CHAPTER 7
STREETS

(Updated 5-16-13)

SECTION 7.1
FLEXIBLE PAVEMENT DESIGN

A. General – This section provides a comprehensive set of design procedures required to produce an acceptable flexible pavement structural design on new and reconstructed roads in the City of South Jordan. These design procedures are based on the recommendations found in the 1993 version of the *"AASHTO Guide for Design of Pavement Structures"* and on recommendations found in the November 1998 version of the *"UDOT Pavement Design Manual"*. All roads in the City, as determined by the City Engineer, must be designed using these empirical methods. The purpose of this specification is to aid the designer in selecting appropriate values to be used in the empirical method.

B. Design Engineer's Responsibilities – The design of a pavement section is a combination of several different and varied factors of civil and geotechnical engineering, which are under the control of the design engineer, not the City. This includes the preparation of an adequate geotechnical report which is representative of soil conditions in the field, at the proper location, both horizontally and vertically, a determination of the types of vehicles which are going to use these roads, the numbers of these types of vehicles, an assumption of the life of the roadway, the equivalent single axle loads (ESALs) the roadway will be subject to, all of which are based on original assumptions prepared and made by the design professionals preparing the pavement section design.

Assumptions and studies made of these initial design parameters are the sole responsibility of the design professional preparing the pavement design and are not dictated by the City. The City is providing maximum and minimum values they may consider in their design, however, the designer is obligated to determine the appropriate value for the road section. The design professional is tasked with performing an adequate design for the pavement section and affixes their stamp and signature indicating they have performed the design in accordance with City standards, and it is adequate to provide the intended service life.

7.1.1 DESIGN VARIABLES

A. Traffic Volumes and Vehicle Distribution: The design procedures for highways and low volume roads are all based on the cumulative expected 18-kip Equivalent Single Axle loads (ESAL) during the analysis period. The designer shall consider the parameters listed in table 7.1 as they use the method

described in the “UDOT Pavement Design Manual” to convert the mixed traffic into the appropriate ESAL value.

Note that values for the actual volume and classification distribution on existing streets shall be collected using permanent counters over a minimum period of 72-hours. The volume and classification distribution for new road sections shall be provided in an acceptable traffic impact study, or by collecting volumes on an existing street that is similar to the new project. In some cases, special consideration must be given to construction traffic.

Once the values for the volume and classification distribution are determined, the designer must then compare the values with the parameters listed in table 7.1 and ensure that they use the most conservative value in calculating the ESAL value.

The designer must determine the projected AADT for the road and then compare it with the minimum AADT allowed by the City and use the greater value in the design. If the road section is a dead-end, with no potential of future growth and less than 80 residences accessing the road, then the minimum AADT volume to be used in the design is 1,000. All other roads must be designed using a minimum AADT volume of 2,000.

Table 7.1 Vehicle Classification Distribution Parameters

Class	Type	Distribution of Traffic
1-2	Motorcycles/Cars	Max = 98.00 %
3	Other 2-Axle, 4-Tire Single Unit Vehicles	Min = 1.00 %
4	Buses	Min = 2 per day
5-7	2- Axle, 6- Tire Single Unit Trucks	Min = 0.89 %
8-10	Single Trailer Trucks	Min = 0.01 %
11-13	Multi-Trailer Trucks	TBD by Designer

B. Selection of Design CBR – Subgrade soil CBR values shall be determined using samples compacted at optimum moisture content to 100 percent of the maximum density obtainable by the AASHTO T-99D method of compaction. CBR tests shall be performed according to AASHTO T-193 except that a standard surcharge weight of 10 pounds shall be used for soaking and the penetration test of all samples. A minimum of one CBR sample per 800 feet of road section must be considered, however, designer is obligated to inspect the site and ensure that the CBR samples are a reflection of the actual soil conditions on site. A max subgrade CBR value of 10 may be used with the AASHTO empirical equation.

