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Appendix A

Table 2.07-1 Street Rights of Way



Figure 2.10-1 Sight Distance Triangle Setbacks

Appendix B

Construction Plans Checklist
Schedule for Quality Control Sampling and Testing

Appendix C

City of Evans Application and Permit for Excavation/Construction in Public Right of Way



SECTION 1 GENERAL PROVISIONS

1.01 AUTHORITY

These standards are promulgated by the City Council of the City of Evans, Colorado, in accordance with the authority contained in Chapter 18.32 of the City of Evans Municipal Code.

Interpretation, enforcement, and revision of these standards have been delegated to the Director of Public Works or his authorized representative.

1.02 APPLICATION

These standards supersede all former engineering standards for streets which are or may be in conflict with these standards.

1.03 AMENDMENT - NOTICE

These standards may be revised, amended, or added to from time to time, and such revision, additions, or amendments shall be binding and of full force and effect as of the date of their publication. It is the responsibility of all holders of these specifications to ensure that the set in use is the current issue.

1.04 DEPARTMENT CONTROL

These standards are composed of written standards of engineering practice, materials specifications, and standard drawings. Interpretation of each section or of any discrepancies between sections shall be made by the Director of Public Works.

1.05 DEFINITIONS

Wherever the following words or phrases appear in these specifications they shall have the following meanings.

- A. ABILITY - that which a person can do on the basis of present development and training.
- B. ACCEPTANCE TESTING - shall mean a test that will be performed by the contractor or its authorized representative according to City's specifications. Acceptance tests shall include but not be limited to the following: CONCRETE - slump, compressive strength, air content, and aggregate sieve analysis tests, SOILS - moisture/density relationship and density tests, AGGREGATE BASE COURSE -moisture density relationship and density tests, HOT BITUMINOUS PAVEMENT tests.
- C. APPROVED EQUAL - alternate equipment of materials
- D. BASE COURSE - the layer or layers of specified or selected material placed on a sub-base or a subgrade to support a surface course.
- E. CDOT Standard Specifications - Colorado Department of Transportation, "Standard Specifications for Road and Bridge Construction" latest edition.
- F. CITY - The City of Evans.
- G. CONSTRUCTION DRAWINGS - detailed and working drawings including plan, profile, and detail sheets of proposed utility improvements approved by the City.
- H. CONSULTANT - the partnership, corporation, or individual who is a Registered Professional Engineer in the State of Colorado hired by the owner and is empowered to act as his agent for the project.

1.05 DEFINITIONS (continued)

- I. CONTRACT DOCUMENTS - The Contract Documents include these Standard Specifications, City approved Soils and Pavement Report and Drawings, and City approved revisions.
- J. CONTRACTOR - the corporation, association, partnership, or individual who has entered into an agreement with the owner/Developer to perform the work, and who is licensed and bonded in the City of Evans in accordance with the requirements of the City Code, for public right-of-way work.
- K. DAYS - intended as calendar days, not normal working days, unless stipulated as working days.
- L. DESIGN SPEED - a speed determined for design and correlation of the physical features of a street that influence vehicle operation; the maximum safe speed maintainable on a specified section of street when conditions permit design features to govern. Design speed is generally higher than the posted speed limit in order to provide a factor of safety and consider other conditions or uses of the street that may affect vehicle operation.
- M. DEVELOPER - the owner, corporation, association, partnership, or individual who has entered into an agreement with the City and has entered into an agreement with the contractor to perform the work.
- N. DIVISION - when referred to in the CDOT Standard Specifications shall mean the City of Evans Public Works Department.
- O. DRIVEWAY APPROACH - that portion of pavement extending from the street gutter lip to the property line for the full width of the access from the public right-of-way to private property.
- P. ENGINEER - a term used in situations where a decision or action may be required by the Public Works Department of the City of Evans. The Engineer shall have the authority on behalf of the City to ascertain that all design and construction is equal to or exceeds the minimum requirements set forth in these criteria and standards.
- Q. EYEBROW - a bulb or semi-circular extension of a curb on one side of a street or at an intersection to provide more frontage for adding more lots.
- R. LETTER OF FINAL ACCEPTANCE - At the expiration date of the warranty period and after all deficiencies are corrected to the satisfaction of the Director of Public Works, a Letter of Final Acceptance will be issued.
- S. LETTER OF INITIAL ACCEPTANCE - At the end of the project and after all deficiencies are corrected to the satisfaction of the Director of Public Works a Letter of Initial Acceptance will be issued and shall constitute the initiation of the warranty period.
- T. MAY - a permissive condition. No requirement for design or application is intended.
- U. MEDIAN RADII - the minimum radius for curbing when used for street medians; measured to flow line.
- V. NORMAL WORKING DAYS - Monday through Friday. Saturdays, Sundays, and legal Holidays shall not be considered normal working days.
- W. OWNER - the developer, corporation, association, partnership, or individual who has entered into an agreement with the City, and has entered into an agreement with the contractor to perform the work.
- X. PLANS - detailed and working drawings including plan, profile, and detail sheets of proposed utility improvements, approved by the City.

1.05 DEFINITIONS (continued)

- Y. PROJECT AS-BUILT RECORD DRAWINGS - Detailed drawings which have been prepared and sealed by the Design Engineer, upon completion and at the time of the certificate of completion, and show actual construction and contain field dimensions, elevations, details, changes made to the construction drawings by modification, details which were not included on the construction drawings, and horizontal and vertical locations of underground utilities which have been impacted by the utility installation.
- Z. PROJECT REPRESENTATIVE - shall mean an authorized representative of the City assigned to complete project inspection for contract performances, standards, and contract compliance.
- AA. PROVIDE - furnish and install complete in place.
- BB. QUALIFIED - acquired abilities: skill, knowledge, experience, that fits a person for a position, office, or profession.
- CC. REMOVE - remove and dispose of legally.
- DD. ROAD OR STREET - as used in this specification shall include the pavement section, right-of-way, sidewalks, driveways, bikeways, alleys, and alley approaches.
- EE. SHALL - a mandatory condition. Where certain requirements in the design of application are described with the "shall" stipulation, it is mandatory that these requirements be met.
- FF. SHOULD - an advisory condition. Where the word "should" is used, it is considered to be advisable usage, but not mandatory. Deviations may be allowed when reasons are given which show that the intent of the standard is met.
- GG. STOPPING SIGHT DISTANCE - shall mean that distance measured from the driver's eye, 3½ feet above the pavement to the top of any object 6 inches high on the pavement anywhere on the road.
- HH. STREET - as used in this specification shall include the pavement section, right-of-way, sidewalks, driveways, bikeways, alleys, and alley approaches.
- II. STREET STANDARD SPECIFICATIONS - the current City of Evans Design Criteria and Construction Specifications for Streets.
- JJ. STREET WIDTH - that distance measured from curb face to curb face across a street which should generally include the gutter pans on each side.
- KK. SUB-BASE - the layer or layers of specified or selected material placed on a subgrade to support a base course, surface course, or both.
- LL. SUBGRADE - the top surface of a roadbed upon which the pavement structure, shoulders, and curbs are constructed.
- MM. SURFACE COURSE - one or more layers of a pavement structure designed to accommodate the traffic load, the top layer of which resists skidding, traffic abrasion, and the disintegrating effects of climate. The top layer is sometimes called "Wearing Course."
- NN. UTILITIES - shall mean all utilities on site prior to the time of any design; such as but not limited to water lines, sanitary sewer lines, drainage lines, electric lines, gas lines, telephone lines, and cable television lines.

1.05 DEFINITIONS (continued)

- OO. WORK - the entire completed construction or the various separately identifiable parts required to be furnished for the project. Work is the result of performing services, furnishing the labor and furnishing and incorporating materials and equipment into the construction.
- PP. WORKING DAYS - Any day, exclusive of Saturdays, Sundays, and holidays, on which weather and other conditions not under the control of the contractor will permit construction operations to proceed with the normal working force engaged in performing those items controlling the completion of the work.
- QQ. WORKING HOURS - The contractor shall restrict working hours to between 7:00 a.m. and 5:00 p.m. on normal city of Evans business days unless prior approval has been obtained from the city.

1.06 ABBREVIATIONS

Wherever the following abbreviations appear in these specifications they shall have the following meanings.

- A. AASHTO - American Association of State Highway and Transportation Officials
- B. ACI - American Concrete Institute
- C. ADA - Americans with Disabilities Act
- D. ADT - Average Daily Traffic
- E. AWWA - American Water Works Association
- F. ASTM - The American Society for Testing Materials
- G. CDOT - Colorado Department of Transportation
- H. CDOT STANDARDS - Colorado Department of Transportation "Standard Specifications for Road and Bridge Construction", latest edition
- I. FHWA - Federal Highway Administration
- J. HBP - hot bituminous pavement
- K. IES - Illuminating Engineering Society
- L. ISD - intersection sight distance
- M. ISSA - International Slurry Seal Association
- N. l.f. - linear feet
- O. mph - miles per hour
- P. MUTCD - Manual of Uniform Traffic Control Devices
- Q. PE - Professional Engineer
- R. PMSC - plant-mix seal coat
- S. psi - pounds per square inch



1.06 ABBREVIATIONS (continued)

- T. RAP - reclaimed asphalt pavement
- U. ROW - Right of Way
- V. TCP - Traffic Control Plan
- W. VPI - vertical point of intersection



SECTION 2 MINIMUM DESIGN CRITERIA

2.01 SCOPE

The purpose of this section is to present the City of Evans criteria for the design of streets. It is to be used by developers, design architects, and design engineers in the design of public and private streets for which approval by the City of Evans Public Works Department is required. All street design, layout, alignment, and classification shall conform to these design criteria, the City of Evans Subdivision Regulations, Comprehensive Plan, and Chapter 18.32 of the Evans Municipal Code.

2.02 INTENT

City's review and approval will only be to determine if the plans, specifications, and construction conform to the City's requirements. City's review and approval will not relieve the design professional and contractor/owner from responsibility for any variation from the City requirements or adequate design standards. The City's review and approval shall not constitute any assumption of responsibility or liability for the design or construction.

The design criteria as presented are intended to aid in preparation of plans and specifications for the City of Evans. These design criteria are considered minimum and a complete design will usually require more than is presented in this document. In special situations where the minimum standards are considered inappropriate a variance to these criteria shall be considered. Written request for each variance should be directed to the Public Works Department.

It is the intent and purpose of the standards and specifications to obtain high quality construction throughout, with the completed work complying with the standards and specifications.

2.03 GENERAL REQUIREMENTS

Prior to any construction, a Developer's Agreement may be required for public improvements.

The provisions stipulated in this section are general in nature and shall be considered as applicable to all parts of these specifications, including any supplements and revisions.

Whenever the provisions of these specifications are found to be inconsistent with any other regulations or codes, the City shall determine the standard to apply. The provisions of these regulations are minimum requirements that do not preclude imposition of more restrictive standards by agreement or by law.

Projects shall comply with all laws, regulations, codes, and ordinances applicable to the design and the furnishing and performance of the work. Except where otherwise expressly required by applicable laws, regulations, codes or ordinances, the City shall not be responsible for monitoring compliance with any law, regulation, code or ordinance.

Prior to the contractor beginning work, an approved set of plans and specifications must be on file with the City of Evans. All contracts, bonds, insurance, permits, and licenses must be fully executed by the contractor before beginning work. Contractor shall have a copy of these standards and specifications on the site at all times during construction.

All construction within the public right-of-way shall be designed by, or under the direct supervision of a registered professional engineer (PE) licensed to practice in the State of Colorado. All drawings and support data submitted to the City for approval must bear the PE's seal and signature. Construction will not be allowed until these documents have been certified by a PE. Any over-lot grading completed during the design phase of the project must be certified by a PE prior to the beginning of construction.

2.03 GENERAL REQUIREMENTS (continued)

Consideration shall be given, within the established framework of local streets, to provide for uniformity of street widths, proper alignment, and conformity to existing street patterns. The street design shall be directly related to the traffic needs. The streets, intersections, driveways, and pedestrian facilities shall be designed to provide for the greatest safety for motorists, pedestrians, and bicyclists.

Reference to standard specifications, manuals, or codes of any technical society, organization, or association, or to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code, or laws or regulations in effect at the time of City approval. However, no provision of any referenced standard specification, manual, or code shall change the duties and responsibilities of the City or any of their consultants, agents, or employees from those set forth in these specifications. Work shall be done in compliance with the approved plans and to the satisfaction of the City.

All alleys shall be paved to a full width and should provide paved access to a paved street at both ends.

Residential lots adjacent to an arterial shall be served by a local street paralleling such arterial, or by a series of cul-de-sacs off a parallel local or collector street. No direct access will be allowed from any lot abutting an arterial.

Construction of partial street widths should be avoided. However, approval may be granted by the Public Works Director. Sufficient engineering data shall be provided to demonstrate acceptable drainage, sight distance, and other related issues. Street improvement plans shall include the entire street width.

Development projects adjacent to existing public roadways must, in addition to dedicating additional right-of-way for future street expansion needs, evaluate existing improvements along those rights-of-way. These improvements include but are not limited to private utilities, irrigation facilities, fences, etc. Developments must provide for proper engineering and construction as necessary to modify and/or protect those facilities as well as provide proper development grading along the existing roadways to accommodate the design and construction of the future roadway improvements. City shall indicate type and requirements of the future adjacent roadway cross-section.

All proposed projects shall be referenced to the City of Evans's adopted vertical control network and shall obtain the location and elevation of the nearest appropriate reference monument from the City prior to survey.

2.04 GEOTECHNICAL REPORT

A geotechnical report shall be submitted to the City, for review and acceptance, prior to any construction related to the installation of public improvements.

2.05 TRAFFIC IMPACT STUDIES

A Traffic Impact Study is required to adequately assess the impact of a development proposal on the existing and/or planned street system. Unless waived by the Public Works Director, a written Traffic Impact Study shall be required for all development proposals.

2.06 PRECONSTRUCTION CONFERENCE

A preconstruction conference will be required prior to the beginning of construction. Attendance should include the Public Works Department, developer/owner, design engineer, general contractor, utility representatives and sub-contractors including: earthwork, utilities, concrete, paving, and signing.

2.07 RIGHTS OF WAY AND STREET CROSS-SECTIONS

Sufficient right-of-way shall be provided as required for the future roadway cross-section, maintenance of the street including cut or fill slopes, auxiliary lanes, landscaping, signing, utilities, and other aspects of the development.

Right-of-way and street widths shall meet or exceed the minimums set forth in the Streets Right of Way Table, Table 2.07-1 in Appendix A. Additional right-of-way and roadway width may be required to accommodate traffic or other development needs such as turn lanes, acceleration/deceleration lanes, extra lanes, pedestrian or bicycle facilities, landscaping, utilities, or construction requirements such as cut or fill slopes.

See below, and the Roadway Section Details (Nos. S-21 through S-31) for additional specifications.

A. GATEWAY ARTERIAL

Gateway Arterials shall be designed with four 12-foot travel lanes and with a 20-foot raised landscaped median, with standard curb & gutter for a total width of 72 foot roadway width, from flow line to flow line. Parking is prohibited on both sides of the roadway.

B. ARTERIAL

Arterials shall be designed with four 12-foot travel lanes and with a 16-foot center turning lane and/or a 16-foot raised landscaped median, with standard curb & gutter for a total width of 68 foot roadway width, from flow line to flow line. Parking is prohibited on both sides of the roadway.

C. MAJOR COLLECTOR

Major collectors shall be designed with four 12-foot travel lanes and standard curb and gutter for a total width of 52 feet from flow line to flow line. Parking is prohibited on both sides of the roadway.

D. COMMERCIAL COLLECTOR

Commercial collectors shall be designed with two 12-foot travel lanes and with a 12-foot center turning lane and/or a 12-foot raised landscaped median, with standard curb and gutter for a total width of 50 feet from flow line to flow line. Parking is prohibited on both sides of the roadway.

E. MINOR COLLECTOR #1

Minor collector #1 shall be designed with two 12 foot travel lanes with a 12 foot turn lane, and with a 40-foot roadway width, flow line to flow line, with standard curb and gutter. Parking is not allowed on either side of the roadway.

F. MINOR COLLECTOR #2

Minor collector #2 shall be designed with two 12 foot travel lanes and with a 28-foot roadway width, flow line to flow line, with standard curb and gutter. Parking is not allowed on either side of the roadway.

G. BOULEVARD COLLECTOR

Boulevard collectors shall be designed with 50-foot roadway width, flow line to flow line, with a 12-foot landscaped median and standard curb and gutter. Parking is allowed on both sides of the roadway but is removed near intersections to allow for left turn lanes.

2.07 RIGHTS OF WAY AND STREET CROSS-SECTIONS (continued)

H. LOCAL #1

Local #1 street shall be designed with a 34 foot roadway width from flow line to flow line with standard curb and gutter. Parking is allowed on both sides of the roadway.

I. LOCAL #2

Local #2 street shall be designed with a 27 foot roadway width from flow line to flow line with standard curb and gutter. Parking is restricted to one side of the roadway.

J. RURAL LOCAL

Rural Local street may be specified for rural and/or large lot developments consisting of at least 1 acre. Roadway widths (flow line to flow line) shall be designed with 28-feet of pavement. Parking is prohibited on both sides of the roadway.

K. ALLEY

Alleys shall be designed with roadway widths (flow line to flow line) shall be designed with 20-feet of pavement. Parking is prohibited on both sides of the roadway

2.08 STREET ALIGNMENT

The street pattern in a subdivision shall be the most advantageous configuration to serve adjoining areas and the entire neighborhood or district. Where appropriate to the design, proposed streets shall be continuous and in alignment with existing, planned, or platted streets.

Proposed streets shall be extended to the boundary lines of the subdivision, except where prohibited by topography or other physical conditions, or where such extension is not necessary for connection to adjacent properties. Where streets will be extended beyond the property line, sufficient engineering data shall be provided to establish feasibility of extension meeting City specifications.

Streets shall be located in accordance with the City of Evans Comprehensive Plan and Transportation Plan.

Utility line easements shall be provided as required for all street classifications.

A. HORIZONTAL ALIGNMENT CRITERIA

All proposed streets shall intersect at right angles unless topography and other limiting factors of good design and safety otherwise require. In no case shall the angle of intersection vary more than 10° from a right angle 100 feet back from the flow line of the intersected street.

Where street intersections are not in alignment, the street's centerline shall be offset in accordance with the Intersection Minimum Roadway Offset Table, Table 2.08-1.

Table 2.08-1
Intersecting Minimum Roadway Offset

Arterial	660 feet
Collector	330 feet
Local	200 feet

The number of intersecting streets along arterials shall be held to a minimum. Such intersections shall be set apart not less than 660 feet on center.

2.08 STREET ALIGNMENT (continued)

Arterials and collectors intersecting with other arterial and collector streets should be at least 1/4 mile apart. Local streets should not intersect major collectors or arterial streets.

All proposed streets shall conform with the horizontal curve standards outlined in the Horizontal Curve Standards Table, Table 2.08-2.

Table 2.08-2
Horizontal Curve Standards

Street Type	Curves (ft)	Minimum Tangent Centerline between all Radius (ft)
Gateway Arterial & Arterial	1530	300
Major & Commercial Collector	745	250
Minor Collector #1 & #2	450	150
Boulevard Collector	450	150
Local #1	250	100
Local #2	250	100
Rural Local	200	100
Alley (where permitted)	60	---

B. VERTICAL ALIGNMENT CRITERIA

Vertical alignment and grades shall be designed to bear a logical relationship to the existing topography and drainage needs, and shall provide for the safety of motorists, pedestrians, and bicyclists.

Continuous changing of grades that create a "roller coaster" effect is not permitted.

All proposed streets shall conform with the minimum and maximum allowable street slope and street grade standards shown in the Allowable Street Slope Table, Table 2.08-3.

Table 2.08-3
Allowable Street Slopes

Street Type	Street Grades % Min. /Max. (a)	Street Cross Slope % (b)
Gateway Arterial & Arterial	0.4/5.0	2.0 Normal crown 4.0 Max. for super elevation
Major & Commercial Collector	0.4/7.0	2.0 Normal crown 4.0 Max. for super elevation
Minor Collector #1 & #2	0.4/7.0	2.0 Normal crown
Boulevard Collector	0.4/7.0	2.0 Normal crown
Local #1	0.4/8.0	2.0 Normal crown
Local #2	0.4/8.0	2.0 Normal crown
Rural Local	0.4/8.0	2.0 Normal crown
Alley (where permitted)	0.4/8.0	2.0 Min.
Emergency	0.4/8.0	2.0 Min.

Notes: (a) Grading behind sidewalks and between detached sidewalk and curb shall be a maximum slope of 4:1.
(b) Normal crown slope is 2%. 1% to 4% is allowable at transition and other non-normal section with special design review.

Minimum grade on gutter shall be 0.4%. Particular attention shall be given to maintain a 0.4% minimum grade especially on a sag vertical curve. Crosspans, cul-de-sacs, and curb return gutters shall have a minimum grade of 0.6%. See Cross Pan Detail (No. S-5).

Connections with existing streets shall be made in a way that will create a smooth transition. The higher volume street at an intersection shall govern the through grade and cross-sections. The maximum allowable approach grade at an intersection shall be 2% for a distance as designated by the Approach Distance to Intersection Table, Table 2.08-4.

2.08 STREET ALIGNMENT (continued)

Table 2.08-4
Approach Distance to Intersection

Intersected Street	Approaching Street		
	Local	Collector	Arterial
Arterial	-----	-----	200 feet
Collector	-----	75 feet	150 feet
Local	50 feet	50 feet	-----

Distances shown are measured from the flow line intersections. The intersection of any street with a higher classification street shall be designed to the ultimate street grade of that street. The grading of the property adjacent to the higher classification street shall meet these ultimate grades.

See Street Intersection Approach Details (Nos. S-33 and S-34) for elevation reference points and street crown transitions at street intersections for collector and arterial, and for local and collector, respectively.

A detail of the intersection, to show drainage and ridability, must be provided. Connection with existing streets shall be smooth transitions and existing grades shall be shown for at least 150 feet on all sides of the connection. The grade and ground lines of all streets that dead end, except cul-de-sacs, shall be continued for 500 feet beyond the proposed construction. The grade and ground lines of all arterials shall be designed to continue 1,000 feet beyond the end of proposed construction.

The minimum K values for crest and sag vertical curves shall be in accordance with the Minimum K Value Table, Table 2.08-5.

Table 2.08-5
Minimum K Value

Design Speed (MPH)	Min. K Value Crest	Min. K Value Sag
30	30	40
35	50	50
40	80	70
45	120	90
50	160	110

The purpose of super elevating a roadway is to improve the riding comfort on curves where the traveling speed is great enough to exert a lateral thrust greater than that which can reasonably be resisted by friction alone.

