

**SECTION 3
STREETS, CURB, GUTTER, SIDEWALK AND SIGNS**

3.1 DESIGN CRITERIA

3.1.1 SUBMISSIONS:

1. Street, Curb Gutter, Sidewalk and Signs Public Improvements Plans: The public improvement plans shall describe the proposed streets and appurtenances thereto in adequate detail so as to serve as construction drawings as well as satisfying the requirements of this section.
2. Street Report: ; A street report shall be submitted with the final plat providing the date, calculations and test results used in the design of the pavement structures. The report will categorize each street as arterial, collector or local based on the definitions given in 3.12.2. Paragraph 1.

3.1.2 METHOD: The design of pavement structures shall be based on the street classification and design criteria contained in this section.

1. Street Classification: Streets shall be classified according to the following general characteristics:
 - a) Arterial Street:
 - 1) Traffic volumes of 10,000 vehicles per day when the land which the arterial serves land that the arterial serves is fully developed.
 - 2) A continuous length of several miles.
 - 3) Accommodates local and through traffic generally connecting with inter community routes.
 - 4) Traffic control provided by traffic signals.
 - b) Collector Street:
 - 1) Traffic volumes exceeding 5000 vehicles per day when the land which the collector serves land that the collector serves is fully developed.
 - 2) A continuous length of a mile or more.
 - 3) Accommodates local traffic from and onto local, other collector and arterial streets.
 - 4) Traffic control provided by traffic signals and stop signs.
 - c) Local Street:
 - 1) Traffic volumes less than 5000 vehicles per day.
 - 2) A continuous length less than one mile.
 - 3) Accommodates local traffic from and onto individual lots and the collector and arterial street system.
 - 4) Traffic Control provided by stop and yield signs.
2. Flexible Pavements: The design of flexible pavements shall be based on the Colorado Department of Highways Transportation methodology, the Design Traffic Number (DTN) given in Table 3-1 and a design period of twenty (20) years. The DTN is defined as the estimated daily 18,000 lbs., single axle load applications for the design lane during the design period.

Minimum thickness of base and asphaltic pavement combinations shall be 2" asphaltic asphaltic concrete and 6" granular base.

**TABLE 3-1
DESIGN TRAFFIC NUMBER**

<u>Zoning Classification</u>	<u>Street Classification</u>		
	<u>Local</u>	<u>Collector</u>	<u>Arterial</u>
Residential	5	30	100
Commercial	30	50	200
Industrial	100	200	200

3. Rigid pavements: Street construction using alternate construction methods such as Deep Strength Asphalt or Portland Cement Concrete will be considered. Should the contractor/developer desire to consider one of these options, the option must be included in the pavement structural cross section design report.

3.1.3 CRITERIA:

1. Streets: Street shall have a logical relationship to topography and to the location of existing or platted streets in adjacent properties. Street, utility rights of way and public open spaces shall conform to approved plans for the extension of such public facilities.
 - a. Minimum street width shall be as shown in Figure 3.8.
 - b. Temporary dead-end streets, and cul de sac streets shall not be more than four hundred (400) feet in length. At the closed end the minimum turn around radius shall be fifty (50) feet. The closed end of the cul de sac street shall be at least one lot from the outside boundary line of any addition, subdivision or tract or from any other street.
 - c. Whenever possible, streets shall intersect at right angles.
 - d. Street grades and vertical curve lengths are set forth in Table 3-2.

**TABLE 3.2
MINIMUM STREET DESIGN CRITERIA**

<u>Street Classification</u>	<u>Maximum Grade</u>	<u>Minimum Grade</u>	<u>Min. vertical curve length</u>
Arterial	5.0 percent	0.5 percent	100 ft.
Collector	6.0 percent	0.5 percent	*100 ft. or 50 ft. per
Local	10.0 percent	0.5 percent	Algebraic grade change *50 ft or 25 ft. per

*Where the algebraic change in grades is less than one percent, vertical curves may be omitted.

- e. Street grades shall be flattened, whenever possible, to a grade of less than four (4) percent for a distance of at least 75 feet when approaching all intersections, and at the intersection a grade of three (3) percent shall be maximum.
- f. All utility service lines and main utility lines shall be installed prior to paving of any street.
- g. Minimum radii of horizontal curves at the street centerline shall be as follows:
 - 1) Arterial streets, five hundred (500) feet.
 - 2) Collector streets, two hundred (200) feet.
 - 3) Local streets, one hundred (100) feet.
- h. Between reverse curves, there shall be a tangent at least one hundred (100) feet in length.

2. Curb, Gutter, sidewalk, Driveway: All curbs, gutters, sidewalks, driveway approaches, and gutter pans shall be constructed with Portland Cement Concrete and shall conform to the Standards Design Drawings as listed in 3.5.

