.
Stop Work Order	This Order requires the owner and contractor to stop all activity on the site except for the work necessary to bring the site into compliance with its approved ESC Plan. Depending on the compliance problem and the City's past experience with the individuals involved, the City may impose the Order on only a portion of the site.	Used when there is an immediate threat to the public safety, property, or water resources. Used when the site has failed to comply with the Letter of Noncompliance.
Municipal Summons	Issuance of a summons to appear before a judge in Municipal Court.	Used when the site has failed to comply with the Erosion and Sediment Control Ordinance or the Stop Work Order.

8.04 TEMPORARY CONTROLS AND INSTALLATION AND MAINTENANCE PROCEDURES

The overall effectiveness of the ESC Plan depends on the correct installation and maintenance of BMP's. With this goal in mind, the City is providing the ESC Plan Standard Notes and Details in Appendix C, which identifies correct installation and maintenance procedures for all City-accepted BMP's. The BMP's are to be included in all ESC Plans and govern all ESC-Permitted construction work in the City. The Standard Notes and Details allow Design Engineers and Permittee(s) to become familiar with one set of BMP's and consistent installation and maintenance requirements. Following are brief descriptions of the standard erosion and sediment control BMP's accepted for use in Commerce City and some of the important installation and maintenance requirements found in the ESC Plan Standard Notes and Details (Appendix C). Example photographs illustrating correctly installed BMP's and practices to avoid are included.



Maintenance procedures are not being followed on this site which may lead to additional costs from fines, sediment clean up and possible stop work orders.

1. **Check Dam (CD).** A check dam is a small rock dam, designed to withstand overtopping, that is placed in a drainageway. The purpose of the check dam is to trap sediment in the backwater zone up-stream of the check and, when used in series, to reduce flow velocities.

   Key Installation and Maintenance Requirements:

   - Riprap utilized for check dams shall have a median stone size of 6".
   - Riprap pad shall be trenched into the ground a minimum of 1'-8".
   - The ends of the check dam shall be a minimum of 1'-6" higher than the center of the check dam.
   - The ESC Manager or approved representative shall inspect check dams weekly and during and after any storm event and make any repairs or clean out as necessary.

- Sediment accumulated upstream of check dams shall be removed when the sediment depth upstream of the check dam is within ½ of the height of the crest.



Properly installed check dam.



This check dam was not keyed in adequately to the channel bank, leading to its failure.



This disturbed drainageway was not protected by a check dam at the downstream site perimeter, allowing sediment to be conveyed off site.

2. **Compost Blanket (CB) and Compost Filter Berm (CFB).** Compost blanket consists of a layer of Class I Compost spread over prepared, seeded topsoil to protect exposed soil against rain and wind erosion and to provide an organic soil amendment to promote the establishment of vegetation. This BMP can be considered as an alternative to erosion control blanket or crimp mulch for stabilizing exposed soils, although it cannot be used in drainageways or concentrated flow areas. Compost filter berms are used on slopes in conjunction with compost blanket to reduce flow length and control rill and gully erosion.

   Key Installation and Maintenance Requirements:

   - Compost blanket shall only be utilized in areas where sheet flow conditions prevail and shall be prohibited in areas of possible concentrated flow.
   - Compost shall be evenly applied at a depth of 2 inches.
   - Compost may be applied utilizing a pneumatic blower or by hand.
   - Compost shall be a Class 1 Compost as defined by specific physical, chemical and biological parameters, including the following particle distribution:
     - 3" (75 mm) 85% to 100% passing
     - 1" (25mm) 85% to 100% passing
     - 3/4" (18 mm) 85% to 80% passing
     - 3/8" (8.5 mm) 50% to 60% passing
     - #4 sieve 20% to 35% passing
   - Filter Berms shall run parallel to the contour and shall have a minimum height of 1-foot and minimum bottom width of 2-feet.

- Filter Berms shall be constructed utilizing pneumatic blower or hand.
- Compost Blanket and Filter Berms shall be inspected weekly and during and after a storm event.





Compost blankets can be used in areas not subject to concentrated flows and shall be applied with a pneumatic blower or by hand.



Utilizing non-approved application methods of compost blanket can cause additional cost due to re-application and additional clean up costs.

3. **Concrete Washout Area (CWA).** A concrete washout area is a shallow excavation with a small perimeter berm to isolate concrete truck washout operations.

Key Installation and Maintenance Requirements:

- Vehicle Tracking Control is required at the access point to the concrete washout area.
- The concrete washout area should not be located near or adjacent to any detention or retention ponds or waterway of any type.
- Signs shall be placed at the construction entrance, at the washout area, and elsewhere as necessary to clearly indicate the location of the concrete washout area to operators of concrete trucks and pump rigs.
- Excavated material shall be utilized in perimeter berm construction.
- Inspect weekly and during and after any storm event. The concrete washout area shall be repaired and enlarged or cleaned out as necessary to maintain capacity for wasted concrete.
- At the end of construction, all concrete shall be removed from the site and disposed of at an approved waste site.



A properly installed concrete washout area with Vehicle Tracking Control.



Extensive wasting of concrete on the construction site requires additional effort to clean up and can impair subsequent revegetation operations.

4. **Construction Fence (CF) and Construction Markers (CM).** Construction fence consists of orange plastic fencing or other City-accepted material attached to support posts and used to delineate limits of construction and to control access to the construction site. If approved by the City, construction markers (CM), consisting of orange painted survey lath at 100-foot maximum spacing, may be used to delineate limits of construction.

   Key Installation and Maintenance Requirements:

   - Steel tee posts shall be utilized for support of construction fence.
   - Maximum spacing of tee posts is 15-feet.
   - Any damaged fence or markers shall be repaired on a daily basis.



Use construction fence to restrict access to site and demark limits of disturbance.



This construction fence is in need of repair. Inspections shall be made weekly and downed sections repaired immediately.

5. **Dewatering (DW).** Dewatering controls consist of a gravel filter provided on the suction end of a pump to reduce the pumping of sediment, a riprap pad at the discharge end of the pump for erosion protection, and a sediment basin to provide for settling before the water is discharged into receiving waters.

   Key Installation and Maintenance Requirements:

- The ESC Manager or approved representative shall obtain a construction discharge (dewatering) permit from the Colorado Department of Public Health and Environment prior to any dewatering operations. All dewatering shall be in accordance with the requirements of the discharge permit and shall be coordinated with the City's ESC Inspector.
- Dewatering operations shall use one or more of the dewatering sumps shown in the ESC Plan Standard Notes and Details (Appendix C) or other means approved by the City to reduce the pumping of sediment, and shall provide a temporary basin for settling pumped discharges prior to release off site.
- A 4' square riprap pad shall be placed at the discharge point.
- The discharge end of the line shall be staked in places to prevent the movement of the line off the riprap pad.
- The ESC Manager or approved representative shall inspect dewatering systems and perform any necessary repairs or maintenance on an hourly basis.



Sump pumps or suction lines can be contained within perforated 5-gallon buckets and surrounded with gravel to reduce the pumping of mud during dewatering operations.



This suction line is not contained in gravel and is pumping excessive amounts of sediment.



These discharge lines require a riprap pad and a settling trap.

6. **Diversion Ditch (DD).** A diversion ditch is a small earth channel used to divert and convey runoff, generally to a sediment basin, check dam, or reinforced rock berm. Depending on slope, the diversion swale may need to be lined with erosion control blanket, plastic (for temporary installations only), or riprap.

Key Installation and Maintenance Requirements:

- In locations where construction traffic must cross a diversion ditch, the Permittee(s) shall install a temporary culvert with a minimum diameter of 12 inches.

- The ESC Manager or approved representative shall inspect all diversion ditches weekly and during and after any storm event and make any repairs or clean out as necessary.



This diversion ditch provides protection for an adjacent drainageway.



Lack of a diversion ditch at the top of this slope to divert upstream runoff has led to severe rill and gully erosion.

7. **Erosion Control Blanket (ECB).** Erosion control blanket is a fibrous blanket of straw, jute, excelsior, or coconut material trenched in and staked down over prepared, seeded soil. The blanket reduces both wind and water erosion.

Key Installation and Maintenance Requirements:

- All erosion control blankets and netting shall be made of 100% natural and biodegradable material; no plastic or other synthetic material, even if photodegradable, shall be allowed.
- In areas where erosion control blanket is shown on the plans, the Permittee(s) shall place topsoil and perform final grading, surface preparation, and seeding below the blanket in accordance with the requirements of Detail 17 of the ESC Plan Standard Notes and Details, Seeding and Mulching (Appendix C). Subgrade shall be smooth and moist prior to blanket installation and the blanket shall be in full contact with the subgrade; no gaps or voids shall exist under the blanket.
- Perimeter anchor trench shall be used at the outside perimeter of all blanket areas.
- Joint anchor trench shall be used to join rolls of blankets together (longitudinally and transversely) for all blankets except 100% straw, which may use an overlapping joint.
- The ESC Manager or approved representative shall inspect erosion control blankets weekly and during and after any storm event and make repairs as necessary.



Ample erosion control blanket is used on this hill slope.



The edges of this erosion control blanket are not trenched in, allowing the blanket to become displaced. Blanket shall be 100% natural and biodegradable.

8. **Inlet Protection (IP).** Inlet protection consists of a small reinforced rock berm and cinder block frame placed in front of (but not blocking) a curb inlet or around an area inlet to reduce sediment in runoff entering the storm sewer system. Pre-manufactured items designed specifically for inlet protection may also be used, subject to approval by the ESC Inspector.

Key Installation and Maintenance Requirements:

- Interim configuration of inlet protection in streets (before paving) shall be installed within 48 hours of pouring inlet. Inlet protection (after paving) shall be installed within 48 hours after paving is placed.
- Inlet protection at area inlets shall be installed within 48 hours of pouring inlet.
- Crushed rock shall be fractured face (all sides) and shall comply with gradation shown on Detail 10 of the ESC Plan Standard Notes and Details (1-1/2" minus).
- Wire mesh shall be fabricated of 10-gauge wire twisted into a mesh with a maximum opening of 1.0 inch (commonly termed "Chicken Wire"). Roll width shall be 48 inches.
- Wire mesh shall be secured using "Hog Rings" or wire ties at 6-inch centers along all joints and at 2-inch centers on ends of berm.
- Reinforced rock berm shall be constructed in one piece or shall be constructed using joint detail of Detail 10 of the ESC Plan Standard Notes and Details.
- The top of reinforced rock berm shall be ½ - 1” below top of curb.
- Tubular markers shall meet requirements of Manual on Uniform Traffic Control Devices (MUTCD), as amended.
- The ends of the reinforced rock berms shall be placed tightly against the curb face on either end of the inlet.

- The ESC Manager or approved representative shall inspect inlet protection weekly and during and after any storm event and make repairs or clean out as necessary. More frequent inspections and repairs shall be required during winter conditions due to freeze/thaw problems.
- Inlet protection is to remain in place until the upstream disturbed area is stabilized and grass cover approved, unless the City approves earlier removal of inlet protection in streets.



Properly installed inlet protection for curb-inlets in a sump condition.



Tubular markers were not placed in front of this inlet protection installation, making it more susceptible to damage from snowplows and other vehicles. This installation is in need of immediate repair.



Properly installed inlet protection for continuous-grade curb-inlets.



Temporary Inlet Protection. This interim configuration of blocks protects a street inlet prior to paving.



This inlet protection is overdue for sediment removal.



Properly installed area inlet protection.



No gaps shall exist between sections of reinforced rock berm.











Blocking the inlet opening or use of alternate materials for inlet protection is prohibited.

9. **Reinforced Check Dam (RCD).** A reinforced check dam is a rock dam contained within a twisted wire gabion, designed to withstand overtopping, that is placed in a major drainageway (upstream watershed area in excess of 100 to 130 acres). Like a check dam, the purpose of the reinforced check dam is to trap sediment in the backwater zone upstream of the check. The reinforcement increases the ability of the rock dam to withstand the larger overtopping flows of major drainageways.

Key Installation and Maintenance Requirements:

- The check dam shall be trenched into the ground a minimum of 1’-6”.
- Erosion Control Blanket shall be placed in the reinforced check dam trench extending a minimum of 1’-6” on both the upstream and downstream sides of the reinforced check dam.
- Gabions shall have galvanized twisted wire netting with a maximum opening dimension of 4 ½" and a minimum wire thickness of 0.10". Wire mesh shall be secured using "Hog Rings" at 4" spacing or other approved means shall be used at all gabion seams and to secure the gabion to the adjacent gabion.
- Riprap utilized for check dams shall have a D50 median stone size of 6".

- The ESC Manager or approved representative shall inspect check dams weekly and during and after any storm event and make repairs or clean out as necessary.
- Sediment accumulated upstream of check dams shall be removed when the sediment depth upstream of check dam is within ½ of the height of the crest.



Reinforced check dams are required in major drainageways to resist breaching from overtopping flows.

10. **Reinforced Rock Berm (RRB).** A reinforced rock berm consists of a linear mass of gravel enclosed in wire mesh to form a porous filter, able to withstand overtopping. The berm is heavy and stable and promotes sediment deposition on its upstream side.

Key Installation and Maintenance Requirements:

- Crushed rock shall be fractured face (all sides) and shall comply with the gradation shown on Detail 12 of the ESC Plan Standard Notes and Details (Appendix C).
- Wire mesh shall be fabricated of 10-gauge wire twisted into a mesh with a maximum opening of 1.0-inch (commonly termed "Chicken Wire"). Roll width shall be 48-inches.
- Wire mesh shall be secured using "Hog Rings" or wire ties at 6-inch centers along all joints and at 2-inch centers on ends of berm.
- For concentrated flow areas the ends of the reinforced rock berm shall be 12” higher than the center of the berm.
- The ESC Manager or approved representative shall inspect reinforced rock berm weekly and during and after any storm event and make repairs of clean out as necessary.
- Sediment accumulated upstream of reinforced rock berm shall be removed when the sediment depth upstream of filter is within 5-inches of the crest.



A reinforced rock berm may be used downgradient of disturbed areas in lieu of silt fence.



Reinforced rock berms are especially useful over bedrock outcroppings or pavement where silt fence and sediment control logs cannot be installed.

11. **RRB for Culvert Protection (RRC).** A reinforced rock berm for culvert protection consists of a reinforced rock berm placed in front of a culvert to reduce sediment in runoff approaching the culvert.

Key Installation and Maintenance Requirements:

- Crushed rock shall be fractured face (all sides) and shall comply with the gradation shown on Detail 12 of the ESC Plan Standard Notes and Details (Appendix C).
- Wire mesh shall be fabricated of 10-gauge wire twisted into a mesh with a maximum opening of 1.0-inch (commonly termed "Chicken Wire"). Roll width shall be 48-inches.
- Wire mesh shall be secured using "Hog Rings" or wire ties at 6-inch centers along all joints and at 2-inch centers on ends of berm.
- For concentrated flow areas the ends of the reinforced rock berm shall be 12-inches higher than the center of the berm.
- The ESC Manager or approved representative shall inspect reinforced rock berm weekly and during and after any storm event and make repairs of clean out as necessary.
- Sediment accumulated upstream of reinforced rock berms shall be removed when the sediment depth upstream of filter is within 5 inches of the crest.



A properly installed reinforced rock berm for culvert protection.



Although some sediment trapping would occur with this alternate arrangement, the standard detail shall be utilized.



Without a reinforced rock berm for culvert protection, culverts fill with sediment.

12. **Sediment Basin (SB).** A sediment basin is an impoundment that captures sediment-laden runoff and releases it slowly, providing prolonged settling times to capture coarse and fine-grained soil particles.

Key Installation and Maintenance Requirements:

- Schedule 40 pipe or greater shall be used for outlet pipe and riser.
- A check dam shall be provided within the basin conforming to Detail #1 of the ESC Plan Standard Notes and Details (Appendix C).
- A gravel pack of 1-1/2-inch rock around the pipe outlet shall be provided.
- The ESC Manager or approved representative shall inspect sediment basins weekly and during and after any storm event and make repairs or clean out as necessary.
- Sediment accumulated within the sediment basin shall be removed when the sediment depth is 1.0-feet deep.

Sediment Basins shall be incorporated into any permanent detention or water quality basins with the following requirements:

- At least one-half of the sediment basin design volume shall be constructed below the lowest orifice of the permanent outlet works. A temporary gravel pack shall be placed in front of the permanent orifices.
- The sediment basin volume shall be kept active and in a maintained condition until vegetation in upstream watershed is fully established and accepted.



Properly installed outlet pipe and gravel pack.



The sediment basin above is improperly installed due to:

- *Lack of an armored spillway.*
- *Pipe perforations set above the spillway crest elevation.*

13. **Sediment Control Log (SCL).** A sediment control log consists of a cylindrical bundle of excelsior, straw, compost, or coconut material designed to form a semi-porous filter, able to withstand overtopping. The log shall be staked into the ground and promotes sediment deposition on its upstream side and a reduction in flow velocities.

Key Installation and Maintenance Requirements:

- The sediment control log shall be trenched into the ground a minimum of 2 inches.
- The ESC Manager or approved representative shall inspect sediment control logs daily and during and after any storm event and make repairs or clean out as necessary.



Sediment control logs shall not be installed in roadside ditches or other concentrated flow areas.



Sediment control logs may be used instead of silt fence on steep slopes.



Sediment control logs shall be placed along a contour.

14. **Sediment Trap (ST).** A sediment trap consists of a riprap berm with a small upstream basin that acts to trap coarse sediment particles. It can be used for upstream disturbed areas less than 1.0 acre. Disturbed areas greater than 1.0 acre require a sediment basin.

Key Installation and Maintenance Requirements:

- The top of the earthen berm shall be a minimum of 6-inches higher than the top of the riprap outlet structure.
- The ends of the riprap outlet structure shall be a minimum of 6-inches higher than the center of the outlet structure.
- The ESC Manager or approved representative shall inspect the sediment trap weekly and during and after any storm event and make repairs or clean out as necessary.



A properly installed sediment trap.

15. **Seeding and Mulching (SM).** Seeding and mulching consists of drill seeding disturbed areas with the approved City seed mix and crimping in straw mulch to provide immediate protection against rain and wind erosion and, as the grass cover becomes established, to provide long-term stabilization of exposed soils. Hydraulic seeding/mulching is not allowed as a seeding method.

Key Installation and Maintenance Requirements:

- All areas to be seeded and mulched shall have native topsoil spread to a depth of at least 6-inches (loose depth). All disturbed areas shall be loosened to a depth of 6-inches prior to spreading topsoil.
- Soil shall be thoroughly loosened (tilled) to a depth of at least 6-inches prior to seeding. The top 6-inches of the seed bed shall be free of rocks greater than 4-inches and soil clods greater than 2-inches. Seeding over any compacted areas that haven't been loosened to a depth of at least 6-inches shall be rejected.

- Seed shall be applied using a mechanical drill to a depth of not less than 1/4-inch and not more than 3/4-inch. Row spacing shall be no more than 6-inches. Material used for mulch shall consist of long-stemmed straw. At least 50-percent of the straw, by weight, shall be 10-inches or more in length. Mulch shall be applied and mechanically anchored to a depth of at least 2-inches. Mulch shall be applied at a rate of 4000-pounds of straw per acre.
- Copies of seed tickets shall be provided to the City's ESC Inspector upon request.
- Seeded and mulched areas shall be inspected for required coverage monthly for a period of two years following initial seeding. Repairs and re-seeding and mulching shall be undertaken after the first growing season for any areas failing to meet the required coverage.
- Seeding and mulching operations must be undertaken when a Grading Permit expires and no renewal is granted.



A drill seeder shall be used to plant seed in the City. With the City's approval, seed may be hand broadcast, at twice the drilled rate, raked and crimp mulched in small areas where it is not possible to drill seed.



A mechanical crimper shall be used to anchor long-stemmed straw mulch.



The area on the left was hydraulic seeded at the same time as the area on the right (across the street) was drilled. Due to poor performances like this example, Hydraulic seeding/mulching is not allowed as a seeding method.



Hydraulic seeding/mulching is not allowed.



This mulch was not crimped into soil and is susceptible to displacement, leaving the seed bed unprotected.

16. **Silt Fence (SF).** Silt fence is a temporary sediment barrier constructed of woven fabric stretched across supporting posts. The bottom edge of the fabric is placed in an anchor trench that is backfilled with compacted soil.

Key Installation and Maintenance Requirements:

- The bottom portion of the silt fence shall be trenched in and compacted so that the silt fence resists being pulled out by hand. Silt fence installation machines that use trenching or slicing may be utilized to install silt fence.
- Use of road graders, backhoes and similar equipment for installation of silt fence is prohibited.
- The ESC Manager or approved representative shall inspect silt fence daily and during and after any storm event and make repairs or clean out as necessary.
- Sediment accumulated upstream of silt fence shall be removed when the upstream sediment reaches a depth of 6-inches.



Properly installed silt fence cannot easily be pulled out of the ground.



Silt fence is to be securely tied into adjacent BMP's such as the sediment control log shown here, or reinforced rock berms or sediment basin embankments.



The lower edge of this silt fence is not anchored in a backfilled trench.

17. **Stabilized Staging Area (SSA).** A stabilized staging area consists of stripping topsoil and spreading a layer of 1-1/2-inch rock in the area to be used for a trailer, parking, storage, unloading and loading. A stabilized staging area reduces the likelihood that the vehicles most frequently entering a site are going to come in contact with mud.

    Key Installation and Maintenance Requirements:

    - Stabilized staging area shall be large enough to fully contain parking, storage, and unloading and loading operations.
    - Stabilized staging area shall consist of a minimum thickness of 3-inches of granular material.
    - Stabilized staging area shall be inspected weekly and during and after any storm event and repaired (by adding more granular material) or enlarged as necessary.



Properly installed stabilized staging area.



Parking, staging, and storage are spread out all over this site, increasing disturbance and erosion.

18. **Surface Roughening Area (SR).** Surface roughening consists of creating a series of grooves or furrows on the contour in all disturbed, graded areas to trap rainfall and reduce the formation of rill and gully erosion.

    Key Installation and Maintenance Requirements:

- Disturbed surfaces shall be roughened using ripping or tilling equipment on the contour or tracking up and down a slope using equipment treads.
- The ESC Manager or approved representative shall inspect surface roughening weekly and during and after any storm event and make repairs (re-roughen soil or repair rill erosion) as necessary.



Properly executed surfacing roughening.



Surface roughening on this slope may have prevented this rill erosion.

19. **Temporary Slope Drain (TSD).** A temporary slope drain is a small culvert or plastic rundown to convey runoff down a slope or channel bank to reduce the occurrence of rill and gully erosion.

Key Installation and Maintenance Requirements:

- Riprap shall be placed at the outfall of the slope drain.
- The ESC Manager or approved representative shall inspect slope drains weekly and during and after any storm event and make repairs as necessary.



Properly installed temporary slope drain pipe alternative).



This plastic lined temporary slope drain allows runoff to be conveyed down a slope without causing rill and gully erosion.

20. **Temporary Stream Crossing (TSC).** A temporary stream crossing consists of a riprap layer (for a ford crossing) or culverts covered with riprap (for a culvert crossing) to allow construction equipment to cross a stream. In either case, excavation of the existing channel banks is not allowed and, in general, disturbance is to be kept to a minimum.

    Key Installation and Maintenance Requirements:

    - Permittee(s) shall confirm that all related stream permitting is obtained prior to installing temporary stream crossings and that all work will be in compliance with such permitting.
    - The ESC Manager or approved representative shall inspect stream crossings weekly and during and after any storm event and make repairs or clean out upstream sediment as necessary.
    - Sediment accumulated upstream of stream crossings shall be removed when the sediment depth upstream of crossing is within 6-inches of the crest (ford crossing) or greater than an average depth of 12-inches (culvert crossing).



Properly installed temporary stream crossing.



This temporary stream crossing is constructed of soil and is not acceptable.

21. **Terracing (TER).** Terracing consists of creating one or more flat benches in high, steep cut or fill slopes to interrupt runoff and reduce the formation of rill and gully erosion.

    Key Installation and Maintenance Requirements:

    - The ESC Manager or approved representative shall inspect terracing weekly and during and after any storm event and make repairs (repair rill erosion, re-roughen soil, or re-seed and mulch) as necessary.



This terraced bench interrupts slope drainage and reduces rill and gully erosion.

22. **Vehicle Tracking Control (VTC).** Vehicle tracking control consists of a 3 to 6 inch crushed rock pad 12 inches thick at all entrance/exit points for a site that is intended to help strip mud from tires prior to vehicles leaving the construction site.

Key Installation and Maintenance Requirements:

- Vehicle tracking control pads shall be installed at every access point to or from the site.
- Vehicle tracking control pads shall consist of hard, dense, durable stone, angular in shape and resistant to weathering. Rounded stone or boulders will not be acceptable. The stones shall be 3-to 6-inches in size and have a specific gravity of at least 2.6.
- A stop sign installed in accordance with the MUTCD, as amended, shall be installed for exiting traffic from the vehicle tracking control pad.
- The ESC Manager or approved representative shall inspect the VTC daily and during and after any storm event.



Use of low density rock such as Rhyolite is not permitted since it does not stay in place and can get tracked onto paved streets.



Properly installed vehicle tracking control.



No vehicle tracking control means mud on streets and an immediate Stop Work Order.



Curb ramps of earth, concrete, or lumber are not permitted in the curb section. Temporary ramps may be used.

23. **Vehicle Tracking Control with Wheel Wash (WW).** Wheel wash consists of a gravel and riprap pad at the main entrance/exit point for the site with an adjacent wash water/sediment trap. If the City requires a contractor to implement this BMP, each wheel of all vehicles coming in contact with dirt or mud shall be cleaned using a high-pressure washer prior to the vehicle leaving the site.

Key Installation and Maintenance Requirements:

- Specific requirements will be specified by the City in cases where vehicle tracking control with wheel wash is required.



A high-pressure washer effectively cleans mud from wheels.

8.05 BMP PLANNING FOR NEW DEVELOPMENT

This section contains guidance for the selection and placement of permanent structural best management practices (BMP's) for new development and significant redevelopment.

8.05.1 APPLICABILITY

All sites within Commerce City that include a total development / redevelopment area of one (1) acre or larger for which a stormwater quality facility is required

must provide permanent structural BMP's to enhance the quality of stormwater runoff. Water quality capture volume (WQCV) must be incorporated into the stormwater detention basins as discussed later in this section. Other permanent BMP's may also be required as appropriate.

8.05.2 PERMANENT BMP PLANNING

The objective of permanent BMP planning is to enhance, to the maximum extent practicable, the quality of stormwater discharged from a site. The most effective permanent BMP plans incorporate the following major elements:

1. Employ runoff reduction practices,
2. Provide water quality capture volume (WQCV), and
3. Stabilize drainageways.

8.05.2.1 RUNOFF REDUCTION PRACTICES

The basic principle behind runoff reduction practices is to minimize the total impervious area for a site and to minimize directly connected impervious areas for a site. The principle behind minimizing directly connected impervious areas is to route runoff from impervious surfaces over landscaped areas to reduce runoff velocities and promote infiltration.

Benefits of Runoff Reduction

Reducing the amount of runoff from a site by minimizing total impervious area and minimizing directly connected impervious areas may provide some of the following benefits:

- Decreased WQCV and, in turn, decreased size of required WQCV facilities.
- Reduced need for irrigation.

BMP's for Runoff Reduction

- Grass Buffer – Uniformly graded and densely vegetated area of turf grass. This BMP requires sheet flow to promote filtration, infiltration, and settling to reduce runoff pollutants.
- Grass Swale – Densely vegetated drainageway with low-pitched side slopes that collects and slowly conveys runoff. Design of longitudinal slope and cross-section size forces the flow to be slow and shallow, thereby facilitating sedimentation while limiting erosion.
- Modular Block Porous Pavement – Modular block porous pavement consists of open void concrete slab units underlain with gravel. The surface voids are filled with sand. This BMP is intended to be used in low traffic areas to

accommodate vehicles while facilitating stormwater infiltration near its source. A variation of this BMP is termed stabilized-grass porous pavement, consisting of plastic rings affixed to filter fabric underlain with gravel. The surface voids are filled with sand and grass sod / or seed. The use of modular block porous pavement is restricted to areas outside the public right-of-way.

Minimizing Directly Connected Impervious Areas and Applying BMP's To a Site

Refer to VOLUME III, "New Development Planning", Section 1.4.3 through Section 1.4.5 for minimizing directly connected impervious areas and associated application guidelines. Refer to VOLUME III, "Structural BMPs", Sections 1.0, 2.0, and 3.0 for runoff reducing BMP design guidelines.

8.05.2.2 WATER QUALITY CAPTURE VOLUME

Urban Drainage and Flood Control District (UDFCD) defines a water quality capture volume (WQCV) as the volume of stormwater produced from an 80th percentile storm event. Capture and treatment of the WQCV shall be the design approach for water quality enhancement because small, frequently occurring storms account for a significant portion of the annual pollutant load.

Benefits of Providing WQCV

Providing a storage volume equal to the WQCV results in 80 percent of the most frequently occurring storms being captured and treated and larger events being partially treated. The primary pollutant removal mechanism consists of physical settling of suspended sediments and associated adsorbed pollutants by long detention periods ranging from 6 to 40 hours, depending on the type of facility. Secondary pollutant removal mechanisms include filtering, biological uptake, and adsorption. The expected probable range of annual pollutant removal ranges from 50 to 80 percent for total suspended solids and from 40 to 80 percent for total phosphorus, depending on the type of facility and specific site conditions.

BMP's That Provide WQCV

- Porous Landscape Detention – Porous landscape detention consists of a low-lying vegetated area underlain by a sand bed with an underdrain. A shallow surcharge zone exists above the porous landscape detention for temporary storage of the WQCV. This BMP allows small amounts of WQCV to be provided on parking lots or adjacent to buildings without using significant developable land areas.

- Extended Detention Basin – An extended detention basin is appropriate for larger sites and is designed to totally empty out sometime after stormwater runoff ends. The extended basin uses a much smaller outlet than a flood control detention basin which extends the emptying time for the more frequently occurring runoff events to facilitate pollutant removal. The WQCV for extended detention basins shall be designed for a 40-hour release time in accordance with VOLUME III.
- Constructed Wetland Basin – A constructed wetland basin is appropriate for large catchments and is a shallow retention pond which requires a perennial supply of water to permit the growth of rushes, willows, cattails, and reeds. It treats runoff by slowing it down to allow time for settling and biological uptake. The WQCV for constructed wetland basins shall be designed for a 24-hour release time in accordance with VOLUME III.
- Wet Extended Detention Basin – A wet extended detention basin has a permanent pool of water that is replaced with stormwater, in part or in total, during storm runoff events. In addition, a temporary extended detention volume is provided above this permanent pool to capture storm runoff and enhance sedimentation. It requires a perennial supply of water to maintain the pool. WQCV for wet extended detention basins shall be designed for a 12-hour release in accordance with VOLUME III. The designer should note that a Retention Pond as defined in VOLUME III is the same as a Wet Extended Detention Basin defined herein. Additionally, a VOLUME III Retention Pond is completely separate and independent of a flood control retention pond facility.

Applying WQCV to a Site

Refer to VOLUME III, “New Development Planning”, Section 1.5.3 through Section 1.5.6 for WQCV application guidelines. Refer to VOLUME III, “Structural BMPs”, Section 5.0 through Section 8.0 for WQCV BMP design guidelines.

Incorporating WQCV into Detention Basins

Whenever possible, it is recommended that WQCV facilities be incorporated into detention facilities. The following approaches are to be implemented when incorporating WQCV into detention facilities:

- Water Quality – The full WQCV is to be provided according to the design procedures documented in VOLUME III.

- Minor Storm – The full WQCV plus the full minor storm detention volume is to be provided.
- 100-Year Storm – The full WQCV plus the full 100-year detention volume is to be provided.
- Retention Ponds – No WQCV will be required for retention ponds used for flood control, provided the design of the retention pond is in accordance with Chapter 12 of the City of Commerce City Storm Drainage Design and Technical Criteria Manual.

8.05.2.3 STABILIZE DRAINAGEWAYS

Drainageway erosion can be a major source of sediment and associated nutrients, such as phosphorus. Urbanization increases the frequency, rate, and volume of runoff which can cause dramatic increases in drainageway bed and bank erosion. Therefore, it is critical that drainageways be stabilized in conjunction with urbanization.

Methods for Stabilizing Drainageways

- Constructed Grass, Riprap, or Concrete-Lined Channel – These methods of channel stabilization have been in practice for some time and are described in the UDFCD Drainage Criteria Manual Volume II (VOLUME II). These methods provide an armored channel section that protects the channel bed and banks from the erosive effects of flowing water. While these methods are effective at reducing channel erosion, the armored low flow channels that are used offer little for water quality enhancement or wetland habitat. The use of riprap or concrete lined flood conveyance channels is not recommended, unless hydraulic or physical conditions require such an alternative.
- Stabilized Natural Channel – In practice, many natural drainageways in and adjacent to new developments are frequently left in an undisturbed condition. While this may be positive in terms of retaining desirable riparian vegetation and habitat, urbanization may cause the channel to become destabilized. When degradation occurs in these drainageways, significant erosion, loss of riparian and aquatic habitat, and elevated levels of sediment and associated pollutants can result. Therefore, it is recommended that some level of stream stabilization always be considered. Small grade control structures sized for a 5-year or larger storm event are often an effective means of establishing a mild slope for the baseflow channel and

arresting stream degradation. Severe bends or cut banks may also need to be stabilized. Such efforts to stabilize a natural waterway also preserves and promotes natural riparian vegetation which can provide paybacks in terms of enhanced aesthetics, habitat, and water quality. The design of stabilized natural channels is described in more detail in VOLUME II.

- Constructed Wetland Channel – Constructed wetland-bottomed channels take advantage of dense natural vegetation to slow down runoff and allow time for settling out sediment and biological uptake. These channels offer natural aesthetic qualities, wildlife habitat, erosion control, and pollutant removal. However, a continuous base flow is necessary to support the wetland vegetation. Regular maintenance is also required for this type of facility to provide nutrient removal. Design guidelines for constructed wetland channels are presented in VOLUME III, "Structural BMP's", Section 10.0.

8.05.2.4 CONSIDER NEED FOR INDUSTRIAL AND COMMERCIAL BMP'S

Specialized BMP's must be considered if a new development or significant redevelopment activity is planned for an industrial or commercial site. Some industrial and commercial facilities may store materials outside, use or store large quantities of hazardous or toxic chemicals, or perform activities that could result in discharges into the storm sewer system. These types of activities are the focus of BMP's relating to industrial and commercial facilities. Refer to the "Industrial Commercial" section of VOLUME III for design guidance for these types of BMP's.

8.05.3 MAINTENANCE OF PERMANENT BMPS

The property owners, heirs, successors, and/or assigns shall be responsible for the maintenance of all drainage facilities including inlets, pipes, culverts, channels, ditches, hydraulic structures, and detention basins located on their property unless modified by the subdivision development agreement. It is the City's responsibility to ensure the long term operation and effectiveness of those permanent structures; therefore, maintenance should be taken into consideration during design.

8.05.3.1 MAINTENANCE REQUIREMENTS

Stormwater facilities must be properly and consistently maintained to function effectively and ensure long-term viability. Regular maintenance is also key to public acceptance of these facilities. Typical maintenance operations to consider in designing facilities include:

- Mowing, trimming, and weed control.
- Pruning of shrub and tree limbs.
- Trash and debris cleanup, especially at grates and flow control structures.
- Sediment removal.
- Removal, replacement, and re-vegetation of porous landscape detention media.
- Sweeping/vacuuming/ replacement of porous pavement and porous pavement detention media.
- Structural repair.

Keeping in mind these and other potential maintenance practices, it is also necessary to fully consider how and with what equipment BMP's will be maintained in the future. Facility design should provide for these operations ensuring adequate access with a minimum of disturbance, disruption, and cost.

8.05.3.2 COMMERCE CITY MAINTENANCE POLICY

Commerce City requires that maintenance access be provided to all storm drainage facilities to assure continuous operational capability of the system. The property owners, heirs, successors, and/or assigns shall be responsible for the maintenance of all drainage facilities including inlets, pipes, culverts, channels, ditches, hydraulic structures, and detention basins located on their property unless modified by the subdivision development agreement. The subdivision development agreement regarding maintenance of storm drainage facilities shall be clearly stated in plat notes and/or warranty deeds for the property in question. Should the owner fail to maintain said facilities, the City shall have the right to enter said property for the sole purpose of operations and maintenance. All such maintenance costs will be assessed to the property owners.

8.06 REFERENCES

Adams County Public Works Department. Stormwater Quality Control Criteria. November 2002.

City of Boise Public Works Department. Boise Storm Water Best Management Practices (BMP) Guidebook. January 1987.

City of Colorado Springs. Drainage Criteria Manual Volume 2 – Stormwater Quality Policies, Procedures and Best Management Practices (BMPS). November 2002.

Colorado Department of Public Health and Environment. CDPS General Permit – Stormwater Discharges Associated With Construction Activity.

Colorado Department of Public Health and Environment. *Colorado's Phase II Municipal Guidance*. October 2001.

City of Commerce City. Department of Public Works. Storm Drainage Design and Technical Criteria Manual. 1987.

Douglas County, Colorado. Department of Public Works Engineering Division. Grading, Erosion, and Sediment Control (GESC) Manual. March 2004.

Urban Drainage and Flood Control District. Urban Storm Drainage Criteria Manual, Volume 3 – Best Management Practices. September 1999.

Appendix A

Contact Information

City of Commerce City Public Works 303-288-8150

ADCOM (Police/Fire): 303-288-1535

Adams County: 303-288-3743

Colorado Department of Public Health and Environment
Spill Hotline: 1-877-518-5608

South Adams County Water and Sanitation District: 303-288-2646

The Following information Shall be Provided to the ESC Inspector

	Company & Contact	Phone	Fax	E-mail
Owner or Owner's Representative				
General Contractor				
ESC Manager				
Alternate ESC Manager				
Grading Sub-Contractor				
Design Engineer				

Appendix B

Typical Inspection Forms

Inspection Report for Verbal Warning

City of Commerce City
Stormwater Management Program
Erosion and Sediment Control Measures
Inspection Report

1. Project Name:	Reason for Inspection:
2. Project Location:	☐ Required 7 Calendar Day Inspection
3. Contractor's Name:	☐ Required Storm Event Inspection
4. Inspection Date:	☐ Other:

1. SWMP available on site?	☐		5. Perimeter Contained?	☐
2. Log Book available on site?	☐		6. Street Sweeping?	☐
3. Soil Tracking?	☐		7. Photographs Taken?	☐
4. Concrete Washout?	☐			

BMP Type	Condition				Comments
	To Be Constructed	Good	Requires Maintenance	Needs Replacement	
Inlet Protection					
Outlet Protection					
Silt Fence					
Erosion Bales					
Concrete Washout					
Sediment Trap					
Seeding					
Mulching					
Erosion Blankets					
Erosion Logs					
Other					

Additional Information and Comments:

Inspector Name Date

Notice of Violation

Erosion and Sediment Control Program		
City of Commerce City	Page 1 of 1	Enforcement Protocol

Project Name:_____
Contractor Name:_____

Reason for Enforcement:

Mud Tracking
Disturbed areas not contained
Inlet Protection
Logbook not current/available
Areas for material/waste storage and fueling not contained
Concrete Washout
No Grading Permit
Other: _____
_____

Verbal Warning date:_____
When site will be reinspected (24 hours after verbal warning):_____

After verbal warning, if the site is not in compliance with the City of Commerce City's Erosion and Sediment Control Ordinance, the City of Commerce City will issue a stop work order for the site.

Comments:

_____
_____
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_____
_____
_____

Please direct any concerns to the City of Commerce City Engineering Division at 303-289-8170

Inspector:_____Date:_____Time:_____

City of Commerce City – Public Works

STORMWATER-Construction Site Inspection Report

(1) Project Name:	(2) Project Location:	(3) Date:
(4) SWMP Current:	(5) Inspection Type:	(6) Inspected By:

(7) BMPs ON SITE AT TIME OF INSPECTION

	In SWMP	Used	Not Needed at this time
(a) EROSION CONTROL BMPs ON SITE			
Seeding	❑	❑	❑
Mulching/Mulch Tackifier	❑	❑	❑
Soil Binder	❑	❑	❑
Erosion Control Blankets	❑	❑	❑
Embankment Protector*	❑	❑	❑
Grading Techniques*	❑	❑	❑
Berm/Diversion	❑	❑	❑
Check Dams*	❑	❑	❑
Outlet Protection*	❑	❑	❑
Other:	❑	❑	❑
(c) BMPs FOR SPECIAL CONDITIONS			
Dewatering Structure	❑	❑	❑
Temp. Stream Crossing	❑	❑	❑
Clear Water Diversion	❑	❑	❑
Contaminated Area Fencing	❑	❑	❑
Other:	❑	❑	❑

	In SWMP	Used	Not Needed at this time
(b) SEDIMENT CONTROL BMPs ON SITE			
Vehicle Tracking Pad	❑	❑	❑
Sediment Trap	❑	❑	❑
Inlet Protection*	❑	❑	❑
Sediment Basin	❑	❑	❑
Perimeter Control*	❑	❑	❑
Other:	❑	❑	❑
(d) MATERIALS HANDLING, SPILL PREVENTION, WASTE MANAGEMENT AND GENERAL POLLUTION PREVENTION			
Stockpile Management*	❑	❑	❑
Materials Management*	❑	❑	❑
Concrete Waste Management*	❑	❑	❑
Saw Water Management*	❑	❑	❑
Solid Waste/Trash Management	❑	❑	❑
Street Sweeping	❑	❑	❑
Sanitary Facility*	❑	❑	❑
Vehicle and Equip. Management	❑	❑	❑
Other:	❑	❑	❑

(8) CONSTRUCTION SITE ASSESSMENT: **Off site Pollutant Discharges are a Violation of the Permit and may result in Formal Enforcement**

(a) Is there evidence of discharge of sediment or other pollutants from the site? ❑ Yes ❑ No
*If yes, explain the discharge and the corrective actions in section 16 (Construction Site Assessment & Corrective Actions) or section 18 (General Notes).
(b) Has sediment or other pollutants discharging from the site reached state waters? ❑ Yes ❑ No
*If yes, see subsection 208.03(c) and Part II A.2 and 3 of the State permit for reporting requirements.

(9) GENERAL NOTES

(10) INSPECTION CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Contractor's Erosion Control Supervisor/SWMP Administrator (Signature Required)	Date:

(11) COMPLIANCE CERTIFICATION

Corrective action(s) has been taken, or where a report does not identify any incidents requiring corrective action, the report shall contain a signed statement indicating the site is in compliance with the permit to the best of the signer's knowledge and belief.

Contractor's Erosion Control Supervisor/SWMP Administrator (Signature Required)	Date:

(12) CONSTRUCTION SITE ASSESSMENT & CORRECTIVE ACTIONS **Off site Pollutant Discharges are a Violation of the Permit and may result in Formal Enforcement**

The construction site perimeter, all disturbed areas, material and/or waste storage areas that are exposed to precipitation, discharge locations, and locations where vehicles access the site shall be inspected for evidence of, or the **potential** for, pollutants leaving the construction site boundaries, entering the stormwater drainage system, or discharging to state waters. If there is evidence of sediment or other pollutants discharging from the site, see section 17 (Construction Site Assessment).

All erosion and sediment control practices identified in the SWMP shall be evaluated to ensure that they are maintained and operating correctly. Identify the condition of the BMP, using more than one letter if necessary: (**I**) Incorrect Installation; (**M**) Maintenance is needed; (**F**) BMP failed to operate; (**A**) Additional BMP is needed; (**R**) Remove BMP. Keep copies of this blank page for additional room if needed.