In the City of Evans, super elevation may be allowed on arterial streets and selected collector streets in order to reduce the minimum centerline radius allowed. Super-elevation shall not be used on local streets. When super-elevations are required, the super elevation shall be in accordance with the recommendations of AASHTO and approved by the City.

When super elevation is used, a minimum 100-foot run out shall be used entering and exiting the super elevated portion. In cases where the super elevation transition changes the gutter on one side of the street from water carrying to non-water carrying, the water must enter a storm sewer system or other acceptable outlet from the street, rather than crossing said street in sheet flow. The gutter shall always be inflow type.

When super elevation is used, the rate of super elevation shall be clearly shown on the drawings along with exaggerated (preferably 1 inch = 20 feet horizontal, 1 inch = 1 foot vertical) profiles of the centerline and both flow lines. The super elevation run-out length, crown run-out length, and point at which full super elevation is reached shall be clearly shown.

The design engineer shall show center line profiles on utility plans with center line stationing. Actual distances and grades of curb returns through the intersection shall be shown.

2.08 STREET ALIGNMENT (continued)

For arterial and major collector streets and for widening of existing streets, the design engineer shall provide cross-sections to the construction limits at minimum of 50-foot intervals on all streets showing existing and proposed construction. All driveways and center line profiles shall be provided to include the street, curb, gutter and walk to a point 20 feet beyond.

2.09 STREET CHARACTERISTICS

All street classifications shall be designed for the safety of motorists, pedestrians and bicyclists. Accessibility shall be provided in accordance with all ADA requirements.

Streets shall be designed to meet the design speeds indicated in Table 2.09-1.

Table 2.09-1
Street Design Speed

Street Type	Design Speed (MPH)	Posted Speed Limit (MPH)	Number of travel lanes
Arterial	55	less than or equal to 45	4
Major & Commercial Collector	45	less than or equal to 40	4
Minor Collector #1 & #2	40	less than or equal to 35	2
Boulevard Collector	40	less than or equal to 35	2
Local #1	35	less than or equal to 30	2
Local #2	35	less than or equal to 30	2
Rural Local	35	less than or equal to 30	2

A. GATEWAY ARTERIAL & ARTERIAL

FUNCTION- See Roadway Section Detail - Arterial (No. S-22) & Roadway Section Detail - Gateway Arterial (No. S-21). Arterial routes shall be designed to permit relatively unimpeded traffic movement and are intended for use on those routes where 4 moving lanes and 1 left-turn lane are required.

CONTINUITY- Arterials are continuous for several miles, generally connecting with intercity routes.

PLANNING CHARACTERISTICS- Arterials should be employed where traffic demand dictates. Arterials should be spaced from 1/2 to 1 mile apart and should, where possible, be continuous. Arterials should act as boundaries between neighborhood areas. Intersections with collectors and arterial streets should be at least 1/4 mile apart. No street parking is allowed on arterial streets.

SAFETY- Arterial streets shall be designed to handle traffic volumes loading from and onto collector and arterial roadways.

TRAFFIC CONTROL- Traffic control shall be provided. Regulation of traffic shall be accomplished through the use of traffic signs, signals, and channelization. Traffic signals will normally be required at intersections.

ACCESS CONDITIONS- Intersections shall be designed at-grade. Access from streets of lower classification will be permitted, but in all cases will be controlled by traffic control devices. Direct access to abutting property is not permitted unless no other access is reasonably available.

B. MAJOR & COMMERCIAL COLLECTOR

FUNCTION- See Roadway Section Detail - Major Collector (No. S-23) & See Roadway Section Detail - Commercial Collector (No. S-27). Major collector streets shall be designed to permit relatively unimpeded traffic movement and are intended for use on those routes where 4 moving lanes are required but where a larger classified street is not warranted.

CONTINUITY- Major & commercial collectors are continuous for 2 miles or more.

2.09 STREET CHARACTERISTICS (continued)

PLANNING CHARACTERISTICS- Major & commercial collector streets should be employed where traffic demands dictate. Major collector streets are intended for use in commercial/industrial areas or high density residential. Intersections with other collector and arterial streets should be at least 1/4 mile apart. Street parking is not allowed on major collector streets.

SAFETY- Major & commercial collectors shall be designed to handle traffic volumes loading from and onto local, other collector, and arterial roadways.

TRAFFIC CONTROL- Traffic control shall be provided. Regulation of traffic shall be accomplished through the use of traffic signs, signals, and channelization. Traffic signals will normally be located only at intersections with arterials.

ACCESS CONDITIONS- Intersections shall be designed at-grade. Access from streets of lower classification will be permitted, but in all cases will be controlled by traffic control devices. Direct access to abutting property is not permitted unless no other access is reasonably available.

C. MINOR COLLECTOR #1 & #2

FUNCTION- See Roadway Section Detail - Minor Collector #1 & #2 (No. S-24 & S-25). Minor collectors collect and distribute traffic between arterial and local streets and serve as main connectors within communities, and link one neighborhood with another. Traffic carried by collector streets should have an origin or a destination within the community. Utility line easements shall be available.

CONTINUITY- Minor collectors should have continuity throughout a neighborhood but need not extend beyond the neighborhood. The minor collector is continuous for less than 2 miles.

PLANNING CHARACTERISTICS- Minor collectors are generally intended for use within residential neighborhoods. Intersections with other collector and arterial streets should be at least 1/4 mile apart. Street parking is not allowed on minor collector streets.

SAFETY- Minor collectors shall be designed to handle traffic volumes loading from and onto local, other collector, and arterial roadways.

TRAFFIC CONTROL- Regulation of traffic shall be accomplished through the use of stop signs and channelization. Traffic signals are normally used only at intersections with major collectors and arterial streets.

ACCESS CONDITIONS- Intersections shall be designed at-grade with access to abutting property permitted.

D. BOULEVARD COLLECTOR

FUNCTION- See Roadway Section Detail - Boulevard Collector (No. S-26). Boulevard collectors collect and distribute traffic between arterial and local streets and serve as main connectors within communities, linking one neighborhood with another. Traffic carried by collector streets should have an origin or a destination within the community. Utility line easements shall be available.

CONTINUITY- Boulevard collectors should have continuity throughout a neighborhood but need not extend beyond the neighborhood. The boulevard collector is continuous for less than 2 miles.

PLANNING CHARACTERISTICS- Boulevard collectors are generally intended for use within residential neighborhoods. Intersections with other collector and arterial streets should be at least 1/4 mile apart. Parking is allowed and is removed near intersections to allow for left-turn lanes.

2.09 STREET CHARACTERISTICS (continued)

SAFETY- Boulevard collectors shall be designed to handle traffic volumes loading from and onto local, other collector, and arterial roadways.

TRAFFIC CONTROL- Regulation of traffic shall be accomplished through the use of stop signs and channelization. Traffic signals are normally used only at intersections with major collectors and arterial streets.

ACCESS CONDITIONS- Intersections shall be designed at-grade with access to abutting property permitted.

E. LOCAL STREETS

FUNCTION- See Roadway Section Details (No. S-28 through S-30). Local streets shall provide direct access to adjacent property. Traffic carried by local streets should have an origin or a destination within the neighborhood. Utility line easements shall be available.

LIMITED CONTINUITY- Local streets should be designed to discourage through traffic from moving through the neighborhood. Local-Standard #1 streets should, however, be continuous within the local commercial area. Local streets are generally no longer than 1/2 mile.

PLANNING CHARACTERISTICS- Local streets should not intersect Major Collectors or Arterial streets. There are 3 different types of local streets based on planned use.

Local #1 streets are intended for use in medium to high density residential neighborhoods. Parking shall be allowed on both sides of Local Standard #1 streets.

Local #2 streets are intended for use in residential neighborhoods where alleyways are utilized. Parking shall be restricted to one side of Local Standard #2 streets.

Rural Local streets are intended for residential developments with a minimum lot size of 2 acres (gross). Local streets should not intersect Major Collectors or Arterial streets. No on-street parking shall be allowed on a Rural Local street. Eight (8) off street parking spaces must be provided by each lot.

SAFETY- Local streets shall be designed for safety of motorists, pedestrians, and bicyclists and the ease of access to adjacent parcels of land.

TRAFFIC CONTROL- Traffic control shall be provided using stop signs at all intersections.

ACCESS CONDITIONS- Intersections shall be designed at-grade with direct access to abutting property permitted.

2.10 INTERSECTIONS

Intersections shall be designed to provide for the safety of motorists, pedestrians, and bicyclists.

Rights of way at intersections shall be adequate to provide for necessary improvements.

Intersection design shall take into consideration auxiliary turn lanes as required by the approved Traffic Impact Study, or as required for site-specific conditions.

The design criteria for all street intersections shall conform with the Horizontal Alignment Criteria outlined in Section 2.08A.

2.10 INTERSECTIONS (continued)

Pedestrian curb ramp access at all intersections and all other locations as determined by the Director of Public Works shall be designed and constructed. See Curb Ramp Details (Nos. S-11 through S-15) for additional specifications.

Clear vision zone is that area which shall be maintained free of obstructions to preserve the sight, distance, and safety of motorists, pedestrians, and bicyclists, by requiring an unobstructed intersection sight distance (ISD) area.

ISD is the unobstructed line of sight necessary for most drivers stopped at an intersection to see an approaching vehicle to avoid a collision. When the lines of sight for both left and right directions are combined, a sight triangle is formed. There should be no visual obstructions over 36 inches higher than the street level within this triangle.

The ISD depends on the design speed and desired maneuver of existing vehicle. These areas shall be free from shrubs, ground covers, berms, fences, signs, structures, parked vehicles, or other materials or items greater than 36 inches in height from the street level. Trees, within the sight distance triangle (whether within the public ROW or on private property) must not impair sight distance. Permits for planting trees are required by the City Parks and Recreation Department which will provide guidelines for the type, location, and spacing of trees. The distances in the Sight Distance Triangle Setbacks Table, Table 2.10-1, are typical sight distance triangles to be used under normal conditions and may be modified by the City in order to protect the public safety and welfare in the event that exceptional sight conditions necessitate such a modification.

Table 2.10-1
Sight Distance Triangle Setbacks

Type of Street	Speed (mph) of Major Street	Y Distance (feet)	X Distance (feet)
Arterial	35 - 50 +	450	10
Collector	30 - 35	350	10
Local	25 - 30	250	10

NOTE: All "X" distances shall be 10 feet measured perpendicular from the projected flow line of the intersecting street. For explanation of distances, see the Sight Distance Triangle Setbacks Figure, Figure 2.10-1 in Appendix A.

2.11 CUL-DE-SACS

Permanent dead-end streets shall be in the form of a cul-de-sac. Dead-end streets without a cul-de-sac shall not be allowed unless designed to connect with a future street. Temporary dead-end streets should be constructed with a temporary turn around or a temporary connection to another street. A minimum 80-foot temporary turn-around easement shall be required as determined by the City on temporary dead-end streets. Turn-around easements shall be required as detailed by the City. See Cul-De-Sac Detail (No. S-6) for additional specifications.

Cul-de-sacs shall have a maximum length of 500 feet (measured along the centerline, from the center line of the intersecting street to the center point of the bulb).

Cul-de-sacs shall have a minimum flowline radius of 45 feet. Cul-de-sacs shall have a minimum ROW radius of 55 feet.

Surface drainage on a cul-de-sac shall be toward the intersecting street. Drainage to back of cul-de-sac must be approved by the Public Works Department. If approved, a 20-foot drainage ROW shall be provided for a storm water pipe and emergency storm water overflow pan, see Emergency Storm Water Overflow Pan Detail (No. S-19) in Section 15. All other design criteria shall be based on the design criteria for the particular street classification.

2.12 PAVEMENT DESIGN

Pavement design shall be in accordance with Section 3, Roadway Structural Design, of these specifications.

2.13 TRANSITIONS

Lane and pavement transition length shall be in accordance with the latest AASHTO requirements.

2.14 STREET PROJECTIONS INTO ADJOINING FUTURE SUBDIVISIONS

The location of projected streets shall allow for the proper projection of the storm sewer and sanitary system into adjacent natural drainage areas.

A stub street is a street that is indicated to dead end into an adjacent unplatted area. The storm drainage from the street will not be allowed to be directed onto the adjacent land. All utilities shall be stub into these areas.

Stub streets shall end at the property line with a cul-de-sac unless the City recommends otherwise.

All stub streets shall be constructed as a part of the development project. Type III barricades shall be permanently installed on all stub streets that do not end on a cul-de-sac.

2.15 BUS STOPS

The following minimum design standards are offered as guidelines for the design and construction of bus stops. The City may vary any of the following requirements as deemed appropriate for the site and its particular situation. It is important that the applicant contact the City early in the review process to determine the exact location and proposed capacity of a bus stop in the proposed development. For additional specifications refer to Bus Stop Detail (S-2).

A. WIDTH

Bus lanes and stops should be asphalt or concrete and at least 10 feet wide

B. LENGTH

1. Near & Far Side Stop

Near-side and far-side bus stops should be asphalt or concrete and at least 40 feet long for a single bus, plus a 30 to 70 foot distance to the radius of intersection.

2. Mid-block Stop

Mid-block bus stops should be asphalt or concrete and include a composite of transition requirements for near and far-side bus stops. Total impacted area for a single bus stop would be 70 feet with a 30 foot bus stop and two-20 foot transitions before and after the bus stop.

C. BUS SHELTER

Bus shelters should be used at major bus stops to protect users from the weather. Locations with high passenger demands and low bus service frequency should be given priority. The shelter should have maximum transparency and be highly visible from the surrounding area to assure users' safety. Shelters should be of vandal proof construction and materials, durable, and easily maintained. The appearance of the shelter should be visually pleasing and in natural tones and have the same look throughout the system. Openings should be at least 32 inches wide. Capacity should be based on maximum passenger accumulation at the stop, with approximately 5 square feet per person allowed to develop size requirements. Bus stops shall not obstruct pedestrian flow or motorists' sight distance.

2.16 DECELERATION LANES - ARTERIAL STREETS

The need for a deceleration lane shall be determined by a traffic impact study and the City.

The required deceleration lengths, excluding stored vehicles, are based on the posted speed limit for the arterial and are in the Deceleration Lane Lengths Table, Table 2.16-1.

Table 2.16-1
Deceleration Lane Length

Posted Speed Limit (mph)	30	35	40	45	50	55
Deceleration Length (ft)*	250	310	370	435	500	600
Transition Taper Ratio	8:1	10:1	12:1	13.5:1	15:1	18.5:1

*These lengths include the taper length.

On many arterials it is not possible to provide the full deceleration length due to existing conditions. In such instances, it will be necessary to coordinate the design with the City.

For deceleration lanes where it is necessary to store stopped vehicles, such as at traffic signals, additional lengths shall be provided to accommodate the average number of vehicles anticipated as indicated from the most recent traffic impact analysis. The recommended storage length for signalized intersections is shown in Table 2.16-2.

Table 2.16-2
Required Storage Length

Turning vehicles per hour	30	60	100	200	300
Storage Length (ft)	25	50	100	200	300

2.17 MEDIANS

Prior to design of any medians on public streets, the City shall be consulted for specific requirements. Generally, medians should be designed to meet the requirements of the AASHTO "Policy on Geometric Design of Highways and Streets" (latest revision).

Landscaped medians shall be provided with drainage facilities to handle sprinkler runoff and nuisance flows. Medians should be constructed with outfall curb and gutter if gutters are not needed to handle drainage.

The nose of the median on arterial streets should be a minimum of 20 feet behind the flow line of the intersected street and shall not encroach on pedestrian crosswalks. Turning templates must be used to determine the shape of the median.

The minimum radius for nose curbs should be 2 feet to flow line. The minimum width of a median shall be 4 feet.

Median cover design shall be approved by the City.

2.18 SIDEWALKS

Sidewalks shall be designed to provide for the safety of pedestrians. See Curb & Gutter Details (Nos. S-7 through S-10) and Detached Sidewalk Detail (No. S-16).

Pedestrian curb ramp access shall be designed and constructed at all intersections and as required by the City. See Curb Ramp Details (No. S-11 through S-15).

Wider sidewalks may be required by the City where warranted by anticipated pedestrian traffic such as at or near schools and/or parks.

All sidewalks shall have a minimum thickness of 6 inches.

2.18 SIDEWALKS (continued)

A. GATEWAY ARTERIAL

Detached sidewalks shall be designed with a 10-foot width and a minimum landscape parkway width of 13 feet. Refer to Roadway Section - Gateway Arterial Detail (No. S-21).

B. ARTERIAL

Detached sidewalks shall be designed with a 10-foot width and a minimum landscape parkway width of 11 feet. Refer to Roadway Section - Arterial Detail (No. S-22).

C. MAJOR COLLECTOR

Detached sidewalks shall be designed with an 8-foot width and a minimum landscape parkway width of 6 feet. Refer to Roadway Section - Major Collector Detail (No. S-23).

D. COMMERCIAL COLLECTOR

Detached sidewalks shall be designed with an 8-foot width and a minimum landscape parkway width of 6 feet. Refer to Roadway Section - Commercial Collector Detail (No. S-27).

E. MINOR COLLECTOR #1

Attached sidewalks shall be designed with an 8-foot width. Refer to Roadway Section - Minor Collector #1 Detail (No. S-24).

F. MINOR COLLECTOR #2

Detached sidewalks shall be designed with an 8-foot width and a minimum landscape parkway width of 7 feet. Refer to Roadway Section - Minor Collector #2 Detail (No. S-25).

G. BOULEVARD COLLECTOR

Detached sidewalks shall be designed with a 8-foot width and a 7-foot minimum landscape parkway. Refer to Roadway Section - Boulevard Collector Detail (No. S-26).

H. LOCAL #1

Sidewalks shall be a 6-foot wide attached or a 5-foot wide detached with a minimum 6-foot landscape parkway. Refer to Roadway Section - Local #1 Detail (No. S-28).

I. LOCAL #2

Sidewalks shall be a 5-foot detached sidewalk with a 6-foot minimum landscaped parkway. Refer to Roadway Section - Local #2 Detail (No. S-29).

J. RURAL LOCAL

Sidewalks are not required on Rural Local streets. Refer to Roadway Section - Rural Local Detail (No. S-30).

2.19 CURB AND GUTTER

All intersections and approved pedestrian crossings shall be designed and constructed with pedestrian curb ramp access. See Curb Ramp Details (Nos. S-11 through S-15).

2.19 CURB AND GUTTER (continued)

Drive approaches will be constructed in accordance with the Driveway Approach Details (Nos. S-17 and S-18). Any deviation from this requirement will be considered on an individual basis.

Minimum grade on gutter shall be 1/2% unless otherwise approved by the director of Public Works.

Refer to the Curb Return Radii Table, Table 2.19-1, for specifications on curb return radii and curb type for each type of roadway.

Table 2.19-1
Curb Return Radii

	Local Curb Return Radii (ft)	Collector Curb Return Radii (ft)	Arterial Curb Return Radii (ft)	Curb Type	Optional
Gateway Arterial & Arterial	-----	30	50	Type 2 Section II-B	N/A
Major & Commercial Collector	-----	30	30	Type 2 Section II-B	N/A
Boulevard & Minor Collector #1 & #2	30	30	30	Type 2 Section II-B	Section D-1A
Local #1	30	30	-----	Type 2 Section II-B (Commercial) & MS Modified (Residential)	Section D-1A
Local #2	25	25	-----	Section D-1A	-----
Rural Local	20	20	-----	-----	-----
Alley	20	-----	-----	-----	-----
Emergency Access Curb	20	-----	-----	-----	-----

A. GATEWAY ARTERIAL & ARTERIAL

Type 2 Section II-B curb & gutter shall be used. See Curb & Gutter Detail (No. S-7). Curb return radii shall be a minimum of 30 feet at the intersection of an arterial/collector and a minimum of 50 feet at the intersection of an arterial/arterial.

B. MAJOR & COMMERCIAL COLLECTOR

Type 2 Section II-B curb & gutter shall be used. See Curb & Gutter Detail (No. S-7). Curb return radii shall be a minimum of 30 feet at the intersection of arterials or collectors.

C. BOULEVARD AND MINOR COLLECTOR #1 & #2

6-inch vertical curb and gutter Standard Type 2 Section II-B shall be used adjacent to all travel lanes. See Curb & Gutter Detail (No. S-7). Section D-1A with detached sidewalk maybe used in residential areas. See Curb & Gutter Detail (No. S-10). Curb return radii shall be 30 feet at all intersections.

D. LOCAL #1

Standard Type 2 Section II-B shall be used on industrial/commercial street. The standard curb and gutter for residential streets is the Standard Type 2 Section MS Modified with attached sidewalk or Standard Type D-1A with detached sidewalk; however, Standard Type 2 Section II-B may also be used with approval from the City. See Curb & Gutter Details (Nos. S-7, S-9, and S-10). Curb return radii shall be 30 feet.

E. LOCAL #2

The standard curb and gutter for Local Standard #2 streets is the Standard Type D-1A with detached sidewalk. See Curb & Gutter Detail (No. S-10). Curb return radii shall be 25 feet.

2.19 CURB AND GUTTER (continued)

F. RURAL LOCAL

Curb and gutter and sidewalks are not required on local-low volume streets. Asphalt radii shall be 20 feet.

G. ALLEY

Where permitted the asphalt radii shall be 20 feet.

H. EMERGENCY ACCESS

The asphalt radii shall be 20 feet.

2.20 DRAINAGE

Drainage system design shall be in accordance with current Comprehensive Drainage Study adopted by the City of Evans.

2.21 CROSS PANS

Cross pans shall be a minimum of 8 feet wide with a maximum flow line depth of 2 inches. Mid-block cross pans shall be a minimum of 10 feet wide with 2½ inches maximum depth. Larger widths may be required by the City.

No cross pans are allowed on arterial streets. Signalized intersections will be evaluated on a case by case basis.

Minimum grade on cross pans at flow line of pan shall be 0.6%.

Cross pan approaches shall be designed using the appropriate design speeds.

Cross pans shall be in accordance with Cross Pan Detail (No. S-5).

2.22 INLETS

Inlets shall not be installed in the curb return and shall not be in line with accessibility ramps.

Inlets shall be designed and constructed in accordance with Comprehensive Drainage Study adopted by the City of Evans.

All inlets shall have language similar to “Do Not Dump - Drains to River.”

2.23 CROSS SLOPE

A minimum cross slope on all streets shall be 2% as measured from the lip of gutter to the street centerline from the high side of the street.

On streets with raised medians, minimum cross slope 2% shall be measured from lip of median gutter to lip of gutter at street edge.

Maximum allowable cross slope (measured as above) shall be 4% on all new construction.

Cross slope for widening an existing street or for adding turn lanes shall be a straight-line grade from crown to lip of new gutter adjacent to new pavement. See Section 2.08B, Vertical Alignment Criteria, for additional specifications.