- a. Sidewalks: Sidewalks shall have a minimum width of four (4) feet and a minimum thickness of four (4) inches. An expansion joint shall be placed between the back of curb and the edge of the sidewalk when poured separately. (See Figure 3.2.)

Concrete sidewalks constructed in pedestrian easements located outside street ROW right-of-way shall be a minimum of six (6) feet in width.

In commercial, industrial and business areas, storm water runoff from roof drains or downspouts shall not be allowed to drain over the sidewalk.

Undersidewalk Under sidewalk drains will be required to transport this runoff into the streets.

- b. Driveway: In residential areas driveways shall not face onto arterial streets. The width of driveway approaches shall be as follows:
 - 1) Residential = 24 feet maximum
 - 2) Commercial = 35 feet maximum

When a new driveway approaches is are required to serve a single propertiesy, they shall be a minimum of ten (10) feet apart. No driveway approach shall be within thirty (30) feet of an intersection. Driveway approaches shall be constructed as follows:

- 1) Residential - 6" un-reinforced concrete, over 4" of compacted aggregate base, if base is required.
- 2) Commercial - 8" reinforced concrete, over 6" of compacted aggregate base, if base is required.

When a new driveway approach is to be installed through existing sidewalk, curb and gutter, the entire existing sidewalk curb and gutter, for the full length and width of the new driveway approach, shall be removed. The cut

necessary to remove the existing sidewalk curb and gutter shall be made perpendicular to the curb and shall be made by saw cutting. Rough edges such as those made by jack hammering shall not be allowed.

- c. Curb and Gutter: Vertical curb and gutter shall be used for all streets, except that gutter pans may be constructed in place of vertical curb and gutter in local streets of industrial zoned areas.

GutterCutter pans shall not cross arterial or collector streets. A transition shall be designed in local streets approaching the gutter pan crossing local streets. Handicapped ramps shall be placed in the sidewalk, curb and gutter at all street intersections.

Connection of new curb and gutter to existing curb and gutter shall be designed to provide a smooth transition of r flow in the gutter with a minimum of head loss. Expansion joint material shall be placed at the point of connection.

Minimum curb radiusradii at intersections shall be as shown in Table 3-3.

**TABLE 3-3
CURB RADIUS RADII AT INTERSECTIONS**

<u>Street Classification</u>	<u>Local</u>	<u>Collector</u>	<u>Arterial</u>	
Local	15	20		20
Collector	20	20	20	
Arterial		20	20	25

2. Signs:

- a. Traffic control Signs: Traffic control signs are categorized as regulatory, warning and guide signs. These signs shall be placed as follows:

- 1) Regulatory Signs:

Stop signs shall be placed to control all traffic entering arterial streets for intersections not controlled by traffic signals. Where two arterials intersect, the stop sign shall normally be posted on the street with the lesser flow of traffic.

Stop signs shall be placed to control all local street traffic entering collector streets for intersections not controlled by traffic signals. Yield signs may be used where visibility permits.

SPEED LIMIT, PARKING PROHIBITION and other regulatory signs as required by the Town.

- 2) Warning Signs:

SCHOOL CROSSING signs shall be placed at all school crossings as designated by the school district.

RAILROAD ADVANCE WRNINGWARNING, DEAD END, PAVEMENT WIDTH TRANSITION and other warning signs shall be placed required by the Town.

- 3) Guide Signs:
 - BIKE ROUTE signs shall be placed to designate bike routes when a part of the street.
- a. Street Name Signs: Street name signs shall be placed on diagonally opposite corners at each intersection so that they will be on the far right-hand side of the intersection for traffic on the major street. Signs naming both streets shall be erected at each location. Local and collector streets in residentially zoned areas require only one street name sign posted at each intersection.
- b. Standardization of Signs: all traffic control signs and street name signs shall be designed to comply with the requirement of the “Manual on Uniform Traffic Control Devices”devices
 - a. preparedPrepared by the U.W. Department of TransportationFederal Highway Administration and The Colorado Supplement to the Federal Manual on Uniform Traffic Control Devices.
 - b. Installation:
 - 1) Posts and Mounting:; Sign posts and their foundations and sign mountings shall be so constructed as to hold signs in a proper and permanent position, to resist swaying in the wind or displacement by vandalism.
The post shall be constructed in two sections - a two (2) inch square stub section, three (3) feet long, which is driven into the ground; and a one and three-quarter (1 ¾) inch square post section which is inserted into the stub and bolted.
 - 2) Height: Signs shall be mounted at a height of seven (7) feet, measured from the bottom of the sign to the top of curb. The height to the bottom of a secondary sign mounted below another sign shall be six (6) feet from the top of curb. Where a traffic control sign is mounted on the same post with a street name sign, it shall be placed below the street name sign, with the bottom of the traffic control sign seven (7) feet from the top of curb.