Continuous maintenance is required on all BMPs. **BMPs that are not operating effectively, have proven to be inadequate, or have failed must be addressed as soon as possible, immediately in most cases.**

Location	BMP	Condition	Comments: Description of Corrective Action and Preventative Measure Taken	Date Completed & Initials

Appendix C

ESC Plan Standard Notes and Details

EROSION AND SEDIMENT CONTROL (ESC) GENERAL NOTES

1. GRADING PLAN IS FOR ROUGH GRADING ONLY. CHANGES MAY BE NECESSARY TO BRING PLANS INTO CONFORMANCE WITH APPROVED DRAINAGE AND SITE PLAN.
2. A WATER TRUCK SHALL BE KEPT ON-SITE TO CONTROL WIND EROSION AND DUST.
3. ANY SETTLEMENT OR SOIL ACCUMULATIONS BEYOND THE PROPERTY LIMITS DUE TO GRADING OR EROSION SHALL BE REPARIED IMMEDIATELY BY THE CONTRACTOR.
4. NO GRADING SHALL TAKE PLACE IN ANY DELINEATED FLOOD HAZARD AREA UNTIL THE FINAL DRAINAGE PLAN HAS BEEN APPROVED AND ALL APPROPRIATE PERMITS HAVE BEEN OBTAINED.
5. ANY CONSTRUCTION DEBRIS OR MUD TRACKING IN THE PUBLIC RIGHT-OF-WAY RESULTING FROM THIS DEVELOPMENT WILL BE REMOVED IMMEDIATELY BY THE CONTRACTOR. UPON WRITTEN NOTICE BY THE CITY, FAILURE TO REMOVE THE MUD OR DEBRIS BY THE CONTRACTOR WITHIN 24 HOURS SHALL CAUSE THE CITY TO STOP ALL WORK UNTIL THE SITUATION IS RESOLVED.
6. WHEN REQUIRED, A COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT (CDPHE), WATER QUALITY DIVISION, STORMWATER DISCHARGE PERMIT SHALL BE OBTAINED AND A COPY SHALL BE SUBMITTED TO THE CITY OF COMMERCE CITY DEPARTMENT OF PUBLIC WORKS.
7. AREAS DISTURBED BY GRADING SHALL BE MULCHED AND RESEEDED WITH NATIVE VEGETATION OR AS APPROVED ON THE PLAN.
8. THE CONTRACTOR SHALL BE SOLELY AND COMPLETELY RESPONSIBLE FOR SAFETY CONDITIONS ON AND ADJACENT TO THE SITE 24 HOURS A DAY, SEVEN DAYS A WEEK.
9. CONTRACTOR SHALL CONTACT UTILITY NOTIFICATION CENTER FOR THE LOCATION OF UNDERGROUND UTILITIES AT LEAST 48 HOURS PRIOR TO COMMENCEMENT OF CONSTRUCTION. (811 or 1-800-922-1987)
10. THE CITY ENGINEER'S SIGNATURE AFFIXED TO THIS DOCUMENT INDICATES THE CITY OF COMMERCE CITY PUBLIC WORKS DEPARTMENT, ENGINEERING DIVISION, HAS REVIEWED THE DOCUMENT AND FOUND IT IN GENERAL COMPLIANCE WITH THE CITY'S STORMWATER QUALITY CONTROL CRITERIA. THE CITY ENGINEER, THROUGH ACCEPTANCE OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY (OTHER THAN AS STATED ABOVE) FOR THE COMPLETENESS AND/OR ACCURACY OF THESE DOCUMENTS.
11. THE ADEQUACY OF THIS ESC PLAN LIES WITH THE ORIGINAL DESIGN ENGINEER.
12. ALL MATERIALS AND WORKMANSHIP SHALL BE SUBJECT TO INSPECTION BY THE CITY. COMMERCE CITY RESERVES THE RIGHT TO ACCEPT OR REJECT ANY SUCH MATERIALS AND WORKMANSHIP THAT DOES NOT CONFORM TO THE APPROVED PLANS.
13. THE PLACEMENT OF EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICES (BMP's) SHALL BE IN ACCORDANCE WITH THE CITY APPROVED PLANS.
14. ANY VARIATION IN MATERIAL, TYPE OR LOCATION OF EROSION AND SEDIMENT CONTROL BMP's FROM THE CITY APPROVED PLANS WILL REQUIRE APPROVAL FROM AN ACCOUNTABLE REPRESENTATIVE OF THE CITY OF COMMERCE CITY ENGINEERING DIVISION.
15. AFTER THE ESC PLAN HAS BEEN APPROVED, THE CONTRACTOR MAY INSTALL THE INITIAL-STAGE EROSION AND SEDIMENT CONTROL BMPS INDICATED ON THE ACCEPTED ESC PLAN.
16. THE FIRST BMP TO BE INSTALLED ON THE SITE SHALL BE CONSTRUCTION FENCE, MARKERS, OR OTHER APPROVED MEANS OF DEFINING THE LIMITS OF CONSTRUCTION, INCLUDING CONSTRUCTION LIMITS ADJACENT TO STREAM CORRIDORS AND OTHER AREAS TO BE PRESERVED.
17. AFTER INSTALLATION OF THE INITIAL-STAGE EROSION AND SEDIMENT CONTROL BMPs, THE PERMITTEE SHALL CALL THE PUBLIC WORKS AT 303-289-8150 TO SCHEDULE A PRECONSTRUCTION MEETING AT THE PROJECT SITE. THE REQUEST SHALL BE MADE A MINIMUM OF THREE BUSINESS DAYS PRIOR TO THE REQUESTED MEETING TIME. NO CONSTRUCTION ACTIVITIES SHALL BE PLANNED WITHIN 24 HOURS AFTER THE PRECONSTRUCTION MEETING.
18. THE ESC MANAGER SHALL BE CERTIFIED IN STORMWATER MANAGEMENT AND EROSION CONTROL AND DOCUMENTATION SHALL BE PROVIDED TO THE CITY.
19. THE OWNER OR OWNER'S REPRESENTATIVE, THE ESC MANAGER, THE GENERAL CONTRACTOR, AND THE GRADING SUBCONTRACTOR, IF DIFFERENT FROM THE GENERAL CONTRACTOR, MUST ATTEND THE PRECONSTRUCTION MEETING. IF ANY OF THE REQUIRED PARTICIPANTS FAIL TO ATTEND THE PRECONSTRUCTION MEETING, OR IF THE INSTALLATION OF THE INITIAL BMP's ARE NOT APPROVED BY THE CITY ESC INSPECTOR, THE APPLICANT WILL HAVE TO PAY A REINSPECTION FEE, ADDRESS ANY PROBLEMS WITH BMP INSTALLATION, AND CALL TO RESCHEDULE THE MEETING, WITH A CORRESPONDING DELAY IN THE START OF CONSTRUCTION. THE CITY STRONGLY ENCOURAGES THE APPLICANT TO HAVE THE ENGINEER OF RECORD AT THE PRECONSTRUCTION MEETING.
20. CONSTRUCTION SHALL NOT BEGIN UNTIL THE CITY ESC INSPECTOR APPROVES THE INSTALLATION OF THE INITIAL BMP's AND THE GRADING PERMIT IS OBTAINED FROM PUBLIC WORKS.
21. THE ESC MANAGER SHALL STRICTLY ADHERE TO THE APPROVED LIMITS OF CONSTRUCTION AT ALL TIMES. THE CITY OF COMMERCE CITY ENGINEERING DIVISION MUST APPROVE ANY CHANGES TO THE LIMITS OF CONSTRUCTION AND, AT THE DISCRETION OF THE ENGINEERING DIVISION, ADDITIONAL EROSION/SEDIMENT CONTROLS MAY BE REQUIRED IN ANY ADDITIONAL AREAS OF CONSTRUCTION.
22. NATURAL VEGETATION SHALL BE RETAINED AND PROTECTED WHEREVER POSSIBLE. EXPOSURE OF SOIL TO EROSION BY REMOVAL OR DISTURBANCE OF VEGETATION SHALL BE LIMITED TO THE AREA REQUIRED FOR IMMEDIATE CONSTRUCTION OPERATIONS.
23. A COPY OF THE GRADING PERMIT AND APPROVED PLANS SHALL BE ON SITE AT ALL TIMES.
24. THE ESC MANAGER SHALL BE RESPONSIBLE FOR ENSURING THAT THE SITE REMAINS IN COMPLIANCE AND SHALL BE THE PERMITTEE'S CONTACT PERSON WITH THE CITY FOR ALL MATTERS PERTAINING TO THE GRADING PERMIT. THE ESC MANAGER SHALL BE PRESENT AT THE SITE THE MAJORITY OF THE TIME AND SHALL BE AVAILABLE THROUGH A 24-HOUR CONTACT NUMBER.
25. THE ESC MANAGER IS RESPONSIBLE FOR CLEANUP OF SEDIMENT OR CONSTRUCTION DEBRIS TRACKED ONTO ADJACENT PAVED AREAS. PAVED AREAS, INCLUDING STREETS, ARE TO BE KEPT CLEAN THROUGHOUT BUILD-OUT AND SHALL BE CLEANED WITH A STREET SWEEPER OR SIMILAR DEVICE AT FIRST NOTICE OF ACCIDENTAL TRACKING OR AT THE DISCRETION OF THE CITY'S ESC INSPECTOR. STREET WASHING IS NOT ALLOWED. THE CITY RESERVES THE RIGHT TO REQUIRE ADDITIONAL MEASURES TO ENSURE AREA STREETS ARE KEPT FREE OF SEDIMENT AND/OR CONSTRUCTION DEBRIS.
26. THE APPROVED PLANS MAY REQUIRE CHANGES OR ALTERATIONS AFTER APPROVAL TO MEET CHANGING SITE OR PROJECT CONDITIONS OR TO ADDRESS INEFFICIENCIES IN DESIGN OR INSTALLATION. ALL CONSTRUCTION TRAFFIC MUST ENTER/EXIT THE SITE THROUGH THE CITY APPROVED ACCESS POINTS. A VEHICLE TRACKING CONTROL PAD IS REQUIRED AT ALL ACCESS POINTS ON THE SITE. ADDITIONAL STABILIZED CONSTRUCTION ENTRANCES MAY BE ADDED WITH AUTHORIZATION FROM THE COMMERCE CITY ENGINEERING DIVISION.
27. THE ESC MANAGER SHALL OBTAIN PRIOR APPROVAL FROM THE DESIGN ENGINEER AND COMMERCE CITY ENGINEERING DIVISION FOR ANY PROPOSED CHANGES.
28. NO PERMANENT EARTH SLOPES GREATER THAN 3:1 SHALL BE ALLOWED.
29. ANY SETTLEMENT OR SOIL ACCUMULATIONS BEYOND THE LIMITS OF CONSTRUCTION DUE TO GRADING OR EROSION SHALL BE REPAIRED IMMEDIATELY BY THE ESC MANAGER. THE ESC MANAGER SHALL BE HELD RESPONSIBLE FOR OBTAINING ACCESS RIGHTS TO ADJACENT PROPERTY, IF NEEDED, AND REMEDIATING ANY ADVERSE IMPACTS TO ADJACENT WATERWAYS, WETLANDS, PROPERTIES, ETC. RESULTING FROM WORK DONE AS PART OF THIS PROJECT.
30. SOILS THAT WILL BE STOCKPILED FOR MORE THAN THIRTY (30) DAYS SHALL BE SEEDED AND MULCHED WITHIN FOURTEEN (14) DAYS OF STOCKPILE CONSTRUCTION. NO STOCKPILES SHALL BE PLACED WITHIN ONE HUNDRED (100) FEET OF A DRAINAGE WAY UNLESS APPROVED BY THE COMMERCE CITY ENGINEERING DIVISION.
31. ALL CHEMICAL OR HAZARDOUS MATERIAL SPILLS WHICH MAY ENTER WATERS OF THE STATE OF COLORADO, WHICH INCLUDE BUT ARE NOT LIMITED TO, SURFACE WATER, GROUND WATER AND DRY GULLIES OR STORM SEWER LEADING TO SURFACE WATER, SHALL BE IMMEDIATELY REPORTED TO THE CDPHE PER CRS 25-8-601, AND COMMERCE CITY. RELEASES OF PETROLEUM PRODUCTS AND CERTAIN HAZARDOUS SUBSTANCES LISTED UNDER THE FEDERAL CLEAN WATER ACT (40 CFR PART 116) MUST BE REPORTED TO THE NATIONAL RESPONSE CENTER, SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT AS WELL AS THE CDPHE. SPILLS THAT POSE AN IMMEDIATE RISK TO HUMAN LIFE SHALL BE REPORTED TO 911. FAILURE TO REPORT AND CLEAN UP ANY SPILL SHALL RESULT IN ISSUANCE OF A STOP WORK ORDER.
32. THE CLEANING OF CONCRETE DELIVERY TRUCK CHUTES IS RESTRICTED TO APPROVED CONCRETE WASH OUT LOCATIONS ON THE JOB SITE. THE DISCHARGE OF WATER CONTAINING WASTE CONCRETE TO THE STORM SEWER SYSTEM IS PROHIBITED. ALL CONCRETE WASTE SHALL BE PROPERLY CLEANED UP AND DISPOSED AT AN APPROPRIATE LOCATION.
33. COMMERCE CITY DOES NOT ALLOW HAY BALES AS A FORM OF EROSION AND SEDIMENT CONTROL.
34. ONCE THE SITE HAS REACHED FINAL STABILIZATION, A FINAL INSPECTION SHALL BE SCHEDULED WITH THE CITY'S ESC INSPECTOR. A CERTIFICATE OF OCCUPANCY WILL NOT BE ISSUED AND/OR THE GRADING BOND WILL NOT BE RELEASED UNTIL THE CITY'S ESC INSPECTOR APPROVES FINAL STABILIZATION.

DETAIL NO.	SHEET NO.	BMP LEGEND	
1	2	CD	CHECK DAM
2	2	CB	COMPOST BLANKET
3	2	CFB	COMPOST FILTER BERM
4	3	CWA	CONCRETE WASHOUT AREA
5	3	CF	CONSTRUCTION FENCE
6	3	CM	CONSTRUCTION MARKERS
7	4	DW	DEWATERING
8	4	DD	DIVERSION DITCH
9	5	ECB	EROSION CONTROL BLANKET
10	6	IP	INLET PROTECTION
11	7	RCD	REINFORCED CHECK DAM
12	7	RRB	REINFORCED ROCK BERM
13	7	RRC	RRB FOR CULVERT PROTECTION
14	8	SB	SEDIMENT BASIN
15	9	SCL	SEDIMENT CONTROL LOG
16	9	ST	SEDIMENT TRAP
17	10	SM	SEEDING AND MULCHING
18	11	SF	SILT FENCE
19	11	SSA	STABILIZED STAGING AREA
20	11	SR	SURFACE ROUGHENING
21	12	TSD	TEMPORARY SLOPE DRAIN
22	12	TSC	TEMPORARY STREAM CROSSING
23	13	TER	TERRACING
24	13	VTC	VEHICLE TRACKING CONTROL
25	13	WW	VTC WITH WHEEL WASH
	14		ROCK AND RIPRAP GRADATIONS
		LOC	LIMITS OF CONSTRUCTION

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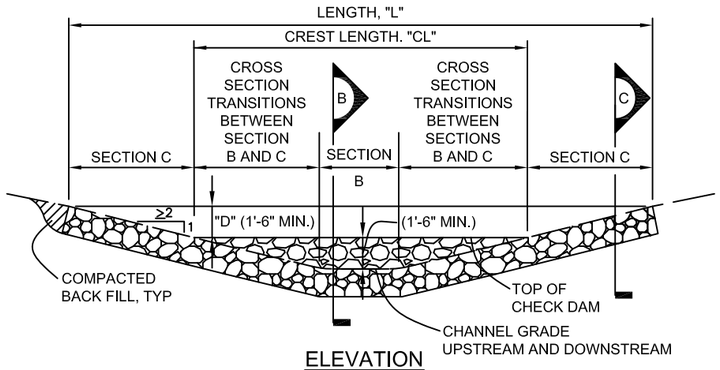
CITY OF COMMERCE CITY
Department of Public Works
8602 Rosemary St.
Commerce City, CO 80022
Ph: 303-289-8150

EROSION & SEDIMENT CONTROL

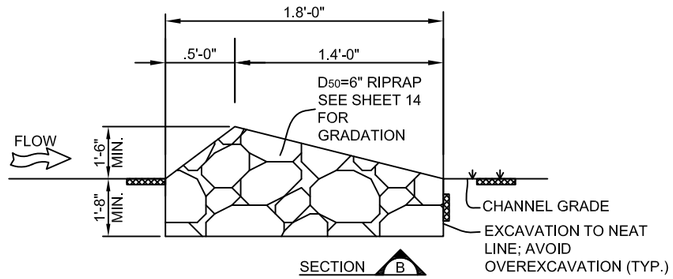
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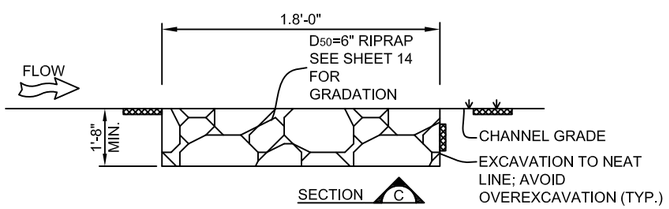
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ELEVATION





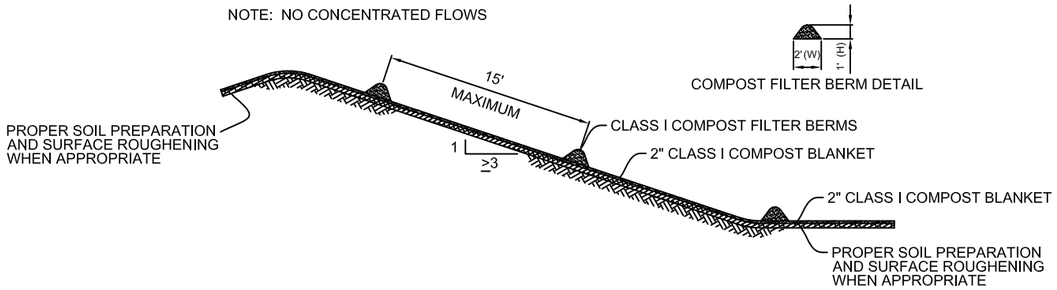
CHECK DAM INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - LOCATIONS OF CHECK DAMS.
   - CHECK DAM TYPE (CHECK DAM OR REINFORCED CHECK DAM).
   - LENGTH, "L", CREST LENGTH, "CL", AND DEPTH, "D".
2. CHECK DAMS INDICATED ON INITIAL ESC PLAN SHALL BE INSTALLED AFTER CONSTRUCTION FENCE, BUT PRIOR TO ANY UPSTREAM LAND-DISTURBING ACTIVITIES.
3. RIPRAP UTILIZED FOR CHECK DAMS SHALL HAVE A D_{50} MEDIAN STONE SIZE OF 6".
4. RIPRAP PAD SHALL BE TRENCHED INTO THE GROUND A MINIMUM OF 1'-8". 5. THE ENDS OF THE CHECK DAM SHALL BE A MINIMUM OF 1'-6" HIGHER THAN THE CENTER OF THE CHECK DAM.

CHECK DAM MAINTENANCE NOTES

1. THE ESC MANAGER SHALL INSPECT CHECK DAMS WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF CHECK DAMS SHALL BE REMOVED WHEN THE SEDIMENT DEPTH UPSTREAM OF CHECK DAM IS WITHIN 1/2 OF THE HEIGHT OF THE CREST.
3. CHECK DAMS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND VEGETATIVE COVER IS APPROVED BY THE CITY.
4. WHEN CHECK DAMS ARE REMOVED, EXCAVATIONS SHALL BE FILLED WITH SUITABLE COMPACTED BACK FILL. ANY DISTURBED AREA SHALL BE SEEDED AND MULCHED AND COVERED WITH EROSION CONTROL BLANKET OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE CITY.

CD CHECK DAM 1



COMPOST BLANKET AND COMPOST FILTER BERM

COMPOST BLANKET NOTES:

1. SEE PLAN VIEW FOR AREA OF COMPOST BLANKET.
2. MAY BE USED IN PLACE OF STRAW MULCH OR EROSION CONTROL BLANKET IN AREAS WHERE ACCESS IS DIFFICULT DUE TO LANDSCAPING OR OTHER OBJECTS OR IN AREAS WHERE A SMOOTH TURF GRASS FINISH IS DESIRED.
3. SHALL ONLY BE UTILIZED IN AREAS WHERE SHEET FLOW CONDITIONS PREVAIL; SHALL BE PROHIBITED IN AREAS OF POSSIBLE CONCENTRATED FLOW.
4. SOIL PREPARATION SHALL BE COMPLETE PER THE SPECIFICATIONS OUTLINED IN THESE CRITERIA PRIOR TO APPLICATION.
5. WHEN TURF GRASS FINISH IS NOT DESIRED, SURFACE ROUGHENING ON SLOPES SHALL TAKE PLACE PRIOR TO APPLICATION.
6. SHALL BE EVENLY APPLIED AT A DEPTH OF 2 INCHES.
7. MAYBE APPLIED UTILIZING PNEUMATIC BLOWER, OR BY HAND.
8. SEEDING SHALL BE DRILLED PRIOR TO THE APPLICATION OF COMPOST OR SEED MAY BE COMBINED AND BLOWN WITH THE PNEUMATIC BLOWER.
9. COMPOST FILTER BERM SHALL BE UTILIZED ON SLOPES WITH A MAXIMUM SPACING OF 15 FEET PER THE REQUIREMENTS FOUND IN THE COMPOST FILTER BERM SECTION.
10. THE ESC MANAGER SHALL INSPECT WEEKLY, DURING AND AFTER ANY STORM EVENT.
11. COMPOST USED IN THE APPLICATION OF THE COMPOST BLANKET SHALL BE A CLASS I COMPOST AS DEFINED BY THE FOLLOWING PHYSICAL, CHEMICAL, AND BIOLOGICAL PARAMETERS:

PARAMETERS	CLASS I COMPOST FOR COMPOST BLANKET
MINIMUM STABILITY INDICATOR	STABLE TO VERY STABLE
SOLUBLE SALTS	MAXIMUM 5mmhos/cm
PH	6.0 - 8.0
AG INDEX	> 10
MATURITY INDICATOR EXPRESSED AS PERCENTAGE OF GERMINATION/VIGOR	80+/80+
MATURITY INDICATOR EXPRESSED AS AMMONIA N/ NITRATE N RATIO	< 4
MATURITY INDICATOR EXPRESSED AS CARBON TO NITROGEN RATIO	20:1
TESTED FOR CLOPYRALID	YES/NEGATIVE RESULT
MOISTURE CONTENT	30-60 %
ORGANIC MATTER CONTENT	25-45 % OF DRY WEIGHT
PARTICLE SIZE DISTRIBUTION	3" (75mm) 100% PASSING 1" (25mm) 95% TO 100% PASSING 3/4" (19mm) 85% TO 90% PASSING 3/8" (9.5mm) 50% TO 60% PASSING #4 20 TO 35% PASSING
PRIMARY, SECONDARY NUTRIENTS; TRACE ELEMENT	MUST BE REPORTED
TESTING AND TEST REPORT SUBMITTAL REQUIREMENTS	STA + CLOPYRALID
ORGANIC MATTER PER CUBIC YARD	MUST REPORT
CHEMICAL CONTAMINANTS	MEET OR EXCEED US EPA CLASS A STANDARD, 40 CFR 503.1 TABLES 1 & 3 LEVELS
MINIMUM MANUFACTURING/PRODUCTION REQUIREMENT	FULLY PERMITTED UNDER COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT, HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
RISK FACTOR RELATING TO PLANT GERMINATION AND HEALTH	LOW

NOTE: CLOPYRALID IS THE COMMON NAME OF A HERBICIDE THAT KILLS BROAD-LEAVED WEEDS SUCH AS DANDELIONS, CLOVER AND THISTLE.

CB COMPOST BLANKET 2

COMPOST FILTER BERM NOTES:

1. SEE PLAN VIEW FOR LENGTH OF COMPOST FILTER BERM.
2. SHALL BE APPLIED TO ALL SLOPES RECEIVING A COMPOST BLANKET AT 15' INCREMENTS.
3. FILTER BERMS SHALL RUN PARALLEL TO THE CONTOUR.
4. FILTER BERMS SHALL BE A MINIMUM OF 1' H x 2' W.
5. FILTER BERMS SHALL BE APPLIED UTILIZING PNEUMATIC BLOWER, OR BY HAND.
6. SHALL ONLY BE UTILIZED IN AREAS WHERE SHEET FLOW CONDITIONS PREVAIL; SHALL BE PROHIBITED IN AREAS OF POSSIBLE CONCENTRATED FLOW.
7. SOIL PREPARATION SHALL BE COMPLETE PER THE SPECIFICATIONS OUTLINED IN THESE CRITERIA PRIOR TO APPLICATION.
8. WHEN TURF GRASS FINISH IS NOT DESIRED, SURFACE ROUGHENING ON SLOPES SHALL TAKE PLACE PRIOR TO APPLICATION.
9. SEEDING SHALL BE DRILLED BEFORE THE APPLICATION OF COMPOST OR SEED MAY BE COMBINED AND BLOWN WITH THE PNEUMATIC BLOWER.
10. THE GESC MANAGER SHALL INSPECT WEEKLY, DURING AND AFTER ANY STORM EVENT.
11. COMPOST USED IN THE APPLICATION OF THE COMPOST BLANKET SHALL BE A CLASS I COMPOST AS DEFINED BY THE FOLLOWING PHYSICAL, CHEMICAL, AND BIOLOGICAL PARAMETERS:

PARAMETERS	CLASS I COMPOST FOR COMPOST FILTER BERM
MINIMUM STABILITY INDICATOR	STABLE TO VERY STABLE
SOLUBLE SALTS	MAXIMUM 5mmhos/cm
PH	6.0 - 8.0
AG INDEX	> 10
MATURITY INDICATOR EXPRESSED AS PERCENTAGE OF GERMINATION/VIGOR	80+/80+
MATURITY INDICATOR EXPRESSED AS AMMONIA N/ NITRATE N RATIO	< 4
MATURITY INDICATOR EXPRESSED AS CARBON TO NITROGEN RATIO	20:1
TESTED FOR CLOPYRALID	YES/NEGATIVE RESULT
MOISTURE CONTENT	30-60 %
ORGANIC MATTER CONTENT	25-45 % OF DRY WEIGHT
PARTICLE SIZE DISTRIBUTION	3" (75mm) 100% PASSING 1" (25mm) 95% TO 100% PASSING 3/4" (19mm) 85% TO 90% PASSING 3/8" (9.5mm) 50% TO 60% PASSING #4 20 TO 35% PASSING
PRIMARY, SECONDARY NUTRIENTS; TRACE ELEMENT	MUST BE REPORTED
TESTING AND TEST REPORT SUBMITTAL REQUIREMENTS	STA + CLOPYRALID
ORGANIC MATTER PER CUBIC YARD	MUST REPORT
CHEMICAL CONTAMINANTS	MEET OR EXCEED US EPA CLASS A STANDARD, 40 CFR 503.1 TABLES 1 & 3 LEVELS
MINIMUM MANUFACTURING/PRODUCTION REQUIREMENT	FULLY PERMITTED UNDER COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT, HAZARDOUS MATERIALS AND WASTE MANAGEMENT DIVISION
RISK FACTOR RELATING TO PLANT GERMINATION AND HEALTH	LOW

NOTE: IF A BIOSOLID COMPOST IS TO BE UTILIZED IT SHALL BE PRODUCED BY A FACILITY IN POSSESSION OF A VALID NOTICE OF AUTHORIZATION (NOA) FOR THE UNRESTRICTED USE AND DISTRIBUTION BY THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT. THE NOA SHALL BE PROVIDED UPON REQUEST TO THE CITY OF COMMERCE CITY.

NOTE: A LAB TEST DETAILING THE CHEMICAL, PHYSICAL, AND BIOLOGICAL PARAMETERS SHALL BE PROVIDED UPON REQUEST BY THE CITY OF COMMERCE CITY.

CFB COMPOST FILTER BERM 3

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APPROVAL

CITY ENGINEER — 05-27-16 DATE

CITY OF COMMERCE CITY
Department of Public Works
8602 Rosemary St.
Commerce City, CO 80022
Ph: 303-289-8150

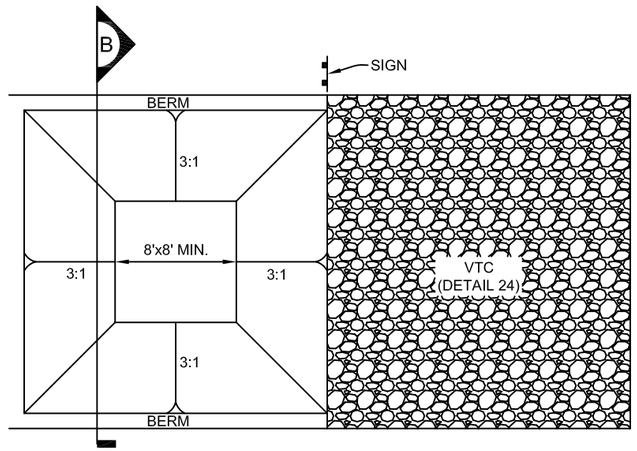
EROSION & SEDIMENT CONTROL

ENGINEERING CONSTRUCTION STANDARDS

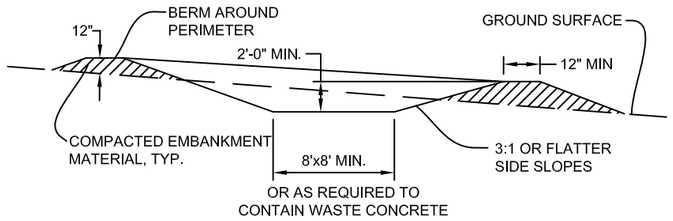
DETAIL NO. 800-02

Sheet No. 2 of 14

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DETAIL A



SECTION B

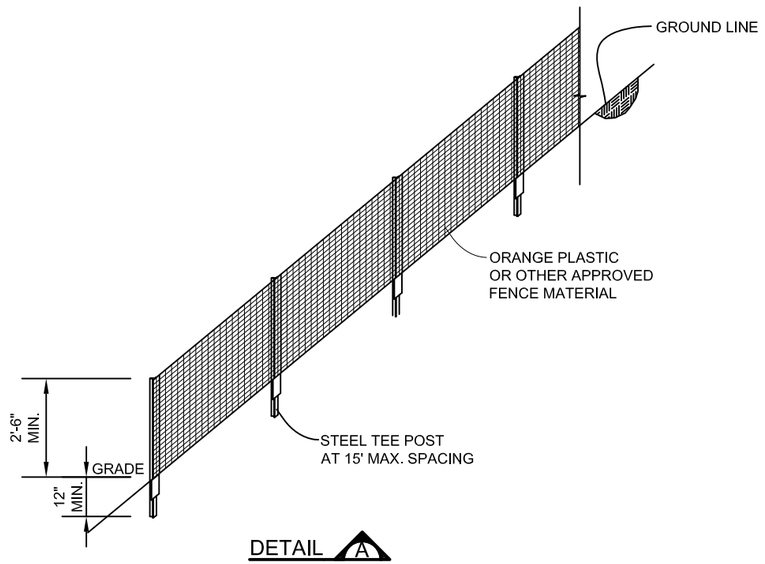
CONCRETE WASHOUT AREA INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - LOCATIONS OF CONCRETE WASHOUT AREA.
2. THE CONCRETE WASHOUT AREA SHALL BE INSTALLED PRIOR TO ANY CONCRETE PLACEMENT ON SITE.
3. VEHICLE TRACKING CONTROL (DETAIL 24) IS REQUIRED AT THE ACCESS POINT.
4. SIGNS SHALL BE PLACED AT THE CONSTRUCTION ENTRANCE, AT THE WASHOUT AREA, AND ELSEWHERE AS NECESSARY TO CLEARLY INDICATE THE LOCATION OF THE CONCRETE WASHOUT AREA TO OPERATORS OF CONCRETE TRUCKS AND PUMP RIGS.
5. EXCAVATED MATERIAL SHALL BE UTILIZED IN PERIMETER BERM CONSTRUCTION.

CONCRETE WASHOUT AREA MAINTENANCE NOTES

1. THE CONCRETE WASHOUT AREA SHALL BE REPAIRED AND ENLARGED OR CLEANED OUT AS NECESSARY TO MAINTAIN CAPACITY FOR WASTED CONCRETE.
2. AT THE END OF CONSTRUCTION, ALL CONCRETE SHALL BE REMOVED FROM THE SITE AND DISPOSED OF AT AN APPROVED WASTE SITE.
3. WHEN THE CONCRETE WASHOUT AREA IS REMOVED, THE DISTURBED AREA SHALL BE DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE CITY.
4. INSPECT WEEKLY, DURING AND AFTER ANY STORM EVENT.

CWA CONCRETE WASHOUT AREA 4



DETAIL A

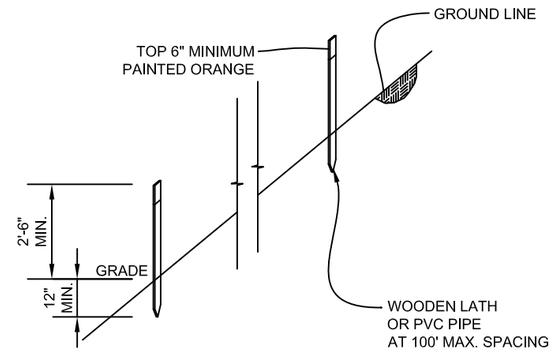
CONSTRUCTION FENCE INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - TYPE OF CONSTRUCTION LIMIT INDICATOR (FENCE OR MARKERS).
   - LOCATION AND LENGTH OF FENCE OR LINE OF MARKERS.
2. CONSTRUCTION FENCE OR MARKERS INDICATED ON INITIAL ESC PLAN SHALL BE INSTALLED PRIOR TO OTHER BMPS AND ANY LAND-DISTURBING ACTIVITIES.
3. STEEL TEE POSTS SHALL BE UTILIZED FOR SUPPORT OF CONSTRUCTION FENCE. MAXIMUM SPACING FOR TEE POSTS SHALL BE 15'.

CONSTRUCTION FENCE MAINTENANCE NOTES

1. ANY DAMAGED FENCE OR MARKERS SHALL BE REPAIRED ON A DAILY BASIS.
2. FENCE OR MARKERS SHALL BE REMOVED AT THE END OF CONSTRUCTION. IF ANY DISTURBED AREA EXISTS AFTER FENCE REMOVAL, IT SHALL BE DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE CITY.

CF CONSTRUCTION FENCE 5

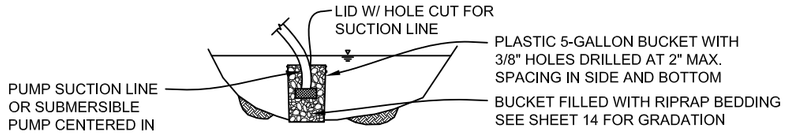


(ALTERNATIVE TO CONSTRUCTION FENCE)

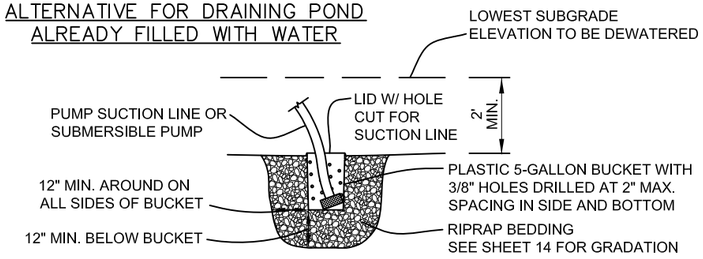
CM CONSTRUCTION MARKERS 6

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Last Modification Date: 5/4/2016	Initials: CJC				
Full Path: WWW.C3GOV.COM		05-27-16		ENGINEERING CONSTRUCTION STANDARDS	Sheet No. 3 of 14
Drawing Name: $FILES$		CITY ENGINEER DATE			
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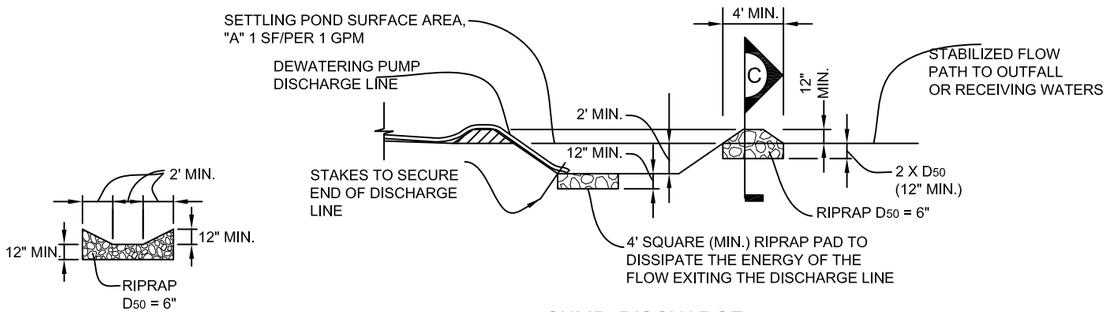
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ALTERNATIVE FOR DRAINING POND ALREADY FILLED WITH WATER



DEWATERING SUMP FOR SUBMERSIBLE PUMP - DETAIL A



BASIN OUTLET - SECTION C

SUMP DISCHARGE SETTLING BASIN - DETAIL B

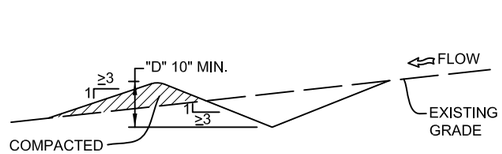
DEWATERING INSTALLATION NOTES

1. THE ESC MANAGER SHALL OBTAIN A CONSTRUCTION DISCHARGE (DEWATERING) PERMIT FROM THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT PRIOR TO ANY DEWATERING OPERATIONS. ALL DEWATERING SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE DISCHARGE PERMIT AND SHALL BE COORDINATED WITH THE CITY ESC INSPECTOR.
2. THE ESC MANAGER SHALL PROVIDE, OPERATE, AND MAINTAIN DEWATERING SYSTEMS OF SUFFICIENT SIZE AND CAPACITY TO PERMIT EXCAVATION AND SUBSEQUENT CONSTRUCTION IN DRY CONDITIONS AND TO LOWER AND MAINTAIN THE GROUNDWATER LEVEL A MINIMUM OF 2-FEET BELOW THE LOWEST POINT OF EXCAVATION AND CONTINUOUSLY MAINTAIN EXCAVATIONS FREE OF WATER UNTIL BACKFILLED TO FINAL GRADE.
3. DEWATERING OPERATIONS SHALL USE ONE OR MORE OF THE DEWATERING SUMPS SHOWN ABOVE OR OTHER MEANS APPROVED BY THE CITY TO REDUCE THE PUMPING OF SEDIMENT, AND SHALL PROVIDE A TEMPORARY BASIN FOR SETTLING PUMPED DISCHARGES PRIOR TO RELEASE OFF SITE OR TO A RECEIVING WATER. SEDIMENT BASIN PER DETAIL 14 MAY BE USED IN LIEU OF SUMP DISCHARGE SETTLING BASIN SHOWN ABOVE.
4. A 4' SQUARE RIPRAP PAD SHALL BE PLACED AT DISCHARGE POINT.
5. THE DISCHARGE END OF THE LINE SHALL BE STAKED IN PLACES TO PREVENT MOVEMENT OF RIPRAP PAD.

DEWATERING MAINTENANCE NOTES

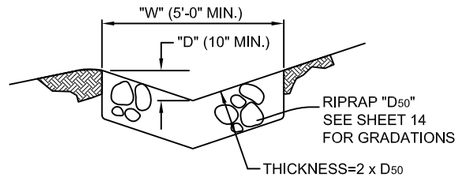
1. THE ESC MANAGER SHALL INSPECT DEWATERING SYSTEMS AND PERFORM ANY NECESSARY REPAIRS OR MAINTENANCE ON A HOURLY BASIS.
2. TEMPORARY SETTLING BASINS SHALL BE REMOVED WHEN NO LONGER NEEDED FOR DEWATERING OPERATIONS. ANY DISTURBED AREA SHALL BE DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE CITY.

DW DEWATERING 7



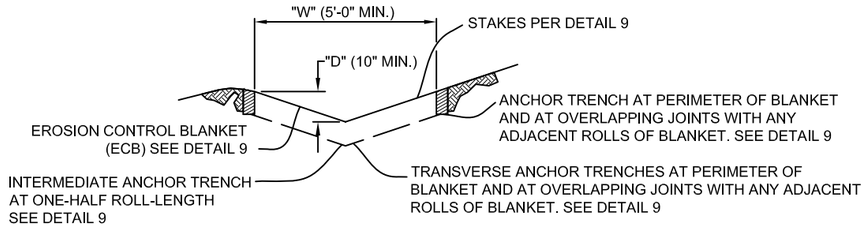
UNLINED - DETAIL A

LONGITUDINAL SLOPE ≤ 0.5%



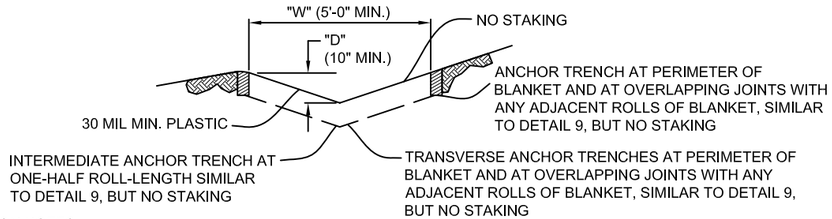
RIPRAP LINED - DETAIL D

LONGITUDINAL SLOPE 3% TO 33%



EROSION CONTROL BLANKET (ECB) LINED - DETAIL B

LONGITUDINAL SLOPE 0.5% TO 3%



PLASTIC LINED - DETAIL C

LONGITUDINAL SLOPE 3% TO 33%

DIVERSION DITCH INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - LOCATION OF DIVERSION DITCH.
   - TYPE OF DITCH (UNLINED, ECB LINED, PLASTIC LINED OR RIPRAP LINED).
   - LENGTH OF EACH TYPE OF DITCH.
   - DEPTH, "D", AND WIDTH, "W" DIMENSIONS.
   - FOR ECB LINED DITCH, EROSION CONTROL BLANKET TYPE (SEE DETAIL 9).
   - FOR RIPRAP LINED DITCH, SIZE OF RIPRAP, "D50".
2. SEE DRAINAGE PLANS FOR DETAILS OF ANY PERMANENT CONVEYANCE FACILITIES OR DIVERSION DITCHES EXCEEDING A 2-YEAR FLOW RATE OF 10 CFS.
3. DIVERSION DITCHES INDICATED ON INITIAL ESC PLAN SHALL BE INSTALLED PRIOR TO ANY LAND-DISTURBING ACTIVITIES.
4. FOR ECB LINED DITCHES, INSTALLATION OF EROSION CONTROL BLANKET SHALL CONFORM TO THE REQUIREMENTS OF DETAIL 9.
5. IN LOCATIONS WHERE CONSTRUCTION TRAFFIC MUST CROSS A DIVERSION DITCH, THE PERMITTEES SHALL INSTALL A TEMPORARY CULVERT WITH A MINIMUM DIAMETER OF 12-INCHES.

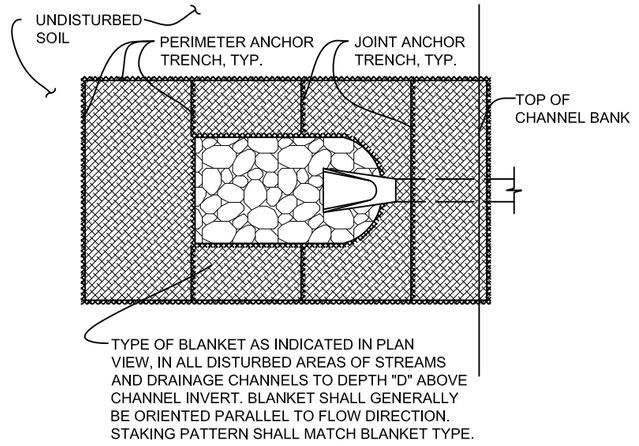
DIVERSION DITCH MAINTENANCE NOTES

1. THE ESC MANAGER SHALL INSPECT DIVERSION DITCHES WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT AS NECESSARY.
2. DIVERSION DITCHES ARE TO REMAIN IN PLACE UNTIL THE END OF CONSTRUCTION, OR, IF APPROVED BY THE CITY, LEFT IN PLACE.
3. IF DIVERSION DITCHES ARE REMOVED, THE DISTURBED AREA SHALL BE DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE CITY.