2.24 STREET LIGHTING SPECIFICATIONS

A. STREET LIGHTING

Generally, street lighting should have a spacing of 500 feet on straight blocks when using a 250 watt high pressure sodium fixture. Use a staggered pattern of 300 feet when using 100 watt high pressure sodium fixtures for Davit poles. Maximum of 300 feet on straight blocks for decorative type poles. Final spacing shall be designed by the electric company serving the area.

Street lighting shall be placed to illuminate intersection, horizontal and/or vertical alignment changes or hazards, stop sign locations and/or street and avenue signs, mail box clusters, and on cul-de-sacs greater than 250 feet long.

Do not place light poles within 5 feet of a fire hydrant.

Install behind sidewalks or with a minimum of two feet clearance from face of curb to roadway side of support pole. Where attached sidewalks/bikeways wider than five feet are used, median lighting will be considered.

Drawings for installations will be prepared by the developer/owner with help from the local power utility and approved by the City prior to installation. New subdivisions shall incorporate the recommended ornamental mast arm fixture and/or pedestrian fixture.

Luminaries for use on local streets must equal or exceed the photometry of the 100 watt high pressure, sodium fixture with a mounting height of nineteen feet. Alternate designs for fixtures, if approved by the City, may be used if installed in more than twenty (20) locations.

B. UNIFORM LIGHTING

Uniform lighting will be used on new roadway projects involving arterial and collector streets. The guidelines of the IES Lighting Handbook, latest edition and the Roadway Design Manual of the Colorado Division of Highways, latest edition and supplemental revisions will be used with engineering and economic considerations. Existing power poles will be used when possible. All fixtures, poles, and designs will be reviewed and approved by the City.

Railroad crossing lighting will conform to the Railroad-Highway Grade Crossing Handbook (FHWA), most recent addition.

Signalized intersections will be lighted using combined street lights and mast arms. Minimum of two opposite corners will be lighted; mounting will be 45° to the geometrics of the intersection.

C. INSTALLATION SEQUENCE

Underground electrical installation shall not begin until after curb and sidewalk is installed. Curb returns should not be installed on any street until after utility conduit is installed.

2.25 TRAFFIC CONTROL

All signs shall conform to current MUTCD Standards and Colorado Supplements.

Street name signs will include City-approved logo.

All signs shall be installed on Telespar-type perforated posts with anchors at proper heights as per current MUTCD Standards.

Sign backings shall be as follows:

2.25 TRAFFIC CONTROL (continued)

- 30 inch x 30 inch or less shall be 0.080 gauge aluminum.
- 36 inch x 36 inch or larger shall be 0.100 gauge aluminum.
- Extruded blades shall be a minimum of 0.091 gauge aluminum.

Street name signs for post mounting shall be extruded aluminum 6 inch x 30 inch (minimum). The City of Evans standard is reflective green background with white letters and numbers, with block numbers and arrows, and if street signs are mounted overhead, upper case letters should be used.

All signs shall be mounted with City-approved, vandal resistant type rivets and with washers.

Telespar type posts shall meet or exceed the following:

- Posts - 1¾ inch x 1¾ inch, 12 gauge, ASTM Specification No. A653, Grade A, drilled on 1-inch centers.
- Anchors - 2 inch x 2 inch x 3 foot, 12 gauge, ASTM Specification No. A653, drilled on 1-inch centers.
- All posts and anchors shall be galvanized to ASTM Specification A653 coating designation G90.

All signs shall be 3M engineer-grade reflective sheeting, 7 year guarantee, or approved equal.

Signs placed on the shoulder of a street shall have a 7-foot clearance (minimum) from the bottom of sign to the ground, or as approved by the City. Overhead signs shall have a 17-foot clearance (minimum) from the bottom of sign to the ground, or as approved by the City.

All signs placed, with the exception of STOP and YIELD signs, shall be near property lines; they are not to intrude on driveways, doorways, or any type of entrance.

Mountings (Caps) for street name signs shall be the type for square telespar and for extruded blades.

Signs shall be placed a minimum of 5 feet from fire hydrant.

Locate STOP sign at the stop bar, a minimum of 4 feet behind crosswalk.

Anchors (stubs) shall be no greater than 3 inches high from ground.

2.26 LANDSCAPE STANDARDS FOR STREETScape AND MEDIANS

The Parks and Recreation Department will approve all tree and shrub plantings on new and existing streetscapes and medians.

2.27 BIKE PATHS OR TRAILS CROSSING UNDER ROADWAYS

Where a bike path or trail crosses under a roadway the horizontal distance shall be 12 feet from abutment to curb or edge of water and the vertical clearance shall be 10 feet from bike path or trail surface to underside of bridge. See Bike Path Detail (No. S-1) for additional information. Please note that the trail surface elevation should be at or above the high water mark for the 2 year storm.



SECTION 3 ROADWAY STRUCTURAL DESIGN

3.01 GENERAL

The design of the pavement cross-section shall be performed by a Professional Engineer registered in the State of Colorado, whose expertise is in geotechnical engineering. The engineer's report for the pavement thickness design and the soils report upon which it is based will be submitted for review and approval prior to the final approval of any construction plans.

The geotechnical engineer shall submit a letter confirming that subgrade in place immediately prior to pavement operations is still in conformance with the pavement design.

Flexible pavements are those pavements which have sufficiently low bending resistance to maintain continuous contact with the underlying structure, yet have sufficient stability to support a given traffic loading condition.

Rigid pavements are those pavements which possess a high bending resistance and distribute loads over a large area of foundation soil. Examples include Portland Cement concrete pavement, or Portland Cement concrete surfaced with asphalt.

3.02 PAVEMENT DESIGN CRITERIA

The design of streets shall be based on the design period of 20 years.

The design of pavements shall be based upon the Roadway Design Manual of the State of Colorado, Department of Transportation, as modified by these specifications.

The Colorado Department of Transportation methodology is accepted for both rigid and flexible street pavement designs.

In no event shall pavement sections be less than the following minimum structural sections:

A. ASPHALT PAVEMENT

The minimum structural section shall be 4 inches of hot bituminous pavement on 6 inches of Class 6 aggregate base course placed on compacted subgrade. If treated subgrade is used, a minimum 4 inches thick Class 6 aggregate base course shall separate treated subgrade from asphalt pavement.

Full-depth asphalt is not an accepted alternate if treated subgrade is used. When fly ash is used, a bond breaker shall be used. The thickness and the type of bond breaker shall be recommended by the geotechnical engineer and approved by the City.

B. CONCRETE PAVEMENT

The minimum concrete structural section shall be 5 inches of non-reinforced Portland Cement concrete pavement placed on 3 inches of Class 4 or Class 5 base and compacted subgrade. Construction plans for concrete pavement shall include a layout for locations of construction joints. Concrete pavement shall not be allowed on local streets.

If the minimum pavement section is to be used, the Soils Report and Pavement Design must demonstrate the adequacy of the structural section for the soil conditions encountered. The City reserves the right to require concrete or treated subgrade in locations where traffic, utilities, type of construction, or time of construction would make asphalt on aggregate impractical.

3.02 PAVEMENT DESIGN CRITERIA (continued)

If a single pavement design is used for all streets within the development, that pavement design shall be based on the worst soil encountered from the standpoint of subgrade support.

Table 3.02-1, Standard Design Volume, Design Speed, and Truck Percentage Table, includes the standard design volumes, speed, and percent truck requirements to be used in the design of all streets unless site-specific conditions or the approved traffic impact study warrant different criteria.

Table 3.02-1
Standard Design Volume, Design Speed, & Truck Percentage

Street Type	Max. Design Vol.	Design Speed	% Truck
Gateway Arterial & Arterial	>16,000	55 MPH	(1)
Major Collector	7,000 to 16,000	45 MPH	(1)
Commercial Collector	4,000 to 7,000	45 MPH	(1)
Minor Collector #1 & #2	1,500 to 4,000	40 MPH	(1)
Boulevard Collector	1,500 to 4,000	40 MPH	(1)
Local #1	<1,500	35 MPH	1%
Local #2	<1,500	35 MPH	1%
Local Stand. #3	<500	35 MPH	1%
Alley	<500	20 MPH	5%

(1) Note: For collectors and arterials the percent truck usage shall be determined on a case-by-case basis.

The resistance value "R" of the subgrade shall be determined by the Hveem stabilimeter test performed in accordance with AASHTO Designation T190 or ASTM D 2844. The resistance value should represent the upper 1 foot of the soil beneath the pavement structure.

The strength coefficients of the various layers of the pavement structure shall be determined from the Colorado Department of Transportation Roadway Design Manual. Hveem stabilimeter and cohesion meter tests are required to determine the strength coefficients.



SECTION 4 GENERAL CONSTRUCTION REQUIREMENTS

4.01 SCOPE

All pavement and street construction within the City of Evans on City ROW or City owned property shall be constructed in accordance with the requirements of this specification and Colorado Department of Transportation Standard Specifications for Road and Bridge Construction, as referenced herein and as related to City Ordinances. All standard specifications, project special provisions, i.e., AWWA, ASTM, ACI, ISSA, etc. are made a portion of these specifications by reference and shall be the latest edition and revision thereof. The City of Evans standards, specifications, and special provisions shall take precedence over conflicting provisions in the CDOT Standard Specifications and other referenced standards. Whenever the provisions of these Standards are found to be inconsistent with any other regulations or codes, the City shall determine the standard to apply. The provisions of these regulations are minimum requirements that do not preclude imposition of more restrictive standards by agreement or by law.

Pavement and street construction shall be done in accordance with engineered construction plans for the work, prepared under the direction of a Professional Engineer and approved by the City of Evans Department of Public Works. Plans shall conform to the Minimum Design Criteria, Section 2, of these specifications and shall show all the information called for on the Construction Plans Check List shown in Appendix B. Construction shall conform to the standard detail drawings included in these specifications. Prior to the contractor/owner beginning work, an approved set of plans and specifications must be on file with the City of Evans Public Works Department. All contracts, bonds, insurance, permits, and licenses must be fully executed by the contractor/owner before beginning work. Contractor/owner shall have a copy of these standards and specifications on the site at all times during construction.

4.02 GENERAL

A. INTERPRETATION

The provisions of these specifications apply to the construction, enlargement, removal, alteration, relocation, repair, trenching, and restoration of any roadway public improvement or common facilities regulated herein.

The contractor/owner shall request clarification of all apparent conflicts by contacting the City. The City will not be responsible for any explanations, interpretations, or supplementary data provided by others.

B. VARIANCES FROM SPECIFICATIONS

When conflicts and/or questions arise between the accepted plans, specifications, development standards, referenced standards or other contract documents, the City shall make the final decision concerning such matters. If administrative changes are made after approval of the plans, the variance from these standards must be approved by the City. Work shall be completed according to the design approved by the City. Clarification shall be obtained from the City for approval of omissions, conflicts, or revisions prior to construction.

Requests for variance shall be submitted in writing to the City Public Works Department. The request shall state the variance requested, the justification and supporting data for the variance, and the requested change to the standards or specifications for the specific project. The City may require that exceptions be signed and sealed by a professional engineer registered to do work in the State of Colorado.

Variations to the Specifications for Street Design and Construction as outlined in this document shall be reviewed by the Public Works Director, or his designee, and shall meet the following criteria:

4.02 GENERAL (continued)

Special circumstances or conditions exist which limit the ability of the design to meet the design standards outlined in this document. Financial difficulties, loss of prospective profits, and previously approved exceptions in other developments shall not be considered special circumstances .

The variance represents an alternative design that will meet the intent of the standards and requirements set forth in this document.

In either case, the variance will not be detrimental to the public interest or other property, or in conflict with the City Comprehensive Plan and Evans Design Specifications, and will not endanger the public safety, health, or welfare. All exceptions for construction specifications must be reviewed and acted on prior to construction.

C. OMISSIONS

Any work not specifically set forth in the construction plans or these standards, but which is necessary as determined by the City, shall be completed.

It is the intent of the standards and specifications to require a functionally complete project (or part thereof) to be constructed in accordance with these standards and specifications. Any work, materials, or equipment that may reasonably be inferred as being required to produce the intended result will be provided whether or not specifically called for. When words which have a well-known technical or trade meaning are used to describe work, materials, or equipment, such words shall be interpreted in accordance with that meaning.

4.03 PROJECT ADMINISTRATION AND MANAGEMENT

A. PRECONSTRUCTION CONFERENCE

A preconstruction conference should be held prior to the commencement of any construction. Attendance should include the Public Works Department, developer/owner, design engineer, general contractor, subcontractors including; earthwork, utilities, curb and gutter, paving and traffic control. All manufacturer's instructions and submittals shall be presented to the City at the pre-construction meeting.

B. REQUIRED PERMITS

All paving and street construction, including required cuts and fill on City ROW, shall be done by a bonded contractor as provided for in Chapter 12.04 of the Evans Municipal Code. No person, firm, or corporation may perform any work in the public ROW without first obtaining the appropriate permit through the Public Works Department. See Appendix C for the City of Evans Application and Permit for Excavation/Construction in Public Right of Way. Once the permit is secured the contractor shall notify the Engineering Division 24 hours prior to initiating construction.

Any permit application shall be accompanied by a continuous bond executed by a reliable surety company which bond shall be conditioned upon compliance with all the provisions of the ordinances of the City of Evans relating to construction in the public ROW and utility easements. Every applicant shall agree in making application for a permit to be bound by all provisions of the Evans Municipal Code Chapter 12, and in particular Article 12.04. Application for a permit shall, if required, be accompanied by set of plans drawn to a minimum scale of 1 inch to 50 feet, showing in detail the location, size, and kind of installation for the project.

A Traffic Control Plan and cover sheet must be submitted and reviewed by Public Works Department before permit for excavation or construction will be issued.

4.03 PROJECT ADMINISTRATION AND MANAGEMENT (continued)

The contractor/owner shall obtain all necessary permits for construction, unless otherwise directed by the City. All permits must be in accordance with City, County, State, and Federal requirements. City review and approval of all permits must be accomplished prior to the start of any construction.

It shall be the responsibility of the contractor/utility to determine the type of permits required by the specific development. The City shall make all available effort to assist the contractor/owner in determining and obtaining required permits. A copy of all permits must be available for inspection on the job site at all times. All required fees must be paid in advance, prior to commencement of any construction.

Utility construction includes new, reconstruction, and repair of private irrigation systems, power, gas, telephone, and cable TV lines and other various appurtenances related to these projects in the public ROW shall obtain City of Evans Application and Permit for Excavation/Construction in Public Right of Way before any construction commences. This permit also covers emergency street cuts.

C. PROJECT INSPECTION

All construction and installations shall be subject to inspection by the City. Certain types of work may have continuous inspection.

It shall be the responsibility of the person performing the work authorized by the permit to notify the City that such work is ready for inspection. The City requires that every request for inspection be received one working day before such service is desired. Such requests may be made by telephone to the Public Works Engineering Division, Monday through Friday between 7:00 A.M. and 5:00 P.M.

The contractor wishing to work outside of these hours and requiring inspection of such work may be assessed an inspection fee based upon the actual costs to the City associated with supplying a representative for overtime hours. Additionally, there will be a 2-hour minimum for inspection work outside of the normal work hours. The contractor is responsible for notifying the Public Works Engineering Division of his intent to work overtime hours, weekends, or holidays. Such notice shall be given as soon as possible, but in no case less than 24 hours prior to the overtime work.

The City shall have total control when determining the need for inspection of any work. The City may make or require other observations and reviews of any work as deemed necessary to ascertain compliance with the City's Development Standards, Design and Construction Specifications, or other standards, specifications and codes.

The City is authorized to check all work performed in connection with street construction, including but not limited to clearing and grubbing, compaction of subgrade; placement of sub-base, base and asphalt; forms, concrete work, signage, pavement markings, and materials to be used.

City representatives present on site may advise contractors on these specifications and they have the authority to reject defective materials and workmanship.

The City shall, in no case, act as foreman or perform other duties for the contractor, or interfere with the management of the work done by the contractor. The presence or absence of the City shall not, in any degree, relieve the responsibility or the obligation of the contractor to perform the work in accordance with the plans or these specifications.

The City shall, at all times, have reasonable and safe access to the work whenever it is in preparation or in progress, and the contractor will provide proper facilities for such access for inspection. The City has the authority to select locations for tests.

4.03 PROJECT ADMINISTRATION AND MANAGEMENT (continued)

Whenever any portion of these specifications are violated, the Director of Public Works may order that portion of construction which is in violation of these specifications or other approved plans, specifications, and materials to cease until such violation is corrected. If deficiencies are not corrected, performance shall be required of the Contractor's Surety. A reinspection of constructed facilities shall occur at the end of the two-year warranty period.

D. MATERIALS AND QUALITY CONTROL TESTING

The contractor is responsible for the quality control testing, acceptance testing, and protection of work. Quality control and acceptance testing may include tests associated with placing of concrete, asphalt, and base course; subgrade preparation; trench compaction. The results from these tests shall be forwarded to the City Engineering Division within 2 weeks after the tests have been completed.

E. MATERIALS, MANUFACTURER'S CERTIFICATES AND RECOMMENDATIONS

All materials and equipment shall be of a quality acceptable to the City. If required by the City, the contractor shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the instructions of the applicable supplier.

When deemed necessary by the City, the contractor shall submit a certificate to the City, secured from the manufacturer of all the material used as a permanent part of the project, certifying that the product as used on the project, conforms to all City specifications. No material shall be used until the certificates are approved by the City.

All manufacturer's recommendations, instructions, or specifications regarding installation and use of products shall be considered a part of these Standard Specifications and of equal force. Any conflict between the manufacturer's instructions and these Standards and Specifications shall be decided and settled by the City and shall not be open for arbitration. All such manufacturer's instructions and submittals shall be presented to the City at the pre-construction meeting.

F. TRAFFIC CONTROL

A Traffic Control Plan (TCP), if required by the City, shall be submitted and accepted by the Engineering Division, 48 hours prior to commencing any work. If the proposed work is in the State Highway right-of-way, then a construction traffic control plan approved by CDOT must be submitted to the Engineering Division prior to commencing any work.

The contractor shall be responsible for all types of traffic, including pedestrians, in the construction area. Special attention shall be given to individuals under the Americans with Disability Act. Any person who makes pavement cuts, excavations, places an embankment, or does any work in public right-of-way, including but not limited to areas along a public street, alley, or sidewalk, shall place barricades, warning signals, detour signs as appropriate, and/or other safety devices at the location, sufficient to warn the public of the hazard, the cut, excavation or embankment. Safety devices must be in compliance with the Manual of Uniform Traffic Control Devices (MUTCD) and the "Colorado Supplement" to the MUTCD, latest revision.

All work areas including but not limited to open cuts, trenches, ditches, manholes, and/or other hazards shall be completely surrounded by approved fencing and other appropriate controls to protect and warn pedestrians and persons using bicycles, wheelchairs, and other vehicles. Temporary walk ways must be provided.

4.03 PROJECT ADMINISTRATION AND MANAGEMENT (continued)

The contractor shall appoint a Traffic Control Supervisor who shall be responsible for traffic control and who shall be certified by the American Traffic Safety Services Association (ATSSA) and/or the Colorado Contractor's Association (CCA). The supervisor must be available 24 hours per day to resolve traffic control problems during construction. All traffic control supervisors shall have in their possession a current TCS card.

No interference with traffic flow on arterial or collector streets shall be permitted before 8:30 A.M. or after 4:00 P.M. on week work days unless authorized by the City. No work shall be performed on local streets before 7:00 A.M. or after 6:00 P.M. each work day unless otherwise approved by the City. When work is stopped for the day, all traffic lanes of an arterial or collector street shall be opened to traffic unless extended closure is authorized by the City. A traffic lane shall be considered satisfactory for opening to traffic only if it is paved with cold mix or permanently patched.

Intersections and driveways shall be closed for a minimum amount of time. The contractor shall coordinate driveway closures by written notification with property owners one week prior to construction with final approval by the City.

After the streets are constructed, the new streets must be controlled with either construction traffic control barricades or approved temporary or permanent traffic control signage (stop signs, street signs, etc.), and pavement markings.

All flaggers shall be properly trained according to State and Federal guidelines. The contractor shall submit copies of flaggers' certification card to the Engineering Division prior to construction. Flagger shall have in their possession a current copy of their certification card.

Removal of any and all permanent signs shall be coordinated with the Engineering Division. It will be the responsibility of the contractor to replace or repair signs prior to and during the 2-year warranty after project completion and acceptance by the City due to poor workmanship and materials .

The contractor shall maintain all necessary barricades, permanent signs, temporary signs, pavement markings, and other traffic control devices during construction and between phases of construction, even if construction activity ceases for a year or more.

The contractor shall maintain responsibility to change or adjust traffic control devices if conditions warrant during construction. The contractor shall immediately repair and replace damaged or missing traffic control devices.

The City of Evans will not be responsible for the maintenance of traffic signs or pavement markings within a project until the improvements have been initially accepted by the City. At that time Public Works will complete an inspection of the development to assure all said signs and pavement markings were installed in accordance to approved plans. If there are deficiencies, the contractor or other party shall be responsible, at no cost to the City, to bring traffic control signs and pavement markings into compliance with approved plans.

Developments with private streets shall also adhere to these same guidelines, except their traffic control devices shall be permanently maintained by their Homeowner's Association group.

The contractor shall hold harmless the City of Evans and City staff against claims arising out of any accidents involving construction work or construction traffic control.

G. CONSTRUCTION STAKES AND SURVEY MONUMENTS

Construction staking shall be the responsibility of the contractor.

4.03 PROJECT ADMINISTRATION AND MANAGEMENT (continued)

All vertical and horizontal control shall be based on the City's monumentation which is in accordance with the Northern Colorado State Plane Coordinate System NAD 83-92 (horizontal) and NA VD 88 (vertical). Proposed reference monumentation shall be approved by the City prior to survey. Surveyors shall use the City's section corners, in accordance to City of Evans Geodetic Survey.

It shall be the policy of the City of Evans to preserve and perpetuate survey monuments in accordance with state law.

H. CONFORMITY OF WORK AND MATERIALS

All work performed and all materials furnished shall be within the lines, grades, cross sections, dimensions, and material requirements, including applicable tolerances, shown on the plans or indicated in these criteria and specifications. It shall be the responsibility of each individual contractor/owner to keep the work area clean during the performance of the work.

I. LOAD RESTRICTIONS

The contractor shall comply with CDOT Section 105.13 of the Standard Specifications for Road and Bridge Construction, latest edition, for truck load restrictions.

J. UTILITY COORDINATION

During construction the contractor shall keep inlets, junction boxes, manholes, control valves, and fire hydrants clear at all times. For all street construction which impacts utilities, the contractor shall provide a City-approved means of temporary service during the approved construction time, and properly reconnect such utility service immediately following construction.