3.2 **SPECIFICATIONS**

3.2.1 SCOPE: The work covered by these specifications concerns the furnishing of all labor, equipment, and materials and performing all operations necessary for the construction of streets, curb and gutter, sidewalks, driveway approaches, gutter pans and signs in accordance with these specifications and the Standard Design Drawings in 3.5.

3.2.2 GENERAL REQUIREMENTS: Streets, curb, gutter, sidewalks driveway approaches, gutter pans and signs shall be constructed in accordance with the direction of a professional engineer and approved by the Town Engineer.
All standard specifications made a portion of these specifications by reference shall be the latest edition and revision thereof.

3.2.3 **MATERIALS:**

1. SubgradeAggregate Sub base Course: Subgrade Sub base material shall be all well graded mixture of sound mineral aggregate particles containing a sufficient quantity of binder material to secure a firm, stable foundation when placed and compacted on the roadwaysubgrade, meeting the following gradation:.

<u>Standard Sieve Size</u>	<u>Percent by Weight Passing</u>
Equivalent to 2/3 the depth of sub base Course layer expressed in inches.	100
#10	80
#200	5-15

2. Soil Sterilization Chemical Agents: Chemical soil sterilization agents used in the construction of public improvements shall be:
 - d. A non selective, pre and post emergent, soil toxic herbicide.
 - e. Active for 1 year after completion of the project.
 - f. Miscible or soluble in water; and
 - g. Non toxicNon-toxic to humans when used under conditions designated by the manufacturer.

Approved soil sterilants, rates of application and usage derived from manufacturer’s recommendations and “Colorado Weed Control Handbook” shall be those acceptable to the Colorado Department of Highways as described in Section 217-71 of their “Standard Specifications for Road and Bridge Construction”, State of Colorado Department of Transportation.

3. Aggregate Base Course: A suitable aggregate base course, compacted to a uniform minimum density of 95% of the Standard Proctor is required under all curb and gutter, sidewalks and driveways if the subgrade alone cannot provide sufficient support to prevent shifting, cracking or settling of finished concrete. Aggregate base courses for streets shall be placed in the location and in the amounts as indicated on the approved public improvement plans.

All materials used in aggregate base courses shall meet all applicable portions of Sections 304 and 703.03 of the “Standard Specifications for Road and Bridge Construction”, State of Colorado, Department of HighwaysTransportation.

The design of the pavement section will allow for the full range of classes of aggregate base course. The top course of aggregate base shall be limited to Class 6 meeting the following gradation:

<u>Standard Sieve Size</u>	<u>Percent by Weight Passing</u>
¾”	100
#4	30-65
#8	25-55
#200	3-12

LL not greater than 30, PI not greater than 6.

4. Portland Cement Concrete: All concrete used in the construction of curb, gutter, sidewalk, and driveways shall have a minimum compressive strength of 3,000 psi in 28 days.

The minimum cement content shall be six (6) sacks of cement per cubic yard. Type II cement shall be used, unless soils testing information indicates that another type of cement is required. If fly ash is to be utilized in the concrete mix, prior approval must be given by the Town Engineer and a concrete mix design, prepared by a testing laboratory, must be submitted for approval. Fly ash must meet the requirements of Class "C": ASTM C-618. Air entrainment in the concrete mixtures shall be provided at the rate of 3% to 6% air content by volume. The proportions of all materials to be used in the concrete mix shall produce a workable mix having a maximum slump of four (4) inches. No water shall be added to the concrete at the job site without approval of the Town Inspector.

5. Steel Reinforcing: Steel reinforcing shall be either Deformed Billet -Steel Bars or Welded Wire Fabric.

<u>Type</u>	<u>Test Method</u>	<u>Requirements</u>
Deformed Billet Steel Bars	ASTM A 615	Grade 40 or 60
Welded Steel Wire Fabric	ASTM A 185	

Reinforcing steel shall be protected at all times from damage when placed in the work, the reinforcing steel shall be free from dirt, detrimental scale, paint, oil, or any other foreign substance which could reduce the bonding.

6. Bituminous Prime Coat: If needed, this work shall consist of preparing and treating an existing surface with bituminous material, and blotter material as required, in accordance with these specifications and in reasonably close conformity with the lines shown on the approved construction plans.
The type and grade of bituminous material to be used for the prime coat shall meet all of the requirements of Section 407 and Section 702 of the "Standard Specifications for Road and Bridge Construction", State of Colorado, Department of Highways Transportation.
Blotter material, if required, shall meet the following gradation requirements.

BLOTTER MATERIAL

<u>Standard Sieve Size</u>	<u>Percent By Weight Passing</u>
1/2"	100
No. 4	90-100
No. 16	30-75
No. 200	0-12

Blotter material shall be used in the amounts necessary to absorb excess bituminous material. Excess blotter material shall be removed prior to the placement of the subsequent courses. Blotter material shall be free from all organic matter, lumps or balls of dirt and any other foreign matter which matter that could cause adverse effects on the final product.