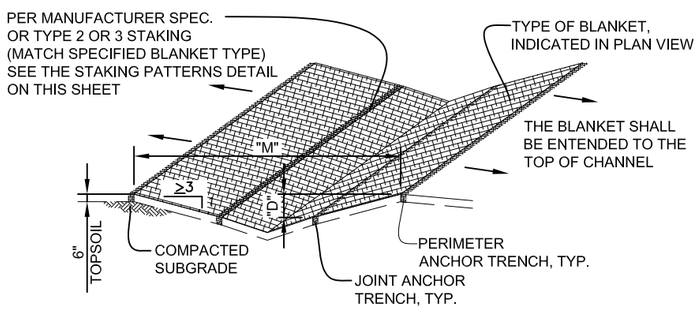
DD DIVERSION DITCH 8

COMPUTER FILE INFORMATION		APPROVAL	CITY OF COMMERCE CITY	EROSION & SEDIMENT CONTROL	DETAIL NO.
Creation Date: 03/10/2016	Initials: CJC		Department of Public Works 8602 Rosemary St. Commerce City, CO 80022 Ph: 303-289-8150		800-04
Last Modification Date: 5/4/2016	Initials: CJC				
Full Path: WWW.C3GOV.COM				ENGINEERING CONSTRUCTION STANDARDS	Sheet No. 4 of 14
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Scale: $SCALESHORT$	Units: ENGLISH	05-27-16 CITY ENGINEER DATE			

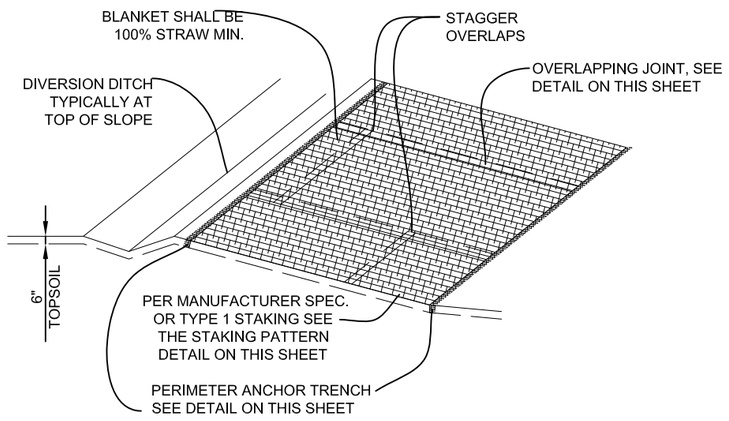
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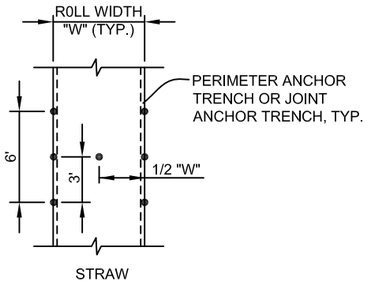
IN DISTURBED AREAS OF STREAMS AND DRAINAGE CHANNELS - DETAIL A



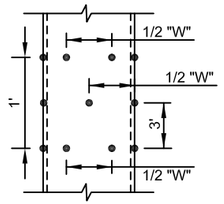
IN DIVERSION DITCH OR SMALL DITCH DRAINAGEWAY - DETAIL B



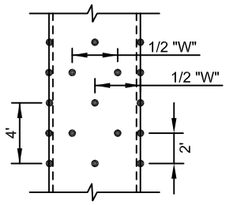
OUTSIDE OF STREAMS AND DRAINAGE CHANNELS - DETAIL C



STRAW



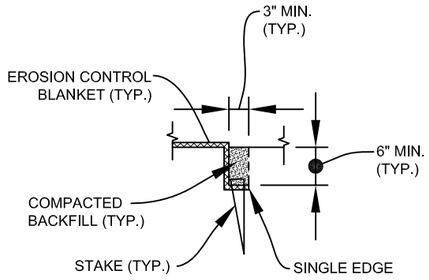
STRAW-COCONUT



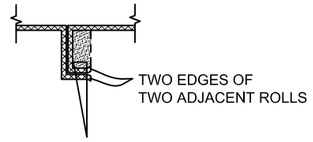
COCONUT OR EXCELSIOR

STAKING PATTERNS

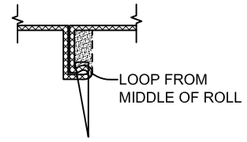
SHALL BE IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATION. IF NO MANUFACTURER'S SPECIFICATION IS AVAILABLE USE THE ACCEPTABLE STAKING PATTERN (AS SHOWN ABOVE),



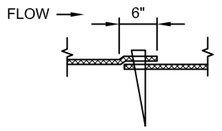
PERIMETER ANCHOR TRENCH



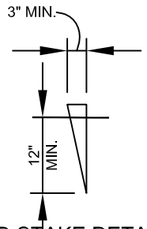
JOINT ANCHOR TRENCH



INTERMEDIATE ANCHOR TRENCH



OVERLAPPING JOINT



WOOD STAKE DETAIL
MINIMUM THICKNESS 1/2"

EROSION CONTROL BLANKET INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - LOCATION OF PERIMETER OF EROSION CONTROL BLANKET.
   - TYPE OF BLANKET (STRAW, STRAW-COCONUT, COCONUT, OR EXCELSIOR).
   - AREA "A" IN SQUARE YARDS OF EACH TYPE OF BLANKET.
2. ALL EROSION CONTROL BLANKETS AND NETTING SHALL BE MADE OF 100% NATURAL AND BIODEGRADABLE MATERIAL; NO PLASTIC OR OTHER SYNTHETIC MATERIAL, EVEN IF PHOTO DEGRADABLE, SHALL BE ALLOWED.
3. IN AREAS WHERE EROSION CONTROL BLANKET IS SHOWN ON THE PLANS, THE PERMITTEE SHALL PLACE TOPSOIL AND PERFORM FINAL GRADING, SURFACE PREPARATION, AND SEEDING BELOW THE BLANKET IN ACCORDANCE WITH THE REQUIREMENTS OF DETAIL 17, SEEDING AND MULCHING. SUBGRADE SHALL BE SMOOTH AND MOIST PRIOR TO BLANKET INSTALLATION AND THE BLANKET SHALL BE IN FULL CONTACT WITH SUBGRADE, NO GAPS OR VOIDS SHALL EXIST UNDER THE BLANKET.
4. PERIMETER ANCHOR TRENCH SHALL BE USED AT OUTSIDE PERIMETER OF ALL BLANKET AREAS.
5. JOINT ANCHOR TRENCH SHALL BE USED TO JOIN ROLLS OF BLANKETS TOGETHER (LONGITUDINALLY AND TRANSVERSELY) FOR ALL BLANKETS EXCEPT STRAW, WHICH MAY USE AN OVERLAPPING JOINT.
6. INTERMEDIATE ANCHOR TRENCH SHALL BE USED AT SPACING OF ONE-HALF THE ROLL LENGTH FOR COCONUT AND EXCELSIOR BLANKETS.
7. THE OVERLAPPING JOINT DETAIL SHALL BE USED TO JOIN ROLLS OF BLANKETS TOGETHER FOR BLANKETS ON SLOPES.
8. MATERIAL SPECIFICATIONS OF EROSION CONTROL BLANKET SHALL CONFORM TO TABLE 7.1.

EROSION CONTROL BLANKET INSTALLATION NOTES - CONTINUED

9. ANY AREAS OF SEEDING AND MULCHING DISTURBED IN THE PROCESS OF INSTALLING EROSION CONTROL BLANKET SHALL BE RESEEDED AND MULCHED IN ACCORDANCE WITH DETAIL 17.
10. SEE DRAINAGE DESIGN PLANS FOR MAJOR DRAINAGEWAY STABILIZATION MEASURES THAT MAY EXCEED THE DESIGN CONDITIONS ASSOCIATED WITH THE DETAILS ABOVE.

TABLE 7.1 - EROSION CONTROL BLANKET TYPE

TYPE	COCONUT CONTENT	STRAW CONTENT	EXCELSIOR CONTENT	NETTING MIN.
STRAW*	–	100%	–	DOUBLE/NATURAL
STRAW-COCONUT	30% MIN.	70% MAX.	–	DOUBLE/NATURAL
COCONUT	100%	–	–	DOUBLE/NATURAL
EXCELSIOR	–	–	100%	DOUBLE/NATURAL

* FOR OUTSIDE OF STREAMS AND DRAINAGE CHANNELS

EROSION CONTROL BLANKET MAINTENANCE NOTES

1. THE ESC MANAGER SHALL INSPECT EROSION CONTROL BLANKETS WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS AS NECESSARY.
2. EROSION CONTROL BLANKET IS TO BE LEFT IN PLACE UNLESS REQUESTED TO BE REMOVED BY THE CITY.
3. ANY EROSION CONTROL BLANKET PULLED OUT, TORN, OR OTHERWISE DAMAGED SHALL BE RE-INSTALLED. ANY SUBGRADE AREAS BELOW THE BLANKET THAT HAVE ERODED TO CREATE A VOID UNDER THE BLANKET, OR THAT REMAIN DEVOID OF GRASS SHALL BE REPAIRED, RESEEDED AND MULCHED AND THE EROSION CONTROL BLANKET REINSTALLED.

ECB EROSION CONTROL BLANKET 9

COMPUTER FILE INFORMATION	
Creation Date: 03/10/2016	Initials: CJC
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Scale: $SCALESHORT$	Units: ENGLISH

APPROVAL

CITY ENGINEER — 05-27-16 DATE

CITY OF COMMERCE CITY
Department of Public Works
8602 Rosemary St.
Commerce City, CO 80022
Ph: 303-289-8150

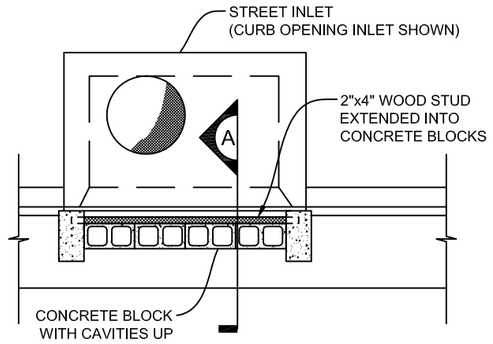
EROSION & SEDIMENT CONTROL

ENGINEERING CONSTRUCTION STANDARDS

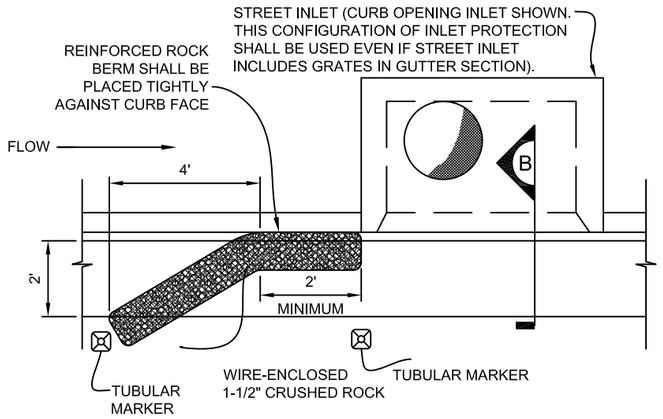
DETAIL NO. 800-05

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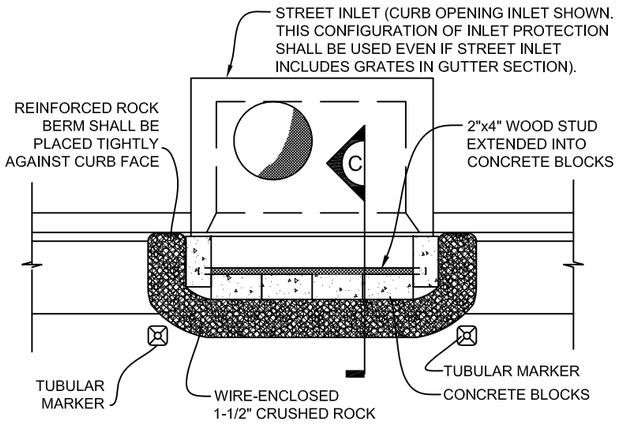
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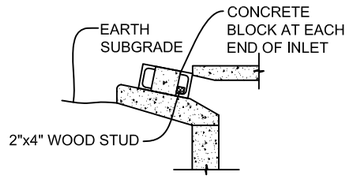
INTERIM CONFIGURATION
(BEFORE PAVING) STREET INLET - PLAN



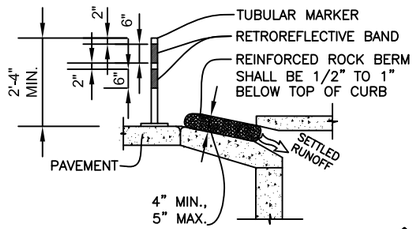
STREET INLET ON CONTINUOUS GRADE
(AFTER PAVING) - PLAN



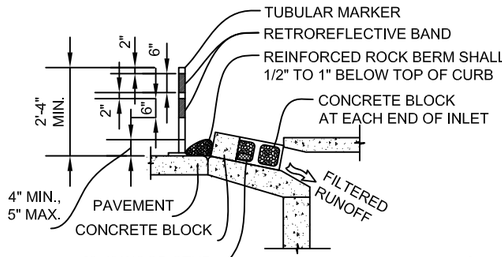
STREET INLET IN SUMP (AFTER PAVING) - PLAN



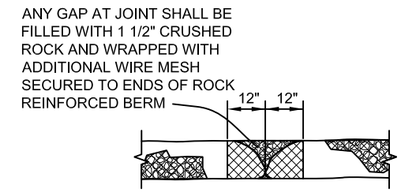
SECTION A



SECTION B

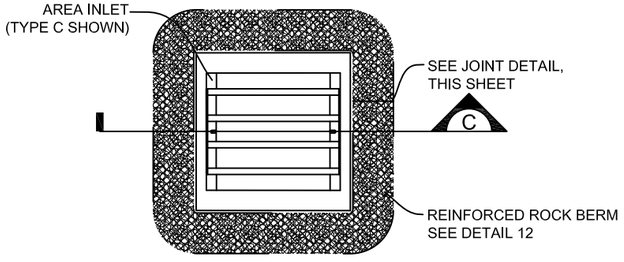


SECTION C

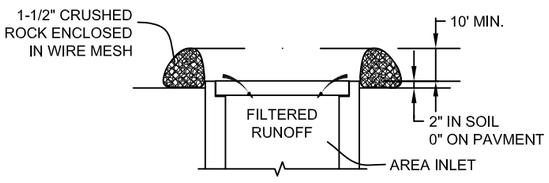


JOINT DETAIL

*PRE-MANUFACTURED ITEMS SPECIFICALLY DESIGNED FOR INLET PROTECTION MAY BE USED AND MUST BE APPROVED BY THE ESC INSPECTOR.



AREA INLET - PLAN



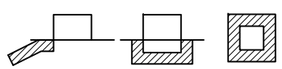
SECTION C

INLET PROTECTION INSTALLATION NOTES

1. INTERIM CONFIGURATION OF INLET PROTECTION IN STREETS SHALL BE INSTALLED WITHIN 48-HOURS OF POURING INLET. INLET PROTECTION (AFTER PAVEMENT) SHALL BE INSTALLED WITHIN 48 HOURS AFTER PAVING IS PLACED.
2. INLET PROTECTION AT AREA INLETS SHALL BE INSTALLED WITHIN 48-HOURS OF POURING INLET.
3. CRUSHED ROCK SHALL BE FRACTURED FACE (ALL SIDES) AND SHALL COMPLY WITH GRADATION SHOWN ON SHEET 14 (1-1/2" MINUS). RECYCLED CONCRETE MEETING THIS GRADATION MAY BE USED.
4. WIRE MESH SHALL BE FABRICATED OF 10 GAUGE WIRE TWISTED INTO A MESH WITH A MAXIMUM OPENING OF 1.0 INCH (COMMONLY TERMED "CHICKEN WIRE"). ROLL WIDTH SHALL BE 48-INCHES.
5. WIRE MESH SHALL BE SECURED USING "HOG RINGS" OR WIRE TIES AT 6-INCH CENTERS ALONG ALL JOINTS AND AT 2-INCH CENTERS ON ENDS OF BERM.
6. REINFORCED ROCK BERM SHALL BE CONSTRUCTED IN ONE PIECE OR SHALL BE CONSTRUCTED USING JOINT DETAIL.
7. TUBULAR MARKERS SHALL MEET REQUIREMENTS OF MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD), AS AMENDED.
8. THE TOP OF REINFORCED ROCK BERM SHALL BE 1/2"-1" BELOW TOP OF CURB.

INLET PROTECTION MAINTENANCE NOTES

1. THE ESC MANAGER SHALL INSPECT INLET PROTECTION WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT AS NECESSARY. MORE FREQUENT INSPECTIONS AND REPAIRS SHALL BE REQUIRED DURING WINTER CONDITIONS DUE TO FREEZE/THAW PROBLEMS.
2. SEDIMENT ACCUMULATED UPSTREAM OF INLET PROTECTION SHALL BE REMOVED WHEN THE SEDIMENT DEPTH UPSTREAM OF ROCK BERM IS WITHIN 2-1/2 INCHES OF THE CREST.
3. INLET PROTECTION IS TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER IS APPROVED, UNLESS THE CITY APPROVES EARLIER REMOVAL OF INLET PROTECTION IN STREETS.
4. WHEN INLET PROTECTION AT AREA INLETS ARE REMOVED, THE DISTURBED AREA SHALL BE DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE CITY.



IP INLET PROTECTION 10

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APPROVAL

CITY ENGINEER — DATE 05-27-16

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8602 Rosemary St.
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Ph: 303-289-8150

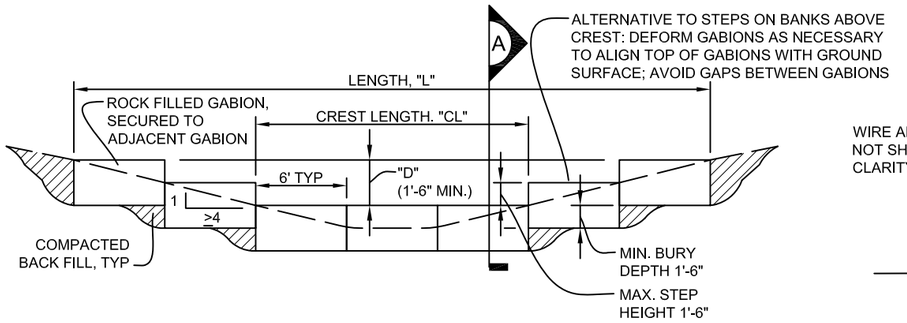
EROSION & SEDIMENT CONTROL

ENGINEERING CONSTRUCTION STANDARDS

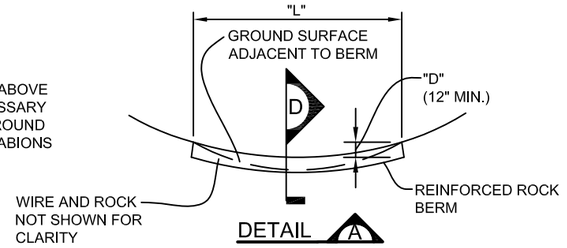
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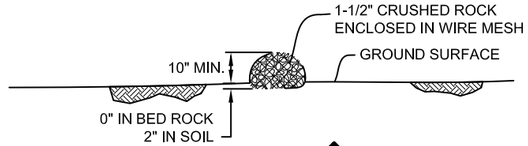
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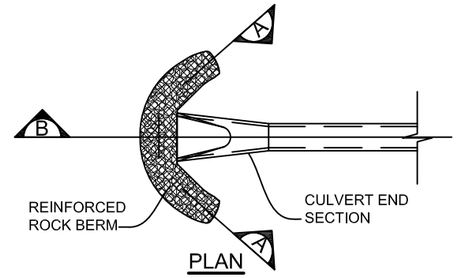
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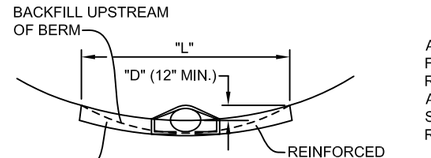
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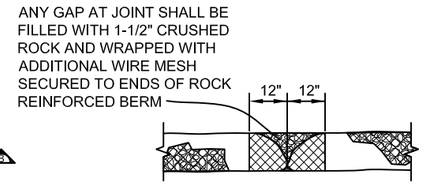
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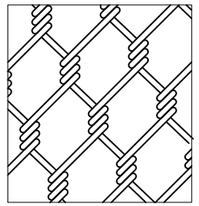
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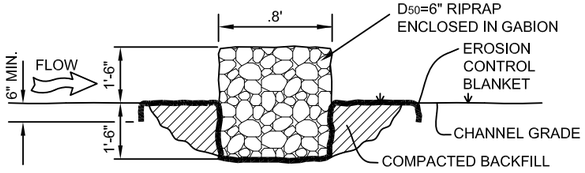
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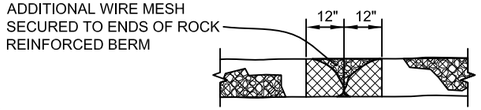
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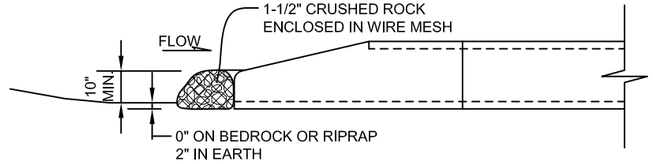
BLOW UP OF TWISTED WIRE GABION



REINFORCED - SECTION A



JOINT DETAIL



SECTION B

REINFORCED CHECK DAM INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - LOCATIONS OF CHECK DAMS.
   - CHECK DAM TYPE (CHECK DAM OR REINFORCED CHECK DAM).
   - LENGTH, "L", CREST LENGTH, "CL", AND DEPTH, "D".
2. CHECK DAMS INDICATED ON INITIAL ESC PLAN SHALL BE INSTALLED AFTER CONSTRUCTION FENCE, BUT PRIOR TO ANY UPSTREAM LAND-DISTURBING ACTIVITIES.
3. REINFORCED CHECK DAMS, GABIONS SHALL HAVE GALVANIZED TWISTED WIRE NETTING WITH A MAXIMUM OPENING DIMENSION OF 4-1/2" AND A MINIMUM WIRE THICKNESS OF 0.10". WIRE "HOG RINGS" AT 4" SPACING OR OTHER APPROVED MEANS SHALL BE USED AT ALL GABION SEAMS AND TO SECURE THE GABION TO THE ADJACENT GABION.
4. RIPRAP UTILIZED FOR CHECK DAMS SHALL HAVE A D MEDIAN STONE SIZE OF 6".
5. THE CHECK DAM SHALL BE TRENCHED INTO THE GROUND A MINIMUM OF 1'-6".
6. EROSION BLANKET SHALL BE PLACED IN THE REINFORCED CHECK DAM TRENCH EXTENDING A MINIMUM OF 1'-6" ON BOTH THE UPSTREAM AND DOWNSTREAM SIDES OF THE REINFORCED CHECK DAM.

REINFORCED CHECK DAM MAINTENANCE NOTES

1. THE ESC MANAGER SHALL INSPECT CHECK DAMS WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF CHECK DAMS SHALL BE REMOVED WHEN THE SEDIMENT DEPTH UPSTREAM OF CHECK DAM IS WITHIN 1/2 OF THE HEIGH OF THE CREST.
3. CHECK DAMS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER IS APPROVED BY THE CITY.
4. WHEN CHECK DAMS ARE REMOVED, EXCAVATIONS SHALL BE FILLED WITH SUITABLE COMPACTED BACK FILL. ANY DISTURBED AREA SHALL BE DRILL SEEDED AND CRIMP MULCHED AND COVERED WITH EROSION CONTROL BLANKET OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE CITY.

RCD — REINFORCED CHECK DAM — 11

REINFORCED ROCK BERM INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - LOCATIONS OF REINFORCED ROCK BERMS.
   - LENGTH, "L", AND DEPTH, "D" DIMENSIONS.
2. REINFORCED ROCK BERM SECTION APPLIES TO CULVERT INLET FILTER AND INLET PROTECTION.
3. CRUSHED ROCK SHALL BE FRACTURED FACE (ALL SIDES) AND SHALL COMPLY WITH GRADATION SHOWN ON SHEET 14 (1-1/2" MINUS). RECYCLED CONCRETE MEETING THIS GRADATION MAY BE USED.
4. WIRE MESH SHALL BE FABRICATED OF 10 GAUGE WIRE TWISTED INTO A MESH WITH A MAXIMUM OPENING OF 1.0 INCH (COMMONLY TERMED "CHICKEN WIRE"). ROLL WIDTH SHALL BE 48-INCHES.
5. WIRE MESH SHALL BE SECURED USING "HOG RINGS" OR WIRE TIES AT 6-INCH CENTERS ALONG ALL JOINTS AND AT 2-INCH CENTERS ON ENDS OF BERM.
6. FOR CONCENTRATED FLOW AREAS THE ENDS OF THE REINFORCED ROCK BERM SHALL BE 12" HIGHER THAN THE CENTER OF THE BERM.

REINFORCED ROCK BERM MAINTENANCE NOTES

1. THE ESC MANAGER SHALL INSPECT REINFORCED ROCK BERM WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF REINFORCED ROCK BERM SHALL BE REMOVED WHEN THE SEDIMENT DEPTH UPSTREAM OF FILTER IS WITHIN 5 INCHES OF THE CREST.
3. REINFORCED ROCK BERMS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER IS APPROVED.
4. WHEN REINFORCED ROCK BERMS ARE REMOVED, ANY DISTURBED AREA SHALL BE DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE CITY.

RRB — REINFORCED ROCK BERM — 12

INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - LOCATIONS OF CULVERT INLET FILTERS.
   - LENGTH, "L", AND DEPTH, "D".
2. CRUSHED ROCK SHALL BE FRACTURED FACE (ALL SIDES) AND SHALL COMPLY WITH GRADATION SHOWN ON SHEET 14 (1-1/2" MINUS). RECYCLED CONCRETE MEETING THIS GRADATION MAY BE USED.
3. WIRE MESH SHALL BE FABRICATED OF 10 GAUGE WIRE TWISTED INTO A MESH WITH A MAXIMUM OPENING OF 1.0 INCH (COMMONLY TERMED "CHICKEN WIRE").
4. WIRE MESH SHALL BE SECURED USING "HOG RINGS" OR WIRE TIES AT 6-INCH CENTERS ALONG ALL JOINTS AND AT 2-INCH CENTERS ON ENDS OF BERM.
5. THE ENDS OF THE REINFORCED ROCK BERM SHALL BE 12" HIGHER THAN THE CENTER OF THE BERM.

MAINTENANCE NOTES

1. THE ESC MANAGER SHALL INSPECT CULVERT INLET FILTER WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF CULVERT INLET FILTER SHALL BE REMOVED WHEN THE SEDIMENT DEPTH UPSTREAM OF FILTER IS 1/2 THE HEITH OF THE REINFORCED ROCK BERM.
3. RRB FOR CULVERT PROTECTION ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER IS APPROVED BY THE CITY.
4. WHEN CULVERT INLET FILTERS ARE REMOVED, ANY DISTURBED AREA SHALL BE DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE CITY.

RRC — RRB FOR CULVERT PROTECTION — 13

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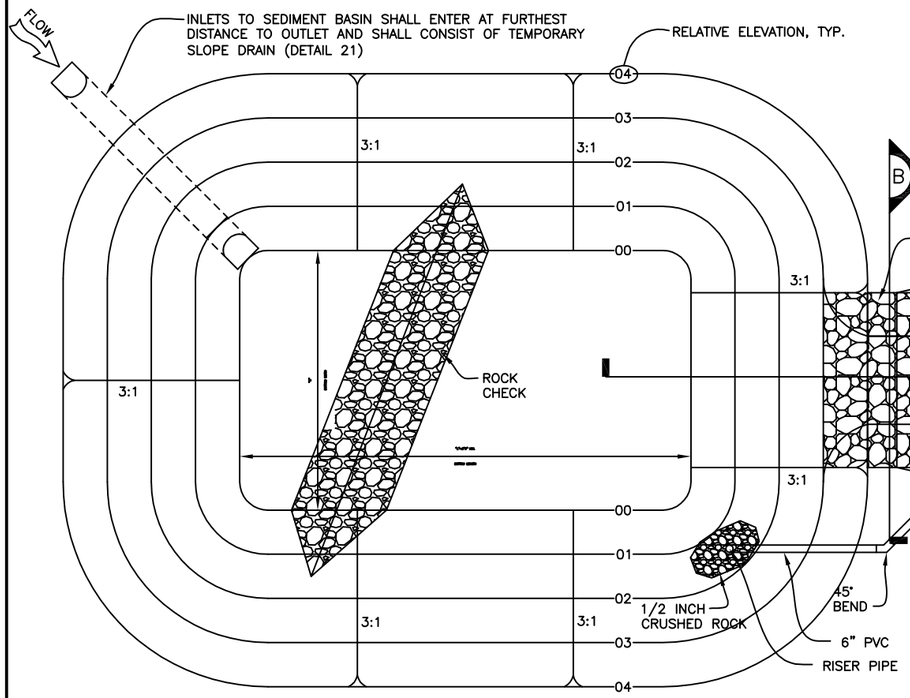
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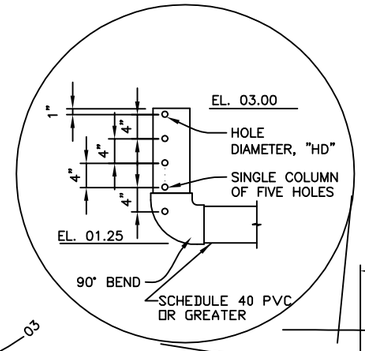
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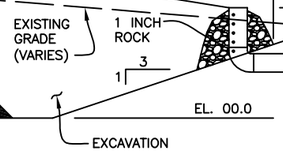
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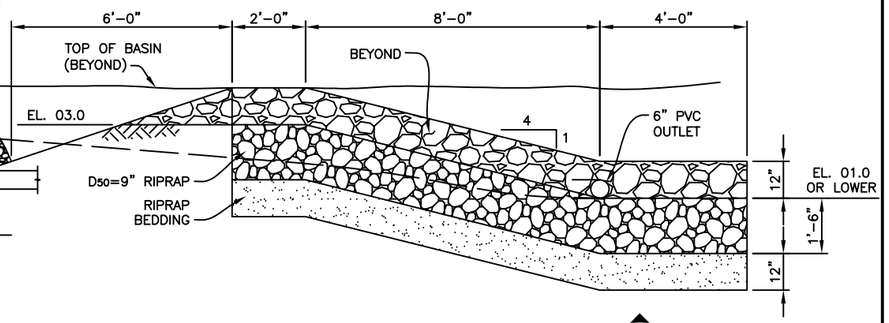
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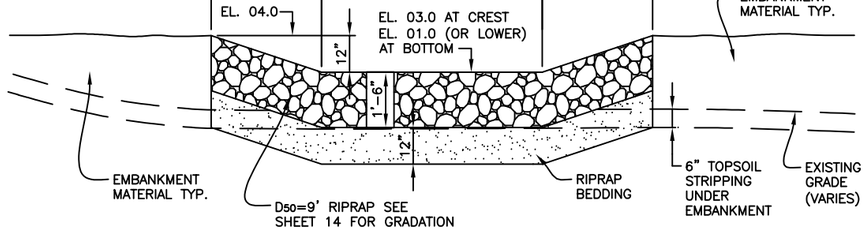
STANDARD BASIN – PLAN







STANDARD BASIN – SECTION A



STANDARD BASIN – SECTION B

SEDIMENT BASIN INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - LOCATION OF SEDIMENT BASIN.
   - TYPE OF BASIN (STANDARD BASIN OR NON–STANDARD BASIN).
   - FOR STANDARD BASIN, CREST LENGTH, "CL", BOTTOM WIDTH, "W", AND HOLE DIAMETER, "HD".
   - FOR NON–STANDARD BASIN, SEE CONSTRUCTION DRAWINGS FOR DESIGN OF BASIN INCLUDING RISER HEIGHT, "H", NUMBER OF COLUMNS, "N", HOLE DIAMETER, "HD", AND PIPE DIAMETER "D".
2. FOR STANDARD BASIN, BOTTOM DIMENSION MAY BE MODIFIED AS LONG AS BOTTOM AREA IS NOT REDUCED.
3. SEDIMENT BASINS INDICATED ON INITIAL ESC PLAN SHALL BE INSTALLED PRIOR TO ANY OTHER LAND–DISTURBING ACTIVITY.
4. EMBANKMENT MATERIAL SHALL CONSIST OF SOIL FREE OF DEBRIS, ORGANIC MATERIAL, AND ROCKS OR CONCRETE GREATER THAN 3 INCHES AND SHALL HAVE A MINIMUM OF 15 PERCENT BY WEIGHT PASSING THE NO. 200 SIEVE.
5. EMBANKMENT MATERIAL SHALL BE COMPACTED TO AT LEAST 95 PERCENT OF MAXIMUM DENSITY WITHIN 2 PERCENTAGE POINTS OF OPTIMUM DENSITY IN ACCORDANCE WITH ASTM D698.
6. PIPE SCH 40 OR GREATER SHALL BE USED.
7. THE DETAILS SHOWN ON THIS SHEET PERTAIN TO STANDARD SEDIMENT BASIN(S) IDENTIFIED ON THE ESC PLAN VIEW DRAWINGS USED FOR DRAINAGE AREAS LESS THAN 15 ACRES. SEE CONSTRUCTION DRAWINGS FOR EMBANKMENT, STORAGE VOLUME, SPILLWAY, OUTLET, AND OUTLET PROTECTION DETAILS FOR ANY SEDIMENT BASIN(S) THAT HAVE BEEN INDIVIDUALLY DESIGNED FOR DRAINAGE AREAS LARGER THAN 15 ACRES.

SEDIMENT BASIN MAINTENANCE NOTES

1. THE ESC MANAGER SHALL INSPECT SEDIMENT BASIN WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT AS NECESSARY.
2. SEDIMENT ACCUMULATED IN SEDIMENT BASIN SHALL BE REMOVED WHEN THE SEDIMENT DEPTH IS WITHIN 2.0 FEET OF THE CREST OF THE SPILLWAY.
3. SEDIMENT BASINS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER IS APPROVED BY THE CITY.
4. IF SEDIMENT BASINS ARE REMOVED, THE DISTURBED AREA SHALL BE SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE CITY.

SB SEDIMENT BASIN 14

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Ph: 303-289-8150

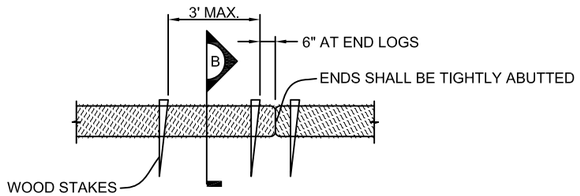
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ENGINEERING CONSTRUCTION STANDARDS

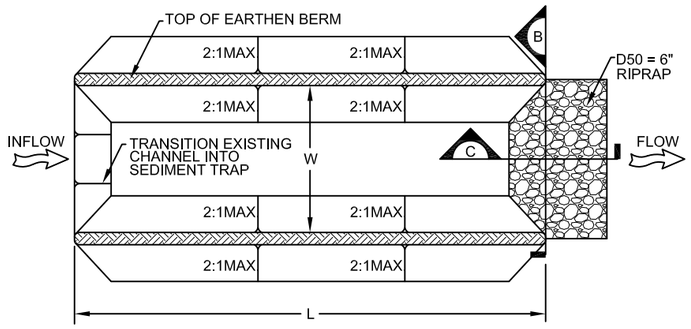
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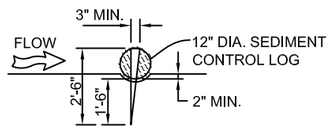
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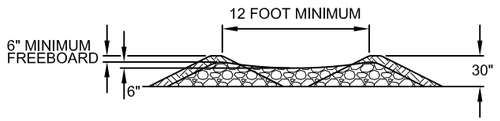
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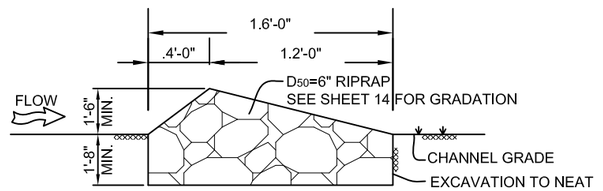
DETAIL A



SECTION B



SECTION B



SECTION C

SEDIMENT CONTROL LOG INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - LOCATION AND LENGTH OF SEDIMENT CONTROL LOG.
2. SEDIMENT CONTROL LOGS INDICATED ON INITIAL ESC PLAN SHALL BE INSTALLED PRIOR TO ANY LAND-DISTURBING ACTIVITIES.
3. SEDIMENT CONTROL LOGS SHALL CONSIST OF STRAW, COMPOST, EXCELSIOR, OR COCONUT FIBER.
4. NOT FOR USE IN CONCENTRATED FLOW AREAS SUCH AS ROADSIDE DITCHES.
5. THE SEDIMENT CONTROL LOG SHALL BE TRENCHED INTO THE GROUND A MINIMUM OF 2".

SEDIMENT CONTROL LOG MAINTENANCE NOTES

1. THE ESC MANAGER SHALL INSPECT SEDIMENT CONTROL LOGS WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF SEDIMENT CONTROL LOGS SHALL BE REMOVED WHEN THE UPSTREAM SEDIMENT DEPTH IS WITHIN ½ THE HEIGHT OF THE CREST OF LOG.
3. SEDIMENT CONTROL LOG SHALL BE REMOVED AT THE END OF CONSTRUCTION. IF ANY DISTURBED AREA EXISTS AFTER REMOVAL, IT SHALL BE DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE CITY.

SCL SEDIMENT CONTROL LOG 15

SEDIMENT TRAP INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - LOCATION, LENGTH AND WIDTH OF SEDIMENT TRAP.
2. SEDIMENT TRAPS INDICATED ON INITIAL GESC PLAN SHALL BE INSTALLED PRIOR TO ANY LAND-DISTURBING ACTIVITIES.
3. SEDIMENT TRAP BERM SHALL BE CONSTRUCTED FROM MATERIAL FROM EXCAVATION. THE BERM SHALL BE COMPACTED TO 95% OF THE MAXIMUM DENSITY IN ACCORDANCE WITH ASTM D698.
4. RIPRAP OUTLET SHALL BE CONSTRUCTED WITH D =6" RIPRAP WITH A MINIMUM OVERFLOW OF 6".
5. THE TOP OF THE EARTHEN BERM SHALL BE A MINIMUM OF 6" HIGHER THAN THE TOP OF THE RIPRAP OUTLET STRUCTURE.
6. THE ENDS OF THE RIPRAP OUTLET STRUCTURE SHALL BE MINIMUM OF 6" HIGHER THAN THE CENTER OF THE OUTLET STRUCTURE.

SEDIMENT TRAP MAINTENANCE NOTES

1. THE ESC MANAGER SHALL INSPECT SEDIMENT TRAPS WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF RIPRAP SHALL BE REMOVED WHEN THE UPSTREAM SEDIMENT DEPTH IS WITHIN ½ THE HEIGHT OF THE RIPRAP OUTLET STRUCTURE.
3. SEDIMENT TRAPS SHALL REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVERAGE IS APPROVED BY THE CITY.
4. WHEN SEDIMENT TRAPS ARE REMOVED THE DISTURBED AREA SHALL BE DRILLED SEEDED AND CRIMP MULCHED OR STABILIZED IN A MANNER APPROVED BY THE CITY.

ST SEDIMENT TRAP 16

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EROSION & SEDIMENT CONTROL

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Sheet No. 9 of 14

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SEEDING AND MULCHING INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - AREA OF SEEDING AND MULCHING.
   - TYPE OF SEED MIX (PERMANENT, TEMPORARY, OR LOW-GROWTH).
2. ALL BRANDS FURNISHED SHALL BE FREE FROM SUCH NOXIOUS SEEDS AS RUSSIAN OR CANADIAN THISTLE, COARSE FESCUE, EUROPEAN BINDWEED, JOHNSON GRASS, KNAP WEED AND LEAFY SPURGE.
3. THE SEEDER SHALL FURNISH TO THE CONTRACTOR A SIGNED STATEMENT CERTIFYING THAT THE SEED FURNISHED IS FROM A LOT THAT HAS BEEN TESTED BY A RECOGNIZED LABORATORY. SEED WHICH HAS BECOME WET, MOLDY, OR OTHERWISE DAMAGED IN TRANSIT OR IN STORAGE WILL NOT BE ACCEPTABLE. SEED TICKETS SHALL BE PROVIDED TO THE CITY UPON REQUEST.
4. DRILL SEEDING MIX SHALL CONFORM TO THE TABLE ON THE RIGHT:
5. IF THE SEED AVAILABLE ON THE MARKET DOES NOT MEET THE MINIMUM PURITY AND GERMINATION PERCENTAGES SPECIFIED, THE SUBCONTRACTOR MUST COMPENSATE FOR A LESSER PERCENTAGE OF PURITY OR GERMINATION BY FURNISHING SUFFICIENT ADDITIONAL SEED TO EQUAL THE SPECIFIED PRODUCT. THE TAGS FROM THE SEED MIXES MUST BE SUPPLIED TO CONTRACTOR AND FORWARDED TO THE CITY INSPECTOR.
6. THE FORMULA USED FOR DETERMINING THE QUANTITY OF PURE LIVE SEED (PLS) SHALL BE (POUNDS OF SEED) X (PURITY) X (GERMINATION) = POUNDS OF PURE LIVE SEED (PLS).
7. PERMANENT SEED MIX SHALL BE USED UNLESS OTHERWISE APPROVED BY THE CITY.
8. ALL AREAS TO BE SEEDED AND MULCHED SHALL HAVE NATIVE TOPSOIL OR APPROVED SOIL AMENDMENTS SPREAD TO A DEPTH OF AT LEAST 6 INCHES (LOOSE DEPTH). HAUL ROADS AND OTHER COMPACTED AREAS SHALL BE LOOSENED TO A DEPTH OF 6 INCHES PRIOR TO SPREADING TOPSOIL.
9. SOIL IS TO BE THOROUGHLY LOOSENED (TILLED) TO A DEPTH OF AT LEAST 6 INCHES PRIOR TO SEEDING. THE TOP 6 INCHES OF THE SEED BED SHALL BE FREE OF ROCKS GREATER THAN 4 INCHES AND SOIL CLODS GREATER THAN 2 INCHES. SEEDING OVER ANY COMPACTED AREAS THAT HAVEN'T BEEN THOROUGHLY LOOSENED SHALL BE REJECTED.
10. SEED IS TO BE APPLIED USING A MECHANICAL DRILL TO A DEPTH OF 1/4 INCH. ROW SPACING SHALL BE NO MORE THAN 6 INCHES. MATERIAL USED FOR MULCH SHALL CONSIST OF LONG-STEMMED STRAW. AT LEAST 50 PERCENT OF THE MULCH, BY WEIGHT, SHALL BE 10 INCHES OR MORE IN LENGTH. MULCH SHALL BE APPLIED AND MECHANICALLY ANCHORED TO A DEPTH OF AT LEAST 2 INCHES. MULCH SHALL BE APPLIED AT A RATE OF 4000 LB. OF STRAW PER ACRE.
11. IF THE PERMITTEE DEMONSTRATES TO THE CITY THAT IT IS NOT POSSIBLE TO DRILL SEED, SEED IS TO BE UNIFORMLY BROADCAST AT TWO TIMES THE DRILLED RATE, THEN LIGHTLY HARROWED TO PROVIDE A SEED DEPTH OF APPROXIMATELY 1/4 INCH, THEN ROLLED TO COMPACT, THEN MULCHED AS SPECIFIED ABOVE.
12. SEEDING AND MULCHING SHALL BE COMPLETED WITHIN 30 DAYS OF INITIAL EXPOSURE OR 7 DAYS AFTER GRADING IS SUBSTANTIALLY COMPLETE IN A GIVEN AREA (AS DEFINED BY THE CITY. THIS MAY REQUIRE MULTIPLE MOBILIZATIONS FOR SEEDING AND MULCHING.
13. MULCH SHALL BE APPLIED WITHIN 24-HOURS OF SEEDING.
14. TACKIFIER SHOULD BE UTILIZED TO HELP WITH STRAW DISPLACEMENT.

SEEDING AND MULCHING MAINTENANCE NOTES

1. SEEDED AND MULCHED AREAS SHALL BE INSPECTED FOR REQUIRED COVERAGE MONTHLY FOR A PERIOD OF TWO YEARS FOLLOWING INITIAL SEEDING. REPAIRS AND RE-SEEDING AND MULCHING SHALL BE UNDERTAKEN AFTER THE FIRST GROWING SEASON FOR ANY AREAS FAILING TO MEET THE REQUIRED COVERAGE.
2. REQUIRED COVERAGE FOR STANDARD, OPEN SPACE AND LOW GROWTH SEED MIXES SHALL BE DEFINED AS FOLLOWS:
   1. THREE (3) PLANTS PER SQUARE FOOT WITH A MINIMUM HEIGHT OF 3 INCHES. THE 3 PLANTS PER SQUARE FOOT SHALL BE OF THE VARIETY AND SPECIES FOUND IN THE CITY APPROVED MIX.
   2. NO BARE AREAS LARGER THAN 4 SQUARE FEET (TWO-FEET BY TWO-FEET OR EQUIVALENT).
   3. FREE OF ERODED AREAS.
   4. FREE FROM INFESTATION OF NOXIOUS WEEDS IN ACCORDANCE WITH SECTION 6.4 OF THE GESC CRITERIA MANUAL.
3. REQUIRED COVERAGE FOR TURF GRASS AREAS SHALL BE DEFINED AS FOLLOWS:
   1. AT LEAST 80% VEGETATIVE COVER OF GRASS SPECIES PLANTED.
   2. NO BARE AREAS LARGER THAN 4 SQUARE FEET (TWO-FEET BY TWO-FEET OR EQUIVALENT).
   3. FREE OF ERODED AREAS.
   4. FREE FROM INFESTATION OF NOXIOUS WEEDS IN ACCORDANCE WITH SECTION 6.4 OF THE GESC CRITERIA MANUAL.
4. RILL AND GULLY EROSION SHALL BE FILLED WITH TOPSOIL PRIOR TO RESEEDING. THE RESEEDING METHOD SHALL BE APPROVED BY THE CITY.