In the event that a manhole frame, valve box, or other fixture is covered up during construction, it shall be made accessible within 24 hours and raised to the proper alignment and grade, prior to acceptance by the City.

Locating or moving existing utilities or coordinating the installation of new utilities is the responsibility of the contractor(s) performing the work. Relocation of utilities which are in a public ROW or easement shall be the responsibility of the contractor.

K. PROTECTION OF EXISTING UNDERGROUND UTILITIES

The contractor shall at all times take proper precautions for the protection of utilities, the presence of which are known or can be determined by field location of the utility companies. The contractor shall be responsible for all expenses relating to damaged utilities. Hand excavation shall be used whenever necessary. It is the contractor's responsibility to call for utility locates and abide by those requirements as outlined by State statutes.

L. ARCHAEOLOGICAL FINDINGS

If the contractor's excavating operations encounter remains of historical or archaeological significance, the operations shall be temporarily discontinued. The contractor shall notify the Engineering Division, which will contact the proper authorities, to determine the disposition of the remains and artifacts. The contractor shall protect the site in such a manner as to preserve the artifacts encountered.

M. PRESERVATION OF PROPERTY

Existing improvements, adjacent property, utilities, trees and plants that are not to be removed shall be protected from injury or damage resulting from the contractor's operations.

4.03 PROJECT ADMINISTRATION AND MANAGEMENT (continued)

N. PROTECTION OF PUBLIC AND PRIVATE INSTALLATIONS

The contractor shall at all times take proper precautions for the protection of driveway culverts, street intersection culverts or aprons, irrigation crossings, mail boxes, driveway approaches, temporary or permanent street markings, signage, and all other identifiable installations that may be encountered during construction. The contractor shall be responsible for all expenses relating to damaged public and private installations.

O. TIMELINESS OF REPAIRS

Repairs which are not considered a hazard to pedestrians, vehicles, or structures shall be completed within 30 days after receipt of written notice to repair from the Public Works Department. Repairs which are considered a hazard to pedestrians, vehicles, or structures shall be completed within 14 calendar days after receipt of written notice to repair from the Public Works Department.

P. PERFORMANCE AND MAINTENANCE GUARANTIES

All development, subdivision, escrow and letter of credit agreements to construct and maintain necessary water distribution, sewer collection, and other public improvements shall be approved by the City and the Public Works Department. Said agreements shall be entered into by City and the owner/developer of the property prior to the time such improvements are constructed and shall be pursuant to these Specifications, pertinent ordinances, rules, regulations and procedures of the City of Evans. The City may enter into such agreements with developer or contractors as may adequately protect the City's interests.

Developers/owners and contractors will be required to provide a performance guarantee with the City of Evans for repairs or maintenance work performed by the City of Evans by reason of default by the contractor, necessary repair of damages caused by the contractor, necessary repairs caused by contractor's poor installation techniques, and costs incurred by the City due to the contractor's failure to perform in accordance with these standards.

Q. ACCEPTANCE OF WORK

Water and sewer utilities shall be inspected throughout installation. Prior to paving operations, all valves and manholes shall be at the top of the subgrade, the water and sewer line shall have passed the required test, and the services shall be marked with a 2x4 board with the appropriate color painted on the board. Upon completion of installation and prior to paving operations, a punch list shall be formulated stating all discrepancies that relate to water and sewer utilities. This punch list will be forwarded to the developer. No paving operations shall commence until the punch list has been cleared. Any work requiring the cutting of the street shall be done at this time. At this time, the contractor will also check and ensure that all water and sewer services are offset from the centerline of each lot by 5 feet each side, unless otherwise indicated on the engineering drawings. No services are to be located in concrete areas.

After paving and all other operations have been completed, a second punch list shall be formulated and sent to the developer. Before initial acceptance, the contractor shall provide the Public Works Director with a final affidavit, signed by the developer that the improvements have been paid for, in full, by the contractor. Upon request from the Public Works Director, the contractor shall provide lien waivers (or some other acceptable assurance) from all subcontractors, and suppliers who have furnished labor, material, or services for the design, construction, or installation of improvements.

4.03 PROJECT ADMINISTRATION AND MANAGEMENT (continued)

Once this punch list has been completed, the final affidavit and/or lien waiver have been signed and the maintenance guarantee has been accepted by the City, as well as cost estimate and as-built drawings for all utilities lines have been submitted to the Evans Public Works Department, the 2-year warranty period shall begin. The Director of Public Works shall send a letter to both the contractor and developer stating this date. Warranty periods may be initiated by phase, if all public improvements in that phase meet the above referenced requirements, including paving, and if the phasing has been shown on the approved prints.

No water meters shall be installed prior to initiating the 2-year warranty period except for park sprinkler meters, which must be installed and accepted for service prior to the initiation of the 2-year warranty period. Meters for sprinkler systems must be installed in the meter pit or vault prior to any taps being performed by contractor's tapping crew.

Just prior to the end of the 2-year warranty period, a third inspection and punch list shall be formulated and sent to the developer. Upon completion of this punch list to the satisfaction of the City, the Director of Public Works shall then send a letter to the developer, stating the acceptance of responsibility for perpetual maintenance of the public improvements by the City of Evans.

Any maintenance, repairs, or replacements on all public improvements that have defects during the 2-year warranty shall be performed by the contractor/developer at the contractor's/developer's expense. The contractor/owner shall be invoiced for all work performed during the 2-year warranty period that is completed by the City of Evans. All payments for work performed shall be received by the Public Works Department prior to the city's acceptance of responsibility for perpetual maintenance of the water and sanitary sewer utility lines.

R. PAYMENTS

When the CDOT Standard Specifications refers to payment or basis of payment it shall be disregarded unless specifically referred to in other contract documents associated with the work. The City of Evans has no responsibility for payments unless the work was contracted by the City.

S. CONFLICTS/QUESTIONS

When conflicts and/or questions arise between the accepted plans, specifications, development standards, referenced standards, or other contract documents, the City shall make the final decision concerning such matters.

T. LIABILITY

The City and the City's authorized representatives charged with the enforcement of these Standard Specifications, acting in good faith and without malice in the discharge of their duties, shall not thereby be rendered personally liable for any damage that may accrue to persons or property as a result of any act or by reason of any act or omission in the discharge of their duties.

U. NO WAIVER OF LEGAL RIGHTS

The City will not be precluded or stopped by any measurement, estimate, or certificate (made either before or after the completion and acceptance of the work) from showing the true amount and character of the work performed and the materials furnished by the contractor/owner, or from showing that any such measurement, estimate, or certificate is untrue or is incorrectly made.

SECTION 5 EXCAVATION, REMOVALS, AND EMBANKMENT

5.01 SCOPE

The work covered by this section includes the furnishing of all labor, equipment, supplies, and materials necessary to perform clearing, grubbing, and removal of objectionable materials from the right-of-way prior to grading operations and placement of embankment to conformity with lines, grades, and typical sections as shown on the plans or as staked.

5.02 SOIL MATERIALS

Soil materials for roadway construction shall be as recommended in the approved soils report. Embankment and fill material shall consist of soil, granular sand, gravel, and cobble material, free from frozen material, organic material, trash, glass, broken concrete, other corrosive, or deleterious material. The contractor shall import approved material as necessary. Embankment and fill material must be stable and have a liquid limit less than 40 and a plastic index less than 15 when tested in accordance with AASHTO T-89 and T-91, respectively.

No material shall have a dimension larger than 6 inches. Where the subgrade layer is less than 6 inches the maximum size shall not exceed $\frac{2}{3}$ the depth of the layer. These size restrictions are contingent upon the material being evenly distributed in finer material such that uniform soil consolidation is achieved. If uniform soil consolidation is not being achieved, the City may reduce the size of materials allowed or change the embankment and fill material requirements.

Where unstable subgrade is encountered, the contractor shall take steps necessary to stabilize the material by techniques such as over-excavation and backfill with approved imported material, use of geotextile fabrics, or other combinations. The contractor shall notify the City of the proposed solution to stabilize the subgrade. If required by the City, the owner's design engineer will make recommendations on stabilization techniques and materials. If tests or observations reveal that material being placed is not of suitable quality and structural value, the contractor shall provide other material as approved by the City.

5.03 CLEARING AND GRUBBING

The natural ground surface shall be cleared of all vegetation such as trees, logs, upturned stumps, roots of downed trees, brush, grass, weeds, and all other objectionable materials within the limits of construction. All surface objects, trees, roots, and other protruding obstructions not designated to remain shall be cleared and/or grubbed, except stumps and roots and nonperishable solid objects which will be removed a minimum of 2 feet below subgrade or slope of embankments. In streets, stumps and root systems shall be removed to below the 2 foot level. Except in areas to be excavated, all holes resulting from the removal of obstructions shall be backfilled with suitable material and compacted in accordance with Embankment Section 5.08.

Trees which are to be removed shall be removed in such a manner as not to injure standing trees, plants, and improvements which are to remain. Any object that is designated to remain and is damaged shall be repaired or replaced as directed by the City at the contractor's expense. Before the start of any overlot grading, stock piling of soil, or clearing or grubbing operation, the contractor/owner shall file and obtain approval for a State of Colorado permit for Erosion and Sediment Control. Erosion control measures shall be installed and functional prior to the start of any land disturbing activities and maintained at all times.

5.04 REMOVAL AND DISPOSAL OF MATERIALS

All materials removed shall be disposed of outside of the right-of-way. No accumulation of flammable material shall remain on or adjacent to the right-of-way. The roadway and related work areas shall be left with a neat and finished appearance. In no case shall the material removed from the right-of-way and stockpiled be left in such a manner as to pose erosion, weed, or other hazard to the public. Stock piles shall be left with long sloping sides and in such a manner as to accommodate the use of mechanical mowing equipment.

5.04 REMOVAL AND DISPOSAL OF MATERIALS (continued)

The contractor shall make all arrangements to obtain permission from property owners for disposal locations outside the limits and view of the project. The contractor shall legally dispose of all material that is deemed unusable by the City, off of the project site, prior to project completion.

5.05 REMOVAL OF EXISTING IMPROVEMENTS

A. BITUMINOUS PAVEMENT

Bituminous pavement shall be removed to clean, straight lines by such methods as cutting, milling, or others that will ensure the breaking of pavement in a straight line. Refer to the Street Cut and Excavation Repair, Section 12, for more specifications. All saw cutting shall not extend past the construction limits by more than the depth of the structure and such over cut shall be sealed by a method approved by the City.

B. CONCRETE PAVEMENT

Crosspans, alley intersections, and concrete pavement shall be removed to the nearest construction joint or saw cut to a minimum depth of 2 inches. Sections shall be saw cut in straight lines either parallel to the curb or perpendicular to the alignment of the sidewalk or curb. All over sawing shall not extend more than the depth of the structure past the construction limits and shall be sealed in the same manner as joints. If the removed portion falls within less than 5 feet of a construction joint, cold joint, expansion joint, or edge, crack, or existing patch, the concrete shall be removed to the joint, crack, edge or patch. See Street Cut and Excavation Repair, Section 12, for restrictions on cutting and patching concrete pavement.

C. CONCRETE CURB, GUTTER, SIDEWALK, AND DRIVEWAYS

Concrete shall be removed to edges neatly sawed to full depth. Sidewalks and driveways shall be saw cut in straight lines either parallel to the curb or perpendicular to the alignment of the sidewalk or curb. No section to be replaced shall be less than 3 feet in either width or length. If the saw cut in the sidewalk or driveway falls within less than 5 feet of a construction joint, expansion joint, or edge, the concrete shall be removed to the joint or edge. The sawing of concrete shall be done carefully, and all damages to concrete to remain in place due to contractor's operations shall be repaired at the expense of the contractor. All saw cutting shall not extend past the construction limits by more than 3 inches and such over cut shall be sealed in the same manner as cracks.

See Street Cut and Excavation Repair, Section 12, for restrictions on cutting and patching concrete curb, gutter, sidewalks, driveways, etc. See Concrete Repair Detail (No. S-3).

5.06 TREE REMOVAL

The City shall be notified and approval obtained prior to excavation of, removal, or trimming of any trees or shrubs within the public rights-of-way.

5.07 EXCAVATION

Excavation of all materials shall be performed in conformity to the lines and grades indicated on the drawings or as staked. Suitable material removed from the excavations may be used in the formation of embankments and backfilling or any other areas within the right-of-way as permitted by the City. Where material encountered within the limits of the work is considered unsuitable by the City, such material shall be excavated as directed by these standards, the plans, or the City, and replaced with suitable material.

5.07 EXCAVATION (continued)

Foundations and the pavement structure shall be placed on original, undisturbed soil or on structural backfill extended to the undisturbed soil. Foundations and the pavement structure shall not be founded on existing fill if encountered at the project site. If existing fill is encountered at the subgrade, the contractor shall excavate to original undisturbed soil and bring the grade to the required elevation with approved material. Existing fill material if encountered at the site shall be removed. Existing fill may be stockpiled for reuse in backfills and embankments if it meets the requirements of the specifications. The contractor shall remove unsuitable soil material as directed by the City. The disposal of unsuitable soil material is the responsibility of the contractor.

Rock that is encountered at the site shall be excavated to a minimum depth of 6 inches below subgrade within the limits of the roadbed.

The contractor shall blend the intersection of cut slopes with the slopes of adjacent natural ground surfaces in a uniform manner. The tops of cut slopes shall be flattened and rounded in accordance with the approved plans.

All excavated material shall be stockpiled in a manner that does not endanger the work or workers, and does not obstruct sidewalks, streets, alleys, or driveways. The work shall be done in a manner that will minimize interference with traffic and drainage of the street. The contractor at the end of each day shall barricade all excavations and ditch lines, remove excess excavated material from travel ways, and thoroughly clean all streets, alleys, and sidewalks affected by the excavation.

Materials encountered during excavation such as rubbish, organic, or frozen material, and any other material which is unsatisfactory for use as backfill shall be removed from the site and appropriately disposed of at the contractor's expense. Stones, concrete or asphalt chunks larger than 6 inches, or frozen material shall be considered unsatisfactory backfill and removed by the contractor, prior to project or phase completion. Frozen material, however, may be thawed out and used at a later date.

5.08 EMBANKMENT

This work shall consist of the construction of embankments by depositing, placing, and compacting material of acceptable quality and structural value above the natural ground or other surface in conformance with the lines, grades, and cross-sections shown on the drawings or as established. Before any embankment is placed, clearing, tree removal, sod and topsoil removal over the entire area shall be performed in accordance with Sections 5.03 through 5.05.

When an embankment is to be placed on slopes, it shall be continuously benched in horizontal layers to key into the existing slope. Each layer of the embankment material shall not exceed 8 inches in loose depth. The contractor shall thoroughly mix and ensure uniform density and moisture for proper compaction.

Whenever material is encountered that is wet or otherwise unstable and is incapable of supporting structures or the roadbed, the material shall be over-excavated to a depth suitable for construction of a stable subgrade. The contractor shall backfill over-excavated areas with a stabilization material approved by the City. An approved filter fabric shall be used where required by the City around the stabilization material and on the subgrade to stabilize the subgrade and prevent fines from migrating into the stabilization material.

Cut areas shall be thoroughly compacted for a depth of 8 inches below finished subgrade. Each layer in fill and cut areas shall be thoroughly compacted by static roller or vibratory equipment. See 7.03 for details of grading, compaction, and subgrade preparation. The base of fill areas should be scarified to a depth of not less than 6 inches and compacted to not less than 95% of maximum density $\pm 2\%$ of optimum moisture content as determined by AASHTO T99 or as recommended by a geotechnical engineer, prior to placement of embankment material. Each layer shall be wetted or aerated, if necessary. No embankment material shall be placed upon soft, spongy, or frozen material or other material, the stability of which is, in the opinion of the City, unsuitable for the placement thereof.

SECTION 6 BACKFILL

6.01 SCOPE

This section includes the material and construction specifications for backfill and filter materials.

6.02 MATERIAL

A. STRUCTURAL BACKFILL

Structural Backfill shall comply with CDOT Standard Specifications Section 703.08.

Class 1 Structural Backfill shall be used on all bridges, box culverts, or where otherwise specified. In addition this material shall have a liquid limit not exceeding 35 and a plasticity index of not over 6 when tested in accordance with AASHTO T 89 and T 90, respectively.

Class 2 Structural Backfill shall be composed of suitable materials developed on the project. To be suitable for use under this classification, backfill shall be free of frozen soil, wood, or other organic material. If the material contains rock fragments or other materials that, in the opinion of the City, will be injurious to the structure, the native material shall not be used for backfilling, and the contractor shall be required to furnish Class 1 Structural Backfill material.

B. FLOWABLE-FILL

Flowable-fill meeting the requirements in CDOT Standard Specifications Section 206.02, should be used to backfill all open cuts in portions of public right-of-way beneath existing paving, curb, gutter, or sidewalk improvements. Alternate backfill methods for large excavations will be considered on an individual review basis with the City.

The amount of water shall be such that the structure backfill (flowable -fill) flows into place properly without excessive segregation.

This flowable fill may be mixed on site, and may consist of either of the following two mixtures:

1. Sand/Cement Slurry

A sand and water mixture with the same cement content as commercial flowable-fill.

2. Small Aggregate Based Mixture

A mixture of aggregate (3/8 of an inch and smaller) and sand that is the same ratio as commercial flow-fill.

In either case, a cap of non-shrink grout with thickness of 5½ inches is to be used on all local and minor collector streets. A cap of non-shrink grout with thickness of 7½ inches is to be used on all arterial and major collector streets. This material may also be mixed on site.

C. FILTER MATERIAL

Filter material shall consist of free draining sand, gravel, slag, or crushed stone. The grading requirements are set forth in CDOT Standard Specifications Section 703.09 and Table 703-5.

During progress of construction, the owner's design engineer will determine the class of filter material to be used. Table 6.02-1, Recommended Filter Classes Table, is intended to be used as a guide.

6.02 MATERIAL (continued)

Table 6.02-1
Recommended Filter Classes

Sieve Size or Designation	Percentage of Soil Passing Designated Sieves		
	*Use Class A,B or C	**Use Class B or C	Use Class C
No. 10	less than 85	----	----
No. 40	less than 24	less than 85	more than 85

* Based on the 3-inch and smaller portion of the soil adjacent to the filter material.

** To drain large quantities of water, use the most open grading recommended.

6.03 STRUCTURAL EXCAVATION

Unsuitable foundation material shall be removed and wasted in a manner acceptable to the City. Unsuitable foundation material which is suitable for embankments and suitable surplus excavated material shall be used in the construction of embankments. Unsuitable material removed below designed elevation shall be replaced with approved material.

Rock, hardpan, or other unyielding material encountered in trenches for culvert pipe or conduit shall be removed below the designed grade for a minimum depth of 12 inches. This extra depth excavation shall be backfilled with loose structural backfill (Class 1) or other approved material. The base of structural backfill shall be scarified to a depth of 6 inches and compacted to a density of not less than 95% of maximum density $\pm 2\%$ of optimum moisture content as determined by AASHTO T99 or as recommended by a geotechnical engineer, prior to placement of any structural element or structural backfill. The type of compaction shall be the same as that required for structural backfill (Class 2), as specified below.

6.04 STRUCTURAL BACKFILL

Backfill shall consist of approved materials uniformly distributed in layers brought up equally on all sides of the structure. Each layer of backfill shall not exceed 12 inches before compacting to the required density and before successive layers are placed. Structural backfill (Class 1) shall be compacted to a density of not less than 95% of maximum density $\pm 2\%$ of optimum moisture content as determined by AASHTO T99 or as recommended by a geotechnical engineer.

Required density for structural backfill (Class 2) shall conform to Section 7.03.

Compaction methods that produce horizontal or vertical earth pressures, which may cause excessive displacement or overturning, or may damage structures, shall not be used.

Backfill material shall not be deposited against newly constructed masonry or concrete structures until the concrete has developed a compressive strength of 80% of the field compressive strength. Shape the surface of the subgrade under structures such that they are not above or more than 1/4 inches below the required subgrade elevation. Unless otherwise indicated in the contract or directed by the City, all sheeting and bracing used in making structure excavation shall be removed by the contractor prior to backfilling.

6.05 FLOWABLE-FILL

Flowable-fill should be placed on top of a minimum of 12 inches of road base material in all utility pot holes in the right-of-way. The maximum layer of flowable -fill shall be 12 inches. Any additional layers shall not be placed until the flowable -fill has lost sufficient moisture to be walked on without indenting more than 2 inches.

Compaction of flowable-fill will not be required. Any damage resulting from placing flowable -fill in lifts that are too thick or from not allowing sufficient cure time between lifts shall be repaired at the contractor's expense.

6.06 FILTER MATERIAL AND PLACEMENT

Construction requirements for filter material for subsurface drains shall conform to the applicable requirements of CDOT Standard Specifications Section 206.05.



6.06 FILTER MATERIAL AND PLACEMENT (continued)

Filter material shall be placed behind bridge abutments, wing walls, and retaining walls as recommended by the owner's design engineer and as provide in the design/construction plans. Wall drain outlets shall be backed with sacked filter material conforming to the gradation requirements for course aggregate No. 3 or No. 4 set forth in CDOT Standard Specifications Table 703-1. Filter material shall be placed in horizontal layers along with and by the same methods specified for structural backfill.

SECTION 7 SUBGRADE AND UNIMPROVED AREA PREPARATION

7.01 SCOPE

The work covered by this section concerns the furnishing of all labor, equipment, supplies, and materials needed to perform preparation of subgrade within the public right-of-way.

7.02 MATERIALS

See Sections 5.02 and 6.02 for additional specifications.

Geotextile reinforcement shall be as recommended by an experienced geotechnical engineer retained by the owner and who is a registered PE in the State of Colorado.

7.03 SUBGRADE COMPACTION

Field compaction densities for embankments and subgrade soils for improved areas shall be as indicated in the soil report but not less than 95% of maximum density $\pm 2\%$ of optimum moisture content as determined by AASHTO T99 or as recommended by a geotechnical engineer.

Field compaction densities for embankments and soils for unimproved areas shall be not less than 90% of maximum density $\pm 2\%$ of optimum moisture content as determined by AASHTO T99.

Do not compact topsoil.

The contractor shall, when requested by the City, furnish the necessary equipment to proof-roll the subgrade even though density tests may indicate compliance with density requirements. Soft and yielding material and other portions of the subgrade which will not compact when rolled or tamped shall be removed as directed by the City and replaced with suitable material. If, based on proof-rolling, the City determines that the subgrade exhibits visible deflection in the form of weaving or pumping and/or the soil cracks, the contractor shall be required to correct the problem to the satisfaction of the City.