7. Asphaltic Concrete: Aggregate for bituminous surfacing shall conform to the requirements of the Colorado Department of Highways of Section 703.04-71, grading E, of the Colorado Department of Transportation "Standard Specifications for Road and Bridge Construction"..

Commercial mineral filler, if required, shall meet the requirement of AASHTO M 17. All bituminous materials shall conform to the requirements of the Colorado Department of Highway Transportation "Standard Specifications for Road and Bridge Construction", Sections 407-71, 409-71 and 702-71. Asphaltic cement AC-10, 85-100 penetration bitumen incorporated on the specified percent as determined by the **CDH job mix for the pit supplying the material (5-6 ½%)**.

The bitumen content for the job-mix formula shall not vary from the single unit value specified by 0.5%±. The job-mix formula shall be submitted to the Town Engineer for approval. Once approval is obtained that job-mix formula will remain valid until such time a s changes in the basic contents occur. These changes could be aggregate source, type of aggregate used, or a change in the bitumen material. If such change occurs, then the revised job-mix formula will have to be resubmitted for approval.

Samples of the completed mix may be taken at the project site for testing as required by the Town Engineer.

Should eth the results of the additional testing indicate that the bituminous mixture placed is in deviation form from the approved job-mix formula, then the mixture could be subject to rejection. Should any of the mixture be rejected, it shall be immediately removed and replaced with an acceptable mixture. The rejection or acceptance of the mixture is place will be made by the Town Engineer or is his authorized representative.

8. Appurtenances:
 - a. Manhole Riser brick: Brick for the upper portions of manholes shall be Grade MS or MM conforming to ASTM Designation C32-69.
 - b. Pre-cast Reinforced Manhole Cones and Sections: Cones and sections shall conform to ASTSM Designation C478-70 except as modified by the Town's Standard Detail Drawing.
 - c. Manhole Steps: Steps shall be non-skid COMCO #12653B or approved equal, non-staggered, 15" C-C being an aluminum magnesium silicide alloy conforming to Federal Specifications QQ-A-200/8.
 - d. Concrete Mortar: Mortar shall be composed of 1 part Type II Portland cement to 2 parts clean snadsand, thoroughly mixed dry and then having only that amount of water added and missed to form a paste of workable consistency. Re-tempered mortar is not acceptable.

- e. Manhole Rings and Covers. Rings and covers shall be gray cast iron conforming to ASTM Designation A-48 free of defects. COMCO #C-1161 or approved equal, having machined metal bearing surfaces.

3.3 CONSTRUCTION

3.3.1 GENERAL REQUIREMENTS: Section 7, General Specifications, shall be followed except as modified in 3.3.2.

3.3.2 SPECIFIC REQUIREMENTS: The following specific requirements shall apply in the construction of the streets, curb gutter, sidewalk and signs:

1. Clearing and Grubbing: The Contractor shall remove from the limits of the ROW or easement all obstructions or obstacles, the presence of which can be determined by visual inspection, such as sod, trees, shrubs, fences, walls and other obstructions called for on the plans.

Removal of shrubs, stumps and trees shall include sufficient length of the root system to insure that the vegetation will not continue to grow. Obstructions, structures, etc., shall be removed to a depth of 3 feet below proposed finish grade.

Removal of stumps, roots trees, shrubs, obstructions, etc., shall be disposed of by the Contractor. The Contractor shall dispose of removed stumps, roots, trees, shrubs, obstructions, etc..

Trees scheduled to remain shall be carefully protected from damage during construction operations. Any trees damaged due to the Contractor's operations shall be replaced as approved by the Town, all at the Contractor's expense.

2. Excavation: All excavation will be unclassified and shall consist of the excavation of all material of whatever character encountered within the limits of the project, ; including, but not limited to, surface boulders, muck, rock, concrete foundations, slabs, stripping, excavation for ditches or channels, borrow, etc. Excavation operations shall be conducted so that material outside the limits of slopes excavation will not be disturbed and to provide adequate drainage at all times. Materials shall not be wasted without permission of the Town Inspector. Insofar as practicable, all suitable materials shall be used in the formation construction of embankments and backfilling. Materials that are considered unsuitable or surplus by the Town Inspector shall be disposed of by the Contractor at his expense. The Contractor at its expense shall dispose of materials that are considered unsuitable or surplus by the Town Inspector.

3. Subgrade: Areas to received embankment and the top of cut areas shall first be stripped of all vegetation, organic material, all other materials that are unsuitable for use in embankment, and disposed of by the Contractor at his expense.

Within the limits of the embankment and cut area, the subgrade shall be scarified to a depth of six (6) inches and the moisture content increased or reduced as necessary to bring the moisture with $\pm 2\%$ of optimum moisture content and compacted to the relative compaction specified below.