PERMANENT DRILL SEEDING MIX

SPECIES	VARIETY	NOTES	% IN MIX	POUNDS OF PLS PER ACRE
BIG BLUESTEM	KAW	PNWS	10	1.1
YELLOW INDIANGRASS	CHEYENNE	PNWS	10	1
SWITCHGRASS	BLACKWELL	PNWS	10	0.4
SIDEOATS GRAMA	VAUGHN	PNWB	10	0.9
WESTERN WHEATGRASS	ARRIBA	PNCS	10	1.6
BLUE GRAMA	HACHITA	PNWB	10	0.3
THICKSPIKE WHEATGRASS	CRITANA	PNCS	10	1
PRAIRIE SANDREED	GOSHEN	PNWS	10	0.7
GREEN NEEDLEGRASS	LODORM	PNCB	10	1
SLENDER WHEATGRASS	PRYOR	PNCB	5	0.6
STREAMBANK WHEATGRASS	SODAR	PNCS	5	0.6
			TOTAL	9.2

TEMPORARY DRILL SEEDING MIX

SPECIES	VARIETY	NOTES	% IN MIX	POUNDS OF PLS PER ACRE
SMOOTH BROMEGRASS	LINCOLN	PICS	30	3.9
INTERMEDIATE WHEATGRASS	OAHE	PICS	30	4.5
PUBESCENT WHEATGRASS	LUNA	PICS	30	4.2
ANNUAL RYEGRASS	N/A	AICB	10	0.8
			TOTAL	13.4

LOW-GROWTH DRILL SEEDING MIX

SPECIES	VARIETY	NOTES	% IN MIX	POUNDS OF PLS PER ACRE
BUFFALOGRASS	TEXOKA	PNWS	20	3.2
BLUE GRAMA	HACHITA	PNWB	20	0.6
WESTERN WHEATGRASS	ARRIBA	PNCS	20	3.2
SIDEOATS GRAMA	VAUGHN	PNWB	20	1.8
THICKSPIKE WHEATGRASS	CRITANA	PNCS	10	1
STREAMBANK WHEATGRASS	SODAR	PNCS	10	1.2
			TOTAL	11.0

SM SEEDING AND MULCHING 17

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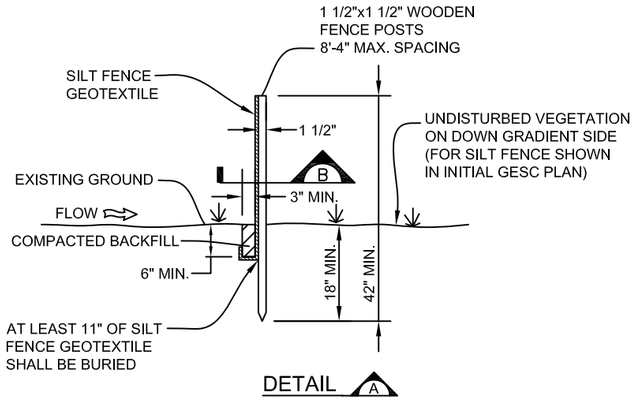
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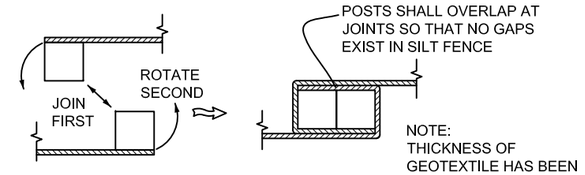
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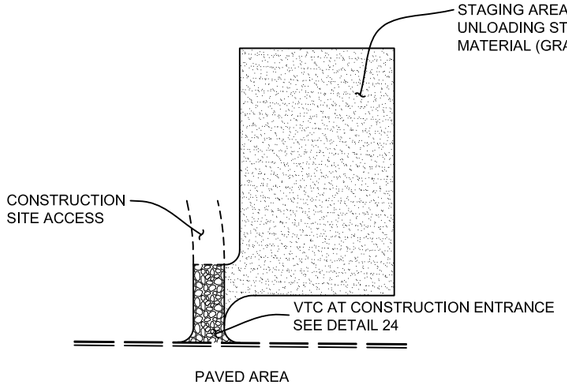
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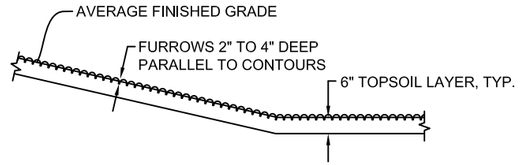
DETAIL A



JOINTS - SECTION B



PLAN



SECTION A

SILT FENCE INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - LOCATION AND LENGTH OF FENCE.
2. ANCHOR TRENCH SHALL BE EXCAVATED WITH TRENCHER, OR WITH SILT FENCE INSTALLATION MACHINE; NO ROAD GRADERS, BACKHOES, ETC. SHALL BE USED. TRENCH SHALL BE COMPACTED BY HAND, WITH "JUMPING JACK", OR BY WHEEL ROLLING. COMPACTION SHALL BE SUCH THAT SILT FENCE RESISTS BEING PULLED OUT OF ANCHOR TRENCH BY HAND.
3. SILT FENCE GEOTEXTILE SHALL MEET THE FOLLOWING REQUIREMENTS:
   - 6-TO 12-GALLONS PER MINUTE PER SQUARE FOOT FLOW CAPACITY.
   - 90 LB. TENSILE STRENGTH PER ASTM D4622.
   - UV DESIGN AT 500 HRS MIN. 70% STRENGTH RETAINED PER ASTM D 4355.
4. SILT FENCE INDICATED ON INITIAL ESC PLAN SHALL BE INSTALLED PRIOR TO ANY LAND-DISTURBING ACTIVITIES.

SILT FENCE MAINTENANCE NOTES

1. THE ESC MANAGER SHALL INSPECT SILT FENCE WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF SILT FENCE SHALL BE REMOVED WHEN THE UPSTREAM SEDIMENT REACHES A DEPTH OF 6-INCHES.
3. SILT FENCE SHALL BE REMOVED WHEN THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER IS APPROVED BY THE CITY. IF ANY DISTURBED AREA EXISTS AFTER REMOVAL, IT SHALL BE SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE CITY.

SF SILT FENCE 18

STABILIZED STAGING AREA INSTALLATION NOTES

1. SEE PLAN VIEW FOR GENERAL LOCATION OF STAGING AREA. CONTRACTOR MAY MODIFY LOCATION AND SIZE OF STABILIZED STAGING AREA WITH CITY APPROVAL.
2. STABILIZED STAGING AREA SHALL BE LARGE ENOUGH TO FULLY CONTAIN PARKING, STORAGE, AND UNLOADING AND LOADING OPERATIONS.
3. IF REQUIRED BY THE CITY, SITE ACCESS ROADS SHALL BE STABILIZED IN THE SAME MANNER AS THE STAGING AREA.
4. STAGING AREA SHALL BE STABILIZED PRIOR TO ANY OTHER OPERATIONS ON THE SITE.
5. THE STABILIZED STAGING AREA SHALL CONSIST OF A MINIMUM OF 3" OF GRANULAR MATERIAL (GRAVEL OR RECYCLED CONCRETE).

STABILIZED STAGING AREA MAINTENANCE NOTES

1. THE ESC MANAGER SHALL INSPECT THE STABILIZED STAGING AREA WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. ESC MANAGER SHALL PROVIDE ADDITIONAL THICKNESS OF GRANULAR MATERIAL IF ANY RUTTING OCCURS OR UNDERLYING SUBGRADE BECOMES EXPOSED.
3. STABILIZED STAGING AREA SHALL BE ENLARGED IF NECESSARY TO CONTAIN PARKING, STORAGE, AND UNLOADING AND LOADING OPERATIONS.
4. ANY ACCUMULATED DIRT OR MUD SHALL BE REMOVED FROM THE SURFACE OF THE STABILIZED STAGING AREA.
5. THE STABILIZED STAGING AREA SHALL BE REMOVED AT THE END OF CONSTRUCTION. THE GRANULAR MATERIAL SHALL BE REMOVED OR, IF APPROVED BY THE CITY, USED ON SITE, AND THE AREA TOPSOILED, DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED.

SSA STABILIZED STAGING AREA 19

SURFACE ROUGHENING INSTALLATION NOTES

1. SURFACE ROUGHENING SHALL BE PROVIDED ON ALL FINISHED GRADES (SLOPES AND "FLAT" AREAS) WITHIN 2 DAYS OF COMPLETION OF FINISHED GRADE (FOR AREAS NOT RECEIVING TOPSOIL) OR WITHIN 2 DAYS OF TOPSOIL PLACEMENT.
2. AREAS WHERE BUILDING FOUNDATIONS, PAVEMENT, OR SOD IS TO BE PLACED WITHIN 7-DAYS OF FINISHED GRADING DO NOT NEED TO BE SURFACE ROUGHENED.
3. DISTURBED SURFACES SHALL BE ROUGHENED USING RIPPING OR TILLING EQUIPMENT ON THE CONTOUR OR TRACKING UP AND DOWN A SLOPE USING EQUIPMENT TREADS.

SURFACE ROUGHENING MAINTENANCE NOTES

1. THE ESC MANAGER SHALL INSPECT THE SURFACE ROUGHENING WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. VEHICLES AND EQUIPMENT SHALL GENERALLY BE CONFINED TO ACCESS DRIVES AND SHALL NOT BE DRIVEN OVER AREAS THAT HAVE BEEN SURFACE ROUGHENED.
3. IN NON-TURF GRASS FINISHED AREAS, SEEDING AND MULCHING SHALL TAKE PLACE DIRECTLY OVER SURFACE ROUGHENED AREAS WITHOUT FIRST SMOOTHING OUT THE SURFACE.
4. IN AREAS NOT SEEDED AND MULCHED AFTER SURFACE ROUGHENING, SURFACES SHALL BE RE-ROUGHENED AS NECESSARY TO MAINTAIN GROOVE DEPTH AND SMOOTH OVER ANY RILL EROSION.

SR SURFACE ROUGHENING 20

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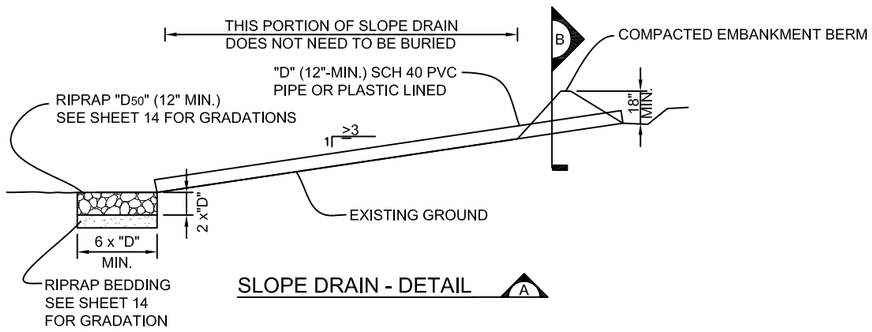
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ENGINEERING CONSTRUCTION STANDARDS

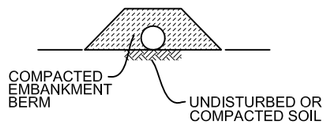
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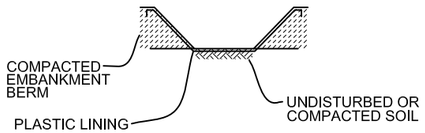
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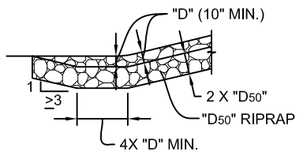
SLOPE DRAIN - DETAIL A



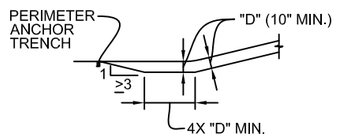
SLOPE DRAIN - DETAIL B



PLASTIC LINED DRAIN-SECTION E



TERMINATION OF RIPRAP LINED
SLOPE DRAIN - DETAIL D



TERMINATION OF PLASTIC LINED
SLOPE DRAIN - DETAIL C

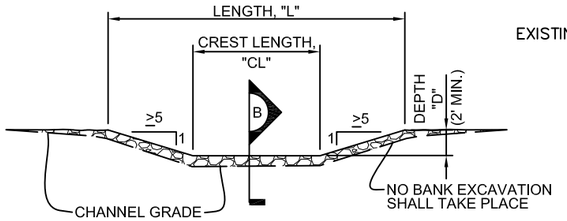
SLOPE DRAIN INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - LOCATION AND LENGTH OF SLOPE DRAIN.
   - PIPE DIAMETER, "D", AND RIPRAP SIZE, "D_{50}".
2. SLOPE DRAIN DIMENSIONS SHALL BE CONSIDERED MINIMUM DIMENSIONS; CONTRACTOR MAY ELECT TO INSTALL LARGER FACILITIES. ANY DAMAGE TO SLOPE OR SLOPE DRAIN DURING RUNOFF EVENTS SHALL BE THE CONTRACTOR'S RESPONSIBILITY.
3. SLOPE DRAINS INDICATED ON INITIAL ESC PLAN SHALL BE INSTALLED PRIOR TO ANY UPSTREAM LAND-DISTURBING ACTIVITIES.
4. FOR TEMPORARY SLOPE DRAINS, PIPE MAY BE INSTALLED ON TOP OF SLOPE; HOWEVER, 12" MIN. COVER AT TOP OF SLOPE SHALL BE PROVIDED.
5. A RIPRAP PAD SHALL BE PLACED AT THE OUTFALL OF THE SLOPE DRAIN.

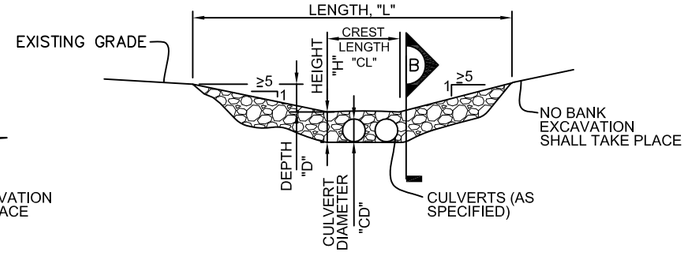
SLOPE DRAIN MAINTENANCE NOTES

1. THE ESC MANAGER SHALL INSPECT SLOPE DRAINS WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS AS NECESSARY.
2. TEMPORARY SLOPE DRAINS ARE TO REMAIN IN PLACE UNTIL NO LONGER NEEDED, BUT SHALL BE REMOVED PRIOR TO THE END OF CONSTRUCTION. WHEN SLOPE DRAINS ARE REMOVED, THE DISTURBED AREA SHALL BE DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE CITY.

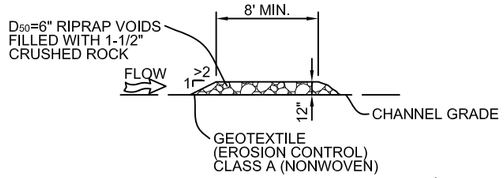
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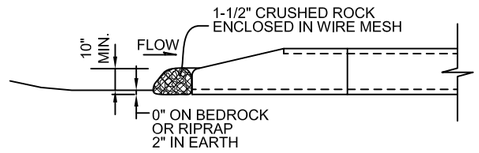
FORD CROSSING - SECTION A



CULVERT CROSSING - SECTION A



FORD CROSSING - SECTION B



CULVERT CROSSING - SECTION B

TEMPORARY STREAM CROSSING INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - LOCATIONS OF TEMPORARY STREAM CROSSING.
   - STREAM CROSSING TYPE (FORD OR CULVERT).
   - FOR FORD CROSSING: LENGTH, "L", CREST LENGTH, "CL", AND DEPTH, "D".
   - FOR CULVERT CROSSING : LENGTH, "L", CREST LENGTH, "CL", CROSSING HEIGHT, "H", DEPTH, "D", CULVERT DIAMETER, "CD", AND NUMBER, TYPE AND CLASS OR GAUGE OF CULVERTS.
2. TEMPORARY STREAM CROSSING DIMENSIONS, D50, AND NUMBER OF CULVERTS INDICATED (FOR CULVERT CROSSING) SHALL BE CONSIDERED MINIMUM DIMENSIONS; ENGINEER MAY ELECT TO INSTALL LARGER FACILITIES. ANY DAMAGE TO STREAM CROSSING OR EXISTING STREAM CHANNEL DURING BASEFLOW OR FLOOD EVENTS SHALL BE THE CONTRACTOR'S RESPONSIBILITY.
3. SEE SHEET 14 FOR RIPRAP AND 1-1/2" CRUSHED ROCK GRADATIONS.
4. FOR A TEMPORARY STREAM CROSSING THAT WILL CARRY LOADS, THE TEMPORARY STREAM CROSSING MUST BE DESIGNED BY THE DESIGN ENGINEER.

TEMPORARY STREAM CROSSING MAINTENANCE NOTES

1. THE ESC MANAGER SHALL INSPECT STREAM CROSSINGS WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF STREAM CROSSINGS SHALL BE REMOVED WHEN THE SEDIMENT DEPTH UPSTREAM OF CROSSING IS WITHIN 6-INCHES OF THE CREST (FORD CROSSING) OR GREATER THAN AN AVERAGE DEPTH OF 12-INCHES (CULVERT CROSSING).
3. STREAM CROSSINGS ARE TO REMAIN IN PLACE UNTIL NO LONGER NEEDED, BUT SHALL BE REMOVED PRIOR TO THE END OF CONSTRUCTION.
4. WHEN STREAM CROSSINGS ARE REMOVED, THE DISTURBED AREA SHALL BE DRILL SEEDED AND CRIMP MULCHED AND COVERED WITH EROSION CONTROL BLANKET OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE CITY.

TSC TEMPORARY STREAM CROSSING 22

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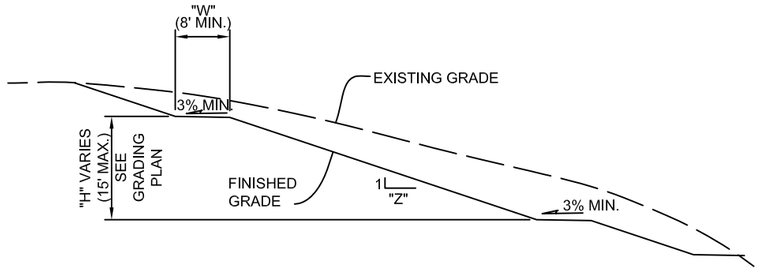
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ENGINEERING CONSTRUCTION STANDARDS

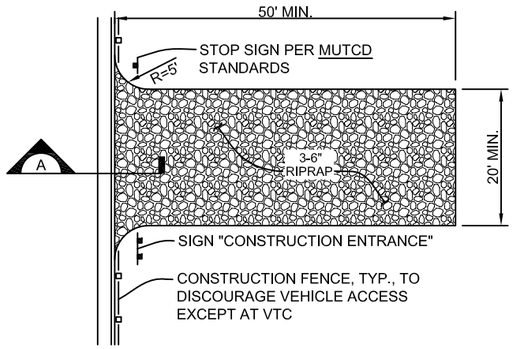
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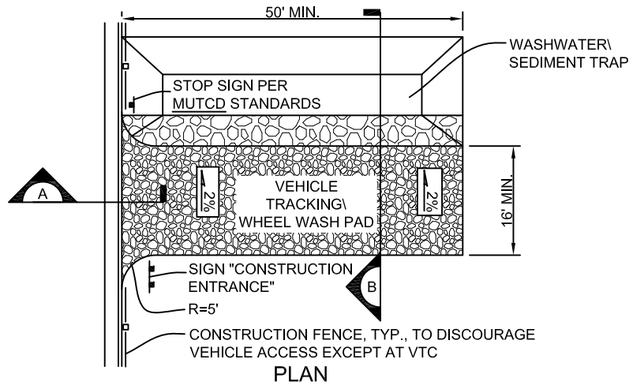
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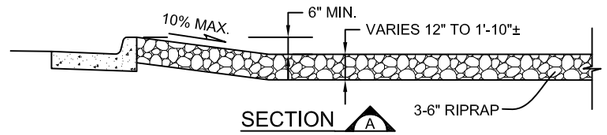
SECTION A



PLAN

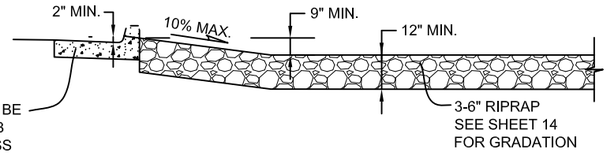


PLAN

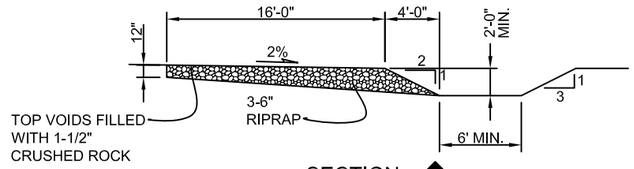


SECTION A

NO MATERIAL INCLUDING WOOD, PIPES, GRAVEL, OR ASPHALT, SHALL BE PLACED IN GUTTER TO FACILITATE MOUNTING CURB; HOWEVER, CURB MAY BE CUT DOWN TO A HEIGHT OF 2" OR HIGHER FOR EASIER ACCESS AND REPLACED AT PROJECT COMPLETION WITH A CITY OF COMMERCE CITY RIGHT-OF-WAY PERMIT.



SECTION A



SECTION B

TERRACING INSTALLATION NOTES

SEE PLAN VIEW FOR:
- WIDTH, "W", AND SLOPE, "Z".

TERRACING IS NOT REQUIRED FOR SLOPES OF 4 TO 1 OR FLATTER.

EARTH (VEGETATED) SLOPES STEEPER THAN 3 TO 1 ARE NOT ALLOWED ON THE SITE.

TERRACING MAINTENANCE NOTES

THE ESC MANAGER SHALL INSPECT THE SURFACE ROUGHENING WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.

ANY RILL EROSION OCCURRING ON SLOPES SHALL BE REPAIRED AND RESEEDED AND MULCHED IN ACCORDANCE WITH DETAIL 17.

TER TERRACING 23

VEHICLE TRACKING CONTROL INSTALLATION NOTES

1. VEHICLE TRACKING CONTROL PADS SHALL BE INSTALLED AT EVERY ACCESS POINT TO SITE.
2. VEHICLE TRACKING CONTROL PADS SHALL CONSIST OF HARD, DENSE, DURABLE STONE, ANGULAR IN SHAPE AND RESISTANT TO WEATHERING. ROUNDED STONE OR BOULDERS WILL NOT BE ACCEPTABLE. THE STONES SHALL BE 3" WITH A MAXIMUM SIZE OF 6". THE STONE SHALL HAVE A SPECIFIC GRAVITY OF AT LEAST 2.6. CONTROL OF GRADATION WILL BE BY VISUAL INSPECTIONS.
3. ANY CRACKED OR DAMAGED CURB AND GUTTER AND SIDEWALK SHALL BE REPLACED BY PERMITTEE.
4. A STOP SIGN INSTALLED IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD), AS AMENDED, SHALL BE INSTALLED FOR EXITING TRAFFIC AT THE VTC.

VEHICLE TRACKING CONTROL MAINTENANCE NOTES

1. ESC MANAGER SHALL INSPECT VEHICLE TRACKING CONTROL DAILY. GRAVEL SURFACE SHALL BE CLEAN AND LOOSE ENOUGH TO RUT SLIGHTLY UNDER WHEEL LOADS AND CAUSE LOOSE GRAVEL TO DISLODGE MUD FROM TIRES. WHEN GRAVEL BECOMES COMPACTED OR FILLED WITH SEDIMENT SO THAT THE EFFECTIVENESS OF THE PAD IS DIMINISHED, CONTRACTOR SHALL RIP, TURN OVER, OR OTHERWISE LOOSEN GRAVEL, PLACE ADDITIONAL NEW GRAVEL, OR REPLACE WITH NEW GRAVEL AS NECESSARY TO RESTORE EFFECTIVENESS.
2. VEHICLE TRACKING CONTROL SHALL BE REMOVED AT THE END OF CONSTRUCTION, THE GRAVEL MATERIAL REMOVED OR, IF APPROVED BY THE CITY, USED ON SITE, AND THE AREA TOPSOILED, DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED.

VTC VEHICLE TRACKING CONTROL 24

VEHICLE TRACKING CONTROL WITH WHEEL WASH INSTALLATION NOTES

1. ALTHOUGH NOT NORMALLY USED, THE CITY RESERVES THE RIGHT TO REQUIRE VEHICLE TRACKING CONTROL WITH WHEEL WASH FACILITIES AT SITES WHERE TRACKING ONTO PAVED AREAS BECOMES A SIGNIFICANT PROBLEM.
2. IF VEHICLE TRACKING CONTROL WITH WHEEL WASH FACILITIES ARE REQUIRED, ALL WHEELS ON EVERY VEHICLE LEAVING THE SITE SHALL BE CLEANED OF MUD USING A PRESSURE-WASHER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING A WATER SOURCE.
3. VEHICLE TRACKING CONTROL PADS SHALL CONSIST OF HARD, DENSE, DURABLE STONE, ANGULAR IN SHAPE AND RESISTANT TO WEATHERING. ROUNDED STONE OR BOULDERS WILL NOT BE ACCEPTABLE. THE STONES SHALL BE 3" WITH A MAXIMUM SIZE OF 6". THE STONE SHALL HAVE A SPECIFIC GRAVITY OF AT LEAST 2.6. CONTROL OF GRADATION WILL BE BY VISUAL INSPECTIONS.
4. ANY CRACKED OR DAMAGED CURB AND GUTTER AND SIDEWALK SHALL BE REPLACED BY CONTRACTOR.
5. A STOP SIGN INSTALLED IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD), AS AMENDED, SHALL BE INSTALLED FOR EXITING TRAFFIC AT THE VTC.

VEHICLE TRACKING CONTROL WITH WHEEL WASH MAINTENANCE NOTES

1. ESC MANAGER SHALL INSPECT VEHICLE TRACKING CONTROL WITH WHEEL WASH FACILITIES DAILY. ACCUMULATED SEDIMENTS SHALL BE REMOVED FROM PAD SURFACE.
2. ACCUMULATED SEDIMENT IN THE WASHWATER/SEDIMENT TRAP SHALL BE REMOVED WHEN THE SEDIMENT DEPTH REACHES AN AVERAGE OF 12-INCHES.
3. VEHICLE TRACKING CONTROL WITH WHEEL WASH FACILITY SHALL BE REMOVED AT THE END OF CONSTRUCTION, THE RIPRAP MATERIAL REMOVED OR, IF APPROVED BY THE CITY, USED ON SITE, AND THE AREA TOPSOILED, DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED.

WW VTC WITH WHEEL WASH 25

COMPUTER FILE INFORMATION	
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Last Modification Date: 5/4/2016	Initials: CJC
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Scale: $SCALESHORT$	Units: ENGLISH

APPROVAL

CITY ENGINEER — 05-27-16 DATE

CITY OF COMMERCE CITY
Department of Public Works
8602 Rosemary St.
Commerce City, CO 80022
Ph: 303-289-8150

EROSION & SEDIMENT CONTROL

ENGINEERING CONSTRUCTION STANDARDS

DETAIL NO. 800-13

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ROCK AND RIPRAP GRADATIONS

TABLE 1. RIPRAP GRADATIONS

D50 MEDIAN STONE SIZE (INCHES)	% OF MATERIAL SMALLER THAN TYPICAL STONE	TYPICAL STONE EQUIVALENT DIAMETER (INCHES)	TYPICAL STONE WEIGHT (POUNDS)
6	70 - 100 50 - 70 35 - 50 2 - 10	12 9 6 2	85 35 10 0.4
9	70 - 100 50 - 70 35 - 50 2 - 10	15 12 9 3	160 85 35 1.3
12	70 - 100 50 - 70 35 - 50 2 - 10	21 18 12 4	440 275 85 3
18	100 50 - 70 35 - 50 2 - 10	30 24 18 6	1280 650 275 10
24	100 50 - 70 35 - 50 2 - 10	42 33 24 9	3500 1700 650 35

TABLE 2. RIPRAP BEDDING

SIEVE SIZE	MASS PERCENT PASSING SQUARE MESH SIEVES
	CLASS A
3"	100
1 1/2"	20 - 90
NO. 4	0 - 20
NO. 200	0 - 3

MATCHES SPECIFICATIONS FOR CDOT CLASS A FILTER MATERIAL AND UDFCD TYPE 1 BEDDING. ALL ROCK SHALL BE FRACTURED FACE, ALL SIDES.

TABLE 3. 1 1/2" CRUSHED ROCK

SIEVE SIZE	MASS PERCENT PASSING SQUARE MESH SIEVES
	NO. 4
2"	100
1 1/2"	90 - 100
1"	20 - 55
3/4"	0 - 15
3/8"	0 - 5

MATCHES SPECIFICATIONS FOR NO. 4 COARSE AGGREGATE FOR CONCRETE PER AASHTO M43. ALL ROCK SHALL BE FRACTURED FACE, ALL SIDES.

COMPUTER FILE INFORMATION	
Creation Date: 03/10/2016	Initials: CJC
Last Modification Date: 5/4/2016	Initials: CJC
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APPROVAL

CITY ENGINEER — DATE 05-27-16

CITY OF COMMERCE CITY
Department of Public Works
8602 Rosemary St.
Commerce City, CO 80022
Ph: 303-289-8150

EROSION & SEDIMENT CONTROL

ENGINEERING CONSTRUCTION STANDARDS

DETAIL NO. 800-14

Sheet No. 14 of 14

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9.00 TRAFFIC SIGNALS

9.01 GENERAL
- 9.01.01 SCOPE AND INTENT
- 9.01.02 CONSTRUCTION MANAGER
- 9.01.03 TRAFFIC CONTROL AND STREET CLOSURE
- 9.01.04 PROTECTION OF PROPERTY
- 9.01.05 CLEANUP AND BARRICADING
- 9.01.06 INTERSECTION POWER
- 9.01.07 FIELD LOCATION
- 9.01.08 INTERSECTION PHASING
- 9.01.09 LICENSE AND PERMITS
- 9.01.10 UTILITIES
- 9.01.11 GUARANTEE
- 9.01.12 WORK HOURS

9.02 REGULATIONS AND CODE

9.03 EQUIPMENT LIST AND DRAWINGS

9.04 AS-BUILTS

9.05 EXCAVATION AND BACKFILL

9.06 REMOVING, REPLACING, AND RESETTING IMPROVEMENTS

9.07 FOUNDATIONS

9.08 CONDUIT

9.09 PULL BOX

9.10 CABINET BASES

9.11 CONDUCTOR AND CABLE

9.12 INTERCONNECT
- 9.12.01 HARDWIRE/COPPER INTERCONNECT
- 9.12.02 FIBER INTERCONNECT
- 9.12.03 RADIO INTERCONNECT

9.13 VEHICLE DETECTION
- 9.13.01 GENERAL
- 9.13.02 VIDEO DETECTION
- 9.13.03 INDUCTANCE DETECTION
- 9.13.04 INDUCTANCE DETECTOR

9.13.05 OTHER DETECTION

9.14 PEDESTRIAN PUSH BUTTONS

9.15 EMERGENCY VEHICLE DETECTION

9.16 BONDING AND GROUNDING

9.17 FIELD TESTING
9.17.01 SIGNAL
9.17.02 FIBER

9.18 CONTROLLER AND CABINET
9.18.01 CONTROLLER AND CABINET INTRODUCTION
9.18.02 CABINET DESIGN AND CONSTRUCTION
9.18.03 TESTING AND WARRANTY

9.19 ON-STREET MASTER CONTROLLER

9.20 TRAFFIC SIGNAL HEADS

9.21 TRAFFIC SIGNAL POLES, MAST ARMS AND LUMINAIRE DAVITS

9.22 SPAN WIRE POLE

9.23 PEDESTAL POLE

9.24 PEDESTRIAN PUSH BUTTON POLE

9.25 ILLUMINATED STREET NAME SIGNS
9.25.01 FLOURESCENT
9.25.02 LED/OTHER

9.26 BLANK OUT REGULATORY/WARNING SIGNS

9.27 SCHOOL FLASHING BEACON ASSEMBLY

9.28 WARNING OR REGULATORY SIGN FLASHING BEACON ASSEMBLY

9.29 SOLAR POWER SYSTEM

9.30 UNINTERRUPTABLE POWER SUPPLY (UPS)
9.30.01 GENERAL
9.30.02 CABINET
9.30.03 OPERATIONAL SPECIFICATIONS

9.31 CLOSED-CIRCUIT TELEVISION (CCTV)
9.31.01 CCTV CAMERA
9.31.02 ENCODER/DECODER

9.32 MISCELLANEOUS HARDWARE

9.33 MAINTENANCE AND EMERGENCY REPAIR DURING CONSTRUCTION

9.34 MOBILIZATION

9.00 TRAFFIC SIGNALS

9.01 GENERAL

9.01.01 SCOPE AND INTENT

The work specified in this section describes the installation of necessary material and equipment to complete traffic signals and/or other electrical systems as specified on the Plans, in the Contract Documents, or herein.

9.01.02 CONSTRUCTION MANAGER

The Construction Manager shall be the Traffic Engineer, or his designated representative, and shall be the responsible person overseeing all work on the City's behalf.

9.01.03 TRAFFIC CONTROL AND STREET CLOSURE

The Contractor will be required to maintain access to all properties throughout the period of construction for this project. The Contractor shall be required to erect, maintain, and remove all barricades, traffic control signs and devices necessary for any street closure including detour signs. Any signs not in use shall be turned away from traffic or removed from the job site. All traffic control devices shall be in good condition. Signs shall be clean, retro reflective, and free of scratches and graffiti.

Any street closure must be pre-approved by the Construction Manager. A Road Closure Packet is required to be completed and submitted a minimum of one week prior to any road closure. All such barricades and traffic control signs and devices shall be in accordance with the latest edition of the "Manual on Uniform Traffic Control Devices for Streets and Highways" including the "Colorado Supplement". Traffic control plans shall be submitted to the Construction Manager for review no later than forty-eight (48) hours in advance of any work.

9.01.04 PROTECTION OF PROPERTY

The Contractor shall assume full responsibility and expense for the protection of all public and private property, structures, water mains, sewers, utilities, etc., both above and below ground, at or near the site or sites of the work being performed under the Contract, or which are in any

manner affected by the prosecution of the work or the transportation of personnel and materials in connection therewith.

The Contractor shall give notice of not less than forty-eight (48) hours to the Department of the City having charge of any property or utilities served by the City and to other owner or owners of public or private property or utilities when they will be affected by the work to be performed under the Contract; and shall make all necessary arrangements with such departments, owner or owners for the removal, replacement, or protection of such property or utilities.

9.01.05 CLEANUP AND BARRICADING

The Contractor shall be responsible for insuring that all work sites are properly cleaned and barricaded prior to the completion of the day's activities.

9.01.06 INTERSECTION POWER

The Contractor shall notify the Construction Manager a minimum of three (3) weeks prior to the signal turn-on so that orders may be issued for power connection to the intersection on the specified turn-on date. The Contractor shall coordinate with the appropriate power company (Xcel Energy, United Power, etc.) to ensure timely connection of power feed.

9.01.07 FIELD LOCATION

All loops, poles, control cabinets, pull boxes, pole foundations and permanent pavement marking material shall be field located by the Construction Manager.

9.01.08 INTERSECTION PHASING

Intersection phasing shall be as defined based on the direction of the coordinated vehicular movements. When intersection phasing defined in the plans and/or project specials conflicts with that defined here within, the Construction Manager shall make final determination as to the intersection phasing.

Coordinated Phases North/South	
Controller Phase	Vehicular Movement
1	Southbound Left Turn
2	Northbound
3	Westbound Left Turn
4	Eastbound
5	Northbound Left Turn
6	Southbound
7	Eastbound Left Turn
8	Westbound
Coordinated Phases East/West	
1	Westbound Left Turn
2	Eastbound
3	Northbound Left Turn
4	Southbound
5	Eastbound Left Turn
6	Westbound
7	Southbound Left Turn
8	Northbound

9.01.09 LICENSE AND PERMITS

The Contractor shall obtain any and all permits as necessary from the City Building Department, the City Public Works Department, and other agencies as required.

9.01.10 UTILITIES

All utility locations and elevations will require field verification in cooperation with the affected companies and public agencies. The Contractor shall be responsible for locating all underground utilities, valve boxes, manholes, etc., and insuring that they are properly protected and adjusted as called for in the plans and/or project specials. When utility adjustments are required, but have not been called for in the plans and/or project specials, the Contractor shall notify the Construction Manager immediately.

9.01.11 GUARANTEE

There shall be a one (1) year guarantee on all work performed by the Contractor. Said one (1) year period shall commence from the date of Final Acceptance.

Materials shall be warranted for a minimum of one (1) year, except as otherwise noted. The Contractor shall supply the Construction Manager with all manufacturers' warranties covering material and parts.

At Final Acceptance, normal operation and maintenance shall become the responsibility of the City.

9.01.12 WORK HOURS

The Contractor shall work only on week days between the hours of 8:00 AM and 5:00 PM. The Contractor, upon approval of the traffic control plan by the Construction Manager, will be allowed lane closures in the public roadway weekdays only from the hours of 9:00 AM to 3:30 PM, unless alternate hours are approved. The Contractor must receive written approval from the Construction Manager for lane closures at any other time; and also, to work weekends or holidays.

9.02 REGULATIONS AND CODE

All materials and workmanship shall conform to the standards of the latest edition of the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction, and these Standards and Specifications. If conflicts arise between the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction, these Standards and Specifications, and the contract documents, the contract documents shall take precedence. In addition to requirements of the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction, these Standards and Specifications, and the contract documents, all material and work shall conform to the requirements of the National Electrical Line Construction of the Public Utilities Commission, the Standards of the American Society for Testing and Materials (ASTM), the American Standards Association (ASA), and any local ordinance which may apply.

Wherever reference is made in these Standards and Specifications to the code, rules, or the Standards mentioned above, the reference shall be construed to mean the code, rule, or standard that is in effect at the date of bidding.

9.03 EQUIPMENT LIST AND DRAWINGS

After contract award, prior to installation, and/or at the Construction Manager's request, the Contractor shall submit shop drawings and

specifications for equipment and materials the Contractor proposes to furnish. The shop drawings and specifications shall be complete as to name of manufacturer, size, and catalog number of unit, and shall be supplemented by such other data as may be required. The Construction Manager's approval shall be required prior to installation.

Inspection or sampling of any materials, other than those materials already approved by the Construction Manager, must be made by the Construction Manager prior to installation. If the Contractor proposes a substitution of material called for in the plans, project specials, as specifically defined in these specifications, or as shown in approved submittals and shop drawings, the Contractor shall provide additional information to prove the substitution item is of equal or superior quality. Any material and/or equipment installed by the Contractor that is not in conformance with these specifications shall be removed or changed at the Contractor's expense.

9.04 AS-BUILTS

The Contractor shall submit "as-built drawings" showing in detail all construction changes, including, but not limited to wiring, cable, and location and depth of conduit. As-Builts shall be submitted at the end of the project and shall be required prior to final acceptance by the City.

9.05 EXCAVATION AND BACKFILL

Excavations for the installation of conduit, foundations, and other appurtenances shall be performed in such a manner as to cause the least possible damage to the streets, sidewalks and other improvements. The trenches shall not be excavated wider than necessary for the proper installation of conduit, foundations, and other appurtenances. Excavating shall not be performed until immediately before installation of conduit, foundations, and other appurtenances. The material from the excavation shall be placed in a position where the least interference with the surface drainage will occur and without obstruction to vehicular or pedestrian traffic. Refer to Chapter 8, "Stormwater Quality Control Criteria", Section 8.04, "Temporary Controls and Installation and Maintenance Procedures" of these these Standards and Specifications. All excavations shall be done in conformance with OSHA regulations. Excavated material shall be removed at the completion of the project or as directed by the Construction Manager.

Excavations, after backfilling, shall be kept well filled and maintained in a smooth and well-drained condition until permanent repairs are made.

Chapter 7, “Permits, Licenses, and Construction Inspection”, Section 7.02.2, “Construction Requirements” of these Standards and Specifications shall govern all backfilling requirements.

All conduit bores shall comply with Chapter 7, “Permits, Licenses, and Construction Inspection”, Section 7.03, “Related Construction and Specifications” of these Standards and Specifications.

At the end of each day's work and any other time construction operations are suspended, all construction equipment and other obstructions shall be removed from that portion of the roadway open for use by public traffic.

Excavations in streets or highways shall be performed in such a manner that, at a minimum, one (1) lane of traffic in each direction shall be open to public traffic during the approved work hours.

When excavations remain open overnight as approved by the Construction Manager, they shall be properly marked to warn motorists and/or pedestrians. The excavation shall be properly barricaded for vehicles and/or pedestrians. If the excavated area is required to be open to traffic, it shall be properly covered by a steel plate.

All excavated areas outside of pavement sections shall be restored to a condition better than what existed prior to the excavation. Areas shall be seeded with native seed mix or re-sodded as appropriate.

9.06 REMOVING, REPLACING, AND RESETTING IMPROVEMENTS

The Contractor shall replace or reconstruct sidewalks, curbs, gutters, rigid or flexible pavement, and any other improvements removed during construction with material meeting the requirements of Chapter 7, “Permits, Licenses, and Construction Inspection”, of these Standards and Specifications, or as otherwise directed by the Construction Manager.

Whenever a part of a square or slab of existing concrete is broken, damaged, or potholed by the Contractor during construction, the entire square or slab shall be removed and the concrete reconstructed, at no cost to the City. Refer to Chapter 7, “Permits, Licenses, and Construction Inspection”, Section 7.02.2.E, “Concrete Pavement Patching” of these Standards and Specifications.

Concrete and asphalt removal shall be cut full depth, or to a depth approved by the Construction Manager. Cuts shall be neat and true with no shatter outside the removal area. When, in the course of concrete removal, damage occurs to a square or slab of existing concrete outside

of the removal area, the square or slab shall be considered damaged with the entire square or slab requiring replacement.

Removal items shall consist of the items specifically identified on the plans, or in writing by the Construction Manager. It shall be the Contractor's responsibility to assure that the Contractor has a full and complete understanding of included items prior to bidding.

Removal of poles and controllers shall include foundation removal to the depth indicated by the Construction Manager. Otherwise, removal shall consist of complete elimination of the specified items. Any conduit runs associated with the foundation shall be extended or abandoned as called for on the plans.

All traffic signal equipment which is removed shall remain the property of the City unless otherwise specified in the plans or by the Construction Manager. City property shall be removed from the work site and returned by the Contractor to the City at 8602 Rosemary Street, Commerce City Colorado 80022, or other designated location.

Reset pay items shall consist of the items specifically identified in the plans, or in writing by the Construction Manager. It shall be the Contractor's responsibility to assure that the Contractor has a full and complete understanding of included items prior to bidding.

Reset items are to be initially removed, then adjusted or modified as directed by the Construction Manager, and finally reinstalled to full operational capability. Modifications and adjustments shall be detailed on the plans or stated in writing by the Construction Manager.

9.07 FOUNDATIONS

All concrete foundations shall be of a class as defined by the most recent revision of the Colorado Department of Transportation latest edition of Standard Specifications for Road and Bridge Construction or as otherwise directed by the Construction Manager.

The bottom of foundations shall rest on properly compacted ground. Cast-in-place foundations shall be poured monolithically. The exposed portions shall be formed to present a neat appearance.

Pre-cast pole footings, if used, shall be used only for roadway lighting and pedestal poles. They shall be installed in drilled holes, with compacted sand, clay, or sandy clay backfill material.

Forms shall be true to line and grade. Tops of foundations, except as noted on plans, shall be finished to curb or sidewalk grade, or as ordered by the Construction Manager. Forms shall be rigid and securely braced in place, and inspected prior to the pouring of concrete. Conduit ends and anchor bolts shall be placed in proper position and to template until the concrete sets.

Anchor bolts shall conform to the manufacturer's specifications and each individual bolt shall have a minimum of two (2) flat washers, one (1) lock washer, and two (2) nuts. Shims or other similar devices will not be allowed for plumbing or raking. When indicated on the plans as a future signal location, foundation bolts shall be protected with the placement of bracing per Detail 900-03 of these Standards and Specifications.

Both forms and ground, which will be in contact with the concrete, shall be thoroughly moistened before placing concrete. Forms shall not be removed until the concrete has thoroughly set.

Reinforcing steel shall be installed in foundations as specified in the construction plans or these Standards and Specifications.

Ground rods shall be provided as indicated in the standard details.

9.08 CONDUIT

All cables and conductors not shown on the plans as aerial cable shall be installed in conduit unless installed in poles, pedestals, or master arms. All metal conduits referred to in the specifications and shown on the plans shall be the rigid pipe type of ductile steel that is adequately galvanized. All PVC conduits shall be Schedule 80 or heavier. For new conduit installations, PVC or Schedule 80 polypipe shall be understood unless otherwise defined.

The conduit schedule shall be as defined in Detail 900-10 of these Standards and Specifications, unless otherwise specified in the traffic signal plans.

The Contractor, at his sole expense, may use larger conduit than specified if desired. Where larger conduit is used, it shall be for the entire length of the run from outlet to outlet. No reducing couplings will be permitted underground.

The ends of all metal conduit, existing or new, shall be well reamed to remove burrs and rough edges. Field cuts of existing or new conduit shall be made square and true, and the ends shall butt together for the full

circumference thereof. Slip joints or running threads will not be permitted for coupling metal conduit. When a standard coupling cannot be used, an approved threaded union coupling shall be used. All couplings shall be screwed up tight until the ends of the metal conduits are brought together.

Where a "stubout" is called for on the plans, a sweeping ell shall be installed in the direction indicated and properly capped using materials manufactured for that purpose. Duct tape, duct seal, and/or other temporary capping materials shall not be permitted. The locations of ends of all conduits in structures or terminating at curbs shall be marked by a "Y" at least three (3) inches high cut into the face of curb, gutter or wall directly above the conduit.

