CHAPTER 5

PAVEMENT DESIGN AND TECHNICAL CRITERIA

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CHAPTER 5
PAVEMENT DESIGN AND TECHNICAL CRITERIA

5.1 GENERAL

5.1.1 Design methodologies for asphalt and Portland cement concrete follow the Colorado Department of Transportation (CDOT) standards and requirements.

5.1.2 **Preliminary Pavement Design Reports**
For all Town land development approvals that involve a subdivision improvements agreement for roadway construction, the applicant must provide, at a minimum, a preliminary subgrade investigation and pavement design report that recommends typical pavement structural section based on the known site soil conditions and the valid Traffic Impact Study. The preliminary reports shall use the Equivalent (18 Kip) Daily Load Applications (EDLA) of Table 5.2. This preliminary pavement design serves as a justification of the roadway improvement costs included in the subdivision improvements agreement.

5.1.3 **Final Pavement Design Reports**
A Final Pavement Design Report based on actual in-place subgrade material shall be submitted and approved by the Town before paving construction is allowed to start.

5.2 SUBGRADE INVESTIGATION

5.2.1 **Field Investigation**
The field investigation shall consist of borings or other suitable methods of sampling subgrade soils to a depth of at least three feet below proposed subgrade elevation, at spacings of not more than 250 feet unless otherwise accepted by the Town. Samples shall be taken after grading is completed and the subgrade is rough cut.

5.2.2 **Classification Testing**
Each subgrade sample shall be tested to determine Liquid Limit, Plastic Limit, Plasticity Index, Atterberg Limits and the percentage passing the U.S. Standard No. 200 sieve. Samples of sands and gravels may require gradation analysis for classification determination. These data shall be determined using the following methods:

Liquid Limit - AASHTO T 89 (ASTM D 4318)
Plastic Limit - AASHTO T 90 (ASTM D 4318)
Percent Passing No. 200 - AASHTO T 11 (ASTM C 117)
Gradation - AASHTO T 27 (ASTM D 422)

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

5.2.3 **Soil Grouping**

To facilitate subgrade support testing, soil samples collected in the field investigation can be combined to form soil groups. These groups shall be based upon the AASHTO Classification. Group Index and location within the area investigated. Groupings shall not consist of samples with different ASSHTO Classifications (Note: there may be more than one group within a given classification). Composite samples can be manufactured by combining small portions of each subgrade sample contained within the group and mixing to provide a uniform composite sample of the soil group. Composite samples shall be subjected to Classification Testing as outlined in Item 5.2.2.

5.2.4 **Subgrade Support Testing**

Individual subgrade or composite samples shall be tested to determine the subgrade support value using either CBR (California Bearing Ratio) or Hveem Stabilometer (R-value) testing. These values shall be used in the design of pavement sections in accordance with the procedures outlined by CDOT standards. Tests shall be conducted in accordance with the procedures listed below in Items 5.2.4.1 or 5.2.4.2.

5.2.4.1 CBR Tests - California Bearing Ratio tests shall be conducted in accordance with AASHTO T 193 with the following modifications:

a. Note 4 of AASHTO T 193 shall not apply. A three-point CBR evaluation is required.

b. Where samples to be tested classify as A-1 through A-5, the requirement for compaction shall be changed from Method T 99 (ASTM D 698) to T 180 (ASTM D 1557). (Note: Where it can be demonstrated that the moisture-treated and compacted subgrade soils exhibit low swell potential (<2.0% under 200 psf pressure), Method T 180 can be used for A-6 or A-7 soils.)

c. Surcharge shall be calculated using a unit weight of 140 pcf for bituminous pavement and 135 pcf for treated or untreated aggregate base course.

d. The design CBR value shall be determined from the CBR--Dry Density Curve and shall be the CBR value at 95 percent compaction.

e. In addition to the values requested in AASHTO T 193, Stress-Penetration curves for each sample, a CBR--Dry Density curve and Proctor Compaction test results shall be reported.

5.2.4.2 R-Value Tests - Hveem Stabilometer tests shall be conducted in accordance with AASHTO T 190. The design R-value shall be at 300 psi exudation pressure. The reported data shall consist of:

a. Dry density and moisture content for each sample.
b. Expansion pressure for each sample.
c. Exudation Pressure - corrected R-value curve showing the 300 psi design R-value.

5.3 PAVEMENT DESIGN CRITERIA

5.3.1 General

Pavement design shall be in accordance with CDOT standards and specifications.

5.3.2 Equivalent (18 Kip) Daily Load Applications (EDLA)

EDLA criteria for each Town roadway classification are given in Table 5.2.

TABLE 5.2
RECOMMENDED
EQUIVALENT (18 Kip) DAILY LOAD APPLICATIONS (EDLA)

Classification	Class Modifier	EDLA Values (1)
Local	Cul-de-sac serving <10 DU	1
	Serving <80 DU	5
	All others	10
Minor Collector	Residential	30
	Commercial	50
Major Collector	All	100
Minor Arterial	All	200
Major Arterial	All	200 (2)

Notes:

(1) Alternative EDLA values may be considered with justification provided by the Traffic Impact Study, proposed land uses, and traffic analysis that defines proportion of truck vehicles.

(2) EDLA for major arterial roadways shall be set on a case-by-case basis, 200 is the recommended minimum for planning purposes.

5.3.2 Minimum Pavement Section

This paragraph provides the minimum acceptable pavement sections for public roadways in the Town. The minimum thickness may be used for preliminary planning purposes or for estimating requirements for subdivision improvement agreements. Final pavement designs shall be based on actual subgrade support test results. Table 5.3 lists minimum thickness for each roadway classification.

TABLE 5.3

RECOMMENDED MINIMUM PAVEMENT SECTIONS

		Composite Section			
Classification	EDLA	Asphalt (Inches)	Treated Subgrade or Base (Inches)	Full Depth Asphalt (Inches)	Portland Cement Concrete (Inches)
Local	(See Table 5.2)	3	6	5.0	5.0
Minor Collector					
A. Residential	30	3	6	5.0	5.0
B. Commercial	50	4	6	6.0	5.5
Major Collector	100	4	6	6.0	5.5
Minor Arterial	200	5	6	7.0	6.0

5.4 SUBGRADE INVESTIGATION AND PAVEMENT DESIGN REPORT

The report shall be prepared by or under the supervision of and signed by a Professional Engineer registered in the state of Colorado and shall include the following information:

A. Vicinity map to locate the investigated area.

B. Scaled drawings showing the location of borings.

C. Scaled drawings showing the estimated extent of subgrade soil types and EDLA for each street.

D. Pavement design alternatives for each street on a scaled drawing.

E. Tabular listing of sample designation, sample depth, Group Number, Liquid Limit, Plasticity Index, percent passing the no. 200 sieve, AASHTO Classification, Group Index, and soil description.

F. CBR (R-value) test results of each soil type used in the design.

G. Pavement design nomographs properly drawn to show Soil Support - EDLA - SN.

H. Design calculations.

I. A discussion regarding potential subgrade soil problems including, but not limited to:
   1. heave- or settlement-prone soils
   2. frost susceptible soils
   3. ground water
   4. drainage considerations (surface and subsurface)
   5. cold weather construction (if appropriate)

6. other factors or properties which could affect the design or performance of the pavement system

J. Recommendations to alleviate or mitigate the impact of problems discussed in Item I above.