Maximum dry densities of all soil types encountered or to be used will be determined in accordance with AASHTO T-99 or T-180 Methods C-D. The percent of relative

compaction required will be equal to or greater than minimum values as hereinafter shown for the various classes of soil and type of compaction.

Soil Classification AASHTO T-180 (AASHO M-145) <u>Compaction</u>	Standard Proctor AASHO T-99 <u>Minimum Relative Compaction</u>	Modified Proctor <u>Minimum Relative</u>
A-1	100	95
A-3	100	95
A-2-4	100	95
A-2-5	100	95
All others	95	90

Compacted subgrade ready to receive sub base material shall conform to the lines, grades and cross-section called for on the plans. Subgrade is to be established by survey.

No curb, gutter, sidewalk, cross-pan, base course or asphaltic concrete is to be placed on soft, spongy or frozen subgrade.

The Towntown Inspector shall inspect and approve the subgrade before any aggregate base course material or concrete can be placed.

4. Soil Sterilization: Subgrade areas to be sterilized, such as parking lots, bituminous sidewalks, etc., shall have all surface vegetation removed within 3 days prior to treating the soil. The soil sterilizer shall then be applied at the rates and in accordance with the manufacturer’s recommendation at a temperature of 70° or higher.

The Contractor shall comply with all Colorado statutes, ordinance, or codes pertaining to the use of application of fungicide, insecticide, herbicides, or other agricultural chemicals.

The Contractor will be held responsible for any damage to plant growth outside the designated treatment area where such damage is attributable to carelessness or improper application of the soil sterilizer.

Care shall be exercised to prevent escape of powder, spray, or vapor which that may damage gardens, shrubs, or trees in the vicinity of the areas being treated. Soil sterilizers shall not be used where they may contaminate water used for irrigation or drinking purposes.

5. Aggregate Base Course: The aggregate base course material shall be uniformly deposited on the approved subgrade by means of the hauling vehicle with or without spreading devices. Aggregate will be distributed over the surface to the depth specified on the approved construction plans.

After the aggregate has been deposited, it shall be spread and finished of the required cross-section by means of a self propelled pneumatic-tired motor grader. The base course material and water may be mixed at the plant in a mixer. Water shall be added during the mixing operation as required to reach specified moisture content for compacting. After mixing to the extent that the product has a uniform homogeneous appearance, the material may be transported to the job while it contains the proper moisture content and may be placed on the roadbed by means of an approved self-propelled aggregate spreader. If the material dried

appreciably prior to final compacting, additional water shall be added by means of a water tank to assist in compaction and to prevent raveling. Water may be applied prior to and during all blading and processing operations to moisten the material sufficiently to prevent segregation of the fine and coarse particles. Water shall be applied during the compaction and maintenance stages in sufficient amounts to assist in compaction and prevent raveling. Compaction shall immediately follow the spreading operation. Where the required thickness is six (6) inches or less, the base course may be spread and compacted in one layer. However, if vibrating compaction equipment is used, and the requirement for density is complied with can be accomplished, the compacted thickness of any one layer may be increased to eight (8) inches. Aggregate bases, to be placed on median strip areas, shoulder areas, and at locations which that are inaccessible to the spreading equipment, may be spread in one or more layers by any means to obtain the specified results. Each layer of material shall be compacted to not less than ninety-five (95) percent relative compaction of the Standard Proctor. It is to be expected that a loss of density in the upper portion of the material may occur due to the elements, or for other reasons. Recompaction to the specified density may be required prior to placement of any subsequent course. Tolerance of the finished surface: When a twelve (12) foot straight edge is laid in any direction, the finished surface shall not deviate at any point more than 0.04 feet.

6. Forms: Slip form construction or stationary forms may be used. Metal or wood forms shall have a depth equal to or greater than the concrete section being placed. Feasible These forms shall have sufficient strength to support the placement of the concrete. Forms shall remain in place for a minimum of four (4) hours. Face plate forms for curb and gutter shall be removed as soon as practicable in order to allow for finishing of the curb face and top. Concrete curb placed by the extrusion process will be an acceptable alternative.

7. Placing Concrete: Prior to the placement of concrete, the contractor shall obtain approval of the installation of formwork from the Town Inspector. Any forms or base course material which has been disturbed shall be corrected prior to the replacement of any concrete. Forms shall be oiled and the base moistened prior to the placement of any concrete. After the forms and base course are approved by the Town Inspector Town Inspector approves the forms and base course, the concrete can may be placed. The concrete shall be placed as uniformly as possible to minimize the amount of movement and spreading. During the placing operation, the concrete shall be spaded and/or vibrated with suitable equipment to insure no formation of voids or honeycomb. Care shall be taken during the vibrating operation to vibrate only enough to insure proper consolidation of the concrete and to bring to the surface a continuous film of mortar. Vibrating shall stop prior to segregation of the concrete. Vibrators shall not be used to move or spread the concrete.
 - a) Cold Weather Concreting: Concrete shall not be placed unless the air temperature is 35° F and increasing. Placement of concrete shall cease

when the decreasing temperature falls below 40° F. When placing concrete in cold weather, the temperature of the mix shall not be less than 50° F nor more than 90° F, at the time of placing. Aggregates and water shall not be heated above 150° F. Calcium chloride or other set acceleration admixtures may be used only if authorized by the Town Inspector. Before placing concrete, all ice, snow, or frost shall be removed from the forms, reinforcing steel and the base. In no case shall concrete be placed directly against frozen ground or ground containing frost.