Conduit bends, except factory bends, shall have a radius of not less than six (6) times the inside diameter of the conduit. Where factory bends are not used, conduit shall be bent without crimping or flattening, using the longest radius practicable. Conduit bends feeding pull boxes and foundations shall have an eighteen (18) inch radius as shown on the standard details.

Conduit shall be laid at a depth of not less than thirty (30) inches below the finished roadway grade and twenty-four (24) inches below the finished grade in all other areas.

Conduit under railroad tracks shall be at the minimum depth below the bottom of tie required by the particular railroad company.

Conduit shall always enter a pedestal base, pull box, pole foundation, cabinet foundation, or any other type structure from the direction of the run only. Conduit connections at junctions shall be tightly secured.

Conduit terminating in a standard or pedestal shall extend approximately two (2) inches vertically above foundations.

All conduit runs that exceed ten (10) feet in length shall have a continuous one-eighth (1/8) inch diameter nylon line pulled into the conduit along with the specified electrical cables. The line shall be firmly secured at each end of the conduit run with three (3) feet of slack. The purpose of this line is to be able to pull future electrical cable through the existing conduit runs. Mule tape shall be installed in place of the nylon line when specified in the plans and/or project specials.

A 14 AWG locate wire shall be installed for the complete length of all new conduit runs installed as part of the project. No less than three (3) feet of slack shall remain in each pull box in which the conduit terminates. Where joint trenching is used, only one locate wire need be installed for each joint

trench. Splicing of locate wire through interconnect conduit shall be required in each pull box, controller cabinet to controller cabinet. Splicing of the locate wire within conduits shall not be permitted.

Existing underground conduit to be incorporated into a new system shall be cleaned with a mandrel and blown out with compressed air.

New conduit runs shown on the plans are for bidding purposes only and may be changed at the direction of the Construction Manager.

Any spare or unused conduits shall be capped using materials manufactured for that purpose. Duct tape, duct seal, and/or other temporary capping materials shall not be permitted.

Polypipe to PVC coupling shall be completed with the use of “E-Loc” couplings or approved equal.

When a cabinet is defined as a master cabinet, a two (2) inch PVC conduit shall be installed from the controller cabinet to the designated telephone company demarcation point.

A two (2) inch PVC conduit shall be installed to all signal poles for the exclusive use of the local utility company providing electrical power for luminaires. The conduit may be laid in trenches cut for signal wire conduit and shall run from the controller cabinet home run pull box to signal poles through associated signal pole pull boxes.

When inductance loops and/or micro loops are required, a two (2) inch PVC conduit shall be installed from the nearest signal pole pull box to a water valve pull box located within the roadway. The two (2) inch conduit shall be routed through and terminated within a pull box located adjacent to both the roadway and the associated inductance loop(s). The conduit may be laid in trenches cut for signal wire conduit.

When conduit is referenced in the project plans or project specials as interconnect conduit, where interconnect conduit runs exceed ten (10) feet in length, and when called for in the project plans or project specials, detectable MaxCell 3x3 innerduct, or approved equal, shall be installed. No less than three (3) feet of slack shall remain in each pull box.

When innerduct is installed, cable runs exterior to the innerduct shall not be permitted. Locate wire and mule tape shall be incorporated in the innerduct. Locate wire shall be spliced in each pull box, controller cabinet to controller cabinet. When conduit houses a single MaxCell 3x3 innerduct, or approved equal, a single mule tape shall be installed

externally to the innerduct and shall serve as a pull line for additional innerduct as required.

Where all innerduct cells are in use and additional cable is required, an additional MaxCell 3x3 innerduct, or approved equal, shall be required. When conduit is inadequately sized for additional innerduct, the Construction Manager shall be notified and shall provide direction.

Mule tape and/or innerduct shall be installed per manufacturer's specifications.

Innerduct shall be measured and paid for by the linear foot of innerduct installed and shall include all labor, equipment, and materials necessary to install the item complete-in-place.

Conduit shall be measured and paid for by the linear foot of conduit installed from center of pull box to center of pull box, center of pull box to center of pole, or center of pull box to center of cabinet and shall include all labor, equipment, and materials necessary to install the item complete-in-place. Allowances shall be made in the linear foot calculation for conduit sweeps and elbows.

9.09 PULL BOX

Pull boxes shall be installed at all locations as shown on the plans and at such additional points as ordered by the Construction Manager.

With the exception of water valves, pull boxes shall be of pre-cast polymer concrete type. The pull box schedule shall be as defined in Detail 900-07 of these Standards and Specifications unless otherwise specified in the traffic signal plans.

Communication Vaults should be installed at all existing and planned traffic signals, and may be considered for use at splice points as to provide adequate space for splice enclosures without minimization of fiber interconnect cable slack.

The maximum spacing for Communication Vaults shall be 500' unless otherwise approved by the Construction Manager.

Pull boxes shall be installed so that the covers are level with curb or sidewalk grade or level with the surrounding ground when no grade is established. The bottoms of all pull boxes shall be set on twelve (12) inches of crushed rock.

Pull box lids shall be imprinted with markings. Painted markings shall not be permitted.

When a new conduit run enters an existing pull box, the Contractor shall temporarily remove the pull box, or tunnel under the side at no less than eighteen inches (18") below the pull box bottom, and enter from the direction of the run. No new conduit will be allowed to enter a new or existing pull box in any other manner than that shown on the standard details.

When pull box usage is for "Communication Vault", a flat format Carsonite, or approved equal, utility marker, with decal, shall be installed in conjunction with the pull box.

Utility Marker

The utility marker shall adhere to the following specifications:

a. Measure 66" x 3.75".
b. Be orange in color.
c. Be constructed of fiberglass reinforced composite material.

Utility Marker Decal

The utility marker decal shall be installed at the top of the utility marker, and shall adhere to the following specifications:

a. Measure 2.5" x 14".
b. Lettering shall be black on orange.
c. UNCC dig notification number shall be defined for as contact phone number.
d. City of Commerce City shall be defined as owner.
e. Wording shall be as shown in Detail 900-07 of these Standards and Specifications, or as otherwise approved by the Construction Manager.

Pull boxes shall be measured and paid for per unit count and shall include all labor, equipment, and materials necessary to install the item complete-in-place.

9.10 CABINET BASES

Controller cabinet bases shall be fiberglass type, sized to match with the controller cabinet, and set with approximately 50% of height extending below grade and 50% extending above grade.

Controller cabinet bases shall be set on a twelve (12) inch deep bed of crushed rock. The interior of the base shall be filled to grade level with crushed rock.

Conduits within the controller cabinet base shall extend a minimum of 6" above the crushed rock. Conduits shall be installed in such fashion as to prevent undo bend stress on cables being fed into the cabinet through these conduits.

Ground rods shall be provided as indicated in the standard details.

9.11 CONDUCTOR AND CABLE

Wiring shall conform to appropriate articles of the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction, and/or the National Electrical Code, as applicable. Wiring within cabinets, junction boxes, etc., shall be neatly arranged. Signal conductors shall be No.14 AWG stranded, conforming to IMSA Spec 20-1-1984.

Power feed cable shall be THHN/THWN copper, installed in conduit, and be sized for the electrical load served. The power feed cable shall have a minimum size of #8 and be sized such that the overall voltage drop, between the local utility company demarcation point and controller cabinet, does not exceed 5%. The Contractor shall install power feed cable from the local utility company power demarcation point to the controller cabinet thru an URD Mold connector located in the controller cabinet home run pull box. URD Mold connectors shall be installed in the home run pull box and shall be used to extend electrical service from the local utility company power demarcation point to the controller cabinet and to street lights on signal poles.

Whenever a raceway is not UL approved, direct burial type insulation shall be required on all associated wiring.

Power cable between the controller cabinet home run pull box and the street lights pole bases shall be type 12-2 UF. Daisy chaining of power cable thru the pole bases using SLK connectors shall be permitted. With the exception of the URD Mold connector in the controller cabinet home run pull box, power cable splices within pull boxes shall not be permitted.

Power cable from the end of each street light davit to the base of the signal pole shall be type 12-2 UF with ground. All street light feeds shall be independently fused at the base of each pole.

All signal cables shall be labeled with colored electrical tape based on the table below.

Direction	Tape Color
Northbound Thru	Red
Northbound Left Turn	Red + White
Northbound Pedestrian	Red + Yellow
Southbound Thru	Green
Southbound Left Turn	Green + White
Southbound Pedestrian	Green + Yellow
Eastbound Thru	Orange
Eastbound Left Turn	Orange + White
Eastbound Pedestrian	Orange + Yellow
Westbound Thru	Blue
Westbound Left Turn	Blue + White
Westbound Pedestrian	Blue + Yellow

Signal circuit wiring shall be accomplished in the following manner:

A separate 21 conductor cable shall be installed between the cabinet and each signal pole. Cables shall be continuous with no splices. Conductor usage has been defined in the table below. All unused conductors shall become spare conductors and shall be coiled and taped back to minimize the chance for a short.

21 Conductor Color to Phase Assignment	
Main Street	
Color	Phase
Solid Green	Green
Solid Orange	Yellow
Solid Red	Red
Solid Blue	Left Turn Green
Solid Black	Left Turn Yellow
Red with White Trace	Left Turn Red
Blue with White Trace	Walk
Black with Red Trace	Don't Walk
Side Street	
Green with Black Trace	Green
Orange with Black Trace	Yellow
Red with Black Trace	Red
Blue with Black Trace	Left Turn Green
Black with White Trace	Left Turn Yellow
Red with Green Trace	Left Turn Red
Blue with Red Trace	Walk

Orange with Green Trace	Don't Walk
Right Turn	
Green with White Trace	Right Turn Green
Orange with Red Trace	Right Turn Yellow
AC Return	
Solid White	AC Return
White with Black Trace	AC Return
White with Red Trace	AC Return

Each signal head shall have its own signal cable to the base of the pole that it is mounted on. Cables shall be continuous with no splices. Conductor usage has been defined in the table below. All unused conductors shall become spare conductors and shall be coiled and taped back to minimize the chance for a short.

Conductor Color	7 Conductor (5 Section Head)	5 Conductor (3 Section Head)	5 Conductor (Pedestrian Head)
Red	Red Ball	Red Ball or Red Arrow	Don't Walk
Orange	Yellow Ball	Yellow Ball or Yellow Arrow	Spare
Green	Green Ball	Green Ball or Green Arrow	Walk
Blue	Green Arrow	Not Available	Not Available
Black	Yellow Arrow	Spare	Spare
White	AC Return	AC Return	AC Return
White/Black	AC Return - LT	Not Available	Not Available

Outboard signal heads shall use “7 Conductor” cable to accommodate for present or future left turns.

When a cabinet is defined as a master cabinet, phone cable shall be installed in conduit from the controller cabinet to the designated telephone company demarcation point. Phone cable shall be #REA-PE54 or equivalent for telephone service. The cable shall be continuous with no splices and run from the telephone service point to the controller cabinet. Adequate cable length shall remain on both cable ends to permit for proper termination.

Pedestrian push button wire shall be shielded single or multiple twisted pairs in polyethylene jacketed cable. Conductors shall be No. 18 AWG stranded copper, minimum. A stranded tinned copper drain wire shall be provided.

Pedestrian push button common wire shall not be connected to the signal neutral circuit.

Inductance detector loop lead-in cable shall be shielded single or multiple twisted pairs in polyethylene jacketed cable. Conductors shall be No. 18 AWG stranded copper, minimum. A stranded tinned copper drain wire shall be provided.

Emergency vehicle detection wiring shall be of the type as specified by equipment manufacturer.

Splicing any conductor, cable or wiring, except loop detector wiring and power cable as defined in these specifications, shall not be permitted in conduit or in pull boxes. All signal conductor splices shall be in the signal pole near the hand hole above grade. Signal load splices shall utilize copper crimp sleeves that compress from four directions as manufactured by Buchanan Company, or approved equal. The crimped sleeve shall then be protected within a flexible rubber insulating cover as manufactured by Ideal Wrap Company, or approved equal. Detector loop lead-in splices in pull boxes below grade shall be fully waterproofed using a DBY-6 splice kit as manufactured by 3M, or approved equal. A minimum of 12-inches of slack shall be left at each splice.

Powdered soapstone, talc, or other approved lubricant shall be used in placing conductors in conduit.

A small permanent tag with the direction and phase printed on it shall be securely attached near the end of each conductor in the controller cabinet. An example is “Ø1-NBLT” where Ø1 is the phase number.

Cabling shall be paid for on a lump sum basis and shall include all labor, equipment and materials necessary to install the item complete-in-place.

9.12 INTERCONNECT

9.12.01 HARDWIRE/COPPER INTERCONNECT

Hardwire/Copper interconnect is not approved for use.

9.12.02 FIBER INTERCONNECT

GENERAL FIBER SPECIFICATIONS

Fiber optic cable shall be Corning Altos, or approved equal. Unless otherwise specified in the project plans or special provisions, the following fiber schedule shall apply:

Usage Description	Fiber Count	Manufacturer	Model	Part Number
Major Backbone	96	Corning	Altos	096EU4-T4101D20
Minor Backbone	24	Corning	Altos	024EU4-T4101D20
Cabinet Lateral	12	Corning	Altos	012EU4-T4101D20

50’ of fiber interconnect cable slack shall be installed in each Communications Vault and pull box through which the fiber interconnect cable travels. Where Communication Vaults and/or pull boxes are inadequately sized for required slack, and/or where Communication Vaults and/or pull boxes are occupied such that additional slack will not fit, the Construction Manager shall be notified and shall provide direction.

50’ of fiber interconnect cable slack shall be installed in each cabinet in which the fiber interconnect cable enters. Where cabinet space is limited, fiber interconnect slack may be stored in the Communication Vault.

Fiber optic cable shall comply with industry standards such as Telcordia Technologies GR-20 (formerly Bellcore), Electronic Industries Association (EIA), Telecommunications Industry Association (TIA), International Telecommunications Union (ITU), International Electrotechnical Commission (EIC), and American Society for Testing and Materials (ASTM).

Fiber optic cable shall meet all requirements stated in this specification. The cable shall be an accepted product of the United States Department of Agriculture Rural Electrification Administration (REA) as meeting requirements of 7CFR1755.900.

All fiber cable shall be of Single Mode, Non-Armored, All-Dielectric, Single Jacketed, Loose Tube Dry Block Construction for outside plant installation.

When fiber cable installation includes cable transition into a building, and where the termination point is greater that 50’ from the building’s fiber cable entry point, fiber cable shall be converted to the appropriate cable type for the structure; plenum or riser rated. Conversion shall be made via a fiber splice panel to minimize losses.

The cable shall be new, unused, and of current design and manufacture.

All fibers in the cable must be usable fibers and meet these specifications.

All optical fibers shall be sufficiently free of surface imperfections and inclusions to meet the optical, mechanical and environmental requirements of this specification.

Each optical fiber shall consist of a germania-doped silica core surrounded by a concentric glass cladding. The fiber shall be a matched clad design.

The fiber shall be coated with a dual layer acrylate protective coating. The protective coating shall be in physical contact with the cladding surface.

FIBER SPECIFICATION PARAMETERS

Color Code

The individual colors for fibers and buffer tube cable cores shall comply with EIA/TIA-598.

Central Strength Member

The central strength member functions as an anti-buckling element, and shall be a glass/epoxy composite dielectric rod. A polyethylene overcoat may be applied to the central member to provide the proper spacing between buffer tubes during stranding.

Cable Buffer Tubes

Optical fibers are enclosed within buffer tubes that have a diameter several times larger than the diameter of the fibers. The optical fibers are loose within the buffer tubes allowing the fibers to move freely. The loose buffer tubes should have a 2.5 mm diameter, with a nominal wall thickness of 0.4 mm.

Buffer tubes shall be of a dual-layer construction with the inner layer made of polycarbonate and the outer layer made of polyester.

Each buffer tube shall contain 12 fibers.

Filler rods may be included in the cable core to lend symmetry to the cable cross-section where needed.

The buffer tubes (and filler rods, if necessary) shall be stranded in a reverse oscillation lay (ROL) technique around the central strength member to allow for easy mid-span access. The core of buffer tubes shall be wrapped with two counter helically applied threads to bind together the cable core.

Binders shall be applied with sufficient tension to secure the buffer tubes to the central member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking (or rendered so by the flooding compound), and dielectric with low shrinkage.

Tensile strength shall be provided by high tensile strength aramid yarns, fiberglass yarns, or both.

Water blocking of the core outside, and around the buffer tubes, shall be accomplished via dry block elements. In addition, water-blocking inside the buffer tubes shall be accomplished via dry block elements.

In buffer tubes containing multiple fibers, the colors or numbers shall be stable during temperature cycling and not subject to fading or smearing onto each other. Colors shall not cause fibers to stick together.

For ease of jacket removal, one clearly identifiable polyester ripcord shall be provided directly under the cable sheath.

Cable Outer Jacket Characteristics

All-Dielectric cables shall be sheathed with minimum or heavy density polyethylene. The minimal nominal jacket thickness shall be 1.4 mm. Jacketing material shall be applied directly over the tensile strength members and water block flooding compound. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus.

The cable sheath shall be free of holes, splits, and blisters.

Cable Outer Jacket Markings

For standard outer jackets, printed characters shall be indent printed with white characters for black jackets, and black characters for non-black jackets.

The characters shall be of proper height and space to produce good legibility. Character height of 2 mm should facilitate adequate readability. An occasional illegible marking is permitted if there is a legible marking on either side.

The cable shall be sequentially marked at two feet intervals. The length intervals shall not be reset to zero on any length of the cable. The actual length of the cable shall be within -0/+1% of the length markings.

Each length of the cable shall be marked with manufacturer's name, manufacturer's part number, month and year cable was manufactured (MM-YY), telephone symbol (indicating fiber is of communications grade), fiber counts, and fiber type (SM, MM, SM/MM).

Cable Packaging

The manufacturer shall supply the product using their standard reel sizes, methods, apparatus, and reel wood lagging.

Reels are assumed to be in good working condition, firm, and able to support the product through shipping and final installation. Reels shall be clean, dry, and free of excessive dirt. All reels shall be checked for high nails, stave fit, and proper stenciling.

Each wood reel shall be permanently marked with the manufacturer's name, "OPTICAL CABLE", an arrow with the words "CABLE END" to indicate the position of the outer cable end, an arrow with the words "ROLL THIS WAY" to indicate direction reel should be rolled to prevent loosening, and reel number.

Outer layers of the reel shall be covered with a protective wrap to limit the solar heating of the cable.

Each end of the cable shall have end seals, either end caps or KELLEMS pulling grips, in order to prevent moisture ingress into the cable during shipping, storage, or installation.

The top end of the cable shall be securely fastened to the inside of the reel flange to prevent the cable from becoming loose in transit or during handling. The bottom end, "test tail", shall be approximately three meters in length and easily accessible. The end shall be protected within a cable slot and be securely fastened to the outside of the reel flange with wire ties or walkout straps.

Each cable shall have certified test data securely fastened to the reel in a waterproof wrapping. The certified test data shall include the following information:

- Cable Number
- Date
- Customer Name
- Ordered Length
- Customer Order Number
- Ship Length
- Customer Cable Code
- Customer Reel Number
- Customer Attenuation Specifications
- Number of Fibers
- Cable Construction
- Fiber Transmission Data
- Bandwidth Data (Multimode Fiber Only)
- Authorized Signature

Each cable shall have a reel tag securely fastened to the reel in a waterproof wrapping. The reel tag (Cut Length Data Sheet) shall include the following information:

- Cable Number
- Date
- Customer Name
- Ordered Length
- Customer Order Number
- Ship Length
- Customer Cable Code
- Customer Reel Number
- Customer Attenuation Specifications
- Number of Fibers
- Beginning and Ending Sequential Length Markings
- Gross Weight
- Net Weight
- Inspected By Signature

Single Mode Fiber Specifications

The dispersion un-shifted Single Mode fiber utilized in the cable specified herein shall conform to the following specifications:

- Typical Core Diameter: 8.3 micrometer;

- Cladding Diameter: 125.0 ± 1.0 micrometer;
- Core-to-Cladding Offset: ≤ 0.6 micrometer;
- Cladding Non-Circularity: ≤ 1.0 %, defined as [l-(minimum Cladding diameter/ maximum Cladding diameter)] x 100
- Coating diameter: 245 ± 10 micrometer;
- Colored Fiber Diameter: nominal 250 micrometer;
- Attenuation Uniformity: No point discontinuity > 0.10 dB at either 1310 nm or 1550 nm;
- Attenuation at the Water Peak: The attenuation at 1383 ± 3 nm shall not exceed 2.1 dB/km;
- Cutoff Wavelength: The cabled fiber cutoff wavelength shall be < 1260 nm;
- Mode-field Diameter (Petermann II): 9.30 ± 0.50 nm at 1310 nm;
- Mode-field Diameter (Petermann II): 10.50 ± 1.00 micrometer at 1550 nm;
- Zero Dispersion Wavelength (ZDW): 1301.5 nm ≤ 1321.5 nm;
- Zero Dispersion Slope (ZDS): ZDS ≤ 0.092 ps / (km x nm^2);
- Fiber Polarization Mode Dispersion (PMD): 0.5 ps / $\sqrt{}_{km}$;
- Fiber Curl: ≥ 4.0 m radius of curvature;
- Maximum Tensile Loads: Short-Term 2700 N (600 lbs);
- Maximum Tensile Loads: Long-Term 890 N (200 lbs);
- Shipping, Storage, and Operating Temperature Range of the Cable: -40 Degrees C to +70 Degrees C.

Quality Assurance Provisions

All optical fibers shall be proof tested by the fiber manufacturer at a minimum load of 100 ksi.

All optical fibers shall be 100% attenuation tested. The attenuation of each fiber shall be provided with each cable reel.

FIBER SPLICING AND TERMINATIONS

Optical Splices and Optical Splice Closures

Splices are not allowed without the authorization of the Construction Manager. If splices are authorized or specified on the plans, each such splice shall occur in a pull box of adequate size to house the splice closure and fiber optic cable slack without exceeding the fiber cable minimum bend radius. All splices shall be enclosed in a water proof splice closure.

Following successful splicing, said splice enclosure and fiber optic cable slack shall be placed inside the pull box.

When fiber splicing is specified in the plans, splicing diagrams shall be provided by the Construction Manager. Splicing diagrams shall define fiber cables to be spliced in part or whole and shall provide buffer tube designation, fiber designation, and routing information of each fiber to be spliced.

The Contractor shall accomplish the fiber splicing work using industry standard splicing tools and hardware.

Splice closures shall be used for splicing lateral fiber optic cable runs to the fiber optic backbone at pull box locations that are identified in the plans. All closures shall include a 1-inch future port kit. The size of the splice closure shall be governed by the number of cables and splices required at each location.

Buffer Tube Fan-out

Fiber fan-outs shall be completed as defined in the plans and/or special provisions. Only those buffer tubes defined shall be fanned out. When additional buffer tubes are present, but are not to be fanned out, a termination panel shall be required. Buffer tubes which have not been fanned out shall be loosely coiled and secured within a termination panel.

Fiber fan-outs shall only be completed within a building or NEMA 4 rated cabinet and shall be of the count and type as defined in the plans and/or special provisions.

Industry standard fan-out kit tools and tool kit consumables shall be used.

During installation, and at no time, shall the fiber fan-out, in part or whole, be reduced to a length shorter than 36 inches. Fiber fan-outs shorter than 36 inches shall be replaced by the Contractor. Fees associated with replacement of fiber fan-outs which were installed by the Contractor, but which do not meet specifications, including terminations and testing, shall be borne by the Contractor and shall not be chargeable to the City.

Terminations

Only those fibers defined shall be terminated.

Connectors shall be "ST" type unless otherwise specified. The connectors shall have a ceramic ferrule with nickel-plated nut and body. The connectors shall be compatible with a physical contact (PC) finish.

All connectors shall be polished to a PC finish such that the return loss per mated pair of connectors is less than -25 dB.

The return loss when the connector is mated with a previously installed connector shall be less than -18 dB.

The connector's insertion loss shall not be greater than 0.20 dB (typical). The connector's loss shall not vary more than 0.20 dB after 1000 repeated matings. Tensile strength shall withstand an axial load of 20 lbs with less than 0.20 dB change.

Index matching fluids or gels shall not be used. The connectors shall be compatible with the optical fiber surrounding jacket and shall be installed on one end of the optical fiber in accordance with the manufacturer's recommended materials, equipment, and practices. The connectors shall be suitable for the intended environment and shall meet, or exceed, the following environmental conditions.

- Operating Temperature: -40 degrees C to +80 degrees C
- Storage Temperature: -40 degrees C to +85 degrees C

The connector loss shall not vary more than 0.20 dB over the operating temperature range.

Connectors shall be protected by a suitably installed waterproof protective cap.

Termination Panel

When a termination panel is specified in the plans for installation in a traffic cabinet, the termination panel shall be a wall mount type suitable for fastening to the cabinet rails. The termination panel shall be sized to accommodate all fibers of the fiber cable(s) entering the termination panel.

When a termination panel is specified in the plans for installation in a building, the termination panel shall be a wall mount type or rack mount type as defined in the plans. The termination panel shall be sized to accommodate all fibers of the fiber cable(s) entering the termination panel.

"ST" type bulkheads shall be used unless otherwise specified.

"Blank" plates, of the same manufacturer as the termination panel, shall be used to cover blanked areas where bulkhead plates would normally be installed, but which are not required.

UNIT OF MEASUREMENT

Fiber interconnect shall be measured by the linear feet installed and shall include all labor, equipment, and materials necessary to install the item end-to-end complete-in-place.

FIBER COMMUNICATIONS EQUIPMENT

Ethernet Managed Switch

An Ethernet Managed Switch shall only be used where specified in the project plans or project specials, and may be considered by the Construction Manager on a per project basis. When specified in the project plans and project specials, the Ethernet Managed Switch shall be of the manufacturer and model number specified.

An Ethernet Managed Switch shall include the power supply, Cat5E/Cat6 Ethernet cable or serial cable as required to connect the Ethernet Managed Switch to the traffic signal controller, and duplex fiber patch cables for connecting the Ethernet Managed Switch to the fiber termination panel.

Unless otherwise specified, the Contractor shall be responsible for proper programming, setup, and testing of the Ethernet Managed Switch. At the City's discretion, the City may opt to have their Maintenance Contractor or other third party complete Ethernet Managed Switch, setup, and/or testing. When the City's Maintenance Contractor or other third party is enlisted for programming, setup, and/or testing of the Ethernet Managed Switch, associated costs for the Maintenance Contractor or third party labor shall be the responsibility of the City.

Ethernet Managed Switches shall be measured by the units installed and shall include all labor, equipment, and materials necessary to install the item complete-in-place.

Fiber Optic Transceivers

Fiber Optic Transceivers shall only be used where specified in the project plans or project specials, and may be considered by the Construction

Manager on a per project basis. When specified in the project plans and project specials, Fiber Optic Transceivers shall be of the manufacturer and model number specified.

Field located Fiber Optic Transceivers shall be shelf mount type, shall include the power supplies, cables as required to connect the Fiber Optic Transceivers to the field equipment, and fiber patch cables for connecting the Fiber Optic Transceivers to the fiber termination panels.

Traffic Operations Center (TOC) located Fiber Optic Transceivers shall be rack mount type, shall include cables as required to connect the Fiber Optic Transceivers to the TOC equipment, and fiber patch cables for connecting the Fiber Optic Transceivers to the fiber termination panels. Fiber card racks shall only be required if specified in the project plans and/or project specials. If a fiber card rack is required, the fiber card rack shall be 19" rack mountable and shall include a power supply capable of powering the card rack with a full compliment of Fiber Optic Transceivers.

Unless otherwise specified, the Contractor shall be responsible for proper programming, setup, and testing of the Fiber Optic Transceivers. At the City's discretion, the City may opt to have their Maintenance Contractor or other third party complete Fiber Optic Transceivers programming, setup, and/or testing. When the City's Maintenance Contractor or other third party is enlisted for programming, setup, and/or testing of the Fiber Optic Transceivers, associated costs for the Maintenance Contractor or third party labor shall be the responsibility of the City.

Fiber optic transceivers shall be measured by the units installed and shall include all labor, equipment, and materials necessary to install the item complete-in-place.

9.12.03 RADIO INTERCONNECT

Where specified in the plans, radio communications shall be included on the project. The radio communication system shall be of the manufacturer and model number specified.

Programming software and manuals shall be supplied with the radio system and shall become the property of the City at the completion of the project.

The radio communication system shall include all ancillary materials required to make the wireless link operational, and to connect the radios to the equipment for which communications was intended, and shall include,

but not limited to, the antenna, coax cable, surge suppression, power supply, serial cable, and/or Ethernet cable.

Unless otherwise specified, the Contractor shall be responsible for proper programming, setup, and testing of the radio communication system. At the City's discretion, the City may opt to have their Maintenance Contractor or other third party complete the radio communication system programming, setup, and/or testing. When the City's Maintenance Contractor or other third party is enlisted for programming, setup, and/or testing of the radio communication system, associated costs for the Maintenance Contractor or third party labor shall be the responsibility of the City.

Radios shall be measured by the paired units installed (Transmitter & Receiver) where both a transmitter and receiver are installed, individually where only a transmitter or receiver are installed, and shall include all labor, equipment, and materials necessary to install the item complete-in-place.

9.13 VEHICLE DETECTION

9.13.01 GENERAL

Unless otherwise noted, all traffic signal vehicle detection systems shall be accomplished through a video detection system.

9.13.02 VIDEO DETECTION

Video detection systems shall consist of one video camera, isolation amplifier for video cabling, an automatic control unit (ACU) and a pointing device. The system shall detect vehicles on a roadway using only video images of vehicle traffic and shall be an Econolite, Traficon, Iteris, or approved equal.

The system shall include software that detects vehicles in multiple lanes using only the video image. Detection zones shall be defined using only a video menu and a pointing device to place the zones on a video image. Up to twenty four (24) detection zones per camera shall be available.

The camera supplied shall be compatible with the video detection system and shall be mounted on the luminaire davit when luminaire davit is present, mast arm when luminaire davit is not present, or other location as defined on the plans or as directed by the Construction Manager. The

camera shall view approaching vehicles at a distance not to exceed 350 feet for reliable detection.

The camera shall be housed in an environmentally sealed enclosure and shall be equipped with a sun shield that prevents sunlight from directly entering the lens. The camera shall be less than 6 inches in diameter, less than 26 inches long and shall weigh less than 12 pounds when the camera and lens are mounted inside the enclosure.

The camera enclosure shall include all required environmental controls as defined by the camera manufacturer and may include a thermostatically controlled heater and/or fan to assure proper operation of the lens iris at both low and high temperatures, and prevent moisture condensation of the optical faceplate of the enclosure.

When a variable focal length lens with variable focus control is supplied as part of the camera, the lens shall be adjusted to suite the site geometry without opening up the camera housing.

When coaxial cable is used between the camera and the cabinet, coax cable shall be a 75 ohm, precision video cable with 20 gauge solid bare copper conductor (9.9 ohms/M), solid polyethylene insulating dielectric, 98" (min) tinned copper double-braided shield and black polyethylene outer covering. The signal attenuation shall not exceed 0.78 dB per 100 feet at 10MHz. Nominal outside diameter is 0.304 inches. This cable shall be suitable for installation in conduit or overhead appropriate span wire. BNC plug connectors shall be used at both the camera and cabinet ends. The coax cable, BNC connectors, and crimping tool shall be of an approved type by the supplier of the video detection system, and the manufacturer’s instructions must be followed to insure proper connection.

Control and other cables required for installation, setup, and operation of the camera and/or video detection system are required, they shall be of the size and type required per manufacturer’s specifications and the National Electric Codes. Control cables shall terminate within the controller cabinet.

The power cable shall be 16 AWG three conductor cable. The cabling shall comply with local and National Electric Codes.

When specified in the project plans or project specials, hardware shall be included for remote programming and viewing of the video detection system through an Ethernet link and static I.P addressing, and shall provide for remote access, via a standard internet browser, to the communication board(s), detection board(s), zone configuration, and live

streaming video. Remote access shall provide for setup and modification of configuration parameters, and retrieval of data and alarm logs.

The complete video detection system shall be warranted to be free of defects in material and workmanship for a period of not less than two years from the date of final acceptance and warranty initiation. During the warranty period, the Contractor shall be responsible for the repair or replacement, at no charge to the City, of any product of the video detection system which fails to operate properly with the exception of failures as a result of vandalism, accident, and/or act of God.

Video detection systems shall be paid for on a lump sum basis and shall include all labor, equipment and materials necessary to install a video detection system for the entire intersection, complete-in-place.

9.13.03 INDUCTANCE DETECTION

When specified in the plans, detector loops shall be installed in accordance with these specifications and the construction plans.

Each individual detector loop is to be spliced to a lead-in cable within a pull box as specified on the plans, and each loop shall consist of one continuous wire, without splicing, to this point. Any required series or parallel connections are to be completed in the pull box.

All detector loops shall have a tag attached to the leading clockwise lead of the loop. This tag shall be marked to indicate the relative location of the loop. This marking shall correspond directly to the phase designations in the Plans.

Detector loop roadway cuts, when required, shall be 3/8-inch in width and of sufficient depth to provide a minimum of 1-inch of sealant above the wire.

Detector loop roadway cuts where required shall be sealed to the surface level of the original roadway with "Gold Label Flex," "3-M Brand model Black 5000", "Bondo No. E-709", or approved equal. ("Bondo No. P-606" is not approved). This sealer is to be used whether or not the roadway is to be overlaid.

Detector loop installations larger than 6-foot x 6-foot shall be of a quadrapole (2-4-2) design, according to the Plans. Duct type loop wire, IMSA 51-5-1984, shall be used for all loops.

Where the detector loop lead enters or resides in a pull box or conduit, the two associated loop lead wires shall be twisted together in a clockwise direction with a twist rate of 10-12 twists per foot.

At a minimum, three (3) feet of twisted loop lead shall be left in the pull box where splicing is to occur.

Detector loops shall be paid for on a unit price basis including loop wire, saw cutting, and sealant for a complete installation to the splice point pull box.

9.13.04 INDUCTANCE DETECTOR

This specification defines the minimum design, operational, and performance requirements for a multiple channel, digital, self tuning inductive detector. Inductive detectors shall be card rack mounted, plug in type, and shall operate from an external 12-24 VDC power supply.

Inductance detectors shall be capable of operating within a TS1 or TS2-Type 1 cabinet.

Inductive detectors shall include a power indicator.

Inductive detectors shall have built-in protection against lightning induced and other transients.

Inductive detectors shall have all user programmed settings and vehicle detector gathered data stored in non-volatile memory.

Each inductive detector shall include two or four complete detector channels.

Each channel of the sensor unit shall automatically self tune to any loop and lead-in inductance from 20 to 2500 microhenries within 10 seconds after application or interruption of supply voltage. Units shall also track changes in loop/lead-in electrical characteristics, as might reasonably be expected to occur in undamaged loops properly installed in sound pavement, without producing false indications or changes in sensitivity.

Each channel shall have both detect and fault indicators.

All vehicle detection parameters shall be programmable separately for each channel. This includes the sensitivity, background adapt rate, recovery method, wash delay time, and wash adapt time.

Each channel at minimum shall be capable of a minimum of eight (8) pulse mode sensitivity levels, seven (7) presence mode sensitivity levels, off mode, and four (4) frequency settings.

Inductance detectors shall be hot-swappable.

Inductance detectors shall operate in temperatures between -29 degrees Fahrenheit and +165 degrees Fahrenheit with a humidity level of 0% to 95% (non-condensing).

When data storage capability is required per project plans and/or special provisions, inductance vehicle detectors shall meet these specifications, and all stored data shall be recoverable via built in RS232/RS485 communication ports.

Inductance vehicle detectors shall be measured by the units installed and shall include all labor, equipment, and materials necessary to install the item complete-in-place.

9.13.05 OTHER DETECTION

Other type of vehicle detection shall only be used where specified in the plans and specifications, and may be considered by the Construction Manager on a per project basis. When specified in the project plans and/or specifications, other types of vehicle detection shall be of the manufacturer and model number specified.

9.14 PEDESTRIAN PUSH BUTTONS

Pedestrian push button assemblies shall be Pelco model SE-2005-08 (ADA pedestrian push button), or approved equal. The button housing shall be black in color. A separate decal sign, MUTCD Reference # R10-3b (non-count down pedestrian signal) or MUTCD Reference # R10-3e (count down pedestrian signal), or approved equal shall be installed with each pedestrian push button.

Push button locators shall only be used where specified in the plans and project specials, and may be considered by the Construction Manager on a per project basis. When push button locators are requested, this function shall be integrated as part of the pedestrian push button, the pedestrian bush button shall be of the manufacturer and model number specified, and shall conform to the MUTCD.

Audible pedestrian indications shall only be used where specified in the plans and project specials, and may be considered by the Construction Manager on a per project basis. When audible pedestrian indications are requested, they may be of the manufacturer and model number specified, and shall conform to the MUTCD.

Pedestrian push buttons shall be paid for on a unit price basis and shall include all labor, equipment and materials necessary to install the item complete-in-place. Pedestrian push buttons shall be paid for under the "Pedestrian Push Button" pay item.

When an audible pedestrian indication is requested and where this function is integrated within the pedestrian push button, the audible pedestrian indication costs shall be included in, as part of, the unit price of the pedestrian push button. Where the audible pedestrian indication function is not integrated within the pedestrian push button, audible pedestrian indications shall be paid for on a unit price basis and shall include all labor, equipment, and materials necessary to install the item complete-in-place.

9.15 EMERGENCY VEHICLE DETECTION

Global Traffic Technologies (GTT) Opticom phase selectors and detectors shall be of the most current model, or as specified herein. Opticom Detectors shall be installed as specified in the plans and may include model numbers 711, 721, and/or 722. Opticom Phase Selectors may include model numbers 752 or 754 as specified in the plans.

Opticom phase selectors and detectors shall be paid for on a unit price basis based on quantities and model numbers and shall include all labor, equipment and materials necessary to install the item complete-in-place.

9.16 BONDING AND GROUNDING

Metallic cable sheaths, conduit, metal poles and pedestals shall be effectively grounded. Bonding and grounding jumpers shall be copper wire or copper strap of the same cross-sectional area, No. 8 AWG for all systems. Loop lead-in cable for loop detectors is to be grounded in controller cabinet only. The other end of the sheath is to be taped and left ungrounded.

Bonding of standards shall be by means of a bonding strap attached to a brass bolt or a 3/16 inch or larger brass or bronze bolt installed in the lower portion of the shaft.

The controller cabinet and each individual pole and/or pedestal shall be attached to its own separate ground electrode via #6 solid bare copper wire. The ground electrodes may be placed in the foundation of the item to be grounded or may be placed in an adjacent pull box located no more than 6-feet away from said foundation. Ground electrodes shall be a one piece copper weld rod of 5/8-inch diameter, 8-feet in length.

Grounding shall be incidental to the pay item for which it is associated.

Electrical service shall be installed as per NEC or as amended by the City. The grounding and bonding of services shall be completed in accordance with Article #250.

Electrical service shall be paid for on a unit price basis and shall include all labor, equipment and materials necessary to install the electrical service, complete-in-place.

9.17 FIELD TESTING

9.17.01 SIGNAL

Prior to completion of the work, the Contractor shall cause the following tests to be made on all traffic signals in the presence of the Construction Manager:

- Each circuit shall be tested for continuity.
- Each circuit shall be tested for grounds.

A functional test shall be made in which it is demonstrated that each and every part of the system functions as specified or intended herein. The functional test for the traffic signal installation shall consist of not less than fourteen (14) days of continuous, satisfactory operation following a three to five day mandatory flashing period, or other flash period as directed by the Construction Manager.

Testing for signals shall be incidental to the pay item for which signal testing is required.

9.17.02 FIBER

GUIDELINES

When fiber optic cable is installed, the fiber optic cable test shall consist of the testing for single mode fiber optic cable as installed. The testing procedures involve an Optical Power Meter Test and/or OTDR test.

The guidelines for fiber optic cable testing include:

Test jumpers and patch cords must be of the same fiber core size and connector type as the cable system:

a. Single Mode fiber 8.3/125 pm

The light source and OTDR must operate with the range of 1310±10 nm or 1550±20 nm for single mode testing in accordance with ANSI/EIA/TIA-526-7.

The power meter and the light source must be set to the same wavelength during testing.

The power meter must be calibrated and traceable to the National Institute of Standards and Technology (NIST).

All system connectors, adapters and jumpers must be cleaned as per manufacturer's instructions before measurements are taken.

Fiber optic cable testing shall be paid for on a lump sum basis and shall include all labor, equipment, and materials necessary to complete end-to-end, bidirectional testing of all fiber installed as part of the project, complete-in-place.

MATERIALS

The following fiber optic test equipment is required to perform fiber optic cable tests:

- An OTDR;
- A test reel, of at least 900 feet;
- A light source at the appropriate wavelength;
- Optical Power Measurement Equipment;
- Test Jumpers as specified

Single Mode Fiber Test Jumpers

a. CPR Test Jumper-1 and Test Jumper-2 shall be 1-5 meters long with connectors compatible with the light source and power meter and have the same fiber construction as the link segment being tested.

FIBER TESTING WITH OTDR

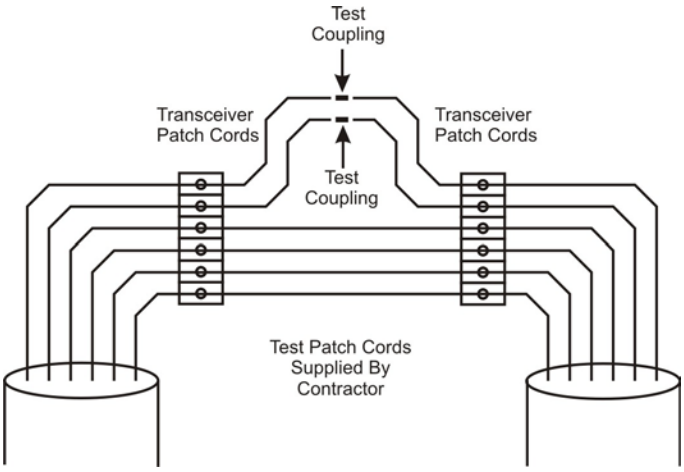
The Contractor shall perform an OTDR test of all fibers in all tubes on the reel, prior to installation of the fiber. The test results shall be supplied to the Construction Manager prior to installation of the cable.

If the fiber is specified as “Install Only”, the Contractor shall test the fiber on the reel and provide the test results to the Construction Manager prior to accepting the cable. After installation, if there are unused portions of cable remaining on the reel, the Construction Manager may request the Contractor or other qualified technician to perform a reel test. The Contractor shall provide the Construction Manager the test results prior to delivering the cable to the Construction Manager. Any cable damaged while in the Contractor’s possession shall be replaced at the Contractor’s expense.

All fiber testing shall be performed on all fibers in the completed end-to-end system. Testing shall consist of a bi-directional end-to-end OTDR trace performed per TIA/EIA-455-61. The system margin loss measurements shall be provided at 1310 nm and 1550 nm for single mode fibers.

Segmented end-to-end testing shall not be less than 1 kilometer (1 mile). Patches for testing shall not exceed five (5).

If the plans require installation of a fiber optic patch panel, the Contractor shall supply patch cords to patch all terminated fibers through the panel for all fiber testing. If patch cords are specified in the plans for final equipment installation, these patch cords shall be connected using a test coupling for the end-to-end test.



OTDR readings will be used to ensure proper installation and to troubleshoot faults. OTDR signature traces will be used for documentation and maintenance. For fibers that are identified in the plans to be left unterminated, an OTDR shall be used to test end-to-end attenuation.

Loss numbers for the installed link shall be calculated by taking the sum of the bi-directional measurements and dividing that sum by two.

The Contractor shall use an OTDR that is capable of storing traces electronically and shall save each final trace.

To ensure the traces identify the end points of the fiber under test and the fiber designation, the Contractor shall use a test reel, if required, to eliminate the “dead zone” at the start of the trace so that the start of the fiber under test can be identified on the trace. Indicate the length of the test reel for all test results.

If the fiber designation is not indicated on the trace itself, the Contractor shall provide a cross-reference table between the stored trace file name and the fiber designation.

In compliance with EIA/TIA-455-61 “Measurement of Fiber or Cable Attenuation Using an OTDR” the Contractor shall record the following information during the test procedure:

- Names of personnel conducting the test.
- Type of test equipment used (manufacturer, model, serial number, calibration date).
- Date test is being performed.
- Optical source wavelength and spectral width.
- Fiber identification.

- Start and end point locations.
- Launch conditions.
- Method of calculation for the attenuation or attenuation coefficient.
- Acceptable link attenuation.

FIBER TESTING WITH OPTICAL POWER METER

When specifically requested in the project plans or project specials, the Contractor shall conduct an Optical Power Meter Test for each fiber installed.

Single mode segments shall be tested in one direction at both the 1310 nm and 1550 nm wavelengths.