Subgrade surfaces below excavated areas such as cut areas and undisturbed areas requiring additional preparation shall be scarified to a minimum depth of 6 inches, wetted or aerated as needed and compacted until the required density and stability is obtained unless otherwise approved by the City. Such scarification shall be done in such a manner as to achieve a uniform mixture of the subgrade soils. Pockets of clay, sand, dry, wet, or stratified soil layers are to be thoroughly mixed, creating a soil blend of uniform consistency.

Scarification shall mean a thorough mixing of the subgrade soils to the required depth either by equipment-mounted ripper teeth or turning the soil with a construction disc. If the scarified soil does not exhibit sufficient subgrade strength for roadway construction, the owner's geotechnical engineer shall be consulted and alternate methods of construction may be approved by the City. Application of geotextile reinforcement may be accepted if recommended by the owner's geotechnical engineer.

If the required compaction is not obtained, it shall be the responsibility of the contractor to re-compact the material. In cases where there is a failure to achieve the required compaction, the City may require that the backfill be removed and replaced with approved backfill material.

If the contractor's scheduling of work, methods, or inclement weather caused a naturally suitable subgrade to become unstable, the area shall be sub-excavated and stabilized as described above at the contractor's expense.

Acceptable compaction test results shall not relieve the contractor from correction or repairing of any substandard work before or during the warranty period.

7.04 GEOTEXTILES

Geotextile reinforcement shall be used in areas of unstable subgrade if recommended by the owner's geotechnical engineer.

7.05 SUBGRADETREATMENT

The surface of the roadbed shall be bladed to the established lines, grades, and cross sections as shown on the plans. The prepared roadbed shall be scarified to the depth and width required for the subgrade stabilization. The material thus obtained shall be pulverized. Application, mixing, and finishing shall be in accordance with CDOT Standard Specifications, Section 307.05 through 307.07. Hydrated Lime shall conform to the requirements of ASTM C 207, Type N. In addition, the residue retained on a #200 mesh sieve shall not exceed 10% when determined in accordance with ASTM C 110 (Drying of the residue in an atmosphere free from carbon dioxide will not be required).

Use of a pozzolan material to treat the subgrade requires a mix design to be submitted by the owner's geotechnical engineer for approval. The pozzolan-treated subgrade will be tested upon completion to verify projected "R" values were achieved.

If fly ash is placed in the subgrade, a layer of bond breaker shall be placed before the placement of asphalt.

7.06 SUBGRADE SURFACE TOLERANCE

The excavation and embankments for the street, intersections, and driveways shall be finished to a reasonably smooth and uniform surface. Variations from the subgrade shall not exceed more than 1/4 inch above or 1/2 inch below the required subgrade elevation in soil and shall be subexcavated to a minimum depth of 6 inches in rock. Where bituminous or Portland cement concretes are to be placed directly on the subgrade, the subgrade plane shall not vary from design grade.

7.07 COMPACTION IN UTILITY TRENCHES, CULVERTS, ETC.

The top 4 feet of all utility trenches within the street right-of-way and easements (including service lines) must be mechanically compacted to 95% of maximum density $\pm 2\%$ of optimum moisture content, as determined by AASHTO T99 or as specified in the soils report, before street construction will be permitted. All water and sewer services, including water and sewer main stub-outs, shall be installed prior to street construction. Compaction shall extend to the street right-of-way line as a minimum. Water settlement and/or jetting of trenches shall not be permitted.

SECTION 8 SUB-BASE

8.01 GENERAL

The sub-base, when required for stabilization of the subgrade, shall consist of a foundation course composed of granular material constructed on the prepared subgrade in accordance with these specifications and in conformance with the lines and grades and typical cross sections as shown on the plans or established.

8.02 MATERIALS

Sub-base material need not be crushed but can be of the pit run variety graded to meet the limits set forth in the CDOT Standard Specifications Table 703-2 for Class 1 material.

The material supplied shall be a well graded mixture, consisting of sound aggregate particles and sufficient filler or other proper quality binding material which, when placed and compacted, will result in a firm, dense, unyielding foundation. Balls of clay within the graded mixture will not be accepted.

8.03 PLACEMENT AND COMPACTION

Each layer of sub-base material shall be placed in layers not to exceed 12 inches in compacted depth. Each layer shall be wetted or aerated, if necessary, and compacted to 95% maximum density $\pm 2\%$ percent of optimum moisture as determined by AASHTO T99 or as recommended by a Geotechnical Engineer. No sub-base material shall be placed upon a soft, spongy, or frozen subgrade or other unsatisfactory subgrade, the stability of which is unsuitable for the placement thereof.

8.04 SUB-BASE SURFACE TOLERANCE

The prepared surface of the sub-base shall not vary from the established grade by more than 1/4 inch above or 1/2 inch below the required subgrade elevation.

SECTION 9 BASE COURSE

9.01 GENERAL

The base shall consist of a foundation course composed of crushed gravel or crushed stone and filler, constructed on the prepared sub-base or subgrade in accordance with these specifications and in conformance with the lines and grades as shown on the plans or established. This work shall be completed in accordance with CDOT Standard Specifications Section 304 except as modified herein.

9.02 MATERIALS

A. BASE COURSE MATERIAL

A design mix shall be submitted to the City for review and approval. Aggregates for bases shall be crushed stone, crushed slag, crushed gravel, natural gravel, or crushed reclaimed concrete or asphalt material which conforms to the quality requirements of AASHTO M 147 except that the requirements for the ratio of minus #200 sieve fraction to the minus #40 sieve fraction, stated in 2.2.2 of AASHTO M 147, shall not apply. The requirements for the Los Angeles abrasion test (AASHTO T 96) do not apply to Class 1, 2, and 3 aggregates.

Crushed gravel or crushed stone base course material shall consist of hard durable particles or fragments of stone or gravel crushed to required size and a filler of sand or other finely divided mineral matter. The portion of the material retained on a No. 4 sieve shall be known as coarse aggregate, and that portion passing a No. 4 sieve shall be known as filler. When produced from gravel, not less than 60% by weight of the coarse aggregate particles, shall be particles having at least one fractured face, and if necessary to meet this requirement, or to eliminate an excess of filler, the gravel shall be screened.

The composite base course material shall be free from vegetation and lumps or balls of clay and shall meet the grading requirements for the class specified for the project. The liquid limit shall be per CDOT Standard Specifications Table 703-2 in accordance with AASHTO T 89, and the plasticity index shall not exceed 6 when the aggregate is tested in accordance with AASHTO T 90.

The Soils Report shall identify areas that in the owner's geotechnical engineer's opinion need to be treated with mineral filler or hydrated lime.

For approved aggregate base course classifications see CDOT Standard Specifications Table 703-2.

B. COMMERCIAL MINERAL FILLERS

Portland cement shall conform to CDOT Standard Specifications subsection 701.01. Hydrated lime shall conform to CDOT Standard Specifications subsection 712.03.

C. PLANT MIXED-BITUMINOUS BASE COURSE

Plant mixed bituminous base may be substituted for the combination of asphalt and untreated base on an equivalent strength basis. This material consists of aggregate and bituminous material mixed in a central plant, spread and compacted on a prepared surface as specified in Section 10 of this document and the CDOT Standard Specifications Section 301.

D. SOIL STERILANTS

Soil sterilants shall be applied under all concrete and asphalt joints and all new concrete unless waived by the City on a case-by-case basis. The sterilization shall be with a pre-emergent herbicide agent, which shall be soluble, dispensable or mixable in water and non-toxic to humans when applied per the manufacturer's recommendations. The agent shall be active for 1 year after application.

9.02 MATERIALS (continued)

The applicator shall be certified by the U.S. Environmental Protection Agency, a licensed applicator, and bonded in the State of Colorado and shall be held responsible for any damage to plant growth outside of the roadway or to the pavement, where such damage is attributable to carelessness or improper application of the agent. The agent shall be applied to the aggregate base course no more than 24 hours prior to paving and shall not be applied during and before inclement weather. The agent shall not be used where it may contaminate water used for irrigation or drinking purposes.

9.03 PLACEMENT AND COMPACTION OF BASE COURSE

A. PLACING

If the required compacted depth of the aggregate base course exceeds 6 inches, it shall be constructed in two or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed 6 inches. When vibratory or other types of special compacting equipment are used, the compacted depth of a single layer may be increased to 8 inches upon request, provided that specified density is achieved.

B. MIXING

The contractor shall mix the aggregate by methods that produce a thorough and homogenous mixture.

C. SHAPING AND COMPACTION

Compaction of each layer shall continue until a density of not less than 95% of the maximum density $\pm 2\%$ of optimum moisture content as determined by AASHTO T180 has been achieved or as recommended by a geotechnical engineer. The surface of each layer shall be maintained during the compaction operations so that uniform texture is produced and the aggregates are firmly keyed. Water shall be uniformly applied during compaction in the quantity necessary for proper consolidation of the material, or the material shall be harrowed, disked, bladed, or otherwise worked to ensure a uniform moisture content.

The subgrade and base course shall be free from standing water during construction. Remove any water encountered during construction to the extent necessary to provide a firm and stable subgrade and base course. Divert surface runoff or use other means necessary to accomplish the above. Do not deposit, tamp, roll or otherwise mechanically compact the aggregate base course in water. Do not construct aggregate base course with frozen material or on frozen subgrade.

The prepared surface upon which the surface course is to be placed will be tested with a 10-foot straight edge, or other approved device. The surface shall be tested prior to the application of any primer or pavement. The variation above or below the testing edge of the straight edge between any two contacts with the surface shall not exceed 1/4 inch. Any areas not complying with these tolerances shall be reworked to obtain conformity.

The in-place compacted thickness of aggregate base course shall be no more than 1/4 inch less than the thickness shown on the approved drawings.

Immediately prior to paving, the aggregate base course shall be proof-rolled as described in 7.03 to verify the base course stability. Areas that are found to be unstable shall be removed and replaced.

9.04 TESTING OF AGGREGATE

The contractor shall sample and test the subgrade, sub-base, and base material prior to being used on the project site. Written results of the tests will be submitted to the City within 10 working days after the results of the tests are known.



9.04 TESTING OF AGGREGATE (continued)

The contractor is responsible for the quality control testing and protection of work until the work is accepted by the City. The contractor will provide acceptance testing. Acceptance testing may include but is not limited to tests associated with the base course subgrade preparation and trench compaction. See the Material Sampling and Testing Schedule in Appendix B for additional requirements.

The City may conduct additional testing. The contractor shall provide access for the City's testing representative, his operations, and materials.

SECTION 10 BITUMINOUS PAVING

10.01 GENERAL

These specifications include general requirements that are applicable to all types of plant-mix bituminous pavements, of gradation of aggregate, kind and quantity of bituminous material, or pavement use. Deviations from these general requirements will be indicated in the specific requirements for each type.

Paving consists of one or more courses of bituminous mixture constructed on a prepared foundation in accordance with these specifications and the specific requirements of the type proposed for the project, and in conformity with the lines, grades, thicknesses, and typical cross-sections shown on the plans or established. This work shall be completed in accordance with CDOT Standard Specifications Section 401 except as modified herein.

10.02 MATERIALS

A. CITY MIX DESIGN

The gradation of the mineral aggregate shall be grading C (3/4-inch maximum) for new street construction. Grading CX (1/2-inch maximum) may be used for overlay or, in special cases, as authorized by the City. Grading G may be used as a bottom lift of asphalt on newly constructed streets.

1. Quality Control

Quality Control of the production of the mixture shall be the sole responsibility of the contractor/owner. All field and laboratory testing shall be performed by a qualified laboratory acceptable to the City. All test results shall be submitted to the City upon completion of the testing.

The City shall have the authority to perform additional acceptance testing at the city’s discretion. The cost of re-testing due to failed acceptance shall be borne by the contractor/owner. The contractor/owner shall cooperate with the Quality Assurance personnel representing the City without delay and shall make the work and materials available for testing at all times.

Typically quality control testing during production of the mix typically is as shown in Quality Control Test Table, Table 10.02-1.

Table 10.02-1
Quality Control Test

TEST	METHOD	FREQUENCY
Gradation	AASHTO T27	a minimum of one for each mix design
Asphalt Content	AASHTO T164, ASTM D4125	a minimum of one for each mix design
Hveem Stability	AASHTO T246	a minimum of one for each mix design
Lottman	CPL 5109	a minimum of one for each mix design
Rice Value and VMA	Asphalt Institute Methods	a minimum of one for each mix design
Asphalt Oil Certificate of Compliance	---	one from each asphalt oil supplier

Where mixes contain polymerized asphalt, gradation samples are obtained from the cold feed. Where mixes contain AC-10F, samples are obtained at the construction site at appropriate locations. Where mix gradations exceed the tolerances shown for two consecutive tests, a new mix design shall be formulated prior to proceeding with any work.

The bituminous plant-mix shall be composed of a mixture of aggregate, filler, or additives (if required and approved), bituminous material, and reclaimed material if permitted. The contractor/owner shall submit the following to the City:

10.02 MATERIALS (continued)

a Mix Design

All Hot Bituminous Paving (HBP) mix designs shall be in accordance with Tables 10.02-2, 10.02-3, and 10.02-4.

Table 10.02-2
Bituminous Paving Mix Criteria

PROPERTY	TEST METHOD	VALUE FOR GRADING	
		C	CX
Voids, percent	CPL 5105	3-5	3-5
Stability, minimum	CPL 5105	40	37
Aggregate retained on the No. 4 sieve with at least 2 mechanically induced fractured faces, % minimum	CP 45	70	70
Accelerated moisture susceptibility - Tensile strength retained (Lottman), Min.	CPL 5109	80	75
Minimum dry split tensile strength, P SI	CPL 5109	30	30
Voids in the mineral aggregate, % minimum	CP 48	13	14
Minimum film thickness, microns	CP 49	7	7
Grade of asphalt cement top layer		AC-10F	AC-10F

Table 10.02-3
Master Range Table for Hot Bituminous Pavement

Sieve Size	Percent by Weight Passing Square Mesh Sieves		
	Grading C	Grading CX	Grading G
1½ in.	---	---	100
1 in.	---	---	90-100
¾ in.	100	---	63-85
½ in.	70 - 95	100	46-78
⅜ in.	60 - 88	74 - 95	---
#4	44 - 72	50 - 78	22-54
#8	30 - 58	32 - 60	13-47
#30	12 - 34	12 - 34	4-26
#200	3 - 9	3 - 9	1-7

Table 10.02-4
Mix Design Tolerances

Maximum Size	±0 percentage points
Passing No. 8 and Larger	±8 percentage points
No. 8 to No. 100	±6 percentage points
Passing No. 200	±3 percentage points
Asphalt Content	±0.5 percentage points
Discharged Mix Temperature	±20° F

b Site-Specific Mix Design

If a site-specific mix design is proposed, the proposed job-mix gradation for each mixture required for the project shall be wholly within the Bituminous Paving Mix Criteria Table, Table 10.02-2, when the tolerances shown in CDOT Standard Specifications Table 401-1 are applied. One (1) mix design shall be submitted for each aggregate source and for each pavement type intended for use in constructing public streets.

No paving shall begin prior to the submittal and approval by the City of such mix designs. Prior to beginning paving each calendar year, the contractor shall submit to the City for review and approval a mix design for each mix.

The City may obtain samples from the hot bituminous pavement supplier for analysis by an independent laboratory.

10.02 MATERIALS (continued)

c Aggregate Source Mix Design

The aggregate source mix design should include the gradation in the mix design, and percentage of each element used in producing the final mix design.

d Refinery Name

The name of the refinery supplying the asphalt cement and source of anti-strip additive for tack mix design.

The Design engineer shall recommend the appropriate mix designations for a specific pavement design based upon:

i Traffic analysis

ii Serviceability

iii Drainage/environmental considerations

iv Evaluation of the subgrade, sub-base, base, and surface course materials

The contractor/owner's proposed job-mix formula for each hot bituminous pavement grading will be tested utilizing materials actually produced and stockpiled for use on the project.

The job-mix formula for each mixture shall establish a single percentage of aggregate passing each required sieve size, a single percentage of bituminous material to be added to the aggregate, and a single temperature for the mixture at the discharge point of the plant.

The job-mix formula for each mixture shall be in effect unless a modification is approved by the City.

Should a change in sources of materials be made, a new job-mix formula shall be established before the new material is used. This new job-mix formula shall be in effect until modified by the City. Requests made in writing by the contractor/owner for changes in the job-mix formula will be considered.

A change in the job-mix formula will require a revised mix design be furnished to the City. The job-produced hot bituminous plant mix will be tested by an approved laboratory retained by the contractor/owner for conformance with the stability or the resilient modulus criteria shown in the Tables 10.02-2, 10.02-3, 10.02-4 of these specifications.

The contractor/owner shall use either an approved anti-stripping additive or hydrated lime. A chemical anti-stripping additive will also be acceptable. The additive shall be added at the refinery or at the hot plant. If added at the plant, an approved in-line blender must be used. The blender shall be in the line from the storage tank to the drier drum or pugmill. The blender shall apply sufficient mixing action to thoroughly mix the asphalt cement and anti-stripping additive.

Production sample testing shall be done in accordance with Table 10.02-1.

Tests for cleanliness, abrasion loss, and percent of fractured faces will be made on representative samples of aggregate taken during production or from the stockpiles. These tests are the responsibility of the contractor/owner.

10.02 MATERIALS (continued)

Reclaimed Asphalt Pavement (RAP) material will be accepted in bituminous plant mix provided that all the requirements for hot bituminous pavement are met, except that the mix shall not contain more than 10% RAP material.

Hot bituminous pavement (HBP) and plant-mix seal coat (PMSC) may be tested for moisture susceptibility by the City. If a sample fails to meet these design criteria, the contractor/owner shall take corrective action before being permitted to continue production. If proper corrective action cannot be readily determined, the City will suspend the use of such material until laboratory tests indicate that the corrective measures taken by the contractor/owner will provide material that is in compliance.

If one or more samples of HBP (doesn't apply to PMSC) fail to meet the requirements of this design criteria, the area that the failing sample represented may be cored and tested according to CDOT Standard Specifications Section 401.02. If core samples indicate a failure to meet this design criteria, the contractor/owner shall extend the warranty for the HBP for a period of time as required by the City or as an option, the contractor/owner may replace the material with new acceptable HBP.

B. AGGREGATES FOR PLANT-MIX HOT BITUMINOUS PAVEMENT

Aggregates for plant-mix hot bituminous pavement shall be of uniform quality, composed of clean, hard, durable particles of crushed stone, crushed gravel, natural gravel, or crushed slag. Excess of fine material shall be wasted before crushing. This percentage will be specified in the Master Range Table for Hot Bituminous Paving Table, Table 10.02-3. The natural sand content shall not exceed 20% of the weight of the total aggregate blend for Gradings C and CX and 15% for Grading G. Natural sand is unprocessed, naturally occurring fine aggregate composed mostly of round particles. All aggregates shall be non-plastic when tested in accordance with AASHTO T 90.

Reclaimed material shall be of uniform quality. The maximum size of the reclaimed asphalt pavement shall be 3/4 inches prior to introduction into the mixer. The maximum aggregate size contained in the combination of reclaimed asphalt pavement and new aggregate shall not exceed the maximum specified in the Master Range Table for Hot Bituminous Paving Table, Table 10.02-3, of these specifications.

The material shall not contain clay balls, organic matter, or other deleterious substances. The aggregate for Gradings C and CX shall have a percentage of wear of 45% or less when tested in accordance with AASHTO T 96.

C. MINERAL FILLER

Mineral filler shall conform to the requirements of AASHTO M 17 and shall consist of rock dust, slag dust, hydrated lime, hydraulic cement, fly ash, or other suitable mineral matter. It shall be free of organic impurities and agglomerations. When used, it shall be dry enough to flow freely. Mineral filler shall be graded according to CDOT Standard Specifications Section 703.06. Mineral filler shall have a plasticity index not greater than 4 excluding hydrated lime and hydraulic cement.

D. HYDRATED LIME

As per CDOT Standard Specification Section 712.03.

E. BITUMINOUS MATERIALS

Per CDOT Standard Specifications. If not so specified the bituminous material for hot mix bituminous pavement shall be AC-10 or AC-20. The type and grade of bituminous material will be specified for the project in the approved job mix formula.

10.02 MATERIALS (continued)

The City may require the contractor to take a sample of the material for testing at any time.

10.03 WEATHER LIMITATIONS

Weather limitations shall be as per CDOT Standard Specification Section 401.07 and Section 407.04.

When it is in the public interest and approved by the City, minimum temperature requirements may be waived for placing tack coats and layers of bituminous mixtures below the top layer of the completed pavement. However, pavement operations will be suspended when density requirements are not met.

10.04 BITUMINOUS MIXING PLANT

The bituminous mixing plant shall be capable of producing a uniform material, have adequate capacity, and be maintained in good mechanical condition. Defective parts shall be replaced or repaired immediately if they adversely affect the proper functioning of the plant or plant units, or adversely affect the quality of the hot bituminous plant-mix.

Acceptable safety equipment, approved by the City, shall be provided by the contractor/owner or the supplier to accommodate sampling and testing.

Hot bituminous plant-mix shall not be stored longer than 9 hours, unless additional protective measures are used and approved.

When hot bituminous plant mix is obtained from a commercial plant, the contractor/owner shall make arrangements for approved laboratory facilities at the plant site for testing hot bituminous paving mixtures. The plant laboratory shall meet the requirements of CDOT Standard Specifications subsection 620.04.

10.05 HAULING EQUIPMENT

Trucks used for hauling bituminous mixtures shall have tight, clean, smooth metal beds thinly coated with a minimum amount of paraffin oil, lime solution, or other approved release agent. Petroleum distillates such as kerosene or fuel oil will not be permitted. Each truck shall have a cover of canvas or other suitable material to protect the mixture from the weather.

Any hauling and/or paving equipment that is leaking oil, fuel, or any other type of liquid, will be removed from the project and will be required to be inspected by the City before it will be allowed back on the project. If the piece of equipment is not fixed and continues to leak on the project, the City may reject the asphalt and require the asphalt to be removed at the contractor's expense.

10.06 BITUMINOUS PAVERS

Self-propelled bituminous pavers shall be provided and equipped with an activated/vibrating screed assembly, heated, capable of spreading and finishing the bituminous plant-mix material in lane widths applicable to the typical section and thicknesses given for the project. Pavers used for shoulders and similar construction shall be capable of spreading and finishing courses of asphalt plant-mix material in widths given for the project.

The paver's receiving hopper shall have sufficient capacity for a uniform spreading operation and shall have an automatic distribution system that will place the mixture uniformly in front of the screed.

The screed or strike-off assembly shall produce the specified finished surface without tearing, shoving, rippling, or gouging the mixture.

10.06 BITUMINOUS PAVERS (continued)

The pavers shall be equipped with automatic screed controls with sensors capable of sensing grade from an outside reference line and maintaining the screed at the specified longitudinal grade and transverse slope. The sensor shall be constructed to operate from either or both sides of the paver and shall be capable of working with a ski-type device at least 30 feet in length, or a short ski or short shoe.