After placing concrete, the temperature of the concrete shall be maintained above 50° F for at least four (4) days. Provide sufficient protection by the placement of loose dry straw or insulated curing blankets. The protection shall be such that it will keep moisture from coming into direct contact with the newly placed concrete. With the use of high early strength cement concrete, the concrete temperature shall be maintained above 50° F for at least two (2) days.

Any concrete placed under these conditions, which is found to be damaged by freezing shall be determined to be unacceptable and shall be removed and replaced as directed by the Town Inspector.

- b) Hot Weather Concreting: Concrete shall not be placed if the temperature of the plastic concrete cannot be maintained at 90° F or lower. Water reducer retarders may be used to retard the rate of hydration and time of set only if approved by the Town Inspector. Accelerators will not be employed in hot weather concreting.
- c) Joints: Joints in concrete curb, gutter, sidewalk and gutter pans shall be designated as expansion joints and weakened plain joints.
 - 1) Expansion Joints: Expansion joints shall be constructed in curbs, gutters, sidewalks and gutter pans as shown on the Standard Drawings. Such joint joints shall be filled with pre-molded joint filler and shall conform to the requirements of ASHTO M 213, or ASTM D 1751, Fiber Type.

One-half inch joints shall be constructed in curb and gutter at the ends of all returns and also at locations matching those expansion joints placed in sidewalks. Expansion joints shall be placed in sidewalks at all curb returns, utility poles, fire hydrants, and street lights. Expansion joint material shall be placed the full depth of the concrete.

Expansion joints in sidewalks shall be placed at a maximum of three hundred (300) foot intervals. Excess expansion joint material protruding above the finish surface of the concrete shall be trimmed flush with the concrete surface.
 - 2) Weakened Plane Joints: Weakened plane joints shall be placed in curb and gutter and sidewalks at a maximum spacing of ten (10) feet. Weakened plane joints shall be a minimum of three-fourths (3/4) inch deep, one-eighth (1/8) inch wide with rounded edges.
- d. Finishing Concrete: Finishing of concrete shall be completed as specified herein for the type of work being performed.

- 1) **Curbs:** The front forms may be stripped as soon as the concrete has sufficiently set. The face and the top of the curb shall be carefully trowelled to a smooth and even finish. Both of the face edges of the **gutter shall be finished with a $\frac{3}{4}$ " radius rounding.** The trowelled surface shall be finished with a fine hair broom applied parallel with the line of work. The edge of the concrete at all expansion joints shall be rounded to a $\frac{1}{4}$ " radius.
- 2) **Sidewalks:** **The forms for sidewalk shall be set to place a slope of $\frac{1}{4}$ " per foot, sloping from the back of the walk down toward the top of curbs.** Following placing, the concrete shall be screeded to the required grade, tamped to consolidate the concrete and to bring a thin layer of mortar to the surface. The surface shall be slanted to a smooth, flat, uniform surface. The concrete shall then be edged at all headers, given a preliminary trowelling and provided with weakened plane joints. **Edges at expansion joints shall be rounded to a radius of $\frac{1}{2}$ inch.** Sidewalk shall be trowelled to a smooth and even surface. All formed edges shall be rounded. Preliminary trowelling may be done with a long handled trowel, but the finish trowelling shall be done by hand trowel. After final trowelling, sidewalks shall be given a fine hair broom finish. Walks shall be remarked as necessary after final finish application.
All forms and headers shall remain in place for a minimum of sixteen (16) hours.
- 3) **Gutters and Gutter Pans:** After the concrete has been thoroughly tamped in such a manner to force the larger aggregate into the concrete and bring to the surface sufficient free mortar for finishing, the surface shall be worked to a true and even grade by means of a float, trowelled with a long-handled trowel and wood float finished. All forms and headers shall remain in place for a minimum of twenty-four (24) hours. **NO heavy traffic shall be allowed over the concrete until design strength has been met.**

5)

Curing: Freshly placed concrete shall be cured by protecting it against moisture loss, rapid temperature change, rain, flowing water, and mechanical injury for a period of not less than seven (7) days after placement. It shall be the contractor's responsibility to protect the concrete from traffic and the elements. Proper curing procedures shall be the responsibility of the contractor. Any one of the following methods may be used:

- 1) **Water Method:** The concrete shall be kept continuously wet by the application of water for a minimum of seven (7) days after the concrete has been placed. The entire surface of the concrete shall be kept damp by the application of water in the form of a fine mist. The moisture from the nozzle shall not be applied directly onto the surface and shall not be allowed to accumulate in sufficient quantity to cause a flow or a washing of the concrete surface.