In compliance with TIA/EIA-526-7 “Measurement of Optical Power Loss of Installed Single Mode Fiber Cable Plant,” the following information shall be recorded during the test procedure:

- Names of personnel conducting the test.
- Type of test equipment used (manufacturer, model, serial number, calibration date).
- Date test is being performed.
- Optical source wavelength, spectral width, and for multimode, the coupled power ratio (CPR).
- Fiber identification.
- Start and end point locations.
- Test direction.
- Reference power measurement (when not using a power meter with a Relative Power Measurement Mode).
- Measured attenuation of the link segment.
- Acceptable link attenuation.

The minor attenuation differences due to test direction are on par with the accuracy and repeatability of the test method. Lateral segments within a building are limited to 90 meters. Therefore, attenuation differences caused by wavelength are insignificant, and as a result, single wavelength testing is sufficient.

ACCEPTABLE ATTENUATION VALUES

Acceptable attenuation values shall be calculated for each fiber tested. These values represent the maximum acceptable test values.

A connection is defined as the joint made by mating two fibers terminated with re-mateable connectors (e.g. ST, SC, LC).

The general attenuation equation for any single mode link segment is as follows:

- Acceptable Link Attenuation = Cable Attenuation + Connection Attenuation + Splice Attenuation
- 8.3 nm single mode attenuation coefficients:

    a. Cable Attenuation = Cable Length (km) x (3.40 dB/km@1310 nm or 0.25 dB/km@1550 nm)
    b. Connection Attenuation (ST or SC connectors) = (# of Connections x 0.39 dB). No more than 0.75 dB per connector.
    c. Splice Attenuation (Mechanical or Fusion) = Splices x 0.20 dB

TEST ACCEPTANCE

The Contractor, solely at the Contractor's cost, shall remake any fusion splices that have test results exceeding acceptable attenuation values.

The Contractor, solely at the Contractor's cost, shall retest any fiber links that have been re-spliced.

The Contractor, solely at the Contractor's cost, shall bring any link not meeting the requirements of this specification into compliance.

SUBMITTALS

The Contractor shall submit test result documentation in electronic format.

After each reel test, the Contractor shall submit one electronic copy of the OTDR trace for every fiber on the reel. Appropriate software, to allow reading of the traces, shall be supplied to the Construction Manager at no cost to the City.

After installation, the Contractor shall submit one electronic copy of the OTDR trace for every spliced fiber. Appropriate software, to allow reading of the traces, shall be supplied to the Construction Manager at no cost to the City.

The Contractor shall submit one electronic copy of all Optical Power Meter Test results for every spliced fiber. Appropriate software, to allow reading of the results, shall be supplied to the Construction Manager at no cost to the City.

9.18 CONTROLLER AND CABINET

9.18.01 CONTROLLER AND CABINET INTRODUCTION

Each controller and cabinet shall be 100% compatible with the City's existing computerized signal system.

This specification sets forth the minimum requirements for a TS2 Type 1 traffic control modular cabinet assembly. The cabinet assembly shall meet, as a minimum, all applicable sections of the NEMA Standard Publication No. TS2-2003 v. 2.06. Where differences occur, this specification shall govern.

Unless otherwise called for in the plans or project specials, all controller cabinets shall be TS2 Type 1 "P" cabinets and shall meet or exceed Siemens EL712 cabinet specifications except for use at two phase pedestrian crossings and/or fire signals. Pedestrian crossing and fire signal controller cabinets shall be TS2 Type 1 "G" cabinets and shall meet or exceed Siemens EL760 cabinet specifications.

A controller shall consist of a complete electrical mechanism to control the operation of traffic control signals, including the timing mechanism and all necessary auxiliary equipment. Controllers shall be Siemens EPAC3108M52 TS2 Type 2 controllers. All equipment furnished shall be the manufacturers' latest, current production model, complete with all standard accessories, tested and delivered by domestic manufacture who is regularly engaged in the construction of such equipment. Each cabinet shall be furnished with full eight phase capability (loop amps, load switch, etc.) regardless of specific intersection design with the exception of mid-block and fire signals.

All electrical conduits running to the control cabinet shall enter from the bottom only, except as noted on the plans. No holes shall be drilled in any part of the cabinet other than the bottom, unless otherwise called for on the plans.

All controller cabinets and control equipment shall be factory wired, ready for operation. Contractor shall test cabinet and controller in his shop prior to installation. Field work will be limited to placing cabinets and equipment

and the connecting of field wiring to field terminal strips. All cabinet wiring shall be neat and firm.

Controller cabinets shall be furnished with all mounting hardware.

Power protection devices shall include the main AC+ power circuit breaker, radio interference suppressors, and lightning and surge protectors. These devices shall be in addition to any protective devices furnished with the controller and auxiliary equipment housed within the cabinet and shall be provided on the load side of the circuit breakers. All devices shall be mounted to the interior wall or the cabinet in the approved manner.

All controller cabinets shall be equipped for and wired for two Opticom card rack mounted Global Traffic Technologies (GTT) Model 752 phase selectors. The phase selector cards, field wiring, and detectors shall not be supplied, unless called for in the plans or project specials.

The controller cabinet shall be paid for on a lump sum basis and shall include all labor, equipment and materials necessary to install the item complete-in-place, including all cabinet accessories internal to the cabinet.

Where cabinets are designated as “Install Only” items, the Contractor shall be responsible for picking up the cabinet from the City of Commerce City Public Works location at 8602 Rosemary Street, or other designated location, bench-testing the cabinet, delivering the cabinet to the jobsite, and prepping and installing the cabinet per the plans and specifications.

Controllers and cabinets shall be measured and paid for per unit count and shall include all labor, equipment, and materials necessary to install the item complete-in-place.

9.18.02 CABINET DESIGN AND CONSTRUCTION

This specification sets forth requirements for a TS2, type 1 traffic control cabinet assembly. All applicable sections of the NEMA standard publication, TS2, shall also be incorporated by reference.

The cabinet shall be constructed of minimum, .125 inch thick, natural aluminum. When specified in the plans, the cabinet shall be powder coat painted Federal Green. The cabinet shall be of clean cut design and appearance having no sharp edges, corners or protrusions. All welds shall accomplish in a workman like manner, and shall be smooth, neatly formed and free of cracks, blowholes or other irregularities. The cabinet top shall slope downward toward the rear of the cabinet to prevent rain

accumulation. The main door of the cabinet shall occupy essentially the entire front and shall provide easy access to the interior. The door shall be fitted with a closed cell, neoprene gasket which shall fit tightly against a lip surrounding the door opening, such that entrance of moisture or dirt is prevented. The upper lip shall include a channel to prevent rain from entering the cabinet interior. The door shall be fitted with a strong, tumbler style lock, a three point latching mechanism and shall include a minimum 3/4" diameter handle, which shall include a hasp to allow the use of a padlock if desired. The door shall be hinged on its right side by means of a piano style hinge fabricated of non-corroding material. The main door shall be fitted with an automatically operating mechanism, capable of holding the door open at approximately 90, 125 and 150 degrees under windy conditions.

The roof of the cabinet shall incorporate an exhaust plenum and vent screen. The vent screen area shall face down to preclude entry of moisture.

The cabinet shall contain a ball bearing type, ventilating fan, having a minimum capacity of 100 CFM, controlled by a thermostat and shall include suitable dust filters for the capacity of the ventilating system. The thermostat shall be adjustable between 80 and 150 degrees Fahrenheit. The filters shall be of the dry type and easily replaced. Filters shall be located behind vent louvers located in the lower portion of the main door and shall be held securely in place.

The cabinet shall be equipped with a fluorescent light fixture located on the inside top of the cabinet, near the front edge. The fluorescent fixture shall accommodate a standard, FT15T12 lamp. The lamp shall be controlled by a door activated switch located near the top of the main cabinet door.

In addition to the main door of the controller cabinet, there shall be an auxiliary door provided in the main door with a lock and standardized police key. This auxiliary door shall incorporate a gasket seal in similar fashion to the main door. The panel behind the auxiliary police door shall contain two (2) switches to accomplish the following functions:

- (1) Change from normal operation to flashing, and vise versa.
- (2) Interrupt power to the signal heads.

Each cabinet shall include a terminal facility, which shall incorporate four major sub sections:

- Detector and communication interface terminal panel located on the cabinet left wall.
- Main terminal panel located on the cabinet rear wall.
- Power distribution panel located on the cabinet right wall.
- The detector terminal panel shall be fabricated of 0.125 inch aluminum and shall incorporate sufficient terminals for the connection of all incoming loop feeder cables, all pedestrian pushbutton wiring and all preemption detector field cables. All field connections shall terminate on pressure style terminal blocks rated at not less than 30 amps per circuit. A ground buss to facilitate the connection of feeder cable shield wires shall be provided adjacent to the field terminal strips. All detector connection wiring shall be terminated on this panel. A pressure style terminal block shall be included which shall serve as a termination point for all serial communication cables used to connect to the various components of the traffic controller system. There shall also be pressure style terminal block which shall serve as a termination and distribution point for all outputs from the cabinet power supply required to be connected to the detector racks. All terminals shall be permanently identified as to their circuit reference. All terminal blocks shall be "dead front" type.

All wiring between the detector loop terminal blocks and the detector rack assembly shall be color coded, twisted pairs. The detector loop terminal points associated with each detector rack shall be arranged in a single vertical row of 32 terminals on the detector panel. If multiple detector racks are required, then multiple, vertical rows of terminals shall be provided. The twisted pair connections to the detector racks shall terminate in a 37 pin "D" connector having a positive latch to ensure a reliable connection to the detector rack.

All internal cabinet serial data shall be carried on cables specifically designed for use with RS485 circuits, and all pairs shall be twisted and color coded. Cables shall be of sufficient length to allow rearrangement of the various components within the cabinet, but shall be coiled neatly to present a workman like appearance.

The main terminal facility panel which shall be located on the rear wall of the cabinet shall include wired socket positions for a flasher, load switches, flash transfer relays, controller I/O terminals and buss interface units (BIU's). It shall be fabricated of .125 brushed aluminum. Each

socket or terminal point shall be silk screened with its circuit reference identification.

The main terminal facility panel shall include pressure type terminal blocks, located horizontally along the lower edge for the connection of all field signal wiring. Immediately above the field hookup terminal blocks, a second series of terminal blocks shall provide a simple method of flash programming which shall involve only the use of simple hand tools. All connections between the field hook up terminal blocks and the flash program blocks shall be color coded, and the wiring diagram shall include clear instructions to facilitate the programming of flashing operation. Flash programming shall not involve any changes of the field signal wiring. All terminal blocks shall be clearly and permanently identified as to their function and circuit reference.

Terminal facility panels shall be available in four configurations, as prescribed by NEMA specification TS2, and described below. Configuration 4 shall be used for all City NEMA "P" cabinets. Configuration 1 shall be used for all City NEMA "G" cabinets.

- Configuration 1: 4 Load switch positions; 2 Flash transfer relay positions; 2 BIU positions; 1 Flasher position.
- Configuration 2: 8 Load switch positions; 4 Flash transfer relay positions; 2 BIU positions; 1 Flasher position.
- Configuration 3: 12 Load switch positions; 6 Flash transfer relay positions; 2 BIU positions; 1 Flasher position.
- Configuration 4: 16 Load switch positions; 8 Flash transfer relay positions; 2 BIU positions; 1 Flasher position.

A bracket or shelf extending at least half the length of the load switch or flasher shall support all load switch and flasher positions. All BIU positions shall be provided with rack style mounting with card edge guides for both the upper and lower edges of the BIU. Each BIU rack position shall have its address pins pre-wired to define the proper operation for each position, and to allow interchange of BIU's without the need for additional programming.

Each flash transfer relay position shall include an RC network, wired in parallel with the coil connection pins.

An expandable, braided, nylon mesh jacket to provide abrasion protection and to ensure a neat appearance of the assembly shall protect all cables within the cabinet assembly, except the serial data cables. All cables shall be securely fastened in place to provide strain relief.

All main terminal facility panels shall include connection cables to a Type 16 Malfunction Management Unit (MMU), as defined by NEMA specification TS2.

A power distribution panel shall be located on the right wall of the cabinet. The assembly shall contain provisions for the connection of the incoming AC service, a main cabinet circuit breaker, a radio interference line filter, lightning arrestor and a mercury buss relay to control the AC power to the signal heads. The lightning arrestor shall be EDCO model ACP-340. The mercury buss relay shall be of the normally open type, and shall have an RC network wired in parallel with its coil circuit. A neutral buss bar having a minimum of 13 positions shall be provided for easy connection of all signal neutral wiring.

The cabinet shall contain an internal test panel which shall contain a switch labeled “Stop Time – Run – Normal”, to facilitate troubleshooting of the controller equipment. In the “Stop Time” position, all timing functions of the controller shall be suspended. The “Run” position shall allow the controller timing to operate without regard for the condition of any other devices within the cabinet. In the “Normal” position, the controller timing functions shall operate normally so long as all other equipment or switches are operating normally. Operation of flash switches or the detection of a fault by the MMU shall immediately apply a stop time input to the controller.

The test panel shall also contain a duplex convenience outlet, separately fused at 15 Amps, and wired directly to the AC input to the cabinet, such that power will be supplied to the outlet even with the main cabinet circuit breaker in its off position.

The cabinet shall include a cabinet power supply meeting the requirements of NEMA specification TS2. The power supply shall be completely enclosed in a brushed aluminum housing and shall be shelf mounted. It shall provide the following voltage and current outputs:

- +12 VDC +/- 1 VDC, 2.0 A
- +24 VDC +/- 1 VDC, 2.0 A
- 12 VAC, 0.25 A

Outputs shall be fused with slow blow fuses of the ratings indicated.
AC power input shall be protected against over current with a 2 Amp slow blow fuse.

LED indicators on the front panel shall denote the presence of 12 VAC, 24 VDC and 12 VDC and the 60 Hz reference signal Test points for logic common and +24 VDC shall also be provided on the front panel.

The cabinet shall include a rack or racks for vehicle detector amplifiers.

9.18.03 TESTING AND WARRANTY

Testing

Each controller and cabinet assembly shall be tested as a complete entity under signal load for a minimum of 48 hours.

Each assembly shall be delivered with a signed document detailing the cabinet final tests performed.

The cabinet shall be assembled and tested by the controller manufacturer or authorized local distributor to ensure proper component integration and operation.

Warranty

The controller and Malfunction Management Unit shall be warranted by the manufacturer against mechanical and electrical defects for a minimum period of 2 years from date of shipment. The manufacturer's warranty shall be supplied in writing with each cabinet and controller. Second party extended warranties are not acceptable.

The cabinet assembly and all other components shall be warranted for a period of one year from date of shipment.

Any defects shall be corrected by the manufacturer or supplier at no cost to the owner.

9.19 ON-STREET MASTER CONTROLLER

A Siemens EPAC-380-M52 On-Street Master Controller shall be provided when called for in the plans and specifications and whenever a cabinet is designated as a master cabinet.

A telemetry interface harness and interface panel shall be supplied with each On-Street Master Controller for enabling of communications between the On-Street Master Controller with all associated local controllers.

The On-Street Master Controller shall include all required telemetry modules for communications to associated local controllers.

An external 56K Hayes-compatible dial-up modem, RJ11 phone jack, and modem cable shall be included and installed in the master cabinet when called for in the plans and specifications and whenever a cabinet is designated as a master cabinet.

The on-street master controller shall be paid for on a unit basis and shall include all labor, equipment and materials necessary to install the item complete-in-place, including all cabinet accessories internal to the cabinet.

9.20 TRAFFIC SIGNAL HEADS

All vehicular traffic signal heads shall be 100% polycarbonate, colored black, with black, detachable, tunnel visors. 12" Signal sections shall be used. Standard signal heads shall be Eagle Signal Corporation, McCain, or approved equal.

All pedestrian signal heads shall be single section, black, symbolized messages, and clam shell mounting. Standard pedestrian signal heads shall be as manufactured by Indicator Controls Corporation, or approved equal.

LED indications shall be furnished for all indications, with the exception of one side-of-pole red indication for each through movement approach, and unless defined otherwise in the plans, shall include red ball, yellow ball, green ball, arrow indications, and countdown pedestrian hand and walk-man indications. Pedestrian indications shall be of the "filled" type. Outlined hand and walk-man indications shall not be permitted.

Traffic LED indications shall meet the requirements of the latest version of the ITE Standards. Verification of LED adherence to ITE standards shall be through a 3rd party "Nationally Recognized Testing Laboratory (NRTL)" to demonstrate compliance to Section 6.3 (Production Tests & Inspections) of the latest ITE VTCSH Full Ball specification dated June 27th 2005 (for LED ball modules), and ITE VTCSH Arrow specifications dated July 1st 2007 (for LED arrow modules), and ITE PTCSI Pedestrian specification dated March 19th 2004 (for LED pedestrian combo or countdown modules). 3rd Party lab must have "Nationally Recognized Testing Laboratory (NRTL" status. Proof of certification must be documented. Proof of certification must be presented when requested by the Construction Manager.

For side-of-pole indications requiring use of incandescent bulbs, and when incandescent bulbs are defined in the plans, traffic signal bulbs shall be General Electric, Durotest, Phillips, or approved equal. Incandescent

bulbs shall be approved for traffic signal use and shall be 116 watt, 130 volt.

All signal head locations shall be approved by the Construction Manager.

All back plates shall be installed on all mast arm mounted and/or span wire mounted traffic signal heads, black in color, and of the louvered design to allow wind passage. Back plates shall not be mounted on side-of-pole mounted traffic signal heads.

Astro-brac or Sky-brac type mounting hardware shall be used to attach all traffic signal heads mounted on mast arms. Refer to Detail 900-11 of these Standards and Specifications.

Industry standard span wire mounting hardware shall be used to attach the signal heads to both the span wire cable and messenger cable on a span wire type installation.

Side of pole traffic signal heads shall use industry standard side of pole hardware on both the top and bottom traffic signal head sections for mounting.

All Band-it material, including buckles, shall be ¾" stainless steel.

During construction, traffic signal heads that have been installed but are not ready for actual electrical connection shall be bagged with a dark opaque material.

Signal and pedestrian heads shall be paid for on a unit price basis and shall include all labor, equipment and materials necessary to install the signal head, complete-in-place.

9.21 TRAFFIC SIGNAL POLES, MAST ARMS AND LUMINAIRE DAVITS

Traffic poles, mast arms, luminaire davits, decorative bases, and ancillary materials shall meet the requirements of the standard details, which indicate the critical dimensions that must be met exactly or within stated tolerances. The intent is to provide traffic poles that match the overall appearance as illustrated and meet the performance requirements of the details and these specifications. Supplier submittals shall be required and shall demonstrate conformity with Detail 900-15 of these Standards and Specifications.

Traffic signal pole foundations shall adhere to foundation standards as referenced in Detail 900-03 of these Standards and Specifications, and

Chapter 9, “Traffic Signals”, Section 7.0, “Foundations”, of these Standards and Specifications.

Traffic poles, mast arms, luminaire davits, and decorative bases shall be wrapped for shipping from the factory in heavy duty paper or plastic to protect them from scratches and abrasions in transit.

Traffic poles, mast arms, luminaire davits, and decorative bases shall be galvanized as per ASTM A123 and A153, then top coat painted. Top coat paint shall be Federal Green, Valmont specification F-283CL, or approved equal. Prior to the installation of traffic poles, mast arms, davits, and/or decorative bases, the Contractor shall wipe clean the outer surfaces. Following the installation of the traffic poles, mast arms, and/or luminaire davits, the Contractor shall touch up nicks and abrasions in conformance with manufacturer’s recommendations.

Two hand holes shall be provided on each pole; one at the base, one flush hand hole behind the signal mast arm connection. The flush covers shall be flush with the base metal giving them a hidden appearance. A “J-hook” wire support shall be provided in each pole shaft above the hand hole behind the mast arm connection. One grounding attachment shall be provided in each pole shaft near the hand hole cover at the base of the pole.

When decorative bases are installed as part of the project, decorative bases shall be installed in conformance with the standard details.

When decorative bases are not installed as part of the project, anchor bolt nut covers shall be provided. A locking device shall be provided to prevent lifting or creeping of the anchor bolt nut covers.

Mast arm connecting bolts shall be of sufficient strength to conform to current AASHTO specifications.

All mast arm and pole shaft end openings shall be provided with set screw caps.

All welding shall conform to AWS D1.1 Sections 1 through 8 and shall be performed by welders certified in accordance with AWS code. All butt welds shall be ground flush with base metal to provide a uniform smooth finish.

Buy American Provision, all steel materials permanently incorporated into the work shall be certified to have been produced in the United States. All manufacturing processes for these materials must occur in the United States and be new domestic steel. Certifications that steel has been

manufactured in the United States shall be provided to the City by the manufacturer.

All materials shall be of the ASTM type as called for in this specification. Mill certifications shall be supplied for proof of compliance to these Specifications.

Valmont brand traffic signal poles, mast arms, luminaire davits, and decorative bases have been pre-approved to meet City specifications. Other brands must be approved by the Construction Manager prior to ordering the poles, mast arms, luminaire davits, and/or decorative bases.

Specialty signal poles, of nostalgia design or other, and which do not meet these specifications, shall only be installed with approval from the Construction Manager.

Traffic signal poles, mast arms, luminaire davits, and decorative bases shall be measured and paid for per unit count and shall include all labor, equipment, and materials necessary to install the item complete-in-place.

9.22 SPAN WIRE POLE

Span wire poles and cables shall be designated to meet the structural requirements given in the latest edition of “Standard Specifications for Structural Support for Highway Signs, Luminaires and Traffic Signals”, published by AASHTO, for a wind velocity of 90 MPH. The minimum pole weights and span wire cable rating given in the standard details shall be increased as necessary in accordance with the AASHTO requirements.

Span wire pole foundations shall adhere to foundation standards as referenced in Detail 900-05 of these Standards and Specifications, and Chapter 9, Section 7.0, “Foundations”, of these Standards and Specifications.

Span wire poles shall be galvanized as per ASTM A123 and A153, then top coat painted. Top coat paint shall be Federal Green, Valmont specification F-283CL, or approved equal.

Span wire poles may be seamless, or may be fabricated as one piece without transverse joints or welds and with only one longitudinal seam which shall be either continuously welded and ground, or rolled flush.

Span wire cable shall be seven wire stranded, common galvanized, and utilities grade. The cable shall have a minimum wire diameter of 3/8 inch,

and shall be rated at 13,000 pounds minimum. Tether cable shall have a minimum diameter of 3/8 inch and shall be stranded, galvanized steel.

Span wire poles shall be measured and paid for per unit count and shall include all labor, equipment, and materials necessary to install the item complete-in-place.

Span wire cable shall be measured and paid for per unit count and shall include all labor, equipment, and materials necessary to install both the span wire cable and tether cable complete-in-place.

9.23 PEDESTAL POLE

Pedestral poles shall be designed to meet the structural requirement given in the latest edition of "Standard Specifications for Structural Support for Highway Signs, Luminaires and Traffic Signals", published by AASHTO, for a wind velocity of 90 MPH. Unless modified by a structural analysis, the pole shall be Schedule 40 galvanized steel. The pole base shall be frangible.

Pedestal pole foundations shall adhere to foundation standards as referenced in Detail 900-09 of these Standards and Specifications, and Chapter 9, Section 7.0, "Foundations", of these Standards and Specifications.

The pedestal pole shall be hot dipped galvanized per ASTM A123 and A153, equivalent to 2 oz. per square foot, inside and out, then top coat painted. Top coat paint shall be Federal Green, Valmont specification F-283CL, or approved equal.

Pedestrian poles shall be measured and paid for per unit count and shall include all labor, equipment, and materials necessary to install the item complete-in-place.

9.24 PEDESTRIAN PUSH BUTTON POLE

Pedestrian push button pole shall be as illustrated in the standard details, constructed of Schedule 40 galvanized steel. Pole base shall be frangible.

Pedestal push button pole foundations shall adhere to foundation standards as referenced in Detail 900-09 of these Standards and Specifications and Chapter 9, Section 7.0, "Foundations", of these Standards and Specifications.

The pedestal push button pole shall be hot dipped galvanized per ASTM A123 and A153, equivalent to 2 oz. per square foot, inside and out, then top coat painted. Top coat paint shall be Federal Green, Valmont specification F-283CL, or approved equal.

Pedestrian push button poles shall be measured and paid for per unit count and shall include all labor, equipment, and materials necessary to install the item complete-in-place.

9.25 ILLUMINATED STREET NAME SIGNS

9.25.01 FLOURESCENT

Illuminated street name signs shall be florescent type, NAIM Series, as manufactured by NuArt Lighting Products. Approved equal shall be permitted when approved by the Construction Manager. Supplier submittals shall be required and shall demonstrate conformity with Detail 900-01 of these Standards and Specifications.

Illuminated street name signs housings shall be constructed of extruded aluminum with a minimum wall thickness of .078". All ferrous hardware parts shall be galvanized and cadmium plated.

The reflectors shall have a minimum reflectance of 85%.

Background sheeting shall be 3M brand DG3 reflective sheeting, series 4090T translucent white. Green transparent overlay film shall be colored Pantone 3435C, or approved equal. Sign panels shall be protected by overlay clear film and shall be 3M brand series 1150 clear. The sign colors shall not fade when exposed to an accelerated test of ultraviolet light equivalent to eight (8) years of outdoor exposure.

The entire surface of the sign panel shall be evenly illuminated. The average of brightness reading for the letters shall be 150 feet – lamberts minimum. The light transmission factor of the sign panel shall provide a letter-to-background brightness ratio between 10:1 and 20:1.

The sign ballasts shall be the high power factor type, single lamp, 200 MA, 120 Volt/60 cycle. There shall be a separate ballast for each fluorescent lamp. Fuses shall be miniature slow-blowing type, with a separate fuse provided for each ballast. Fluorescent lamps shall meet ANSI Standard C78. One lamp holder for each lamp shall be the spring loaded type. The entire sign and its components shall operate over a temperature range of -30 degrees F. to +160 degrees F.

Terminal blocks shall be molded, phenolic, barrier type rated at 15 ampere, 1000 V and shall have waterproof marking strips. No wiring splices will be permitted within the sign without the permission of the Construction Manager or his designee.

Illuminated street name signs shall be measured and paid for per unit count and shall include all labor, equipment, and materials necessary to install the item complete-in-place.

9.25.02 LED/OTHER

LED or other type illuminated street name signs shall only be used where specified in the plans and specifications and may be considered by the Construction Manager on a per project basis. When specified in the project plans and/or specifications, LED or other type illuminated street name signs shall be of the manufacturer and model number as specified.

9.26 BLANK OUT REGULATORY/WARNING SIGNS

Blank out regulatory or warning sign housings shall be constructed of aluminum unless directed otherwise by the Construction Manager. All ferrous hardware parts shall be galvanized cadmium plated, or stainless steel. Supplier submittals shall be required and shall demonstrate conformity with Detail 900-02 of these Standards and Specifications.

Blank out regulatory or warning signs shall be of LED type.

The cabinet interior and circuit connections shall be readily accessible via hinged doors or removable panels. The lens panel shall be removable without the use of tools.

The sign color shall not fade when exposed to an accelerated test of ultraviolet light equivalent to five years of outdoor exposure.

The entire surface of the sign panel shall be evenly illuminated. All messages shall be clearly legible attracting attention under any lighting conditions for an advance distance of at least 500 feet. When illuminated, the sign shall be visible anywhere within the approximately a 60 degree cone centered about the optic axis.

The sign panel shall completely blank out when not energized.

Terminal blocks shall be molded, phenolic, barrier type rated at 15 ampere, 1000 V and shall have waterproof marking strips. No wiring

splices will be permitted within the sign without the permission of the Construction Manager.

The overall weight of the complete sign assembly including mounting hardware shall not exceed 90 lbs.

Blank out regulatory/warning signs shall be measured and paid for per unit count and shall include all labor, equipment, and materials necessary to install the item complete-in-place.

9.27 SCHOOL FLASHING BEACON ASSEMBLY

School flasher beacon assemblies shall be Type 1 or Type 2 as defined in the project plans and shall be as shown in the standard Detail 900-04 of these Standards and Specifications.

Type 1 school flasher beacon assemblies shall incorporate a speed radar sign. The speed radar sign shall be model RU2 Fast 250 as supplied by RU2 Systems, Inc. or approved equivalent.

LED indications shall be furnished for all indications. For solar installations, LED indications shall be 12V type.

School flasher LED indications shall meet the requirements of the latest version of the ITE Standards. Verification of LED adherence to ITE standards shall be through a 3rd party "Nationally Recognized Testing Laboratory (NRTL)" to demonstrate compliance to Section 6.3 (Production Tests & Inspections) of the latest ITE VTCSH Full Ball specification dated June 27th 2005. 3rd Party lab must have "Nationally Recognized Testing Laboratory (NRTL)" status. Proof of certification must be documented. Proof of certification must be presented when requested by the Construction Manager.

Front mount school flashing beacon assembly signal heads shall flash alternately.

Each school flasher beacon assembly shall include a NEMA Type 4, natural aluminum enclosure for housing the associated time clock unit and electrical connections. When solar power is used in conjunction with the school flashing beacon assembly, the NEMA Type 4 enclosure shall be of sufficient size to house all associated solar power equipment, including the battery(s).

The NEMA Type 4 enclosure shall be lockable and provided with a treasury type lock Corbin number R357SGS, or exact equivalent.

A time clock, RTC model number AP21T, or approved equal shall be incorporated in the school flashing beacon assembly NEMA Type 4 enclosure.

Terminal blocks shall be molded, phenolic, barrier type rated at 15 ampere, 1000 V. No wiring splices will be permitted within the school flasher beacon assembly or NEMA Type 4 enclosure without the permission of the Construction Manager.

For 120VAC installations, a main circuit breaker shall be installed in the NEMA Type 4 enclosure between the service feed and school flashing beacon assembly electronics. Fuse(s) in place of the circuit breaker shall not be permitted. A main circuit breaker shall not be required for solar type installations.

For 120VAC installations, a 120VAC receptacle shall be installed within the NEMA Type 4 enclosure.

School flashing beacon assemblies shall be paid for on a unit price basis and shall include all labor, equipment, materials, and electrical service connections necessary to install a school flashing beacon assembly, complete-in-place, on a single pole.

9.28 WARNING OR REGULATORY SIGN FLASHING BEACON ASSEMBLY

A warning or regulatory sign flashing beacon assembly shall be as shown in the standard Detail 900-14 of these Standards and Specifications.

LED indications shall be furnished for all indications. For solar installations LED indications shall 12V type.

Warning or regulatory sign flashing beacon assembly LED indications shall meet the requirements of the latest version of the ITE Standards. Verification of LED adherence to ITE standards shall be through a 3rd party “Nationally Recognized Testing Laboratory (NRTL)” to demonstrate compliance to Section 6.3 (Production Tests & Inspections) of the latest ITE VTCSH Full Ball specification dated June 27th 2005. 3rd Party lab must have “Nationally Recognized Testing Laboratory (NRTL” status. Proof of certification must be documented. Proof of certification must be presented when requested by the Construction Manager.

Front mount warning or regulatory sign flashing beacon assembly signal heads shall flash simultaneously.

All terminations shall be made on a terminal block located within the signal head. Terminal blocks shall be molded, phenolic, barrier type rated at 15 ampere, 1000 V. No wiring splices will be permitted within the warning or regulatory sign flashing beacon assembly without the permission of the Construction Manager.

Warning or regulatory sign flashing beacon assemblies shall be paid for on a unit price basis and shall include all labor, equipment, materials, and electrical service connections necessary to install a warning or regulatory sign flashing beacon assembly, complete-in-place, on a single pole.

9.29 SOLAR POWER SYSTEM

The solar power system shall be of sufficient size to adequately support the power requirements of the attached equipment year round.

The solar power system shall incorporate a solid-state solar controller including a high output solar regulator and low voltage disconnect.

The solar power system shall operate on input voltages ranging from 11.5 VDC to 25 VDC.

The solar regulator's minimum rating shall be 25A at 12 VDC, temperature compensation.

The solar panel position shall be field settable to the correct degree required at the location.

The solar system shall use automatic night dimming to conserve power.

The solar power system shall include all labor, equipment, and materials necessary to install a solar power system, complete-in-place, on a single pole.

9.30 UNINTERRUPTABLE POWER SUPPLY (UPS)

9.30.01 GENERAL

A UPS shall be incorporated in all new traffic signals and where otherwise specified in the plans and project specials. Approved manufacturers include Alpha, Clary, Econolite, Myers, PSI, and Signal Sense, and shall meet or exceed these specifications.

The UPS shall be installed per manufacturer's specifications.

Programming software and manuals shall be supplied with each UPS and shall become the property of the City at the completion of the project.

A UPS shall include all labor, equipment, and materials necessary to install the item complete-in-place.

9.30.02 CABINET

All UPS equipment, including the UPS, batteries, all related equipment, and cabling, shall be housed within a single cabinet other than the standard traffic signal cabinet. These cabinets, pony cabinets, shall be directly mountable on either exterior sidewall of the traffic signal cabinet.

Cabinets which only house a portion of the equipment shall not be permitted.

The pony cabinet's finish shall match with the controller cabinet, natural aluminum or powder coat painted Federal Green.

The pony cabinet shall be sized to attach to either exterior sidewall of the traffic signal NEMA "P" Cabinet as specified in these specifications.

All UPS components shall be rated for use in the pony cabinet provided.

9.30.03 OPERATIONAL SPECIFICATIONS

Power Input/Output

- Use 120VAC, 60 Hz, single phase source input.
- Provide for input surge suppression.
- Output a single phase pure AC sine-wave regulated at 120VAC (± 3%), 60Hz.
- Be capable of operating in the voltage range of 85VAC to 135VAC without using the batteries.
- Be of double-conversion/true on-line, or line interactive design.

    - Double Conversion/True On-Line:
      As a double conversion/true on-line design, the UPS unit shall be in an always on condition continuously monitoring the input and shall provide continuous frequency and voltage regulation at the output. Upon loss of utility power, the UPS shall transfer to battery

mode in 0ms. No transfer time shall be experienced when transitioning to full UPS operation.

- Line Interactive:
  As a line interactive design, the UPS unit shall be in an always on condition continuously monitoring the input voltage; regulating the output voltage when utility power falls out of tolerances. Upon loss of utility power, the UPS shall transfer to full UPS operation in <5ms.

- Be installed in series with the utility power such that the UPS powers the entire traffic signal cabinet and all associated equipment.

Run Time

- Provide for full signal operation at an average of 700 Watts for a minimum of one hour, with additional minimum flash time of two hours.
- Provide for user definable full run time settings to define full run time prior to the UPS transitioning to flash operation.
- Provide for user definable battery level flash settings by which the user can change battery level flash settings.
- Remain in, or automatically transition to flash operation, when utility power fails and the UPS battery levels are below, or fall below, the user defined battery level flash settings.
- Restore the signal to full operation any time utility power is restored or power is supplied via the generator receptacle.
- Include a low battery cutout to prevent critical discharge of, and damage to, the UPS batteries.
- Provide a battery recharge of 95% within eight hours.

Indications, Alarms, Faults

- Provide a means by which the user can accurately check the battery charge level, and UPS load level.
- Provide indications which display the current condition of the UPS including the presence or absence of a critical UPS fault, and the presence or absence of utility power.
- Provide an automatic bypass by which the UPS unit is bypassed and runs off utility power if a critical internal UPS fault occurs.

- Provide a single dry contact relay output and alarm trigger with user definable trigger options to notify the owner of critical events and/or failures to include:

    - UPS critical fault
    - Loss of utility power input
    - Low battery condition

Switches, Ports, Receptacles, Controls

- Provide a bypass switch by which the user can manually bypass the UPS and power the signal via utility power. This feature is to be used in the case of UPS failure and/or the need for UPS maintenance or repair procedures.
- Include a generator receptacle accessible via the exterior of the traffic signal cabinet and UPS cabinet.
- Provide automatic sensing of generator power. The UPS shall be configured such that the UPS provides regulated 120VAC, 60 Hz, single phase output power to run the signal in full operation and recharges the UPS batteries while under generator power. The UPS shall be configured to run the signal in full operation regardless of the UPS's battery charge level.
- The UPS unit shall automatically sense when generator power is applied, and when generator power fails. When generator power is applied, the UPS unit shall be configured such that it automatically reverts to generator power.
- When generator power fails (generator power falls outside of acceptable signal tolerances), the UPS unit shall be configured such that it automatically reverts back to either utility power or UPS battery power respectively based upon the availability at the time.
- Provide all required software and cabling for local UPS management.
- Provide options and solutions for networked remote monitoring and management of the UPS through an Ethernet switch and/or other networking device.

Hardware, Software, Cabling

All UPS units shall include all components, hardware, cabling, installation manuals, and software required for complete installation, operation, programming, monitoring, and maintenance of the UPS system.

Warranty

All proposed UPS equipment shall be warranted for a period of two years by the manufacturer.

9.31 CLOSED-CIRCUIT TELEVISION (CCTV)

9.31.01 CCTV CAMERA

CCTV cameras shall be installed where indicated on the project plans or as otherwise directed by the Construction Manager. Mounting height shall be at the direction of the Construction Manager.

Each CCTV cameras shall be Panasonic model number WVCS954 and shall include a Panasonic POD9CW outdoor housing and Panasonic PAPM3 pole mount adapter. Approved equals shall be acceptable as approved by the Construction Manager.

CCTV camera power supplies shall be Altronix model number T2428100C, or approved equal. The power supply input shall be rated for 115VAC 50/60 Hz, .95 Amps. The power supply output shall be rated for 24VAC @ 4 Amps or 28VAC @ 3.5 Amps. An inline fuse shall be provided and rated @ 3.5 Amps/250V.

Composite cable, as supplied by MSN Communications (303-347-8303), shall be installed, shall be of adequate length to reach between the associated communications equipment and CCTV camera, and shall include molded connectors that mate with those of the camera. Composite cable shall include coax cable, communications cable, power cable, and other cables as required for full camera operability.

CCTV camera control shall be established via RS-485 data communications. Multiplex-coaxial communications shall not be permitted.

Communications equipment for both video and data communications shall be defined in the project plans or project specials, and shall adhere to their independent specifications as defined in these Standards and Specifications.

The CCTV camera power supply, and associated communications equipment, shall be shelf mounted or rail mounted within the traffic signal cabinet. When specified in the project plans or project specials, or at the direction of the Construction Manager, a separate NEMA 3R or NEMA 4

enclosure shall be installed, shall be of adequate size, and shall house the CCTV camera power supply, communications equipment, and all cable connections.

CCTV cameras shall be measured by the units installed and shall include all labor, equipment, and materials including, but not limited to, the CCTV camera, power supply, composite cable, necessary to install the item complete-in-place.

9.31.02 ENCODER/DECODER

A video Encoder/Decoder shall be required whenever the CCTV camera video and/or data communications are being routed via an Ethernet Managed Switch.

Encoder/Decoder shall be Pelco Net300 series, or approved equal, and shall, at minimum, meet the specifications as defined.

Internet communications shall support RTP, RTCP, UDP, IP, HTTP, SNMP, IGMP, ICMP, and ARP.

Video coding shall support MPEG-4.

Encoder/Decoder shall provide for one BNC, PAL/NTSC, 75 Ohm, 1V Peak-To-Peak input/output, one RS-232/RS-422/RS-485, bidirectional, 9-pin, D-Sub data port, one dry contact alarm input, one dry contact alarm output, and one LAN 10/100 BaseT, auto sensing port.

Encoder/Decoder shall support PAL and NTSC formats with image sizing as defined. For PAL format, 704 x 576 pixels @ 4CIF, 704 x 288 pixels @ 2CIF, and 352 x 288 pixels @ CIF. For NTSC format, 704 x 480 pixels @ 4CIF, 704 x 240 pixels @ 2CIF, and 352 x 240 pixels @ CIF.

Encoder/Decoder shall be user programmable via Internet Explorer. The user shall be able to program, communication parameters, maximum bandwidth rates, frame skip rates, point-to-point,/unicast/multicast modes and associated parameters, and security settings.

Encoder/Decoder shall support variable video frame rates of up to 30 frames per second.

Encoder/Decoder shall be rated for operation at temperatures of 32 degrees F to 122 degrees F, with an 80% max relative humidity, non-condensing.

Unless otherwise specified, the Contractor shall be responsible for proper programming, setup, and testing of the Encoder/Decoder. At the City's discretion, the City may opt to have their Maintenance Contractor or other third party complete Encoder/Decoder, setup, and/or testing. When the City's Maintenance Contractor or other third party is enlisted for programming, setup, and/or testing of the Encoder/Decoder, associated costs for the Maintenance Contractor or third party labor shall be the responsibility of the City.

Encoder/Decoders shall be measured by the paired units installed (Encoder & Decoder) and shall include all labor, equipment, and materials necessary to install the item complete-in-place.

9.32 MISCELLANEOUS HARDWARE

All ferrous mounting hardware and weatherheads shall be galvanized, cadmium plated, or made of stainless steel to resist corrosion.

Payment for these items shall be incidental to the pay item to which the miscellaneous hardware item is attached.

9.33 MAINTENANCE AND EMERGENCY REPAIR DURING CONSTRUCTION

During the construction, reconstruction, fourteen-day test period, and until signal acceptance by the City, the Contractor shall maintain the system or systems on a 24 hour basis. The cost of any maintenance necessary except electrical energy, and maintenance due to damage by public traffic, shall not be paid for separately but shall be included in the cost of the work.

Acceptance by the City of the work performed by the Contractor shall only take place after all punch list items have been satisfactorily completed and inspected by the City.

The Contractor shall provide the Construction Manager with a 24 hour one call phone number for reporting of any and all signal malfunctions. Fees incurred for such service shall not be paid for separately but shall be included in the cost of the work.

All malfunctions of a controller and its accessory equipment shall be considered an emergency unless otherwise identified by the City. Equipment malfunctions and/or damage, which in the opinion of the Construction Manager or other City authorized person, constitutes a serious hazard or inconvenience to the public, shall be considered an

emergency. The Contractor shall undertake emergency repairs no later than one (1) hour after the City notifies the Contractor of the emergency.

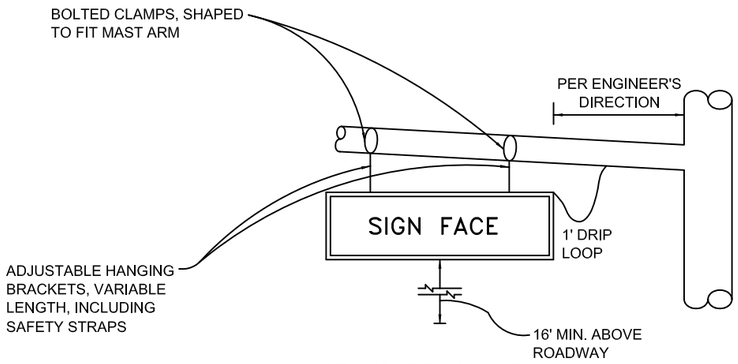
Malfunctions of a controller and its accessory equipment, which are identified by the Construction Manager or other City authorized person, as non-emergency repairs shall be considered non-emergency. The Contractor shall undertake non-emergency repairs no later than 24 hours after the City notifies the Contractor of the non-emergency.

If the Contractor fails to respond within the defined response time, the Construction Manager may elect to employ the services of the City's designated Traffic Signal Maintenance Contractor to perform the said maintenance work. In such cases, the Contractor shall reimburse the City for labor, equipment, and material charges associated with the utilization of the City's designated Traffic Signal Maintenance Contractor.

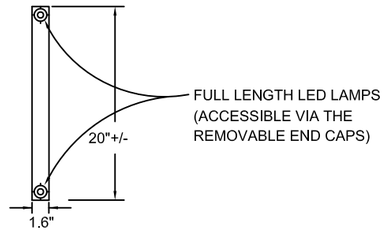
9.34 MOBILIZATION

This work shall consist of the mobilization of personnel, equipment and supplies at the project site in preparation for work on the project. This item shall also include costs incurred for labor and operations which must be performed prior to beginning the other items under the Contract.

Mobilization shall be paid for on a lump sum basis.



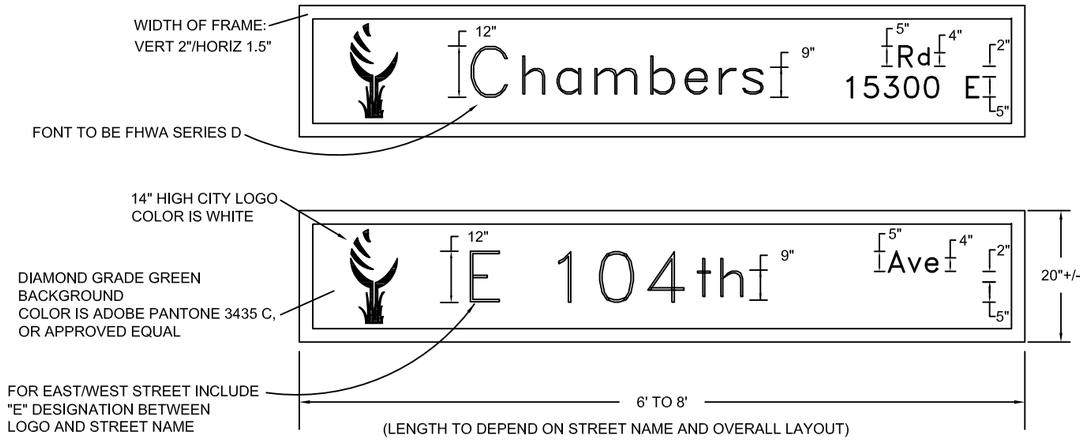
STANDARD MOUNT



SIDE VIEW

NOTES

1. FINAL SIGN LAYOUT AND LETTERING DETAILS PER PROJECT MANAGER'S DIRECTION.
2. SIGN TO BE DOUBLE SIDED WITH WHITE PRINT ON GREEN BACKGROUND FOR STREET NAME AND LOGO.