The type of devices to be furnished shall be as provided in the specifications for the project.

The controls shall be capable of maintaining the screed at the specified transverse slope within $\pm 0.1\%$.

Manual operation will be permitted for constructing irregularly shaped and minor areas.

If the automatic controls fail or malfunction, the equipment may be operated manually for the remainder of the normal working day, provided specified results are obtained.

If the contractor/owner fails to obtain and maintain the surface tolerances, specified in Section 10.12C, the paving operations shall be suspended until satisfactory corrections, repairs, or equipment replacements are made.

Placement of hot bituminous pavement on a waterproofed bridge deck shall be accomplished with equipment that will not damage the membrane or protective covering.

10.07 TACK COAT

Whenever new asphaltic pavement is placed on existing bituminous pavement, or against existing concrete surfaces (including gutter pans, curbs, manholes, and valve boxes) a bituminous tack coat shall be applied to the existing pavement prior to placing the new pavement. When the new pavement abuts the old pavement, the contractor/owner shall cut the old pavement as per Section 11, Street Cut and Excavation Repair Section, and spray the edge of the old pavement with a tack coat. The tack coat material shall conform to requirements for bituminous materials found in CDOT Standard Specifications Section 407, latest edition.

The surface to receive the tack coat shall be dry and cleaned by an approved method until all dust, debris, and foreign matter are removed. The tack coat material shall be applied at a rate of between 0.05 and 0.10 gal/yd² and temperature which will provide a very thin coating uniformly distributed over the entire area to be covered. The tack coat shall not be applied at temperatures outside the requirement in CDOT Standard Specifications Standard 407.04. At the City's direction, the contractor/owner shall provide adequate means of calibrating or measuring the rate of application which should not exceed 0.10 gal./yd².

10.08 SURFACE CONDITIONING

Before starting the paving, the contractor shall ensure that utility lines, piping, general grading, and heavy trucking are complete so such operations will not damage paving work.

Prior to placing the pavement, the contractor shall adjust manholes, valve boxes, and other fixtures to below pavement grade. These fixtures shall be adjusted to final grade after paving. For additional specifications, see Manhole Raising Detail, No. S-20; Water Valve Raising Detail - Potable Water Valve, No. S-36; and Water Valve Raising Detail - Nonpotable Water Valve, No. S-37.

Irregularities in the existing pavement or base shall be brought to uniform grade and cross section. Prior to placing tack coat and beginning overlay work, the surface shall be swept to remove accumulations of loose gravel and debris in those areas where this is applicable. Contact surfaces of curbing, gutters, manholes, and other structures shall be sprayed with a uniform coating of bituminous material prior to placing bituminous mixture against them.

10.09 PREPARATION OF BITUMINOUS MATERIAL

The bituminous material shall be heated to the specified temperature without local overheating and shall be continuously supplied to the mixer at a uniform temperature within the specified range.

10.10 PREPARATION OF AGGREGATES

Heating and drying of the aggregates shall be accomplished without damaging the aggregate.

When hydrated lime is used it shall be added to the aggregate in accordance with one of the following methods:

A. LIME SLURRY ADDED TO AGGREGATE

The hydrated lime shall be added to the aggregate in the form of slurry and then thoroughly mixed in an approved pugmill. The slurry shall contain a minimum of 70% water by weight.

B. DRY LIME ADDED TO WET AGGREGATE

The dry hydrated lime shall be added to wet aggregate (a minimum of 3% above saturated surface dry) and then thoroughly mixed in an approved pugmill.

The lime-aggregate mixture may be fed directly into the hot plant after mixing or it may be stockpiled for not more than 90 days before introduction into the plant for mixing with the bituminous material.

The hydrated lime may be added to different sized aggregates and stockpiled, by adding 75% of the lime to the aggregate passing the No. 4 sieve and 25% to the aggregate retained on the No. 4 sieve.

10.11 MIXING AND TEMPERATURE

The dried aggregates and asphalt shall be combined in the mixer in the quantities required to meet the job-mix formula. The materials shall be mixed until the aggregate is completely and uniformly coated and the asphalt is uniformly distributed throughout the aggregate.

The temperature of the mixture when discharged from the mixer shall be as shown in the Asphalt Maximum Mixture Temperature Table, Table 10.11-1, or according to the approved job mix formula.

Table 10.11-1
Maximum Asphalt Mixture Temperature

Asphalt Grade	Temperature (degrees Fahrenheit)
AC-20 (Rubberized)	320
AC-20	290
AC-10	280
AC-5	275

The mixture shall not be delivered for use on the roadway at a temperature lower than 235° Fahrenheit for mixes not containing rubberized asphalt.

Storing or holding of asphalt mixture will be permitted, provided the characteristics of the mixture are not altered. If storing or holding of the mixture causes segregation, excessive heat loss, or adversely affects the quality of the finished product, corrective action shall be taken. Unsuitable mixture shall be disposed of at the contractor/owner's expense.

When placing hot bituminous mixture over bridge decks covered by waterproofing membrane, the minimum temperature of the mixture when rolling operations begin shall be 250° Fahrenheit. The job-mix formula temperature may be increased up to 30° Fahrenheit to obtain this temperature.

10.12 SPREADING AND FINISHING

A. BITUMINOUS PAVERS AND OTHER EQUIPMENT

Bituminous pavers shall be used to distribute the mixture to the established grade and required thickness over the entire width or partial width as practicable.

The contractor/owner shall protect the asphalt (both existing and new) from solvents and oils. Any piece of equipment leaking any fluid shall be removed from the work site immediately and shall not return to the work site until all leaks are repaired. If any piece of equipment leaks any fluid a second time, it shall be removed from the work site immediately and shall not be allowed on the work site again for the remainder of the project. The contractor/owner shall not use diesel or other solvents to remove or prevent the sticking of asphalt to the wheels of rubber-tired rollers or other equipment used on the asphalt.

B. BITUMINOUS SURFACE COURSE

The bituminous surface course shall be placed in at least two lifts on all street types.

The first lift shall be a minimum (not an average) of 2 inches finished thickness on arterials and collectors. On local streets, the first lift shall be a minimum of 1½ inches and a maximum of 2 inches. The top lift shall be a minimum of 1 inch finished thickness. A tack coat between lifts is required. (This does not apply to plant-mix seal coat.)

C. SURFACE TOLERANCE

For surface courses, the finished surface of the bituminous pavement when tested with a 10-foot straight-edge parallel to the centerline or perpendicular across joints will show variations as measured from the testing face of the straight-edge to the surface of the pavement, which shall not exceed 3/16 inch or as per CDOT Specification Section 401.20. There shall be no allowance for standing water on the final pavement surface. After compaction, the asphalt pavement adjoining the curb and gutter shall be between 1/4 and 1/2 of an inch higher than the lip of the gutter pan. Areas that do not meet the required surface accuracy shall be clearly marked, and, if the City requires repair, the contractor/owner shall correct the area by removing defective work and replacing it with new material as directed.

D. THICKNESS TOLERANCE

Any deficiency in the total thickness of the asphaltic pavement shall not exceed 10% for any one sample with the average deficiency for all samples not to exceed 7½%. Final decision for correction of deficiencies shall not be made until a pavement evaluation is made by an independent testing laboratory retained by the contractor/owner.

E. LONGITUDINAL JOINTS

The longitudinal joint in both new pavement and overlay pavement layers shall offset the joint in the layer immediately below by 12 inches. The joints in any pavement layer shall not fall in a wheel track. The joints in the top layer of new pavement not built on top of an existing pavement shall be located at the centerline of the pavement and at the outside edge of the travel lanes for two-lane roadways and at the lane lines and at the outside edge of the travel lanes for roadways of more than two lanes.

Where paving operations are on the present traveled roadway, the contractor/owner shall arrange paving operations so there will be no exposed longitudinal joints between adjacent travel lanes at the end of a day's run. With the approval of the City, the contractor/owner may be permitted a vertical or tapered exposed longitudinal joint when the thickness of pavement course being placed is 1 inch or less, or a tapered exposed longitudinal joint when the thickness of pavement course being placed is greater than 1 inch. Minimum width of taper shall be three times the thickness of the pavement course.

10.12 SPREADING AND FINISHING (continued)

On areas where the use of mechanical spreading and finishing equipment is impracticable, the mixture shall be dumped, spread, raked, screeded, and luted by hand tools to the required compacted thickness. All oversized aggregate accumulating during hand raking shall be removed from the roadway surface and disposed of properly.

Production of the mixture shall be maintained so pavers can be used in echelon to place the wearing course in adjacent lanes.

F. SEGREGATION OF ASPHALT

The bituminous mixture shall be transported and placed on the roadway without segregation. All segregated areas behind the paver shall be removed immediately upon discovery. The segregated material shall be replaced with specification material before the initial rolling has taken place. If more than 50 square feet of segregated pavement is ordered removed and replaced in any continuous 500 linear feet of paver width lay-down, operations shall be discontinued until the source of the segregation has been found and corrected.

The City will determine the extent of segregated areas. The contractor shall correct all segregated areas at his own cost.

10.13 HAND PLACEMENT

In narrow, deep, or irregular sections; intersections; turnouts; or driveways where it is impractical to spread and finish the mixtures by machine methods, the contractor/owner may use acceptable hand methods as accepted by the City.

When the mixture is to be spread by hand, upon arrival on the work site, it shall be dumped on the area on which it is to be spread. Immediately thereafter it shall be distributed into place by means of hot shovels and spread with hot rakes in a loose layer of uniform density and correct depth. Tines of the rakes shall be not less than 1/2 inch longer than the maximum diameter of aggregate particles and in no case should the space be less than 1 inch. Loads shall not be dumped any faster than they can be properly handled by the raker.

The raker will not be permitted to stand in the hot mixture while raking it, except where necessary to correct errors in the first raking. The raking must be carefully and skillfully done in such a manner that after the first passage of the roller over the raked mixture, a minimum amount of back patching will be required.

Placing mixture shall be as continuous as possible and the roller shall pass over the unprotected edge of the freshly laid mixture only when the laying of this course is to be discontinued for such intervals of time as to permit the mixture to become chilled.

10.14 COMPACTION

The plant-mix bituminous pavement shall be compacted by rolling. Both steel wheel and pneumatic tire rollers will be required. The number, weight, and type of rollers furnished shall be that which is sufficient to obtain the required density while the mixture is in a workable condition. Compaction shall begin immediately after the mixture is placed and be continuous until the required density is obtained. When the mixture surface temperature falls below 185° Fahrenheit, no further compaction effort will be permitted unless approved.

All roller marks, ripples, or other surface defects shall be removed with the finish rolling. Use of vibratory rollers with the vibrator on will not be permitted during surface course final rolling and will not be permitted on any rolling on bridge decks covered with waterproofing membrane.

10.14 COMPACTION (continued)

Pavement shall be compacted to a density of 92% to 96% of the maximum theoretical density, determined according to AASHTO T 209. Along forms, curbs, headers, walls, and all other places not accessible to the rollers, the mixture shall be thoroughly compacted with mechanical tampers.

Any mixture that becomes loose and broken, mixed with dirt, or is in any way defective, shall be immediately removed and replaced with fresh hot mixture, and compacted to conform with the surrounding area.

10.15 JOINTS

Placing of the bituminous paving shall be continuous, and rollers shall not pass over the unprotected end of a freshly laid mixture. Transverse joints shall be formed by cutting back on the previous run to expose the full depth of the course. A coat of bituminous material shall be applied to contact surfaces of all joints just before additional mixture is placed against the previously compacted material. Location and configuration of longitudinal joints shall be in accordance with CDOT Standard Specification subsection 401.16.

10.16 QUALITY CONTROL TESTING SPECIMENS

The contractor/owner shall furnish the bituminous paving mixture necessary for quality control testing. A qualified testing laboratory acceptable to the City shall sample and test the specimens. All test results shall be submitted to the City within 10 working days of the completion of testing. The contractor/owner shall be responsible for the quality control tests.

The primary purpose for sampling and testing fresh bituminous paving mixtures is to determine conformity with the job-mix formula for acceptance. Results of these tests may be used by the producer to control uniformity of the mixture at the place of manufacture. It is, therefore, very important that the samples of bituminous mixture represent, as nearly as possible, what the manufacturer is producing. A typical quality control testing program is as follows:

- One density test per 1000 linear feet of pavement per day with a minimum of 3 tests per project.
- Obtain 1 sample for each 500 tons or fraction thereof of mix produced on a project, but not less than one sample per project.
- One Marshall Density test and gradation and extraction test per day of paving operation, unless the paving for the day is less than 100 tons.

10.17 ACCEPTANCE TESTING

The contractor will provide acceptance testing. See the Material Sampling and Testing Schedule in Appendix B.

Cores will be taken at the City's discretion to determine specific density, depth thickness of the asphaltic pavement, and compliance with the design mix. Core samples should be taken after the final lift. Where the core samples have been taken, new material shall be placed and compacted into the holes by the contractor to conform with the surrounding areas.

Testing the in-place pavement for compliance with the requirements for surface smoothness may be required by the City. The City may perform additional acceptance testing if it is necessary to determine that the pavement is acceptable or to determine the extent of unacceptable pavement. The contractor shall repair or remove and replace any unacceptable pavement as required by the City.

The contractor shall be responsible for the costs associated with re-testing due to failed acceptance tests. The contractor/owner may contract with a qualified engineer to evaluate the unacceptable pavement and propose a remedy for review and approval by the City.

SECTION 11 STREET CUT AND EXCAVATION REPAIR

11.01 GENERAL

The purpose of this section is to provide guidelines for cutting and replacement of street surfaces in a manner that shall not degrade the existing improvements and shall be accomplished with minimum inconvenience to the users.

A. PROJECT INSPECTION

All construction and installations shall be subject to inspection by the City or its authorized representative. Refer to Section 4.03C for additional specifications on project inspection.

B. TRAFFIC CONTROL

The contractor/owner shall be responsible for all types of traffic, including pedestrians, in the construction area. Refer to 4.03F for additional specifications on traffic control.

C. LICENSES AND PERMITS REQUIRED

Refer to Section 4.03C for additional specifications on project inspection..

D. COORDINATION

Coordination between the contractor/owner and the City is essential in an effective street patching effort.

Except for emergencies, no excavation or street repair should be undertaken without a permit. In the case of emergencies, obtain a permit for the excavation as soon as possible after the work has begun. The permit process is intended to identify problems with proposed work before it begins, as well as to maintain a record of construction in the public right-of-way.

No excavation or street repairs should be allowed in new pavements (whether new construction or overlays) for the first 5 years of the pavements' life. Street cuts in new pavements will be approved only as a last alternative, when boring or jacking for the proposed street crossing are not possible.

Traffic control plans shall be submitted 48 hours in advance of construction and/or excavation permit.

E. PAVEMENT MANAGEMENT

The pavement condition shall be surveyed with the City prior to and after the work is completed.

In the case of minor repairs, these pavement surveys can be made by visual observation. However, in the case of a major project which involves excessive haul of materials or unusually heavy construction equipment or activity, non-destructive testing of the pavement condition before and after construction may be appropriate.

Street repairs for a particular section should be consistent with the pavement management strategy for that pavement.

11.02 MATERIALS

A. HOT BITUMINOUS PAVEMENT PATCHING

Patching materials shall conform to the requirements of Street Construction Specifications Section 10.02. New material used during infrared patching shall be hot bituminous pavement (Grading CX).

11.02 MATERIALS (continued)

Conventional patching shall be performed with hot bituminous pavement (Grading C). Grading CX may be used with approval from the City. See Street Construction Specifications Section 10.02A and the Bituminous Paving Mix Criteria Table, Table 10.02-2, for the properties of CX and C Grading.

This work consists of constructing one or more courses of bituminous pavement on a prepared base in accordance with these specifications, and in conformity with the lines, grades, thicknesses, and typical cross-sections shown on the plans or established. Work in this section shall be completed in accordance with CDOT Standard Specifications Section 403 except as modified herein.

The bituminous pavement shall be composed of a mixture of aggregate, filler if required, and bituminous material.

B. CONCRETE PAVEMENT PATCHING

Patches for concrete pavement shall consist of Portland cement concrete Class P. Refer to CDOT Standard Specifications Section 601 for more specifications. The City may approve Class A or B concrete as a substitute on a case by case basis.

C. CONCRETE STRUCTURES

The concrete materials shall conform to the requirements of Sections 14.02A through 14.02F of this document.

D. FLOWABLE FILL

Non-shrinkable trench backfill shall meet the requirements of Section 6.02B.

11.03 REMOVAL OF EXISTING IMPROVEMENTS

A. GENERAL

Whenever practical, existing pavements should be removed to clean, straight lines, parallel and perpendicular to the flow of traffic. Patches with angled sides and irregular shapes should be avoided.

Avoid patches within existing patches. If this cannot be avoided, make the boundaries of the patches coincide.

On arterial and collector streets, do not leave strips of pavement less than one-half lane in width from the edge of the new patch to the edge of an existing patch or the lip of the gutter. In the case of residential streets, do not leave strips less than 8 feet in width from existing patches.

The City of Evans reserves the right to require overlays in areas determined by the City to have excessive patching.

B. BITUMINOUS PAVEMENT

Bituminous pavement shall be removed to clean, straight lines and should be perpendicular or parallel to the flow of traffic. The contractor shall remove and properly dispose of pavement and road surfaces as a part of trench excavation. If the limits of the asphalt removal are within 3 feet of the edge of pavement, the pavement shall be removed and replaced to the edge of the pavement. The width of pavement removed along the trench for the installation of pipe shall not exceed the width of the trench specified by more than 1 foot of each side of the trench without approval of the City.

11.03 REMOVAL OF EXISTING IMPROVEMENTS (continued)

The edge of the trench should not be closer than 3 feet to concrete structures (i.e. curb and gutter, sidewalks, driveways, inlets, etc.). The actual distance shall be dependent upon the characteristics of the soil, the type of equipment that is used for trenching, and the methods used for excavation and backfill. If, in the opinion of the City, concrete structures are endangered by undermining of the structure or settlement, the City may require that the structure be replaced, or special construction methods may be required, or the distance of the trench from the structure will be increased.

The contractor shall use such methods such as cutting, drilling, or others that will ensure the breaking of pavement in a straight line. The face of the remaining pavement shall remain approximately vertical. If the edge is damaged during construction, it shall be re-cut prior to final bituminous patching. All saw cutting shall not extend past the construction limits by more than 3 inches and such over-cut shall be sealed in the same manner as cracks.

C. CONCRETE PAVEMENT AND CONCRETE STRUCTURES

Concrete to be removed shall be cut vertically with square edges such that each edge of the finished patch will be parallel or at right angles to the direction of traffic. The edge for removal will be in a straight line set by a string line, chalk line, or other means to ensure a straight removal line.

The contractor shall use methods such as saw cutting to ensure the breaking of concrete pavement in a straight line and shall avoid breaking away the edges of the existing pavement or damaging the remaining pavement with heavy construction equipment. Remove sections to existing joints in the case of concrete in good repair. In damaged concrete, the limits of removal should be determined in the field by the City or an authorized representative.

On sidewalks, bikeways, curb and gutters, valley gutters, driveways, and alley approaches the minimum removal section shall be 5 feet in length, as long as the remaining section is a minimum of 5 feet long. If the remaining section is less than 5 feet long, the entire panel shall be removed and replaced.

All concrete sawcuts are to be cut to full depth and shall be saw cut in straight lines, either parallel to the curb or perpendicular to the alignment of the sidewalk or curb. The sawing of concrete shall be done carefully, and all damages due to contractor's operations to concrete to remain in place shall be repaired at the expense of the contractor. Where monolithic curb, gutter, and sidewalk is encountered and only removal of curb and gutter is specified, a straight, full-depth sawcut will be required to separate the curb and gutter from the sidewalk.

Removed concrete shall be replaced within 3 days from the time it was removed (weather permitting). In no case shall the contractor be allowed to remove more concrete until the 3-day replacement schedule has been re-established.

Concrete placed during cold weather shall comply with CDOT Standard Specifications 601.12 and 601.13.

In order to allow for forming and patch-back, when removing curb and gutter or sidewalk abutting asphalt pavement, the contractor shall remove the adjacent asphalt pavement and base course 24 inches wide and 6 inches deep if the City determines that the asphalt surface is either damaged by removal activities or out of alignment with the curb and gutter.

If a sidewalk or curb and gutter section are removed and replaced without the removal of the adjacent asphalt, it must be placed such that there are no voids exist between the concrete and asphalt and the fall in the lip of the gutter section must also meet the required cross-section within $\pm 1/4$ inch.

11.03 REMOVAL OF EXISTING IMPROVEMENTS (continued)

D. GRAVEL SURFACED STREETS

When trenches are excavated in streets or alleys that have a gravel surface, the contractor shall replace such surfacing with Class 6 backfill material conforming to CDOT Standard Specifications Section 703.03. Gravel replacement shall be 1 inch greater in depth than that which originally existed, with a minimum of 5 inches and shall be adequately compacted. The surface shall conform to the original street grade. Where the completed surface settles, additional gravel base shall be placed and compacted by the contractor immediately after being notified by the City to restore the roadbed surface to finished grade.

E. CLEAN UP

The contractor shall remove all debris from all sidewalks, curb and gutters, pans, and driveways at the construction site and dispose of the debris in an appropriate location.

11.04 TRENCH EXCAVATION AND BACKFILL

A. EXCAVATION

The contractor shall protect the street and alley surfaces, drainage facilities, and all existing improvements from excavated materials, equipment operations, and other construction operations. Any damaged improvements shall be the responsibility of the contractor. Adequate provisions must be made to assure that traffic and adjacent property owners experience a minimum of inconvenience.

Trench excavations in existing right-of-way under existing pavements, curb and gutters, and/or sidewalks, shall conform to Backfill Section 6, and shall be backfilled with flowable-fill unless otherwise approved. Trench excavations in new development shall conform to this section. Potholes excavated for utility locates shall also be backfilled to those specifications

Boring of utilities, whether service lines or main utility lines, shall be done in such a manner as to ensure there is no settlement of the soil or surface improvements. The contractor is responsible for all settlement and damage that occurs due to boring or jacking operations. Tunneling shall not be permitted.

Trenches shall be excavated along the lines and grades established, and in no case shall more than 200 feet of trench be opened in one place in advance of the completed and backfilled installation.

All excavated material shall be stockpiled in a manner that does not endanger the work or workmen and that does not obstruct sidewalks, streets, and driveways. Hydrants under pressure, valve pit covers, valve boxes, electrical apparatus, manholes, inlets, and other utility controls shall be left unobstructed and accessible during construction, unless otherwise approved by the City. If an emergency access is needed to any utility which is blocked, whether approved or not, the contractor shall be responsible for removing the obstruction. Gutters shall be kept clear or other satisfactory provisions made for street drainage, and the natural water course shall not be obstructed.