- 2) Curing Compound Method: The entire surface of the concrete shall be sprayed uniformly with a curing compound. The application of the curing compound shall be as per the manufacturer's recommendations. This method shall not be used until all finishing is complete. All traffic on the concrete surface shall be kept to an absolute minimum until the curing time is complete.
 - 3) Waterproof Membrane Method: The membrane shall be formed into sheets of such width as to provide a complete cover over the entire surface. All joints in the sheets shall be securely cemented together in such a manner as to provide a waterproof joint. Overlay of sheets shall be a minimum of eighteen (18) inches. The sheets shall be securely weighted down which will insure proper protection to the concrete.
8. Steel Reinforcing: Steel reinforcing shall be placed in the locations and in the quantities as shown in the Standard Design Drawings and public improvement plans.
- Bent bar reinforcement shall be code bent to the shape shown on the plans. All bar reinforcement shall be accurately placed in the positions shown on the plans or Standard Drawings, and securely fastened so that no movement occurs during the placement of the concrete. When the spacing of bars exceeds one (1) foot in either direction, all intersections shall be tied. Distance from forms and ground shall be maintained by means of block, hangers or chairs.
- The placement of all reinforcing shall be furnished in the full lengths indicated on the plans or Standard Drawings. Splicing of bars, except where shown on approved plans, plans will not be permitted without approval of the Town Inspector.
- In lapped splices, the bars shall be placed in contact and wired together. The length of lap for deformed bars shall be at least twenty four (24) bar diameters for Grade 40 and at least thirty six (36) bar diameters for Grade 60, with a minimum splice lap of twelve (12) inches. Welded wire mesh reinforcement shall be lapped at least one (1) mesh opening wide with all ends and edges securely fastened.
9. Bituminous Prime Coat: The contractor shall provide equipment for heating and applying the bituminous prime coat material and the blotter material. The equipment shall be capable of applying the materials in a uniform manner at the specified rates of application.
- Bituminous material shall not be applied when the weather conditions are such that the application will not perform the desired function. No bituminous material shall be applied to any surface which surface that is wet, frozen, or in any other conditions which conditions that the Town Inspector considers unsuitable. In any case no bituminous material shall be applied when the atmospheric air temperature is below 50° 'F.
- The surface upon which the bituminous prime coat is to be placed shall conform to the established lines and grades, shall be smooth and uniform and shall be

compacted to this the required density. If the required density deteriorates between the time the gravel course was compacted originally and the time the prime coat is placed, for any reason whatsoever, the surface shall be re-compacted to the required density at the expense of the contractor.

Bituminous material shall be applied to the width of the section to be primed by means of a pressure distributor in a uniform, continuous spread. When traffic is maintained, not more than one half (1/2) of the width of the section shall be treated in one application. Care shall be taken that the application of bituminous material at the junctions of spreads is not in excess of the specified amount. Excess bituminous material shall be squeegeed from the surface area.

Skipped areas of deficiencies shall be corrected.

When traffic is maintained, one way one-way traffic shall be permitted on the untreated portion of the roadbed. As soon as the bituminous material has been absorbed by the surface and will not pick up, traffic shall be transferred to the treated portion and the remaining width of the section shall be primed.

Application rate shall be between .20 and .30 gallon per square yard of surface area.

The temperature requirement pertaining to the application of liquid asphalts and asphaltic emulsions shall conform to the requirement of the following table.

SPRAYING TEMPERATURE OF LIQUID ASPHALTS

<u>Grade & Type RC, MC & SC</u>			<u>Minimum</u>		<u>Maximum</u>
	F°	C°	F°	C°	
70	120	49	180	82	
250		165	74	220	104
800		200	93	255	124
30000	235	113	290	143	

The primed surface shall be maintained by removing all loose sand prior to placing any pavement or surfacing material thereon. Immediately in advance of placing asphaltic concrete or asphaltic concrete base, additional prime coat shall be applied as directed to areas where the prime coat has been damaged, and loose or extraneous material shall be removed.

10. Asphaltic Concrete Pavements: Asphaltic concrete material, from a stationary plant, meeting Colorado Department of Highways Transportation job mix shall be placed and compacted in layers on a prepared subgrade surface in conformity with the lines, grades and typical cross section shown on the public improvement plans.

The storage yard, stationary mixing plant, distributor, hauling equipment, laydown pavers, and rollers shall conform to the requirements of the Colorado Department of Highways Transportation Specification Section 401.08-71 thru 401.11-71.