ILLUMINATED SIGN TYPICAL LAYOUT

GENERAL NOTES

1. STREET NAME SIGN TO BE FREE-SWINGING OR LIMITED-SWINGING. SIGN FIXTURE AND PANELS SHALL WITHSTAND 90 MPH WIND LOADING, WITH STRUCTURAL REQUIREMENTS MEETING AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS," LATEST EDITION.
2. HOUSING TO BE CONSTRUCTED OF ALUMINUM.
3. NEOPRENE GASKETS SHALL BE INSTALLED BETWEEN THE SIGN PANEL FRAME AND FIXTURE HOUSING TO PREVENT WATER ENTRANCE. SCREENED WEEP HOLES SHALL BE PROVIDED ON HOUSING BOTTOM FOR DRAINAGE.

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APPROVAL

CITY ENGINEER — DATE: 05-27-16

CITY OF COMMERCE CITY
Department of Public Works
8602 Rosemary St.
Commerce City, CO 80022
Ph: 303-289-8150

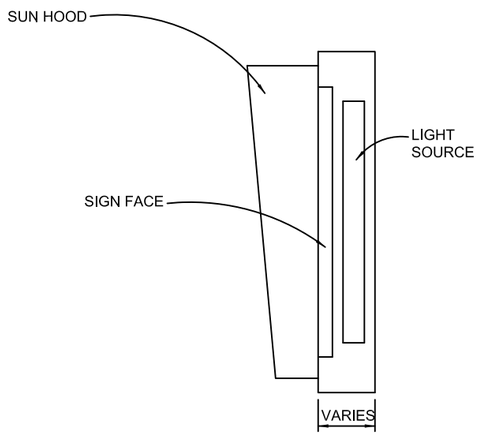
ILLUMINATED STREET NAME SIGN

ENGINEERING CONSTRUCTION STANDARDS

DETAIL NO. 900-01

Sheet No. 1 of 1

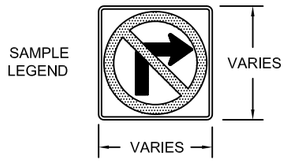
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SIDE VIEW

NOTES

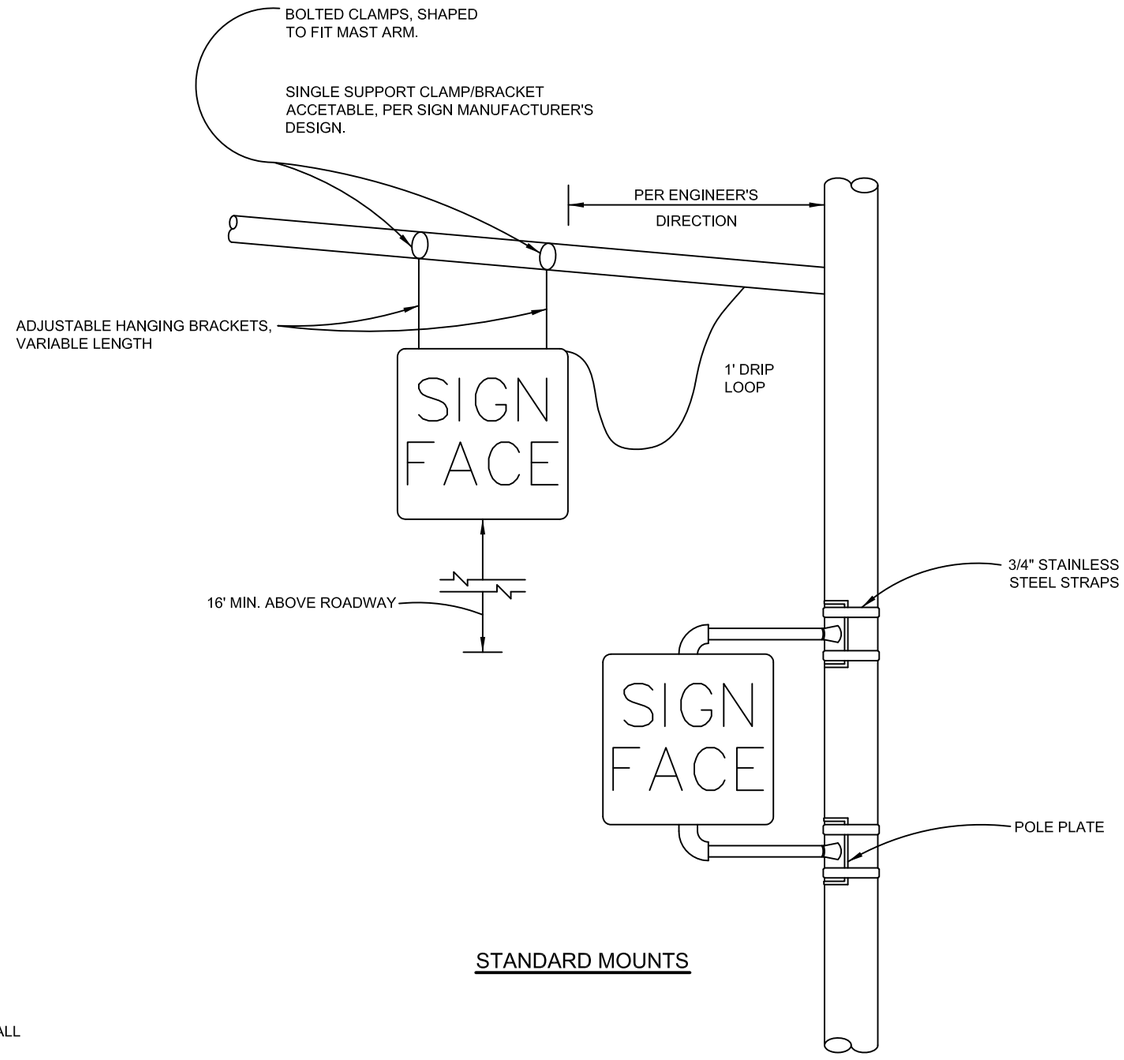
1. SIGN MAY BE SINGLE-SIDED OR DOUBLE SIDED PER ENGINEER'S DIRECTION.
2. SIGN COLOR, LEGEND AND SIZE PER ENGINEER DIRECTION.



TYPICAL SIGN LAYOUT

NOTES

1. LIGHT SOURCE SHALL BE LED. SIGN FACE SHALL COMPLETELY BLANK OUT WHEN NOT ENERGIZED.
2. CABINET INTERIOR AND CIRCUIT CONNECTIONS SHALL BE READILY ACCESSIBLE VIA HINGED DOORS OR REMOVABLE PANELS. THE LENS PANEL SHALL BE REMOVABLE WITHOUT THE USE OF TOOLS.



STANDARD MOUNTS

GENERAL NOTES

1. SIGN FIXTURE AND PANELS SHALL WITHSTAND 90 MPH WIND LOADING, WITH STRUCTURAL REQUIREMENTS MEETING AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS," LATEST EDITION.
2. HOUSING SHALL BE CONSTRUCTED OF ALUMINUM UNLESS OTHERWISE DIRECTED BY ENGINEER.
3. NEOPRENE GASKETS SHALL BE INSTALLED BETWEEN THE SIGN PANEL AND FIXTURE HOUSING TO PREVENT WATER ENTRANCE. SCREENED WEEP HOLES SHALL BE PROVIDED ON HOUSING BOTTOM FOR DRAINAGE.

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APPROVAL

05-27-16

CITY ENGINEER — DATE

CITY OF COMMERCE CITY
Department of Public Works
8602 Rosemary St.
Commerce City, CO 80022
Ph: 303-289-8150

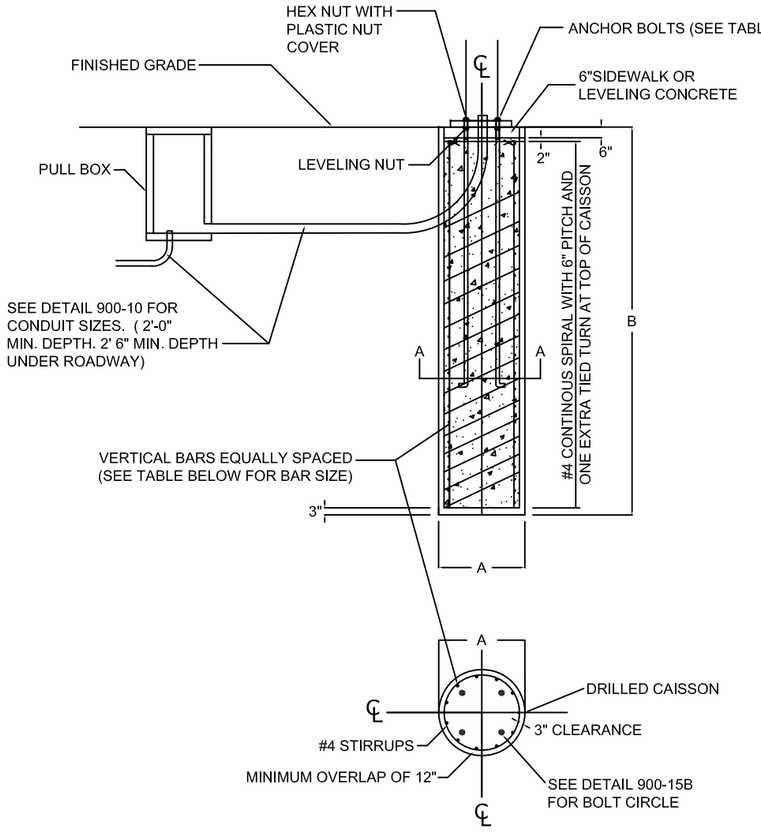
REGULATORY WARNING SIGN

ENGINEERING CONSTRUCTION STANDARDS

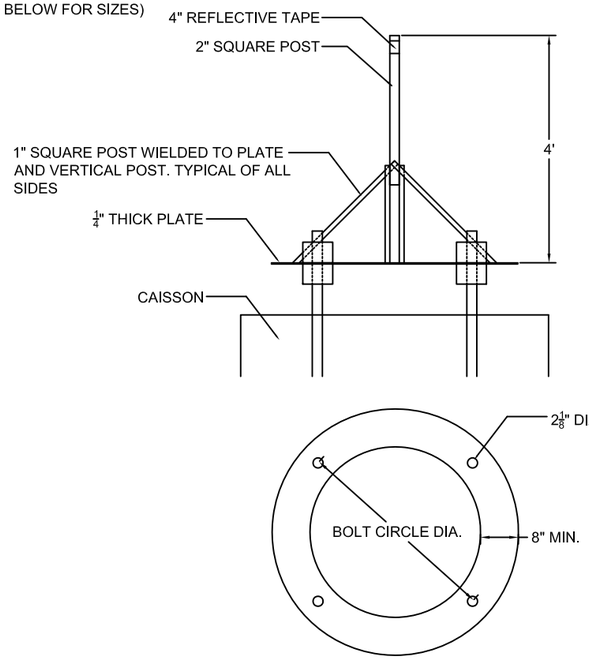
DETAIL NO. 900-02

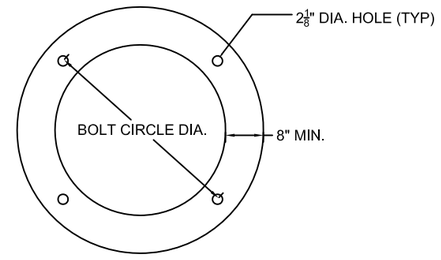
Sheet No. 1 of 1

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TRAFFIC SIGNAL POLE CAISSON
FOR MAST ARM POLES





BOLT PROTECTION AT FUTURE
SIGNAL POLE LOCATIONS

GENERAL NOTES

1. CONCRETE CLASS AS PER THE COLORADO DEPT. OF TRANSPORTATION. REINFORCED STEEL: PER AASHTO M31 SPECIFICATION, GRADE 60 FOR #9, #5 & #4 BARS.
2. SHAFT FOR CONCRETE FOUNDATION TO BE DRILLED BY MECHANICAL AUGER. CASING, IF USED IN PLACING CONCRETE, SHALL BE REMOVED UPON COMPLETING POUR.
3. FOUNDATION DESIGN REQUIRES THAT THE SHAFT BE FOUNDED IN COMPACT SAND, CLAY, OR SANDY CLAY. THE ALLOWABLE SAFE LATERAL BEARING CAPACITY OF SOIL (AROUND SHAFT) TO BE 1,300 LBS./SQ. FT. MINIMUM AT DEPTH OF 4.0 FT. BELOW TOP OF FOUNDATION. THE AVERAGE FRICTIONAL RESISTANCE OF THE SOIL (AROUND THE SHAFT) TO BE 460 LBS./SQ. FT. MINIMUM ALLOWABLE,UNDER WIND LOADING (TORSION). IF THE SOIL INVESTIGATION (CONDUCTED PRIOR TO CONSTRUC- TION) INDICATES THE ABOVE NOTED REQUIREMENTS CANNOT BE MET, OR IF "EXPANSIVE" SOIL IS AN EXISTING PROBLEM, THEN THE FOUNDATION DESIGN SHOWN WILL HAVE TO BE MODI- FIED AND APPROVED BY THE ENGINEER.
4. SHOULD ROCK BE ENCOUNTERED, THE SHAFT SHOULD EXTEND 6 FT. MINIMUM INTO ROCK. THE ALLOWABLE SAFE LATERAL BEARING CAPACITY OF ROCK TO BE 4,300 LBS./SQ. FT. THE SOIL (INCLUDING ROCK) SURROUNDING THE SHAFT SHOULD BE INVESTIGATED TO ENSURE IT WILL RESIST THE TORSIONAL MOMENT OF 93,435 FT. LBS.
5. CONCRETE SHALL BE POURED IN LIFTS NOT EXCEEDING 3 FEET IN DEPTH. AT THE POURING OF EACH LIFT, CONCRETE SHALL BE MECHANICALLY VIBRATED TO REMOVE AIR POCKETS.
6. FOUNDATIONS SHOULD BE POURED 10 TO 20 DAYS IN ADVANCE OF POLE INSTALLATION. SEE PROJECT SPECIAL PROVISIONS FOR SPECIFIC DIRECTIONS.
7. WHEN AMBIENT TEMPERATURE IS BELOW 40° F. POURED FOUNDATIONS SHALL BE COVERED WITH BLANKETS AND/OR STRAW PER DIRECTIONS OF THE ENGINEER.

CASSION DATA
(FOR SINGLE AND DOUBLE ARM INSTALLATION)

DIAMETER (IN.) (A)	DEPTH (FT.) (B)	MAST ARM LENGTH. (FT)	VERTICAL BARS	ANCHOR BOLTS (D)
36	10.0	UP THRU 35	11 - #9	4 - 1.75"
42	14.0	40 THRU 55	14 - #9	4 - 1.75"
48	18.0	60 THRU 75	18 - #9	4 - 2"

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MAST ARM POLE FOUNDATIONS

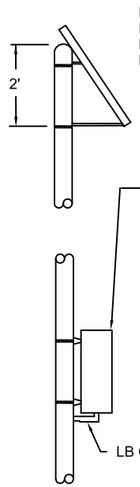
ENGINEERING CONSTRUCTION STANDARDS

DETAIL NO. 900-03

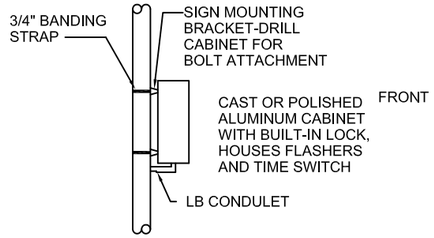
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OPTIONAL SOLAR PANEL

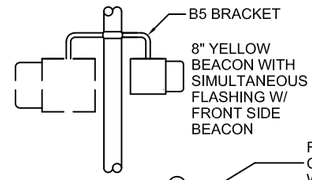


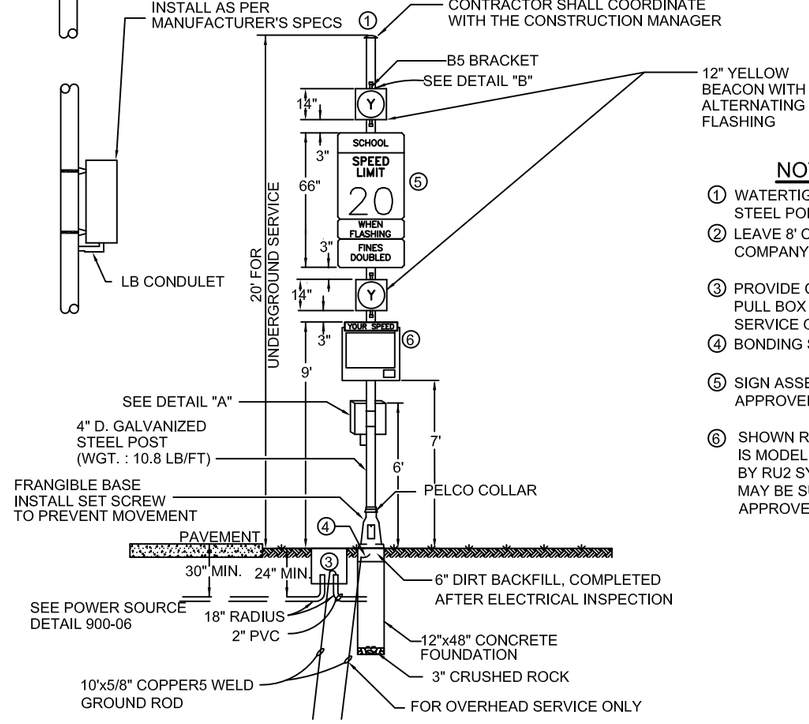
DETAIL "A"



DETAIL "B"

OPPOSITE DIRECTION 8" FLASHER





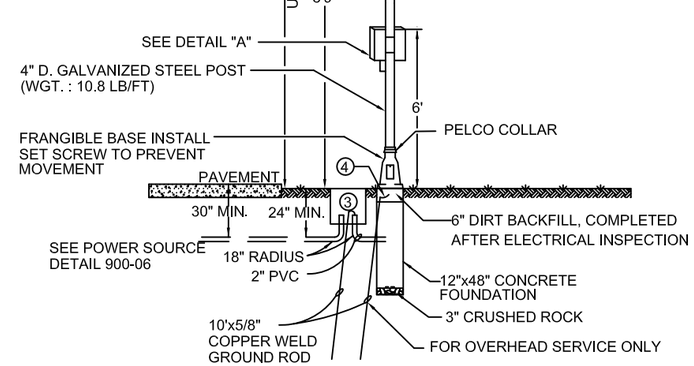
NOTES

1. WATERTIGHT GALVANIZED STEEL POLE CAP
2. LEAVE 8' COILED WIRE FOR UTILITY COMPANY CONNECTION
3. PROVIDE CONDUIT AND TYPE III PULL BOX FOR UNDERGROUND SERVICE ONLY
4. BONDING STRAP IN BACKFILL
5. SIGN ASSEMBLY LAYOUT TO BE APPROVED BY THE CITY
6. SHOWN RADAR SPEED DISPLAY SIGN IS MODEL RU2 FAST 250 SUPPLIED BY RU2 SYSTEM, INC. 877-9829-5237. MAY BE SUBSTITUTED BY A CITY APPROVED ALTERNATIVE.

FLASHING BEACONS

ALL FLASHING BEACONS SHALL BE POLYCARBONATE WITH TUNNEL VISORS AND BLACK HOUSINGS

SCHOOL FLASHING BEACON ASSEMBLY TYPE 1



SCHOOL FLASHING BEACON ASSEMBLY TYPE 2

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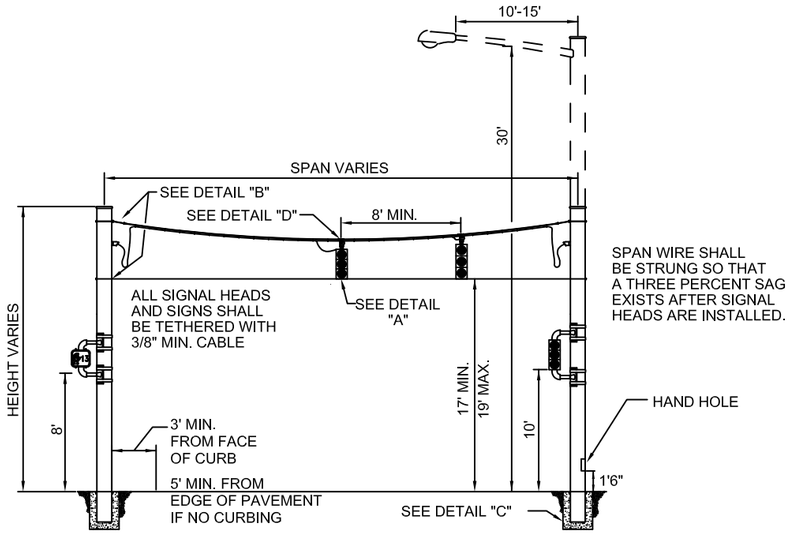
SCHOOL FLASHING BEACON

ENGINEERING CONSTRUCTION STANDARDS

DETAIL NO. 900-04

Sheet No. 1 of 1

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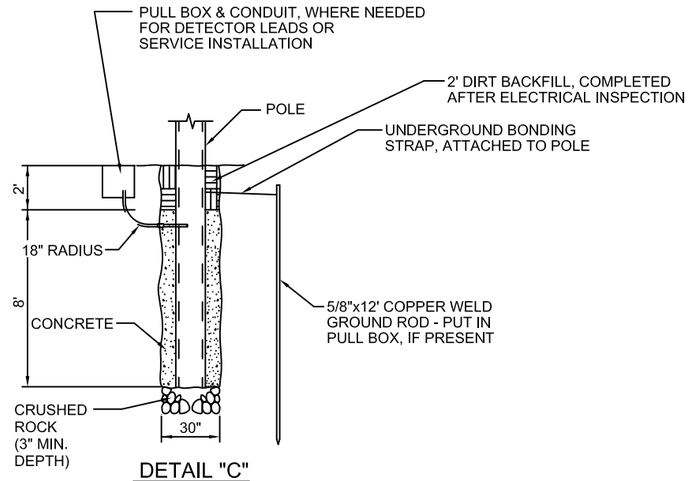
GENERAL NOTES

1. SPAN WIRE POLES SHALL BE HOT DIPPED GALVANIZED PRIMER AND FINISHED WITH FEDERAL GREEN POWDER COATING. POLE SURFACE SHALL BE WIPED CLEAN AND FREE OF DEBRIS PRIOR TO FINISH APPLICATION. FINISH APPLICATION SHALL BE COMPLETED PRIOR TO INSTALLATION OF SIGNAL/PEDESTRIAN HEADS AND PEDESTRIAN PUSH BUTTONS. FOLLOWING INSTALLATION OF THESE ITEMS, CONTRACTOR SHALL TOUCH UP NICKS AND ABRASIONS AS NEEDED.

2. DESIGN CRITERIA SHALL MEET LATEST AASHTO EDITION OF "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS," FOR A WIND VELOCITY OF 90 MPH.

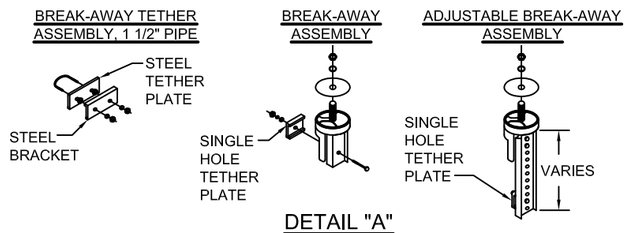
3. SPAN WIRE POLES SHALL BE FABRICATED OF GALVANIZED STEEL WITH A MIN. YIELD STRENGTH OF 35 KSI. AND A MIN. WEIGHT PER LINEAR FOOT AS FOLLOWS: 49.5 LB. FOR 12" DIA. POLES. POLES SHALL BE INSTALLED SO THAT THEY WILL BE PLUMB WHEN DEFLECTED BY THE INSTALLED LOAD. SPAN WIRE CABLE SHALL BE A MINIMUM OF 3/8 INCH D IAMETER, RATED AT A MINIMUM OF 13,000 POUNDS.

4. SPAN WIRE SIGNAL HEADS SHALL HAVE ONE POWER FEED WIRE IN AND OUT PER HEAD. CONNECTIONS SHALL BE MADE ONLY ON THE SIGNAL HEAD TERMINALS, WITH NO EXTERNAL SPLICES.



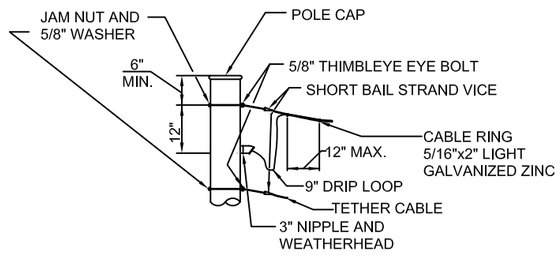
DETAIL "C"

TYPICAL TRAFFIC SIGNAL SPAN WIRE POLE FOOTING (CAST IN PLACE)



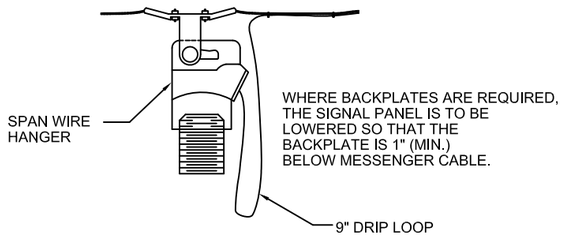
DETAIL "A"

TETHERING OPTIONS



DETAIL "B"

TYPICAL CABLE AND TETHER INSTALLATION



DETAIL "D"

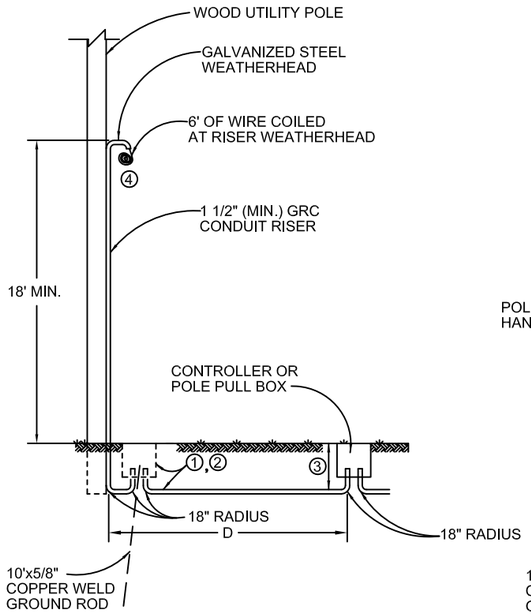
TYPICAL SPAN WIRE MOUNTING

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Last Modification Date: 5/4/2016	Initials: CJC				
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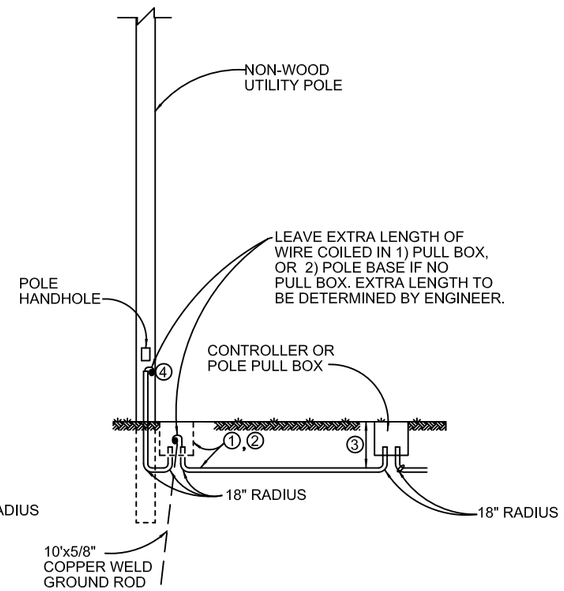
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NOTES

1. PROVIDE TYPE III PULL BOX/GROUND ROD AND 2" PVC CONDUIT ONLY IF D EXCEEDS 10'
2. PROVIDE 2" GRC CONDUIT WITHOUT PULL BOX/GROUND ROD IF D IS LESS THAN 10'
3. MINIMUM CONDUIT DEPTHS: UNDERGROUND 24" UNDER PAVEMENT 30"
4. WHERE REQUIRED BY UTILITY COMPANY, CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING PERMIT AND INSPECTION FROM THE LOCAL MUNICIPALITY.

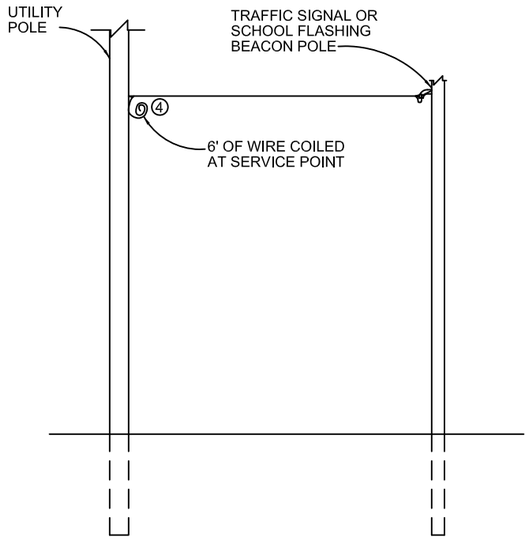


WITH WOOD UTILITY POLE



WITH NON-WOOD UTILITY POLE

TYPICAL UNDERGROUND POWER FEED
FOR TRAFFIC SIGNALS AND SCHOOL FLASHING BEACON ASSEMBLIES

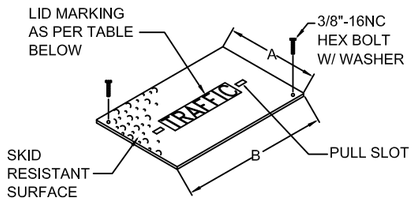


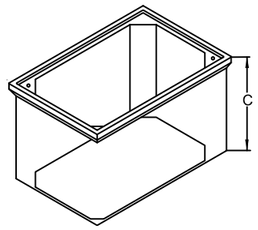
TYPICAL OVERHEAD POWER FEED FOR
TRAFFIC SIGNAL AND SCHOOL FLASHING BEACON ASSEMBLIES

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Last Modification Date: 5/4/2016	Initials: CJC				
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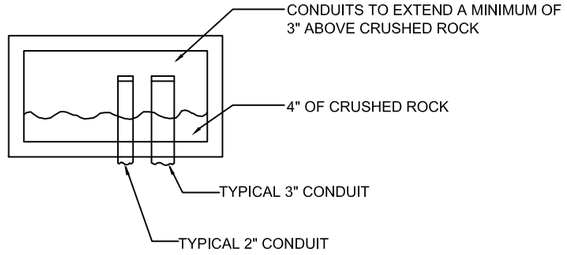
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COVER

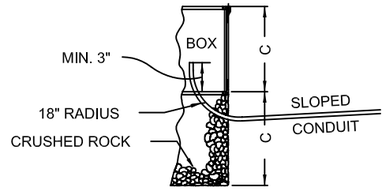




BOX



TYPICAL PULL BOX

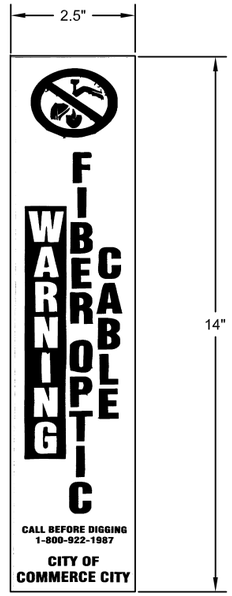


TWO BOXES & EXTENSION

FIBERGLASS REINFORCED POLYMER CONCRETE DESIGNED FOR SERVICE LOAD (MINIMUM) OF 15,000 LBS. OVER A 10" SQUARE

PULLBOXES

PULL BOX USAGE	SIZE (A X B X C)	PULL BOX LID MARKING
CABINET HOME RUN PULLBOX	24"x36"x18"	TRAFFIC
SIGNAL POLE PULL BOX	17"x30"x12"	TRAFFIC
DETECTOR PULL BOX (SIDE OF ROAD)	12"x12"x12"	TRAFFIC
DETECTOR WATER VALVE	WATER VALVE	TRAFFIC
COMMUNICATION VAULT (T/S CABINET)	30"x48"x18"	TRAFFIC COMM
COMMUNICATION VAULT (INTERMEDIATE LOCATIONS)	24"x36"x18"	TRAFFIC COMM
TELEPHONE DEMARCATION	13"x24"x12"	TRAFFIC COMM
ELECTRICAL DEMARCATION	13"x24"x12"	ELECTRIC



UTILITY DECAL

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PULL BOX (PLASTIC/PREFAB)

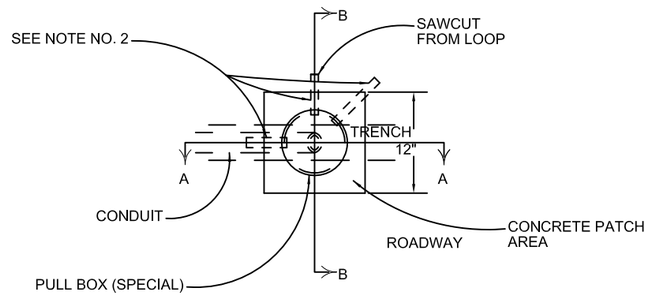
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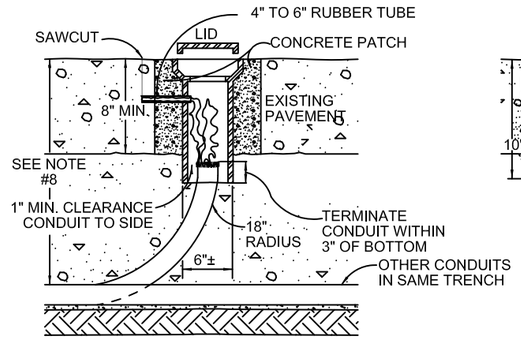
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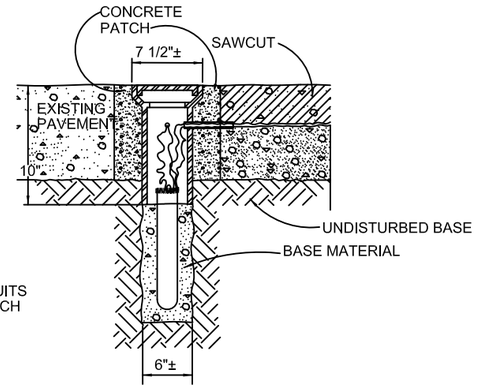
PULL BOX (SPECIAL)



TOP VIEW



SECTION A-A



SECTION B-B

GENERAL NOTES

1. PULL BOX (SPECIAL) SHALL BE A WATER VALVE STEM TYPE PULL BOX MADE OF ALUMINUM WITH A CAST IRON LID. THE PULL BOX SHALL HAVE THE CAPABILITY OF ACCEPTING RISER RINGS FOR FUTURE OVERLAYS. THE LID SHALL HAVE THE WORD "TRAFFIC" PRINTED ON IT.

2. PULL BOXES SHALL HAVE 3/4" TO 1" DIAMETER HOLES DRILLED OR TORCHED 3" FROM TOP TO ACCEPT A 4" TO 6" RUBBER TUBE (3/4" GARDEN HOSE). THE NUMBER OF HOLES SHALL BE AS PER PLANS OR AS DIRECTED BY THE CITY ENGINEER.

3. CARE SHALL BE TAKEN DURING BACKFILL COMPACTION TO PREVENT COLLAPSE OF THE TUBES.

4. 2' MINIMUM SLACK OF BOTH FEED AND LOOP WIRES IS TO BE PROVIDED SO THAT ALL TESTING AND SPLICING CAN BE DONE OUTSIDE OF THE PULL BOX.

6. PULL BOX IS TO BE LOCATED IN AN AREA OF THE STREET NOT HEAVILY TRAVELED IF POSSIBLE AND CENTERED A MINIMUM OF 12" FROM THE CONCRETE GUTTER PAN.

7. ALL WORK LISTED ABOVE FOR INSTALLATION OF PULL BOXES SHALL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE PRICE OF THE CONDUIT.

8. CONDUIT UNDER ROADWAY SHALL BE LOCATED AT A DEPTH OF NOT LESS THAN 30 INCHES.

9. PULL BOX LID SHALL BE FLUSH TO 1/4" LOW OF FINAL GRADE.

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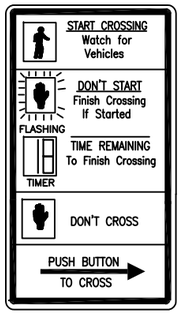
PULL BOX (SPECIAL)

ENGINEERING CONSTRUCTION STANDARDS

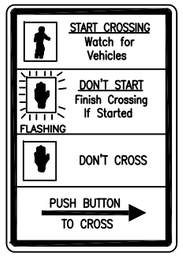
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TYPICAL PEDESTRIAN PUSH-BUTTON SIGNS

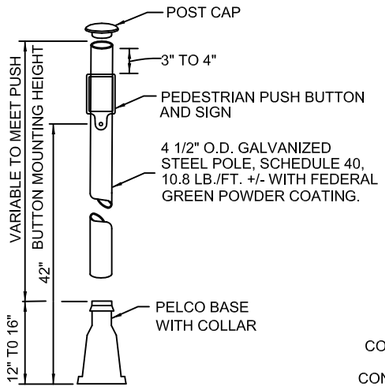
SIGN SHALL BE LABEL (STICK-ON) TYPE

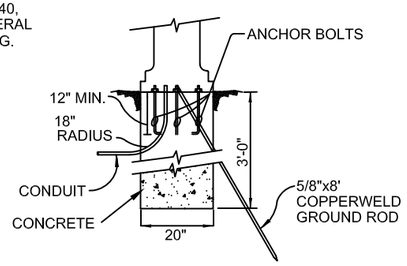


R10-3e
9"x15"
COUNTDOWN



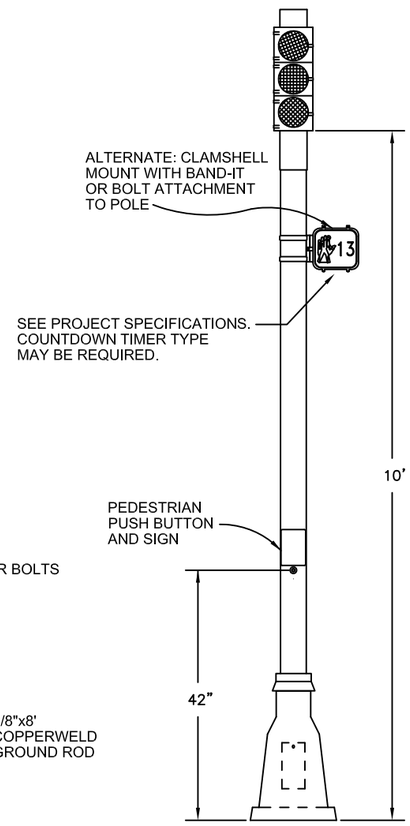
R10-3b
9"x12"
NON-COUNTDOWN

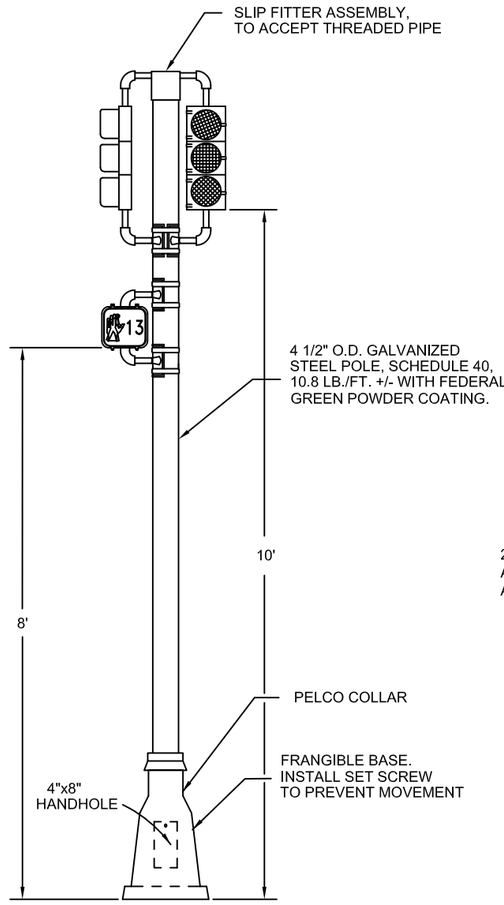




FOUNDATION DETAIL

PEDESTRIAN PUSH BUTTON POLE





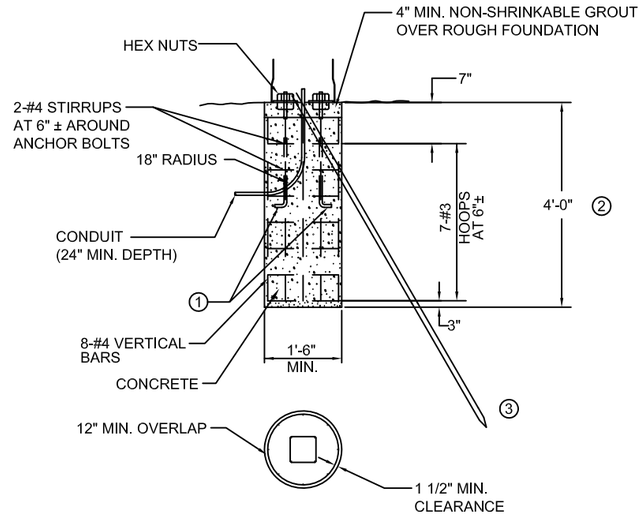
PEDESTAL POLE SHALL BE HOT DIPPED GALVANIZED PER ASTM A123, EQUIVALENT TO 2 OZ. PER SQUARE FOOT, INSIDE AND OUT

TYPICAL PEDESTAL POLE DETAIL

1/4" SPLIT PIN SHALL BE INSTALLED IN THE UPPER PORTION OF THE ALUMINUM BASE AND SHALL COMPLETELY PENETRATE BASE AND POLE TO SECURE POLE TO PREVENT MOVEMENT OR TWISTING. PELCO COLLAR TO BE INSTALLED.

FOOTING NOTES

1. ANCHOR BOLTS (FURNISHED WITH POLE) PER MANUFACTURER'S TEMPLATE.
2. CAISSON DESIGNS REQUIRE THAT THE CAISSON BE FOUNDED IN COMPACT SAND, CLAY OR SANDY CLAY. IF, BY VISUAL INSPECTION OF THE HOLE, OTHER MATERIAL IS PRESENT, THE CAISSON DESIGN SHALL BE MODIFIED AND APPROVED BY THE CONSTRUCTION MANAGER.
3. 5/8"x8' COPPERWELD GROUND ROD THROUGH FOUNDATION, INTO GROUND.
4. HAND HOLE SHALL BE PROVIDED.