The work shall be done in a manner that will minimize interference with traffic. The contractor at the end of each day shall barricade all excavations and ditch lines, remove excess excavated material from travel ways, and thoroughly clean all streets, alleys, and sidewalks affected by the excavation.

Materials encountered during excavation such as rubbish, organic or frozen material, and any other material which is not satisfactory for use as backfill in the opinion of the City, shall be removed from the site and disposed of regularly by the contractor at his expense. Stones, concrete, or asphalt chunks larger than 6 inches, or frozen material shall be considered unsatisfactory backfill and removed by the contractor.

11.04 TRENCH EXCAVATION AND BACKFILL (continued)

B. BACKFILL

Backfill in existing or proposed streets, curbs, gutters, sidewalks, bikeways, and alleys is divided into three categories: initial, intermediate, and final lifts as defined below. Also see Trench Excavation & Backfill Detail (No. S-35).

1. Initial Layer

The initial layer consists of the section from the bottom of the excavation to a point 6 to 12 inches above the top of the installation. Placement and compaction of the initial layer shall be as specified by the utility to protect their installation. If placement is not specified by the applicable utility, it shall be installed as per Trench Excavation & Backfill Detail (No. S-35).

2. Intermediate Layer

The intermediate layer consists of the section above the initial layer to a point within 12 inches of the ground level or the bottom of the pavement section, whichever is greater.

When the type of backfill material is not indicated on the drawings or specified, the contractor may backfill with the excavated material, provided that such material consists of loam, clay, sand, gravel, or other materials that, in the opinion of the City, are suitable for backfilling. Excavated material to be used for backfill shall be free of all rocks, stones, or boulders having a dimension greater than 6 inches, provided that frozen earth, organic materials, cinders or other corrosive material, broken asphalt and concrete, debris and roots are removed.

If excavated material is indicated on the drawings or specified for backfill and there is a deficiency due to a rejection of part thereof, the contractor shall furnish the required amount of sand, gravel, or other approved material. Rocks or stones which are larger than 3 inches, in any dimension, shall not be placed within 1 foot of pavement subgrade or within one foot of the finished surface of unpaved areas.

The intermediate layer in existing or proposed streets, curbs, gutters, valley gutters, sidewalks, bikeways, and alleys shall be placed in uniform, horizontal lifts not to exceed 8 inches loose and shall be compacted to a minimum dry density of 95% throughout the intermediate layer. All compacted backfill shall be $\pm 2\%$ of the optimum moisture content as determined by AASHTO T99 or as recommended by a geotechnical engineer.

The intermediate layer within the right of way, but not below improvements shall be placed in uniform, horizontal lifts not to exceed 12 inches loose and shall be compacted to a minimum dry density of 90% throughout the intermediate layer. All compacted backfill shall be $\pm 2\%$ of the optimum moisture content as determined by AASHTO T99.

3. Final Layer

The final layer consists of that section above the intermediate layer, to the finished elevation or the bottom of the pavement section.

The final layer shall be Class 4, 5, or 6 aggregate base course, as defined in CDOT Standard Specifications Section 703.03, and shall be placed in uniform lifts no greater than 6 inches in compacted depth and compacted to 95% of maximum density, $\pm 2\%$ of optimum moisture content as determined by AASHTO T99 or as recommended by a geotechnical engineer. See Trench Excavation & Backfill Detail (No. S-35) for additional specifications.

11.04 TRENCH EXCAVATION AND BACKFILL (continued)

No ponding or jetting of trenches or use of a hydrohammer or any impact-type compaction is allowed. Compaction shall be done by mechanical methods.

C. FLOWABLE-FILL

The use of flow-fill (non-shrinkable trench backfill) is considered an acceptable alternative to backfilling and compacting with native or imported soils. Material specifications are given in Section 6.02B.

11.05 SURFACE RESTORATION

A. GENERAL

All persons working, obstructing, or making excavations in streets or public rights-of-way shall restore the street or public place to a condition at least as good as, if not better than, the condition prior to the work, obstruction, or excavation, with minimum inconvenience to the users.

Proof-rolling is required on subgrades and base courses prior to placement of subsequent courses. Proof-rolling shall be performed with equipment and in a manner acceptable to the City. The contractor shall provide any equipment required for proof-rolling. Areas found to be weak and those areas which fail, shall be corrected and brought into compliance with these specifications by the contractor.

Completed street repairs should have a rideability at least as good as, if not better than, the pavement prior to the repairs.

Do not place overlays with feathered edges and ends along curb and gutter or pans. Overlays on collectors and arterials should be placed by first removing the existing pavement to the desired depth by grinding and then replacing the pavement flush with the adjacent surfaces.

On some residential streets, overlays with feathered transitions may be acceptable, but the City should be consulted in planning such overlays. Particular care must be taken in constructing overlays to provide smooth transitions, and to avoid problems with drainage or access at the edges of gutters.

Transverse patches on arterial and collector streets shall be overlaid across the entire street width for a distance of 15 feet on either side of the patch.

Do not allow the edges of patches to fall in existing wheel paths. The edges of patches parallel to the direction of traffic should be limited to the boundaries of lanes or to the centerline of travel lanes. Patches should have a smooth longitudinal grade consistent with the existing roadway. Patches should also have a cross-slope or cross-section consistent with the design of the existing roadway.

Surface tolerances for street repairs should meet the standard for new construction as per CDOT Specification Section 401.20.

Avoid weakening or destroying the existing pavement around an excavation with heavy construction equipment, stockpiling or delivery of materials, etc. When damage does occur, remove the damaged pavement, extending the limits of the street repair, before replacing the pavement.

When the proposed excavation falls within 10 feet of a section of failed pavement, the failed area should be removed to sound pavement and patched.

Scarring, gouging, or other damaged pavement adjacent to a patch shall be removed and the pavement repaired.

11.05 SURFACE RESTORATION (continued)

In the case of older pavements where the likelihood of cracking and potholes next to the patch is greater, it may be necessary to extend the limit of the pavement patch and reinforce this area with a geotextile as specified in CDOT Standard Specifications Section 420.

For patches in asphalt, a tack coat shall be applied to all edges of the existing asphalt before placing the new pavement.

If the final surface is not immediately installed, place a temporary asphalt surface on any street cut opening with either a hot mix or cold mix paving material. Temporary surfaces shall be compacted and sealed to prevent degradation of the repair and existing structures during the temporary period.

Any temporary repair that fails to provide a smooth nonhazardous riding surface shall be removed and replaced immediately by the contractor. As soon as conditions allow, the contractor shall remove the temporary patch and install a permanent patch in accordance with these specifications. The contractor shall be responsible for maintaining temporary patches in a manner satisfactory to the City until they are replaced. In case of an emergency the City may elect to repair the temporary patch and back charge the contractor for the repair of the patch.

All permanent patches and repairs shall be appropriate to the surface; for example, concrete patches in concrete surfaces, concrete base with asphalt overlay patches will be expected in permanent "overlay" concrete streets, etc. In no case is there to be an asphalt patch in concrete streets or concrete patch in asphalt streets. Any repair not meeting these requirements will be removed and replaced by the contractor/owner at his expense.

All patches shall be made within the time frame stipulated in the street cut permit. Repair shall be made as rapidly as is consistent with high quality workmanship and materials. Use of fast setting concrete and similar techniques is encouraged when possible, without sacrifice of the quality of repair. Completion of the job including replacement of pavement and cleanup shall normally be accomplished within 2 days after the repair work or activity involving the cut is done. Extension of time for completion shall be with the approval of the City. If the repairs are not completed in the allotted time the City will repair the street at the contractor/owner's expense.

Removal and replacement of unsatisfactory work shall be completed within 30 days of written notification of the deficiency.

Upon completion of repair activities on shouldered roads, the contractor/owner will be responsible for restoring the road side shoulder.

B. BORE HOLES

Bore holes (openings less than 6 inches in diameter) shall be filled with concrete patching material to prevent entry of moisture. Concrete patching material used shall be in all cases compatible with the existing surface. Subgrade shall be replaced and compacted to provide necessary support to the surface.

All cut edges shall be cleaned and then painted with a tack coat of bitumen cement.

All material and methods shall comply with Sections 9 through 11.

The sealing of bore holes is the responsibility of the contractor/owner or persons making the bore. The completed job shall be flush with the surrounding pavement and have no indentations, pockets, or recesses that may trap and hold water.

11.05 SURFACE RESTORATION (continued)

C. REPLACING CONCRETE STRUCTURES

1. Placement

Replacement shall be with concrete unless otherwise indicated on the permit. All material and methods shall comply with Street Construction Specifications Section 15.

Subgrade requirements shall be as per CDOT Standard Specification Section 412.08.

No pea gravel, sand, or other material with less than 10% passing the #100 sieve will be allowed as bedding beneath any concrete within the City right-of-way. Where a section of concrete sidewalk, curb and gutter, valley gutter, bikeway, driveway, or alley approach has been disturbed, it shall be removed to a joint if the joint is situated within 5 feet of the proposed or existing cut. Otherwise, a straight line shall be sawcut prior to replacement. No section to be replaced shall be less than 5 feet in either width or length.

Where new construction abuts existing, the work shall be accomplished so that the variance in grade between the old and new work does not exceed 1/4 inch.

2. Testing

Testing shall be as per Material Sampling and Testing Schedule, found in Appendix B.

3. Finishing

Refer to Section 14.08 through 14.10 for specifications on finishing concrete.

D. BITUMINOUS PAVEMENT

When trenches are excavated in areas having a bituminous surface the contractor shall replace such surfacing as follows: cut to clean straight vertical line parallel or perpendicular to the flow of traffic, 1 foot beyond the actual excavation on all sides. See Trench Excavation & Backfill Detail (No. S-35) for additional specifications.

Place and compact the full-depth asphaltic concrete pavement in layers with the maximum thickness of 3 inches having a minimum depth of 3 inches or 1 inch greater than the original pavement, whichever is greater, and shall not to exceed 7 inches. Overlaying layers of asphaltic concrete pavement shall not be placed until the lower layer has cooled sufficiently to provide a stable material which will support the equipment without rutting, shoving, or moving in any manner. The temperature of the lower asphalt layer shall be less than 150° Fahrenheit before placing the second asphalt layer.

The transverse joint at each end of the overlay shall be milled a minimum of 1½ inches or removed to provide a smooth transition from the overlay to the existing pavement.

Newly patched areas may not be opened to traffic earlier than 2 hours after the completion of the patching work so that the asphalt has adequate time to cool before being subjected to traffic loads.

Patching materials and construction requirements for bituminous pavement shall meet the requirements for plant-mix hot bituminous pavement as specified in Section 10.

Patching work adjacent to new concrete may not commence until the concrete has cured for a minimum of 5 days. This time may be reduced if test results verify that field-cured test cylinders have attained an average compressive strength of 2,500 psi during a shorter curing time.

11.05 SURFACE RESTORATION (continued)

No patching may commence until the exposed subgrade at the base of the patch has been compacted adequately.

Apply a tack coat prior to paving with plant-mix hot bituminous pavement to the contact edges of previously constructed bituminous layers, aggregate base course, subgrade, concrete surfaces, and metal surfaces abutting or projecting into the bituminous pavement.

Patching may be performed by either conventional or infrared methods. Infrared patching, if used must conform to the following requirements:

- The infrared heating unit must be equipped with adjustable height controls and heating chambers capable of heating the existing bituminous pavement to a workable temperature without oxidizing or burning the oils. There shall be no flame in direct contact with the existing pavement surface.
- The heating unit must operate within 6 inches of the existing pavement surface and be capable of heating an area that extends a minimum of 30 inches beyond the face of the new pavement.
- Heat shall be continuously applied to the patch area until the existing pavement material can be manually raked and shaped to a depth of 2 inches below the surface. The heated surface material located within 24 inches of the new pavement shall be immediately raked off of the roadway surface, mixed with an approved rejuvenating agent, and placed into the void adjacent to the new pavement. The rejuvenating agent shall be applied at the rate of 0.20 gal./yd² (0.044 gallons per linear foot for a 24 inch width). Mechanized compaction equipment shall be used to compact this material. Excess material shall be disposed of by the contractor.
- New hot bituminous pavement material shall be added as necessary to fill the remaining void. This patch area shall be raked and luted as necessary to match the elevation of the adjacent pavement and concrete and provide positive drainage. A self-propelled, vibratory roller shall be used to provide complete compaction of the patch area and a smooth texture which matches the elevation of the surrounding surfaces. All oversized rocks shall be removed from the roadway surfaces.

E. FULL-DEPTH ASPHALT PATCHING

Full-depth asphalt patching shall be a minimum thickness of 3 inches or 1 inch greater than the existing asphalt, whichever is greater, and should not exceed 7 inches.

F. BITUMINOUS PAVEMENT WITH CONCRETE BASE

The concrete base shall be replaced with not less than 6 inches of 4,000 psi concrete to a line 1 inch lower than the bottom of the concrete pavement. The finish bituminous wearing surface shall not be placed on top of the concrete base for a period of 2 days or until the compressive strength of the concrete is 2,000 psi or greater. Apply a tack coat of bitumen cement prior to application of the bituminous surface material.

G. CONCRETE STREETS

The pavement shall be removed back to the nearest contraction or expansion joint. Minimum patch shall be 1/4 panel section but no less than 6 feet by 5 feet with the 6 foot dimension in the longitudinal direction. The concrete shall be replaced with 4,000 psi concrete to match the finish of the existing pavement.

11.05 SURFACE RESTORATION (continued)

To increase the load transfer and protect the pavement against differential settlement, the contractor shall drill the existing concrete pavement and provide smooth expansion dowels at 24 inches, minimum, distance on center at the mid-depth of the concrete. To facilitate this movement, the part of the dowel that protrudes into the patch shall be painted and covered with a 1/16 of an inch coating of grease.

Concrete construction shall be protected from vehicular traffic, including contractor vehicles for a period of not less than 7 days. This time may be reduced if test results verify that field cured test cylinders have attained an average compressive strength of 3,000 psi. Concrete shall be coated and sealed with a uniform application of membrane curing compound as outlined in CDOT Standard Specifications Section 412.14.

The use of high early-strength concrete shall be used on all arterial and collector streets. High, early strength concrete repairs may be opened to traffic within 2 days unless "Quick Strength" concrete is used. Regardless of the type of concrete used, repairs may not be opened to traffic until the average compressive strength of field-cured test cylinders is at least 3,000 psi when tested.

H. JOINT FILLING

Following placement of the concrete surface, the joints shall be thoroughly cleaned of all foreign material, and then filled with hot-poured elastic type joint filler conforming to ASTM D 1190 or D 3405 as per CDOT Standard Specifications subsection 705.01. Joint material shall be filled to within 1/4 inch of the surface. Excess material shall be scraped off to provide a smooth riding surface.

11.06 MATERIAL TESTING

The contractor is responsible for the quality control testing and protection of work. Testing may include but is not limited to tests associated with placing of concrete, asphalt and base course subgrade preparation, and trench compaction. See the Material Sampling and Testing Schedule in Appendix B.

The contractor shall be responsible for the costs associated with re -testing due to failed acceptance tests. Additional testing for construction quality control, such as establishing roller patterns, compaction tests, etc., is considered for the contractor's convenience and shall be provided by the contractor at his discretion.

SECTION 12 MANHOLE AND VALVE BOX ADJUSTMENT

12.01 GENERAL

The contractor shall adjust all manholes, valve boxes, survey monument boxes, and other fixtures encountered within the area to be paved to conform to the finished surface of the pavement to be built as per the street plans and details and in accordance with all requirements outlined in these specifications.

12.02 MATERIALS

Concrete, HDPE, or steel grade rings shall be used for adjusting manhole frames and covers, valve boxes, and other similar devices to proper grade and alignment. An acceptable non-shrink grout shall be used for resetting manhole frames and grade rings. Concrete used around manholes and valves boxes in asphalt paved streets shall be in accordance with Class B concrete as defined in CDOT Standard Specifications Section 601.02. When reinforcing steel is used it shall conform to CDOT Standards Specifications Section 602. Additional specifications on raising manhole frames and covers, and water valve boxes can be found in Section 15 in details No S-20, Manhole Raising Detail; No. S-36, Water Valve Raising Detail - Potable Water Valve; and No S-37 Water Valve Raising Detail - Nonpotable Water Valve.

12.03 PROJECT INSPECTION

Manhole frames and covers and valve boxes and all other similar devices which must be accessed from the surface shall be raised to final grade. After adjustment, the contractor shall notify the City for an inspection to check for cleanliness, proper alignment, and elevation.

All valve boxes shall be inspected by applying a valve key to each operating nut to ensure an acceptable alignment.

12.04 SAFETY

To provide proper protection to the public, manhole frames and covers and valve boxes shall be accessible no later than 24 hours after they have been buried by the work in progress and brought to final grade within one week.

In order to provide safety for the traveling public, proper traffic controls shall be utilized and maintained at all times.

12.05 ASPHALT PAVEMENT LOCATIONS

Following installation of the final lift of asphalt pavement, final grading adjustments shall be made for all manhole frames and covers, and water valve boxes. Final grading adjustments shall be made within a 1-week period following placement of the final wearing surface. The pavement shall be removed in clean straight lines, final grading adjustments of the manhole frame or water valve box shall be completed using approved materials, and the concrete collars shall be 8 inches thick and 1-foot wide. For additional specifications, see Manhole Raising Detail, No. S-20; Water Valve Raising Detail - Potable Water Valve, No. S-36; and Water Valve Raising Detail - Nonpotable Water Valve, No. S-37.

12.06 ADJUSTMENT FOR CONCRETE PAVEMENT

After placement of the concrete and jointing has begun, a transverse joint will be placed at each manhole frame and water valve box or other similar device. In the event that a manhole frame, water valve box, or other similar device should be covered up during construction, the contractor will be responsible for raising the manhole frame or water valve box up through the concrete. This work will take place no later than 24 hours after completion of the work. The concrete edges will be full-depth saw cut and be a minimum of 12 inches from the manhole frame or water valve box.



12.06 ADJUSTMENT FOR CONCRETE PAVEMENT (continued)

After removal of the old concrete, the existing slab will be drilled 8 inches deep. 16 inch long #4 reinforcing bars will be placed at 12 inches in center. Concrete pavement shall be replaced to the existing depth plus 1 inch, or a minimum of 6 inches, whichever is greater. A minimum mix design for concrete as shown above in Section 11.02C shall be used.

The concrete shall be protected from weather and rapid loss of moisture. Concrete shall be protected for vehicular traffic of a period not less than 7 days (3 days with high/early or quick strength concretes). The above installation procedure shall apply to this method and shall occur prior to the application of the final wearing surface around these appurtenances.

SECTION 13 PAVEMENT MARKING STANDARDS

13.01 SCOPE

All pavement marking installations shall be in compliance with the current Manual on Uniformed Traffic Control Devices (MUTCD).

At intersections and 150 feet back in all directions, all markings shall be thermoplastic, preformed plastic, or other permanent type marking, to include without limitation: crosswalks, stop bars, arrows, only's, channelization lines, center line, etc.

13.02 GENERAL

The following requirements govern the placement of all pavement markings. When the term "full compliance" is used, it means pavement markings shall meet the requirements of the MUTCD.

A. PAVEMENT MARKING PLAN

When pavement marking location details are not provided in the design, the contractor shall submit a layout of existing conditions to the City for approval or modification. This layout is to be used as the final pavement marking plan.

B. ROADWAYS CLOSED TO TRAFFIC DURING CONSTRUCTION

Full compliance pavement markings shall be in place on all roadways prior to opening for traffic.

C. ROADWAYS CONSTRUCTED UNDER TRAFFIC

Full compliance final pavement markings shall be placed within 10 working days after final surfacing is completed. Full compliance pavement markings shall also be placed on any roadways open to traffic when the project pavement work is discontinued for more than 2 weeks.

D. TEMPORARY PAVEMENT MARKINGS AND CONTROL POINTS

Temporary pavement markings and control points for the installation of those pavement markings for roadways that are being constructed under traffic are as follows:

When one roadway of a normally physically divided highway is closed, and a crossover is constructed, full compliance pavement marking shall be placed along the tapers and through the median crossovers to the two-way traffic section. Pavement marking through the two-way traffic section shall be as shown on the plans. Removal of these markings shall not leave a scar which conflicts with permanent markings.

The following criteria apply to all construction and maintenance on roadways except for roadways described in Section 13.02D.

- Control points, 4-inch by 1-foot marks at 40-foot intervals, are guide markers for the installation of temporary and/or full compliance markings.
- All temporary broken line pavement markings shall be installed daily as needed and shall be at least 18 inches long with a maximum gap of 38 feet. An 18-inch stripe with a maximum gap of 18 feet may be used on curves for roadways with severe curvature. A severe curve is defined as a curve whose safe speed is 10 mph or more below the approach posted speed limit.
- Temporary pavement markings for no passing zones shall be full compliance.

13.02 GENERAL (continued)

- For short term situations (3 calendar days or less) where temporary broken center lines are installed, no passing restrictions may be identified by appropriate signs including R4-1 and R4-2 until final markings are installed.
- Temporary pavement stencils (school, railroad etc.) are not required unless detailed on the plans.
- Temporary pavement markings shall be installed per manufacturer’s recommendations in such a way that the markings adequately delineate the desired alignment.
- Control points, temporary pavement markings and contractor pavement marking plans will not be paid for separately but shall be included in the work.

13.03 PAVEMENT MARKINGS WITH PAINT - WATERBORNE

Low VOC, ready mixed, one component, 100% acrylic waterborne traffic paints.

All paints shall be suitable for application to asphaltic or Portland cement concrete pavements when applied with or without glass beads.

Striping shall be done when the air and pavement temperatures are at least 50° Fahrenheit and rising. The pavement surface and weather conditions shall be conducive to satisfactory results.

Equipment shall be capable of painting a clean edged stripe of the designated width (\pm 1/4 in.) and shall have a bead dispenser directly behind synchronized with the paint applicator. For center lines and lane lines, an automatic skip control shall be used that will paint a stripe with a gap as shown on the plans. Machines having multiple applicators shall be used for center lines with “no passing zones.” In areas where machines are not practical, suitable hand-operated equipment shall be used. All stripes shall be protected until dry. Paint and beads shall be applied as per CDOT Specification Section 627.04.

Pavement marking paint shall conform to the requirement listed in the Pavement Marking Paint Requirements Table, Table 13.03-1. All proportions are by weight. Pigment composition and vehicle composition shall not vary by more than 1% of each amount specified.