Plant mix Asphaltic concrete shall be placed only on properly constructed and accepted subgrades that are free from water, snow, or ice. The bituminous mixture shall have a minimum ambient temperature of 280° F in the truck at point of delivery and shall be placed within the following air temperature limitations:

<u>Compacted Thickness</u>	<u>Minimum Placement Air Temperature</u>
<1"	60°F
1" - 2 ½"	50°F
>2 ½"	40°F

Prior to the placement of Asphaltic concrete, the surface of existing pavement or base course shall be brought to uniform grade and cross section as directed.

Asphaltic concrete shall be placed by means of bituminous pavers, spread and struck off to the grade and elevation established. The longitudinal joint in the finish layer shall overlap any sub-layer by 6 inches and shall be as follows:

- a) For two lane streets - at the center line/centerline of the pavement and at the outside edge of the traveled lanes.
- b) For streets of more than 2 lanes - at the lane lines and at the outside edges of the travel lanes.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable, the mixture shall be spread, raked, and compacted by hand tools. For such areas, the mixture shall be dumped, spread, and screeded to give the required compacted thickness.

Where Asphaltic concrete is placed along a curb, sufficient material shall be deposited so as to provide a compacted thickness 1/8 inch above the lip of the gutter pan.

Following spreading of asphaltic Asphaltic concrete and adjusting irregularities, the bituminous mix shall be thoroughly and uniformly compacted by rolling. On lifts of 3 inches or more, breakdown rolling shall follow immediately after the paving machine using rubber tired rollers, free of recapped tires, followed by steel wheel rolling until all roller marks are eliminated and a minimum density of 93 percent of the theoretical maximum density for the job mix has been obtained.

Unless otherwise directed, rolling shall begin at the sides and proceed longitudinally parallel to the street centerline, each trip overlapping one half the roller width, gradually each trip overlapping one half the roller width, gradually progressing to the crown of the street. When abutting a previously placed lane, the longitudinal joint should be rolled first, followed by the standard rolling procedures.

Any displacement occurring as a result of the reversing of the direction of a roller, or other cause, shall be corrected at once by the use of rakes and addition of fresh mixture when required.

Adhesion of the mixture to the rollers shall be prevented. Wheels shall be kept properly moistened with water or water mixed with a small quantity of detergent. Excess liquid will not be permitted.

Rollers shall not pass over the unprotected end of a freshly laid mixture unless authorized by the Town Inspector. Transverse joints shall be formed by cutting back on the previous run to expose the full depth of the course. When directed by the Town Inspector, a coat of bituminous material (RC) shall be used on contact surfaces of all joints just before additional mixture is placed against the previously rolled material.

The variation between any two contacts with the surface shall not exceed 3/16 inch in 10 feet. Humps or depressions exceeding the specified tolerance shall be corrected by removing defective work and replacing it with new material as directed.

11. Other pavements: Deep strength asphaltic concrete and Portland cement concrete pavements may be allowed. Design plans and specifications for these alternate pavements must be submitted to the Town Engineer for approval.

3.4 **TESTING**

3.4.1 COMPACTION TESTS: Compaction tests to verify specified compaction of subgrade and aggregate base course in all streets shall be performed on an average of one test for every two hundred lineal feet of street. Tests shall be performed by an independent testing laboratory in the presence of the Town Inspector.

3.4.2 CONCRETE TESTS: Concrete used in constructing public improvements specified in this section and throughout the remaining sections of this manual shall be tested as follows:

<u>Test</u>	<u>ASTM Specifications</u>
Slump	C 143
Air Content	C 173
Test Cylinders	C 31 or C 513
Core Samples	C 42

Slump shall be measured by the Contractor each time test cylinders are to be made and at any other time upon request of the Town Inspector. The slump shall not be more than 5 inches or as specified in this manual. Air content shall be measured each time test cylinders are to be made. Test cylinders shall be made by an independent testing laboratory in sets of four. One cylinder shall be field cured and broken at 7 days. Three cylinders shall be laboratory cured and broken at 28 days. If the 28 day cylinders do not meet the specified minimum compressive strength then a representative number of concrete cores may be taken from the structure to determine if the in place concrete meets the specified strength. The deficient concrete

shall be replaced at the Developer's expense. A set of test cylinders may be taken for each 50 CY of concrete placed or fraction thereof as required by the Town Inspector.

3.5 STANDARD DESIGN DRAWINGS

- Figure 3-1 Concrete Curb and Gutter
- Figure 3-2 Concrete Sidewalk
- Figure 3-3 Residential Driveway Approach
- Figure 3-4 Commercial Driveway Approach
- Figure 3-5 Concrete Gutter Pans
- Figure 3-6 Handicapped Ramp
- Figure 3-7 Monolithic Concrete Sidewalk and Curb & Gutter
- Figure 3-8 Typical Street Cross Sections
- Figure 3-9 Street Intersection Grades Detail