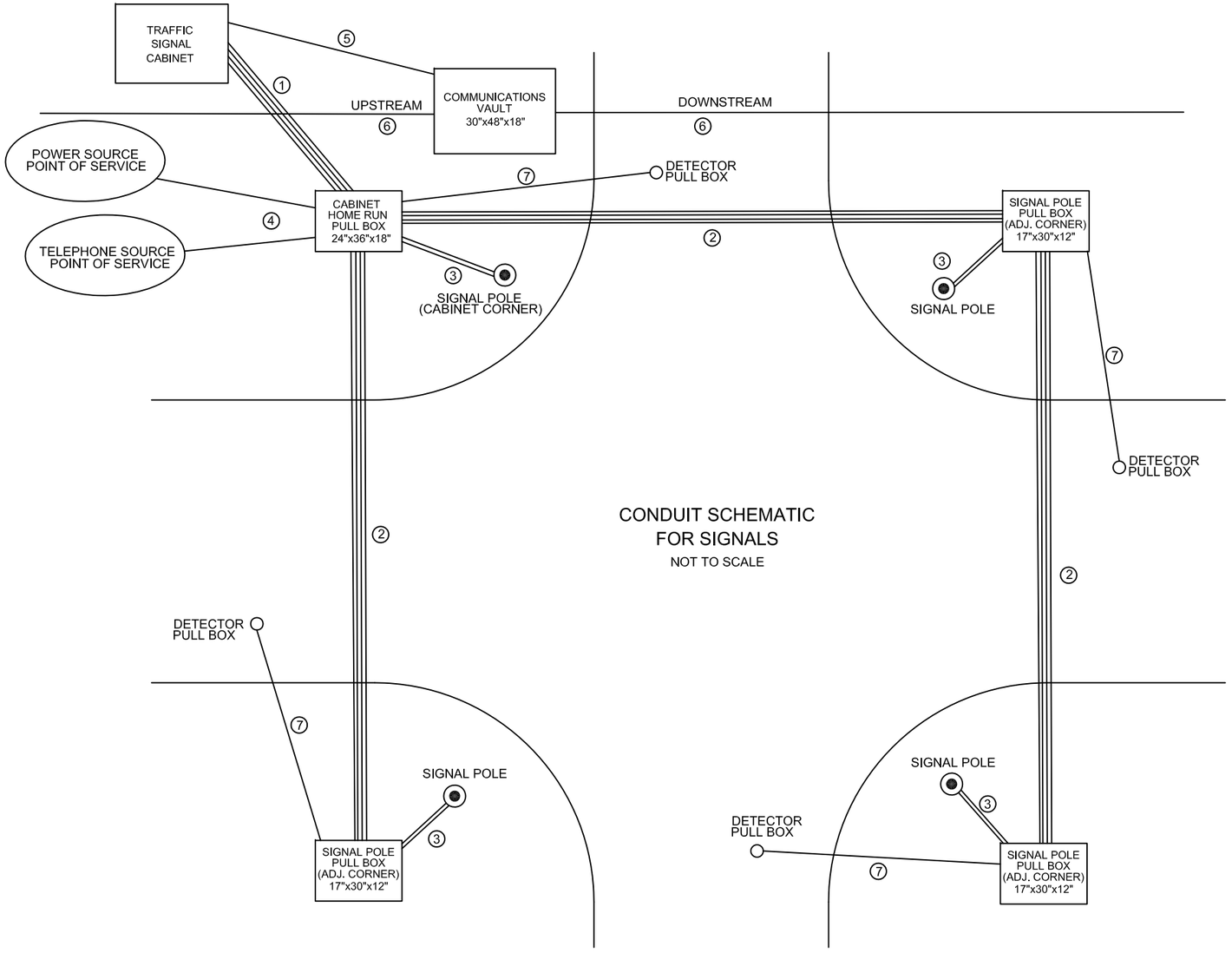


TYPICAL PEDESTAL POLE FOUNDATION

(CAST IN PLACE)

COMPUTER FILE INFORMATION		APPROVAL			DETAIL NO.
Creation Date: 03/10/2016	Initials: CJC				900-09
Last Modification Date: 5/4/2016	Initials: CJC				
Full Path: WWW.C3GOV.COM					
Drawing Name: $FILES$					
Scale: $SCALESHORT$	Units: ENGLISH	CITY ENGINEER	05-27-16 DATE	CITY OF COMMERCE CITY Department of Public Works 8602 Rosemary St. Commerce City, CO 80022 Ph: 303-289-8150	PEDESTRIAN POLE ENGINEERING CONSTRUCTION STANDARDS Sheet No. 1 of 1

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CONDUIT SCHEMATIC
FOR SIGNALS
NOT TO SCALE

RECOMMENDED CONDUIT/CABLE RELATIONSHIPS

① "CABINET HOME RUN PULL BOX" TO "TRAFFIC SIGNAL CABINET"
- 1 OF 1 - 2" CONDUIT: POWER FROM POINT-OF-SERVICE
- 1 OF 3 - 3" CONDUITS: LOW VOLTAGE & VIDEO
- 2 OF 3 - 3" CONDUITS: FIELD WIRING (120 VAC)
- 3 OF 3 - 3" CONDUITS: SPARE

② "CABINET HOME RUN PULL BOX" TO "SIGNAL POLE PULL BOX (ADJ. CORNER)"
"SIGNAL POLE PULL BOX (ADJ. CORNER)" TO "SIGNAL POLE PULL BOX (ADJ. CORNER)"
- 1 OF 1 - 2" CONDUIT: LUMINAIRE POWER
- 1 OF 3 - 3" CONDUITS: LOW VOLTAGE & VIDEO
- 2 OF 3 - 3" CONDUITS: FIELD WIRING (120 VAC)
- 3 OF 3 - 3" CONDUITS: SPARE

③ "CABINET HOME RUN PULL BOX" TO "SIGNAL POLE (CABINET CORNER)"
"SIGNAL POLE PULL BOX (ADJ. CORNER)" TO "SIGNAL POLE"
- 1 OF 1 - 2" CONDUIT: LUMINAIRE POWER
- 1 OF 1 - 3" CONDUITS: FIELD WIRING

④ "CABINET HOME RUN PULL BOX" TO "POINTS OF SERVICE"
- 1 OF 2 - 2" CONDUITS: POWER FROM POINT OF SERVICE
- 2 OF 2 - 2" CONDUITS: TELEPHONE FROM POINT OF SERVICE (IF REQUIRED)

⑤ "COMMUNICATIONS VAULT" TO "TRAFFIC SIGNAL CABINET":
- 1 OF 1 - 2" CONDUIT: INTERCONNECT

⑥ "COMMUNICATIONS VAULT" UPSTREAM/DOWNSTREAM:
- 1 OF 1 - 3" CONDUIT: INTERCONNECT

⑦ "CABINET HOME RUN PULL BOX" TO "DETECTOR PULL BOX"
"SIGNAL POLE PULL BOX (ADJ. CORNER)" TO "DETECTOR PULL BOX"
- 1 OF 1 - 2" CONDUIT: INDUCTANCE DETECTOR WIRING

NOTE: ⑦ IS SHOWN AS A REFERENCE ONLY. INSTALL ONLY IF REQUIRED IN THE CONSTRUCTION PLANS AND SPECIFICATIONS.

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Ph: 303-289-8150

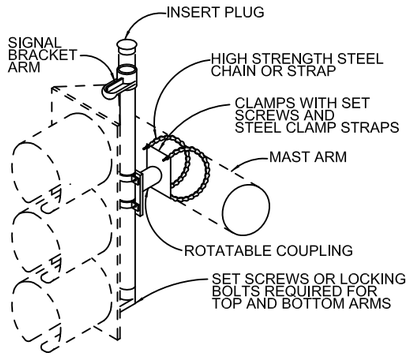
CONDUIT SCHEMATIC

ENGINEERING CONSTRUCTION STANDARDS

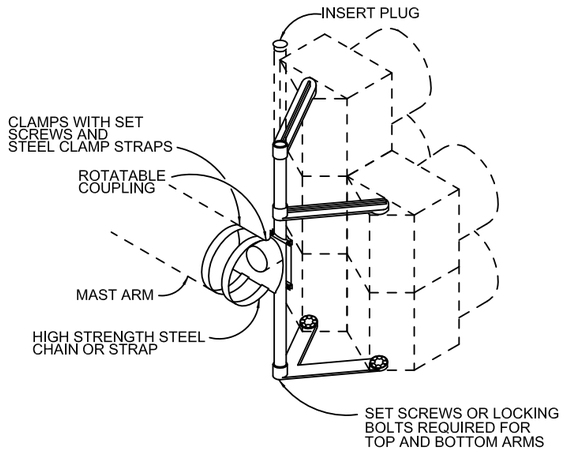
DETAIL NO. 900-10

Sheet No. 1 of 1

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DETAIL OF MAST ARM MOUNTING
FOR IN-LINE SIGNAL HEAD
(3-SECTION OR 5-SECTION)

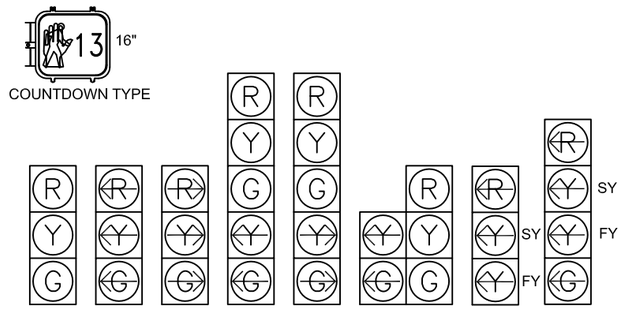


DETAIL OF MAST ARM MOUNTING
FOR SIDE-BY-SIDE SIGNAL HEAD
(5-SECTION)

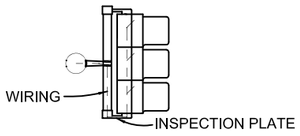
NOTES

ALL VEHICLE SIGNAL HEADS SHALL BE POLYCARBONATE WITH 12" SECTIONS AND TUNNEL VISORS.

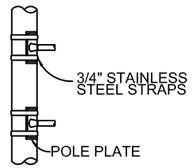
ALL VEHICLE AND PEDESTRIAN SIGNAL HEADS SHALL BE LED TYPE AND BLACK IN COLOR, WITH THE EXCEPTION OF THE SIDE OF POLE SIGNALS. SIDE OF POLE SIGNALS SHALL HAVE RED BULBS. PEDESTRIAN HEADS SHALL BE COUNTDOWN TYPE.



PEDESTRIAN AND VEHICLE SIGNAL HEADS



WIRING DIAGRAM



TYPICAL SIDE OF POLE
SIGNAL MOUNTING

MOUNTING NOTES

1. PIPE COUPLINGS FOR SIGNAL BRACKETS SHALL BE EITHER 1-1/2 OR 2 INCH DEPENDING UPON THE SIGNAL HEAD TO BE INSTALLED. SIGNAL BRACKETS SHALL BE FURNISHED BY THE MANUFACTURER OF THE SIGNAL HEADS.
2. UNLESS OTHERWISE SPECIFIED, ALL TRAFFIC SIGNALS MOUNTED ABOVE THE ROADWAY SHALL HAVE A HEIGHT OF 17' TO 19' ABOVE THE PAVEMENT GRADE AT THE ROADWAY CENTER. ALL SIDE-OF-POLE MOUNTED TRAFFIC SIGNALS SHALL HAVE A HEIGHT OF 10' ABOVE GROUND LINE AND PEDESTRIAN SIGNALS SHALL HAVE A HEIGHT OF 8' ABOVE GROUND LINE AS MEASURED TO THE BOTTOM OF THE SIGNAL HEAD HOUSING OR BRACKET.
3. MAST ARM MOUNTED SIGNAL HEADS SHALL USE ASTRO-BRAC's OR SKY-BRAC. ALL SIGNAL HEADS SHALL BE MOUNTED IN SUCH A MANNER AS TO BE EASILY REMOVED FROM THEIR SUPPORTING STRUCTURE.
4. GASKET SEALING COMPOUND SHALL BE USED IN ADDITION TO ANY LEAD WASHERS REQUIRED FOR CREATING A WATER-TIGHT CONNECTION BETWEEN THE SIGNAL HEAD AND MOUNTING BRACKET.
5. SIGNAL HEADS SHALL BE SECURELY AFFIXED BY USE OF A SERRATED COUPLING OR OTHER ACCESSORIES RECOMMENDED BY THE SIGNAL MANUFACTURER.
6. WIRING FROM INSIDE MAST ARM THROUGH A 1" FIELD DRILLED HOLE IN ARM SHALL BE BROUGHT THROUGH THE MOUNTING SUPPORT TUBE AND LOWER ARM (AS SHOWN). FIELD DRILLED HOLES SHALL HAVE RUBBER GROMMETS INSTALLED.

GENERAL WIRING NOTES

1. TRAFFIC SIGNAL CONDUIT SHALL NOT CARRY WIRING OF OTHER UTILITIES.
2. EXCEPT FOR LOOP DETECTOR LEADS, ALL SPLICES SHALL BE IN HAND HOLES AT POLE BASES AND NOT IN PULL BOXES.
3. PEDESTRIAN AND VEHICLE SIGNAL HEADS SHALL BE INDIVIDUALLY WIRED FROM THE POLE BASE TO THE SIGNAL HEAD.
4. CONTRACTOR SHALL PROVIDE 2 WIRING DIAGRAMS OF THE SIGNAL INSTALLATION TO THE CITY.
5. UNLESS ALLOWED BY THE ENGINEER, WIRE SHALL NOT OCCUPY MORE THAN 40% OF THE INSIDE AREA OF CONDUIT.

COMPUTER FILE INFORMATION	
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8602 Rosemary St.
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Ph: 303-289-8150

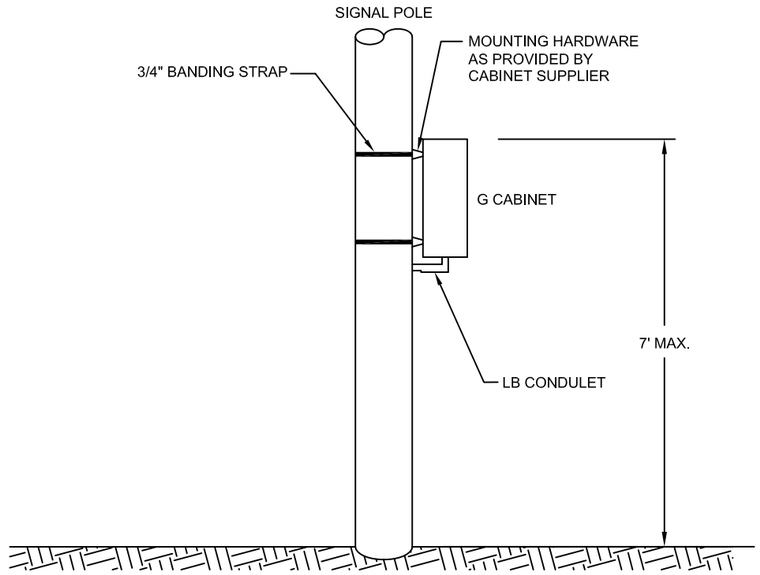
SIGNAL HEAD MOUNTING

ENGINEERING CONSTRUCTION STANDARDS

DETAIL NO. 900-11

Sheet No. 1 of 1

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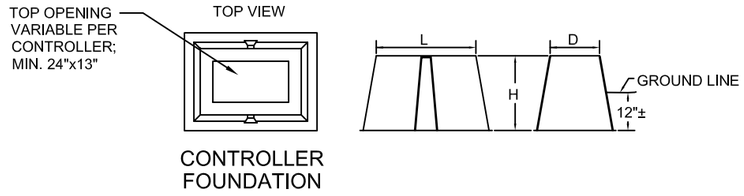
TYPICAL SIDE-OF-POLE MOUNTED
CONTROLLER CABINET

NOTES

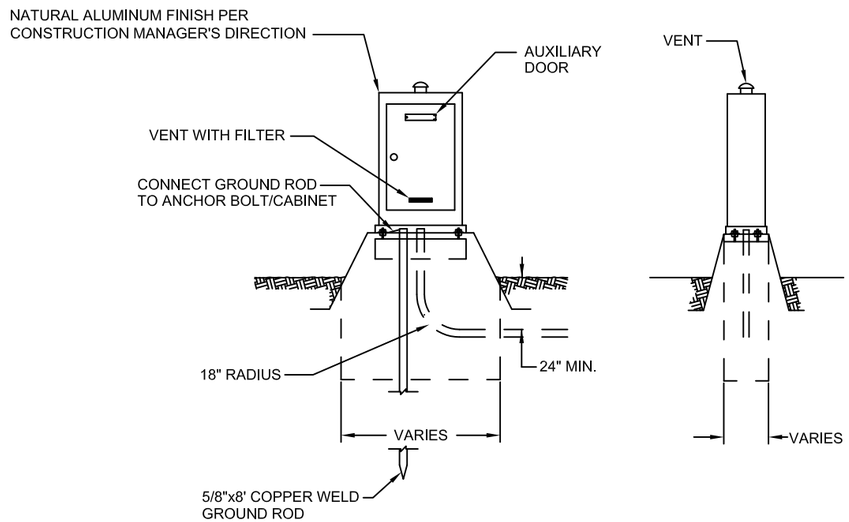
AN UNINTERRUPTABLE POWER SUPPLY (UPS) SHALL BE INSTALLED WITH THE CONTROLLER EQUIPMENT. SEE SPECIFICATIONS.

CABINET FOUNDATION

	L	D	H
P CABINET	44"	26"	24"



CONTROLLER
FOUNDATION



TYPICAL BASE MOUNTED CONTROLLER CABINET
INSTALLATION AND FIBERGLASS FOUNDATION

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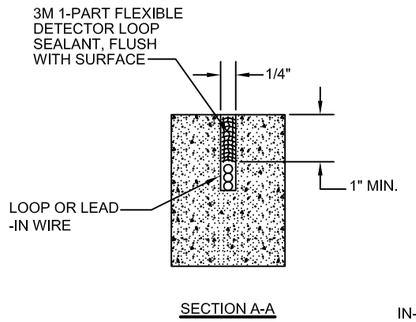
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Department of Public Works
8602 Rosemary St.
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Ph: 303-289-8150

CONTROLLER CABINET

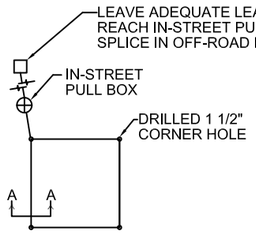
ENGINEERING CONSTRUCTION STANDARDS

DETAIL NO. 900-12

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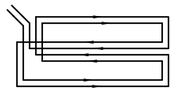


SECTION A-A

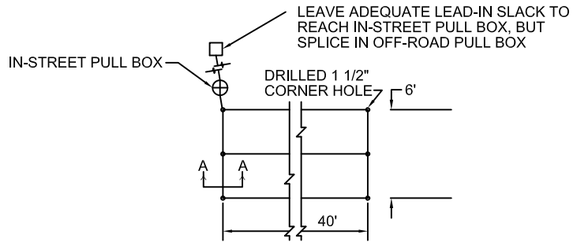


TYPICAL 6'x6'
LOOP

LOOP TURNS	
SIZE OF LOOP	NUMBER OF TURNS
6' X 6'	4
6' X 8' TO 6' X 20'	3
6' X 22' TO 6' X 40'+	2
THE NUMBER OF TURNS MAY BE ADJUSTED BY THE ENGINEER IN THE FIELD. WIRING CONNECTIONS TO BE FIELD DETERMINED.	



QUADRAPOLE WIRING

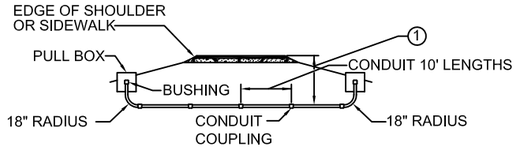


TYPICAL 6'x40'
QUADRAPOLE LOOP

LOOP SAW CUT AND INSTALLATION

NOTES

1. IMMEDIATELY BEFORE LAYING THE LOOP CABLE, THOROUGHLY CLEAN AND DRY SAW CUT WITH HIGH PRESSURE COMPRESSED AIR.
2. LOOP WIRE IN ADJACENT LOOPS SHALL BE LAID UNIFORMLY IN EITHER A CLOCKWISE OR COUNTER-CLOCKWISE DIRECTION AND THE LOOP TAGGED TO INDICATE THE DIRECTION.
3. USE A BLUNT, NON-METALLIC INSTRUMENT TO PUSH WIRE INTO SLOT.
4. LOOP WIRE SHALL BE CONTINUOUS (NO SPLICES) FROM THE PULL BOX. SPLICES IN PULL BOX SHALL BE WATERPROOFED WITH 3M SPLICE KIT.
5. CONTINUITY TEST FOR EACH LOOP SHALL BE CONDUCTED 1) BEFORE ANY LOOP SEALER IS INSTALLED AND 2) AFTER LOOP SEALER IS INSTALLED AND LEAD-IN CABLE IS SPLICED AND TRAINED TO THE CONTROLLER. "RESISTANCE-TO-GROUND" AND "INDUCTANCE" SHALL BE MEASURED AND RECORDED FOR EACH TEST.



CONDUIT PLACEMENT UNDER PAVEMENT OR SIDEWALK

NOTES

(1)	MINIMUM CONDUIT DEPTH:	UNDER PAVEMENT 30"	UNDER SIDEWALK 24"

ALL PVC CONDUIT SHALL BE SCHEDULE 80

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CONDUIT DETAILS

ENGINEERING CONSTRUCTION STANDARDS

DETAIL NO. 900-13

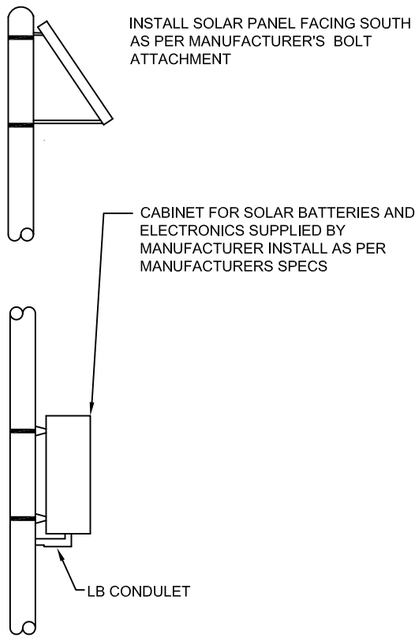
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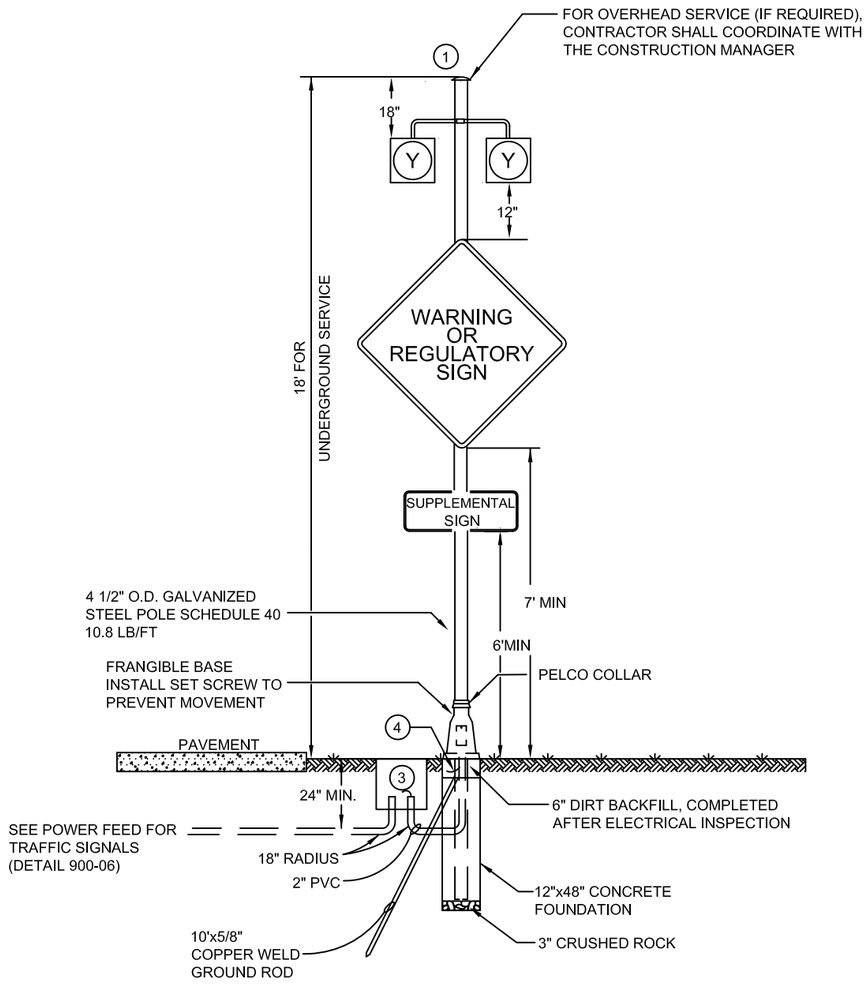
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FLASHING BEACONS

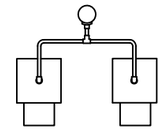
ALL FLASHING BEACONS SHALL BE 12" POLYCARBONATE WITH TUNNEL VISORS AND BLACK HOUSINGS

OPTIONAL SOLAR

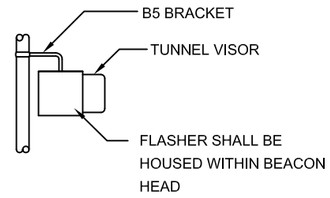




BEACON TOP VIEW



BEACON SIDE VIEW

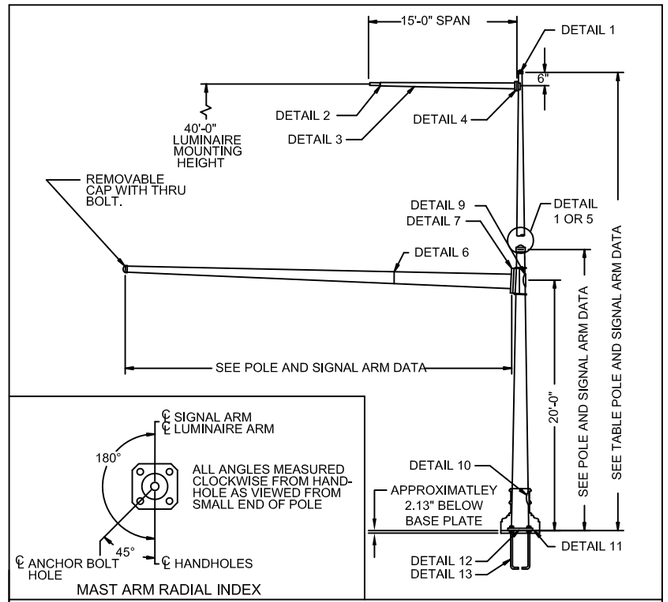


NOTES

1. WATERTIGHT GALVANIZED STEEL POLE CAP
2. LEAVE MINIMUM OF 8' COILED WIRE FOR UTILITY COMPANY CONNECTION AT UTILITY DEMARCATION POINT
3. PROVIDE CONDUIT AND PULL BOX FOR UNDERGROUND SERVICE ONLY
4. BONDING STRAP IN BACKFILL

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Last Modification Date: 5/4/2016	Initials: CJC				
Full Path: WWW.C3GOV.COM				ENGINEERING CONSTRUCTION STANDARDS	Sheet No. 1 of 1
Drawing Name: $FILES$					
Scale: $SCALESHORT$	Units: ENGLISH	CITY ENGINEER 05-27-16 DATE			



MAST ARM RADIAL INDEX

COMMERCE CITY, COLORADO POLE SERIES

MATERIAL DATA

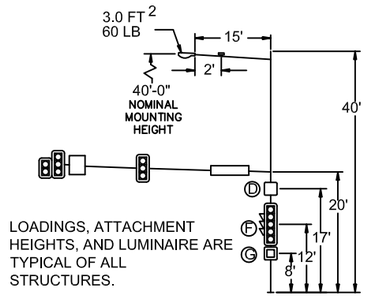
COMPONENT	ASTM DESIGNATION	MIN. YIELD (KSI)	COMPONENT	ASTM DESIGNATION	MIN. YIELD (KSI)
POLE SHAFT (OTHER)	A595 GR. A	55	LUM. ARM ATTACHMENTS	A36	36
POLE SHAFT .250,.188	A572 GR. 65	65	MAST ARM ATTACHMENTS	A36	36
ARM SHAFT .219,.250,.281	A572 GR. 65	65	MAST ARM CONN. BOLT	A325	-
ARM SHAFT (OTHER)	A595 GR. A	55	LUM. CONNECTION BOLT	A307	-
ANCHOR BOLTS	F1554	55	GALVANIZING HARDWARE	A153	-
POLE BASE	A36	36	GALVANIZING STRUCTURES	A123	-

FINISH:PAINT OVER GALVANIZED
BASE COAT:HOT DIP GALVANIZE TO ASTM 123
FINISH COAT: TGIC OR URETHANE POLYESTER POWDER
VALMONT SPEC.: F-283CL
COLOR:FEDERAL GREEN

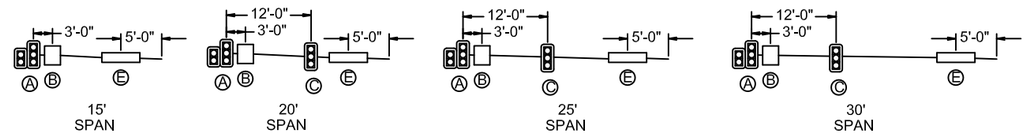
CC - 24.5 - 40 - 65 - 15

- 15 — LUMINAIRE LENGTH
- 65 — MAST ARM LENGTH
- 40 — LUMINAIRE MOUNTING HEIGHT: 40'-0"
- 24.5 — BASE POLE LENGTH
- CC — COLORADO POLE SERIES

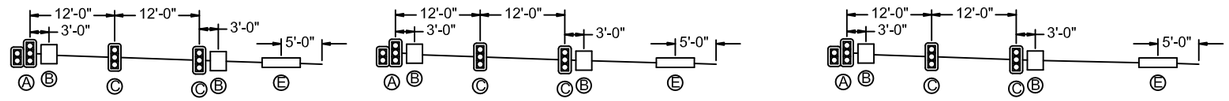
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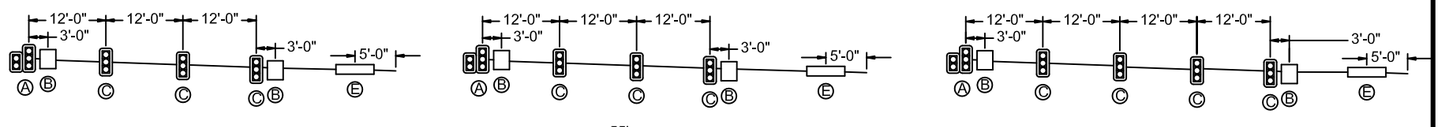
LOADINGS, ATTACHMENT HEIGHTS, AND LUMINAIRE ARE TYPICAL OF ALL STRUCTURES.



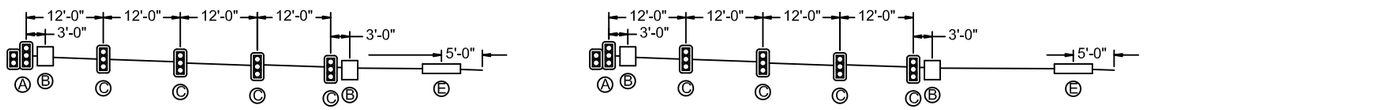
15' SPAN | 20' SPAN | 25' SPAN | 30' SPAN



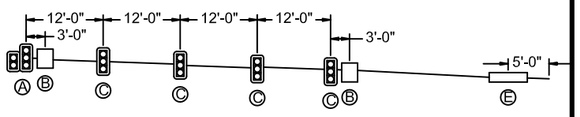
35' SPAN | 40' SPAN | 45' SPAN



50' SPAN | 55' SPAN | 60' SPAN



65' SPAN | 70' SPAN



75' SPAN

DEVICE	DESCRIPTION	PROJ.AREA (FT^2)	WEIGHT (LBS)
Ⓐ	12"-5 SEC. SIGNAL WITH BACKPLATE	13.72	71
Ⓑ	30" X 36" REGULATORY SIGN	7.50	25
Ⓒ	12"-3 SEC. SIGNAL WITH BACKPLATE	8.67	38
Ⓓ	24" X 30" REGULATORY SIGN	5.00	15
Ⓔ	20" X 96" INT. ILLUM. STREET SIGN	13.33	125
Ⓕ	DUAL SIGNALS	13.61	142
Ⓖ	DOUBLE 16" PED SIGNALS	8.00	80

REV	DRAWN BY–DATE	CHECK BY–DATE	DESCRIPTION
B	MRL1 12/15/06	MRL1 12/15/06	REVISED DECORATIVE BASE COVERS
A	MRL1 04/15/06	MRL1 04/15/06	ADDED DECORATIVE BASES
—	MRL1 11/22/05	MRL1 11/23/05	— — — — — — — — — — — —

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REV: B

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APPROVAL

CITY ENGINEER — DATE 05-27-16

CITY OF COMMERCE CITY
Department of Public Works
8602 Rosemary St.
Commerce City, CO 80022
Ph: 303-289-8150

MASTARM POLES

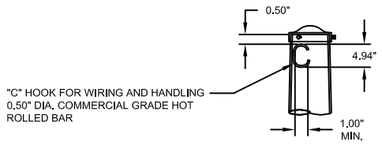
ENGINEERING CONSTRUCTION STANDARDS

DETAIL NO. 900-15A

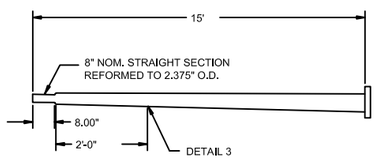
Sheet No. 1 of 1

POLE AND SIGNAL ARM DATA

ARM SPAN (FT)	POLE TUBE				POLE BASE				ANCHOR BOLT				SIGNAL ARM DATA									POLE TOP EXTENSION			
	BASE DIA. (IN)	TOP DIA. (IN)	LENGTH (FT)	GAUGE OR THK. (IN)	SQUARE "S" (IN)	BOLT CIRCLE "Y" (IN)	THK. "M" (IN)	HOLE "Z" (IN)	DIA. "K" (IN)	LENGTH "J" (IN)	HOOK "H" (IN)	THREAD LENGTH "U" (IN)	PLATE SHAPE "A" X "A"	BOLT PATTERN "B" X "B"	POLE PLATE THICK "C" (IN)	GUSSET THICK "D" (IN)	CONNECTION BOLT "F"	QTY. OF BOLTS	FIXED END DIA. (IN)	FREE END DIA. (IN)	GAUGE OR THICK (IN)	SPAN (FT)	BASE DIA. (IN)	TOP DIA. (IN)	WALL THICK (IN)	LENGTH (FT)
15.00	14.50	11.07	24.50	0.250	23.00	23.00	2.00	2.00	1.75	84.00	6.00	8.00	19.25 X 19.25	16.00 X 16.00	1.50	0.375	1.25"-7UNC X 3.25" LONG	4	7.00	4.90	7	15.00	11.78	9.47	0.1793	18.04
20.00																			8.00	5.20	7	20.00				
25.00																			10.00	6.50	7	25.00				
30.00																			10.50	6.30	7	30.00				
35.00																			11.00	6.10	3	35.00				
40.00	16.00	12.57	24.50	0.250	23.00	23.00	2.00	2.00	1.75	84.00	6.00	8.00	22.25 X 22.25	18.50 X 18.50	1.75	0.438	1.50"-7UNC X 3.75" LONG	4	12.50	6.90	3	40.00	13.33	10.77	0.1875	18.23
45.00																			13.00	6.70	3	45.00				
50.00																			13.00	6.36	DET.6	50.00				
55.00																			13.34	6.00	DET.6	55.00				
60.00	19.00	15.50	25.00	0.250	25.00	25.00	2.00	2.25	2.00	84.00	6.00	10.00	26.75 X 26.75	23.00 X 23.00	2.25	0.500	1.50"-7UNC X 4.50" LONG	4	14.04	6.00	DET.6	60.00	16.31	13.77	0.1875	18.11
65.00																			14.74	6.00	DET.6	65.00				
70.00																			15.44	6.00	DET.6	70.00				
75.00																			16.14	6.00	DET.6	75.00				



DETAIL 1 — POLE TOP

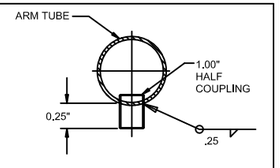


ARM RISE AFTER LOADING IS BETWEEN -0° DEG. +2° DEG FROM THE HORIZONTAL.

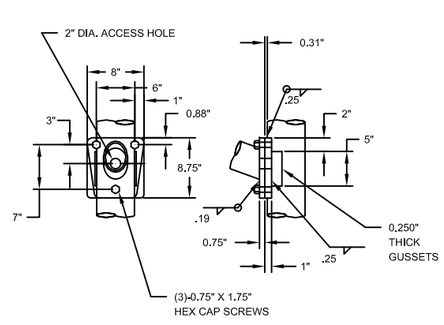
ARM SPAN (FT)	FIXED END DIA. (IN)	FREE END DIA. (IN)	GA.
15	4.50	2.38	11

DETAIL 2 — LUMINAIRE ARM DATA

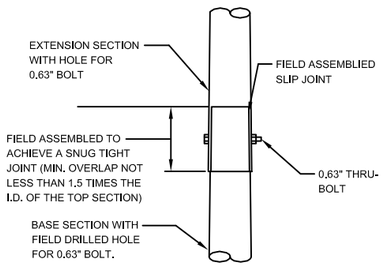
NOTE: ONLY TO BE SUPPLIED ON IDENTIFIED LUMINAIRE ARMS.



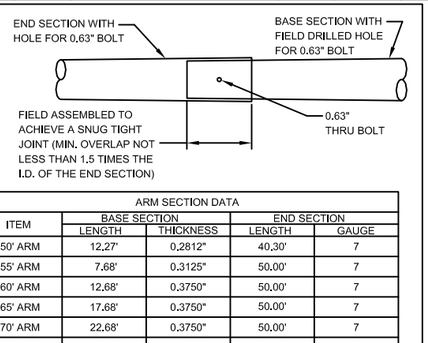
DETAIL 3 — COUPLING



DETAIL 4 — LUMINAIRE ARM ATTACHMENT

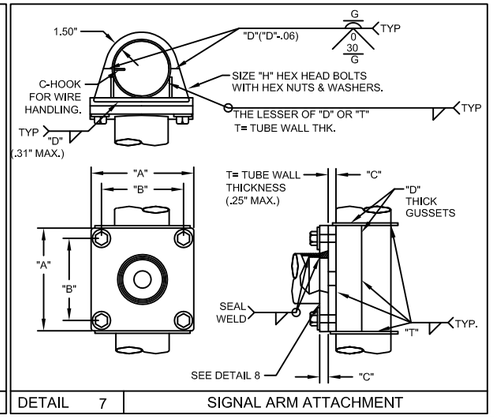


DETAIL 5 — POLE TOP EXTENSION

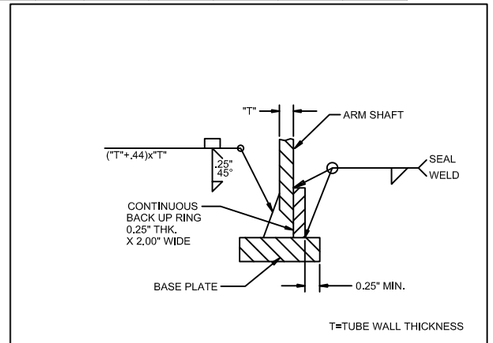


ARM SECTION DATA				
ITEM	BASE SECTION		END SECTION	
	LENGTH	THICKNESS	LENGTH	GAUGE
50' ARM	12.27'	0.2812"	40.30'	7
55' ARM	7.68'	0.3125"	50.00'	7
60' ARM	12.68'	0.3750"	50.00'	7
65' ARM	17.68'	0.3750"	50.00'	7
70' ARM	22.68'	0.3750"	50.00'	7
75' ARM	27.68'	0.3750"	50.00'	7

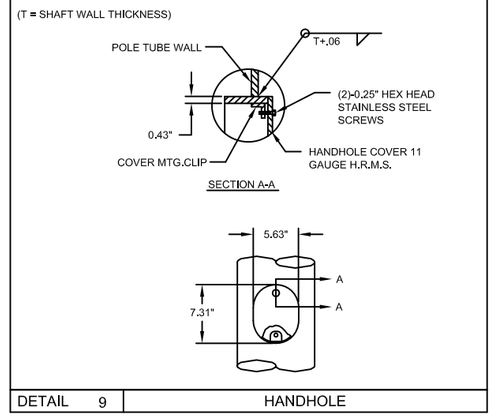
DETAIL 6 — SIGNAL ARM SLIP JOINT



DETAIL 7 — SIGNAL ARM ATTACHMENT



DETAIL 8 — ARM PLATE WELD



DETAIL 9 — HANDHOLE

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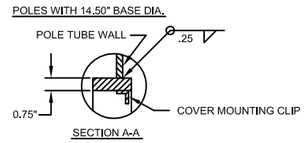
ENGINEERING CONSTRUCTION STANDARDS

DETAIL NO. 900-15B

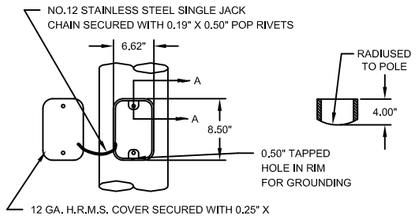
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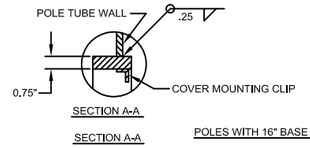
NOTE: HAND HOLES ON THE 14.50" AND 19.00" BASE POLES WILL BE SEMI-FLUSH. hAND HOLES ON 16" BASE POLES WILL BE FLUSH.

POLES WITH 14.50" BASE DIA.



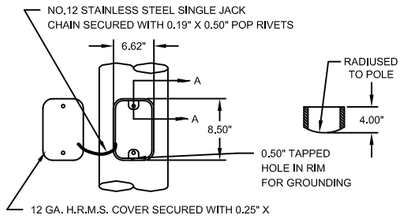
SECTION A-A

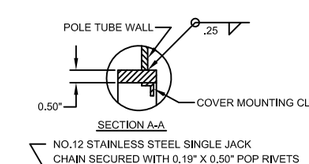




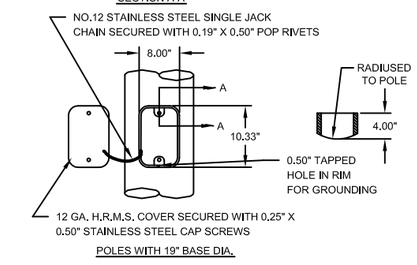
SECTION A-A

POLES WITH 16" BASE DIA.





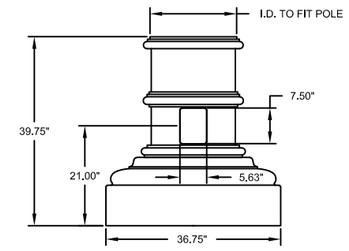
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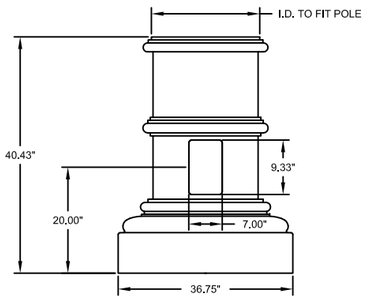
POLES WITH 19.00" O.D. BASE

DETAIL 10	LOWER HANDHOLE

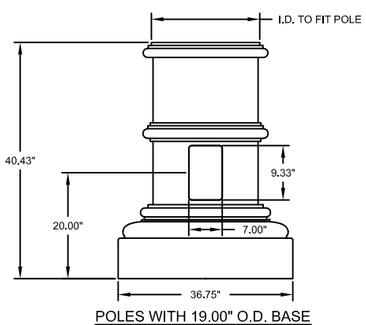
NOTE: ALL DIMENSIONS NOMINAL.



POLES WITH 14.50" O.D. BASE

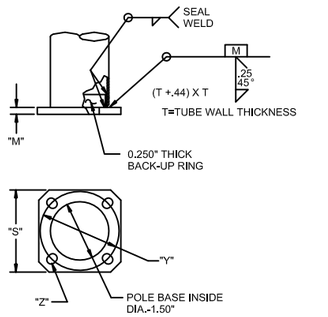


POLES WITH 16.00" O.D. BASE



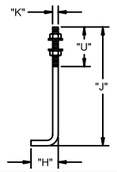
POLES WITH 19.00" O.D. BASE

DETAIL 11	DECORATIVE BASE COVERS



DETAIL 12	POLE BASE

(4)-ANCHOR BOLTS WITH (2) HEX NUTS AND (2) WASHERS PER BOLT WITH THREADED END GALVANIZED AT LEAST 12".



DETAIL 13	ANCHOR BOLT

THESE TRAFFIC SIGNAL SUPPORT STRUCTURES ARE DESIGNED IN ACCORDANCE WITH LOADING AND ALLOWABLE STRESS REQUIREMENTS OF 2001 AASHTO "STANDARDS SPECIFICATION FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", FOURTH EDITION. WIND LOADS ARE BASED ON A BASIC WIND SPEED OF 100 MPH WITH A RECURRENCE INTERVAL OF 50 YEARS, AND A FATIGUE CATEGORY OF II. FATIGUE LOADS ARE BASED ON THE REQUIREMENTS OF SECTION 11.7 AND THE FOLLOWING DESIGN LOADS:

VORTEX SHEDDING: NOT APPLICABLE FOR STRUCTURES WITH A TAPER OF AT LEAST 0.14 IN/FT, PER AASHTO.

NATURAL WIND GUSTS: THE YEARLY MEAN WIND SPEED FOR NATURAL WIND GUSTS WILL BE ASSUMED TO BE 11.2 MPH.

GALLOPING: STRUCTURES ARE NOT DESIGNED TO RESIST PERIODIC GALLOPING FORCES.

TRUCK-INDUCED GUST: STRUCTURES ARE DESIGNED TO INCLUDE TRUCK-INDUCED GUSTS. (THE SPECIFIED AVERAGE TRUCK SPEED IS 65 MPH)

AASHTO 2001 SPECIFICATIONS

NOTE: THE HAND HOLES IN THE TRAFFIC POLES WILL BE MOUNTED TO CORRESPOND TO THE HAND HOLE OPENINGS IN THE DECORATIVE BASES.

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MASTARM POLES

ENGINEERING CONSTRUCTION STANDARDS

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900-15C

Sheet No. 1 of 1

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