Table 13.03-1
Pavement Marking Paint Requirements

Characteristics:	YELLOW	WHITE
Viscosity at 77 degrees F, KU	80-90	80-90
Dry to no pick up time, ASTM D-711 without beads, minutes	3 max.	3 max.
No-Track time, Actual @ 77 degrees F/50% RH, seconds	90 max.	90 max.
Directional Reflectance %	87 min.	50 min.
Contrast Ratio @ 15 mils wet	0.98 min.	0.95 min.
Scrub test, Cycles	1000 min.	1000 min.
Volatile Organic Compound, grams/liter	Below 150	Below 150
Total Pigment, % By Weight	62 min.	62 min.
Total Solids, % By Weight	76 min.	76 min.
Total Solids, % By Volume	58 min.	58 min.
PH	9.6 min.	9.6 min.

13.04 EPOXY PAVEMENT MARKINGS

The epoxy pavement marking compound shall conform to CDOT Specification Section 627.05.

13.05 THERMOPLASTIC PAVEMENT MARKING

The thermoplastic pavement marking compound shall conform to CDOT Specification Section 627.06 and AASHTO M 249.

13.06 PAVEMENT PRIMERS

The type and application rate of epoxy resin primer shall be as recommended by the manufacturer of the thermoplastic or preformed plastic pavement marking.

A primer application rate of zero will not be accepted, except for thermoplastic marking and inlaid preformed plastic pavement marking placed on new asphalt surfaces as recommended by the manufacturer and approved by the City. However, if the City determines that a new asphalt surface has become soiled, prior to placement of the pavement markings, pavement primer will be required and shall be applied as approved.

The epoxy resin primer material may be accepted at the job site on the basis of a manufacturers' certification, or a sample may be sent to the laboratory for testing, in which case 3 weeks shall be allowed between sampling and intended use.

13.07 PREFORMED PLASTIC PAVEMENT MARKING

The preformed plastic pavement marking compound shall conform to CDOT Specification Section 627.09 and to ASTM D 4505, Type I, Class B, C, D, or E, and shall have a minimum thickness of 60 mils.

13.08 PAVEMENT MARKING TAPE

The removable pavement marking tape shall conform to CDOT Specification Section 627.10.

13.09 RAISED PAVEMENT MARKERS

Temporary raised pavement markers shall be installed on center lines, edge lines, and lane lines where specified in the contract. Single markers shall be installed at 5-foot intervals for solid lines. A group of four markers at 3-foot spacing and at 40-foot intervals shall be installed for skip lines.

Raised pavement marker shall not be less than 3½ inches nor more than 4½ inches in the major dimension and not more than ¾ inch in height. The marker shall contain a reflective element not less than 0.38 square inches in area. The color of the marker and the reflective element shall match the color of the pavement marking line. The reflective quality requirements shall be at least equal to the minimum values found in CDOT Specification Section 713.18.

The marker shall be ceramic or plastic and shall be secured to old or new pavement using an adhesive approved by the manufacturer.

SECTION 14 CONCRETE STRUCTURES

14.01 GENERAL

Curbs, gutters, sidewalks, valley gutters, bikeways, driveways and alley approaches constructed within the City of Evans shall be concrete unless approved otherwise by the City.

Construction requirements for concrete sidewalks and bikeways shall conform to CDOT Standard Specifications subsection 608.03 except as modified by these specifications. Construction requirements for concrete curb shall conform to CDOT Standard Specifications subsection 609.03 except as modified by these specifications.

Where a section of concrete sidewalk, curb and gutter, valley gutter, bikeway, driveway, or alley approach has been disturbed, it shall be removed to a joint if the joint is situated within 5 feet of the proposed or existing cut, otherwise a straight line shall be saw cut prior to replacement. Where new construction abuts existing, the work shall be accomplished so that the variance in grade between the old and new work does not exceed 1/4 inch.

14.02 MATERIALS

A. REFERENCES

Materials shall meet the requirements of the following CDOT Standard Specifications subsections:

•	Fine Aggregate	703.01
•	Coarse Aggregate	703.02
•	Portland Cement	701.01
•	Water	712.01
•	Air Entraining Admixtures	711.02
•	Joint Filler	705.01
•	Curing Materials	711.01
•	Reinforcing Steel	709.01
•	Chemical Admixtures	711.03
•	Dowel Bars and Tie Bars	709.03

B. CLASSIFICATION

Use the following classes of concrete as per CDOT Standard Specifications subsections 601.02 and 601.03 for the following items:

•	Sidewalks and bikeways	Class A or B
•	Curb and gutters, and valley gutters	Class A or B
•	Driveway and alley approaches	Class A, B or P

C. FLY ASH

Fly ash may be used in concrete for sidewalks, curb and gutters, valley gutters, bikeways, driveways, alley approaches, and storm drainage structures.

Fly ash for concrete shall conform to standard CDOT Specification Section 701.02 except that a maximum of 15% by weight of fly ash will be accepted in any mix design. For any source of fly ash the contractor/owner shall provide complete test results indicating that the material meets all the above material specifications.

The fly ash may also be subject to sampling and testing by the City. Test results that do not meet the physical and chemical requirements may result in suspending the use of fly ash until necessary corrections have been taken to ensure that the material meets the specifications. The fly ash intended for use on the project shall have been tested and accepted prior to its use.

14.02 MATERIALS (continued)

D. MIX DESIGN

1. All concrete shall be ready mixed concrete. No concrete shall be field mixed. Concrete mix design consists of selecting the aggregates appropriate for the concrete application. The proposed mix shall be tested in accordance with ACI code requirements. The contractor must submit one (1) mix design per each concrete type intended for use within the public rights-of-way at the start of each calendar year. No concrete shall be placed prior to the submittal of such mix designs.
2. Concrete for bikeways shall be fiber-reinforced as approved by the City.

E. ADDITIVES

1. Additives for concrete, other than those specified in the mix design, shall not be used without prior approval of the City. When approved for use, chemical admixtures or additives shall comply with applicable ASTM or AASHTO standards. Application of admixtures shall be as per manufacturer's specifications. Calcium chloride or admixtures containing chloride shall not be allowed in reinforced concrete, and is strictly prohibited in the production of high early strength concrete. The maximum amount of high early additive is 2%.
2. Coloring for colored concrete shall be accomplished by the addition of an approved commercially pure or synthetic mineral pigment as specified in the contract documents.
3. Air entraining admixtures shall conform to AASHTO M-154 latest edition.
4. Pozzolans can be used with the approval of the City, after the following requirements have been met:
 - its use is justified;
 - tests have been made to determine the suitability with regard to water requirements, strength development, shrinkage, heat of hydration and durability; and
 - additional curing requirements have been specified.
5. Water-reducing and set-controlling admixtures shall conform to AASHTO M-194 according to the following types:
 - Type A - Water Reducing
 - Type B - Retarding

F. STEEL REINFORCEMENT

Bikeways and oil and gas access points shall be reinforced according to the design engineer recommendation. Steel reinforcement shall conform to CDOT Standard Specification Section 709.

14.03 PREPARATION OF SUBGRADE

Subgrade preparation shall be completed in accordance with Section 7 of these specifications.

No pea gravel, sand, or other material with less than 10% passing the #100 sieve will be allowed as bedding beneath any concrete within the City's right-of-way.

14.03 PREPARATION OF SUBGRADE (continued)

If, in the opinion of the City, the foundation soil is of such character that it will swell or shrink with changes in its moisture content to such an extent that the concrete may be damaged, the soil shall be excavated as directed by the City and refilled and compacted with material which meets the requirements of these specifications.

The subgrade and/or sub-base shall be brought to a firm and unyielding condition with a uniform density. All soft and yielding material and other portions of the subgrade that will not compact readily when rolled or tamped shall be removed and replaced with suitable material. Concrete shall not be placed on a soft, spongy, frozen, or otherwise unsuitable subgrade.

Before placing any concrete, the subgrade shall be tested for conformity with the cross-section shown on the plans, using an approved template, or other approved method. The finished subgrade shall be kept smooth, damp, and compacted prior to placing concrete.

All subgrade areas shall be proof-rolled before placement of concrete.

14.04 PLACING CONCRETE

A. ALIGNMENT AND GRADE

The alignment and grade elevations of the forms shall be checked by the contractor prior to concrete placement and necessary corrections will be made. Any forms that have been disturbed or subgrade that has become unsuitable shall be corrected, and forms reset and rechecked. Any variations in grade and alignment shall be subject to approval by the City prior to placing the concrete. Forms shall be oiled prior to placement of concrete. The subgrade shall be moist but not wet prior to placing concrete. After the Inspector has approved the forms and subgrade, the concrete shall be deposited on the subgrade to the required depth and width in successive batches and in a continuous operation. The concrete shall be placed as uniformly as possible to minimize the amount of spreading necessary. While being placed, the concrete shall be spaded or vibrated with suitable tools to prevent the formation of voids or honeycomb. Vibration shall not be used to move concrete. All curves shall be constructed with flexible forms. Curb ramps shall not have a lip between the flow line of the gutter and the ramp approach.

The flow line of all new valley gutters shall be a straight-line grade between the gutter at each end of the new valley gutter. The contractor is required to set finishing screed points at minimum intervals of 10 feet along the flow line to control the finished elevation. The screed points shall be removed or driven through the plastic concrete into the subgrade after the concrete has been finished to the required elevation. The use of timber screed points is expressly prohibited.

No low spots which cause water to pond will be acceptable. Sidewalks, curb and gutters; valley gutters, bikeways, driveways, and alley approaches shall be formed and placed true to line, grade, and cross section. The finished surface must be straight and true to within 1/4 inch along any 10-foot length of the new concrete in the vertical or horizontal plane. Forms for sidewalks (attached or detached) shall be so set that the sidewalk shall have a slope toward the street of 2%. Bikeways shall have a side slope of 2%. The maximum extended running slope of sidewalks (attached or detached) and bikeways shall not exceed 5%.

B. CONSTRUCTION STAKES

The contractor/owner shall provide all construction stakes required for curbs, gutters, sidewalks, and structures, and will furnish all necessary information relating to lines and grades. The contractor shall be held responsible for the reasonable preservation of all such stakes. The contractor shall not remove stakes until 3 working days after placement of the concrete unless approved by the City.

14.04 PLACING CONCRETE (continued)

C. VIBRATION

Concrete shall be thoroughly compacted or vibrated. Care shall be taken in vibrating concrete to bring only a continuous film of mortar to the surface. Vibration shall stop before any segregation of the concrete occurs. Any evidence of lack of consolidation or over-consolidation shall be regarded as sufficient reason for requiring the removal of the section involved and its replacement with new concrete at the contractor's expense.

D. LIMITATIONS OF PLACING CONCRETE

Limitations on the placing of concrete shall conform to CDOT Standard Specifications subsections 601.12 (b) and (c), and 412.15.

14.05 BATCHING

Batching of concrete shall conform to CDOT Standard Specification Section 601.06.

14.06 MIXING

Mixing of concrete shall be required to conform to CDOT Standard Specification Section 601.07.

The contractor shall submit to the City the ready mix delivery ticket for each load upon request by the City indicating the following:

- Supplier's name and date
- Truck number
- Project number and location
- Concrete class designation
- Cubic yards batched
- Mix design identification
- Type, brand, and amount of cement
- Brand and amount of all admixtures
- Weight of the fine and coarse aggregates
- Moisture content of fine and coarse aggregates
- Gallons of batch water
- Time at which water was added
- Elapsed time between when water was added and concrete load was in place
- Amounts of initial and supplemental water added
- Name of individual authorizing supplemental water
- Numerical sequence of delivery by indicating cumulative yardage delivered on each ticket
- Record discharge time, water-cement ratio, air content, slump, and revolutions of the drum

14.07 TEST REQUIREMENTS

The contractor shall provide quality control testing of concrete including the testing of concrete cylinders for compression testing, and air and slump tests. Copies of quality control test results shall be furnished to the City within 10 days of testing. The contractor will provide for acceptance testing associated with placing of concrete, base course and subgrade preparation, and trench compaction. See the Material Sampling and Testing Schedule in Appendix B. The contractor shall be responsible for the costs associated with re-testing due to failed acceptance tests.

Concrete acceptance testing to be completed by the contractor will follow these procedures:

14.07 TEST REQUIREMENTS (continued)

- One cylinder will be broken at 7 days, two cylinders will be broken at 28 days, and one held on reserve for test if there is a failure on one of the 28 day tests. If the 28 day cylinders do not meet the specified minimum compressive strength, then a representative number of concrete cores, as determined by the City, shall be taken by the contractor/owner to determine if the in-place concrete meets the specified strength.
- Concrete cylinders for strength tests will be molded and cured in accordance with the "Practice for Making and Curing Concrete Test Specimens in the Field", ASTM C31 and tested in accordance with "Test Method for Compressive Strength of Cylindrical Concrete Specimens", ASTM C39.
- Air, slump, and temperature tests will be conducted when cylinder sets are taken or whenever consistency of concrete appears to vary.
- Each sample of compression test cylinders will be marked or tagged with the date and time of day the cylinders were made. The location in the work site will be identified where the concrete represented by the cylinders was placed. The delivery truck or batch number will be identified, and the air content and slump measured and recorded. Copies of each test result will be furnished to the City.
- Concrete shall meet the following minimum acceptance standards:
 - Maximum slump shall not exceed 4 inches for any class of concrete.
 - Air content shall not deviate from the design air content by more than $\pm 1\%$.
 - Strength of concrete shall not be more than 500 psi below the required field compression strength on any single break and the average of any three consecutive breaks shall not be more than 250 psi below the required field compression strength. Concrete that does not meet the acceptance criteria of this section shall be removed and replaced.

14.08 FINISHING CONCRETE

A. FINISHING

After the concrete has been placed and consolidated in the forms, it shall be finished. A wood float shall be used to bring the surface of the concrete to its final form; excessive working of the surface will not be permitted. Surface skim patching of sprawled concrete will not be allowed. These areas will be removed and replaced.

The final texture of all exposed surfaces shall be obtained by light brooming. For sidewalks, bikeways, and driveway, broom the surface in the direction perpendicular to the main traffic flow. For all concrete surfaces that are designed to carry storm water such as curbs and gutters, valley gutters, and crosspans, broom the surface in the direction of flow. After completion of brooming and before the concrete has taken its initial set, all edges in contact with the forms shall be tooled with an edger having a 1/4 inch radius. No dusting or topping of the surface or sprinkling with water to facilitate finishing will be permitted.

B. REMOVE FORMS

Face forms for concrete curb, if used, may be removed for finishing curb face and fillets as soon as the concrete will retain its shape. Concrete curbs must be in place for at least 6 hours before the forms are removed.

14.09 JOINTS

A. TRANSVERSE JOINTS

See Concrete Transverse Joint Detail, (No. S-4) for details on transverse joints. Transverse joints (contraction joints) shall be located as per Transverse Joint Location Table, Table 14.09-1. When combination curb, gutter, and walk are used, the joint shall be continuous through all three elements. Joint depth shall be a minimum of 1/3 the thickness of the concrete. Joint width shall be 1/8 inch wide and a maximum of 1/4 inch wide except at expansion joints. For tooled joints, the edges adjacent to joint shall be rounded with an edge of 1/4 inch radius. Joints for bikeways shall be removable plastic dummy joint strips or saw cut at 10-foot intervals. Tooled joints shall not be allowed on any bikeway except at expansion joints. See Bike Path Detail (No. S-1), for additional specifications. Saw cutting of joints shall be performed as soon as the concrete surface is hard enough to allow the sawing operation without otherwise marring the concrete surface, prior to any development of shrinkage cracks. Saw-cutting shall proceed around the clock if necessary to meet these requirements.

Table 14.09-1
Transverse Joint Location

Concrete Apparatus	Distance Between Transverse Joints (ft)
Curb & Gutter, Cross Pan	10'
Sidewalk - Greater than or equal to 8' Wide	10'
Side walk - Less than 8' Wide	5'

B. EXPANSION JOINTS

Expansion joints shall be required as shown on Concrete Transverse Joint Detail (No. S-4). Expansion joints where required shall be filled with 1/2-inch thick, full depth, preformed expansion joint material as per CDOT Standard Specifications Section 705.01. Expansion joint material must be set vertical and with the top edge 3/4 inch below the finished surface. The joint shall be edged with a 1/4 inch radius edging tool. All expansion joints shall be caulked as per Concrete Transverse Joint Detail (No. S-4).

14.10 CURING

Concrete for sidewalks, curb and gutters, valley gutters, bikeways, driveways, and alley approaches shall be cured in the same manner as Portland Cement Pavement as per CDOT Standard Specifications Section 412.14 except as modified herein.

Concrete shall be cured by protecting it against loss of moisture, rapid temperature change, freezing, rain or hail, flowing water, and mechanical injury for a period of not less than 5 days after placement. Immediately after finishing operations have been completed, the entire surface of the newly poured concrete shall be covered by the curing medium. The edge of concrete exposed by the removal of forms shall be protected immediately to provide these surfaces with continuous curing treatment. The coating shall be protected against marring for a period of at least 5 days after application. Any coating marred, or otherwise disturbed, shall be given an additional coating. White pigmented, liquid, membrane-forming curing compound conforming to AASHTO M-148, Type II, Class B shall be used unless another method is approved by the City. If the use of a curing compound results in streaked or blotchy appearance, the method shall be stopped and a suitable means of curing used. The contractor may request permission to use an additional concrete sealing agent to protect his concrete work which will be exposed to salts, chemicals, or other elements. All concrete, regardless of temperature, weather or season, shall be protected from premature drying for a period of not less than 5 days after the concrete is poured. Curing will not be required longer than 72 hours if high-early strength concrete is used. It shall be the contractor's responsibility to protect the concrete being cured from the elements, traffic, and vandalism. The contractor shall have the equipment needed for adequate curing available before commencing concrete placement. Inadequate protection by the contractor shall be cause for suspension of concreting operations and damaged concrete shall be removed and replaced at the contractor/owner's expense.

14.11 DRIVEWAY INSTALLATIONS

See Driveway Approach Details (Nos. S-17 and S-18) for specifications on driveway approaches for attached and detached sidewalks, respectively. All driveways constructed of concrete within public right-of-way shall conform to the requirements of these specifications. The width of the driveway shall be 20 feet at the intersection of the back of curb for detached sidewalks, and at the intersection of the back of the sidewalk for attached sidewalks. When constructed of concrete, the thickness shall not be less than 6 inches. Driveways abutting a curb, gutter, and sidewalk combination or drive-over curb and gutter or driveway gutter pan or any cross gutter shall have a strip of non-extruding expansion joint material 1/2 inch thick, conforming to the cross-sections of the driveway, placed between the driveway and the sidewalk or curb or cross gutter so as to provide for the expansion of the concrete driveway. See Concrete Transverse Joint Detail, (No. S-4) for specifications on expansion joints. Oil and gas entrances shall have a minimum of 8-inch thick driveways with fiber reinforcement.

14.12 ALLOWABLE CURB CUTS

Curb cuts will be evaluated based on acceptable access control requirements by the City.

14.13 PROTECTION/DEFACED/DAMAGED OR DEFECTIVE CONCRETE

The contractor shall be responsible for taking adequate steps to protect concrete placed during inclement weather. Limitations on the placing and protecting concrete shall conform to CDOT Standard Specifications Sections 601.12 (b) and (c), and 412.15. Any concrete damaged by precipitation or extreme temperatures or otherwise defective shall be removed and replaced at the contractor/owner's expense.

14.14 BACKFILLING

Immediately upon removal of side forms, the space adjoining the concrete shall be backfilled with suitable material, properly compacted, and brought flush with the surface of the concrete and adjoining ground surface. In embankments, the backfill shall be level with the top of the concrete and the maximum slope shall be 4:1. Where detached sidewalks occur, the space between the curb and walk shall be backfilled on a straight line from the top of walk to the top of curb, not to exceed a 4:1 slope.

14.15 OPENING TO TRAFFIC

Walks and bikeways shall not be opened to pedestrian or bicycle traffic for at least 24 hours after placement; driveways, curb & gutters, and valley gutters shall not be opened to vehicular traffic for at least 7 days after placement or until field-cured test cylinder breaks show an average compressive strength of 2500 psi. Exception may be made where high early-strength cement is used and a compressive strength of 3,000 psi is attained. In cases where high early-strength cements are used, the contractor shall request a variance from the City for opening to traffic sooner. The contractor shall maintain suitable barricades to comply with the foregoing requirements.

SECTION 15 STREET STANDARD DETAIL DRAWINGS

15.01 GENERAL

This section contains the detail drawing referenced throughout these specifications.

15.02 STREET STANDARD DETAILS

DETAIL NO.	DETAIL TITLE
S-1	BIKE PATH
S-2	BUS STOP
S-3	CONCRETE REPAIR
S-4	CONCRETE TRANVERSE JOINT
S-5	CROSS PAN
S-6	CUL-DE-SAC
S-7	CURB & GUTTER - TYPE 2 II-B
S-8	CURB & GUTTER - TYPE 2 B & IB
S-9	CURB & GUTTER - TYPE 2 MS MODIFIED
S-10	CURB & GUTTER - D - 1A
S-11	CURB RAMP - AT T INTERSECTION
S-12	CURB RAMP - DETACHED ADJOINING ATTACHED SIDEWALK
S-13	CURB RAMP - ATTACHED SIDEWALK
S-14	CURB RAMP - DETACHED SIDEWALK - STREET CORNER
S-15	CURB RAMP - DETACHED SIDEWALK
S-16	DETACHED SIDEWALK
S-17	DRIVEWAY APPROACH - ATTACHED SIDEWALK
S-18	DRIVEWAY APPROACH - DETACHED SIDEWALK
S-19	EMERGENCY STORM WATER OVERFLOW STRUCTURE
S-20	MANHOLE RAISING
S-21	ROADWAY SECTION - GATEWAY ARTERIAL
S-22	ROADWAY SECTION - ARTERIAL
S-23	ROADWAY SECTION - MAJOR COLLECTOR



- S-24 ROADWAY SECTION - MINOR COLLECTOR #1
- S-25 ROADWAY SECTION - MINOR COLLECTOR #2
- S-26 ROADWAY SECTION - BOULEVARD COLLECTOR
- S-27 ROADWAY SECTION - COMMERICAL COLLECTOR
- S-28 ROADWAY SECTION - LOCAL #1
- S-29 ROADWAY SECTION - LOCAL #2
- S-30 ROADWAY SECTION - RURAL LOCAL
- S-31 ROADWAY SECTION - ALLEY
- S-32 SIDEWALK CHASE
- S-33 STREET INTERSECTION APPROACH - COLLECTOR & ARTERIAL
- S-34 STREET INTERSECTION APPROACH - LOCAL & COLLECTOR
- S-35 TRENCH EXCAVATION & BACKFILL
- S-36 WATER VALVE RAISING - POTABLE WATER
- S-37 WATER VALVE RAISING - NONPOTABLE WATER