Designer must schedule an appointment with the City Engineering Department 48 hours prior to collecting CBR samples to be used for the flexible pavement design. The City will have an inspector meet the designer on site at the time they are taking the samples. For a CBR sample to be considered for the design it must be witnessed by a South Jordan City inspector. The designer must show the inspector where they’ll be taking the tests and have adequate tools to ensure

that they are taking the samples at the correct horizontal and vertical location of the future roadway. If soil on site is inconsistent, then additional samples may be needed at the discretion of the inspector.

C. Additional Pavement Design Parameters – Table 7.2 lists additional parameters that designer must consider or include in the design of the pavement section.

Table 7.2 Pavement Design Parameters for Flexible Pavement

Description	Parameter
Growth Rate:	TBD by Designer
Analysis Period or Design Life:	20 yrs
Reliability:	90%
Standard Deviation	0.45
Initial Serviceability	4.2
Terminal Serviceability	2.5
Drainage Coefficient	Max = 1.0
Subgrade CBR (for design equation)	Max = 10.0
Structural No. Hot Mix Asphalt	0.40 per inch
Structural No. Untreated Base Course	0.10 per inch
Structural No. Granular Borrow	0.08 per inch

D. Stability and Constructability - It is generally impractical and uneconomical to place layers of material that are less than some minimum thickness. The following values are the City of South Jordan's minimum thicknesses for surface and base layers. These values are not a substitute for a professionally prepared roadway structural section design but are used as a starting point in the design process.

Table 7.3: Asphalt Concrete Pavement Minimum Structural Section

Subgrade Class	Pavement Section	Roadway Classification	
		Local	Minor Collector
Very Poor (CBR <3)	Asphalt Concrete Surface	3.5"	4"
	Untreated Base Course	10"	8"
	Granular Backfill Borrow	*	12"
	Non-Woven Geotextile Required	Yes	No
Poor (CBR 4-9)	Asphalt Concrete Surface	3"	4"
	Untreated Base Course	9"	14"
	Granular Backfill Borrow	*	*
	Non-Woven Geotextile Required	Yes (If CBR is 4 or less)	Yes (If CBR is 4 or less)
Medium (CBR 10 or more)	Asphalt Concrete Surface	3"	4"
	Untreated Base Course	8"	10"
	Granular Backfill Borrow	*	*
	Non-Woven Geotextile Required	No	No
* Additional depth may be needed if the subgrade has a high frost hazard potential.			

7.1.2 FROST HAZARD IDENTIFICATION

Frost action creates a hazard to pavement performance by causing the surface to heave and by decreasing the soil support by increasing the moisture content above the normal saturation content. The following three conditions must exist for a pavement frost hazard to exist:

1. Temperatures below freezing.
2. A water table above the frost line or a source of water that can saturate the soils above the frost line by infiltration or capillary action.
3. A grain size distribution that will result in frost susceptible pore sizes.

The typical depth to the frost line at varying locations within South Jordan is between 20 and 30 inches. Many of the soils above the frost line in the City may be classified as frost susceptible according to grain size classification criteria. The most distinguishing factor for identifying pavement frost hazards is condition 2 (water supply).

For frost susceptible soils within the frost zone, the frost hazard may be rated as high, or low, according to the following conditions. The designer must include a frost hazard rating in the site evaluation documentation verifying that an evaluation of frost action has been attempted and has not been overlooked. When the rating is unknown, the City Engineer will determine if frost action mitigation measures need to be included in the design based upon the recommendation and data collected by the designer.

The conditions associated with a high frost hazard potential include:

1. A water table within 10-feet of the pavement surface.
2. Observed frost heaves in the area.
3. The U.S. Army Corps of Engineers (USCOE) considers inorganic soils containing 3-percent (by weight) or more of grains finer than 0.02 mm in diameter, to be frost susceptible for pavement design purposes.
4. A potential for the ponding of surface water and the occurrence of soils in the frost zone beneath the pavement to become saturated due to the ponding.

The conditions associated with a low frost hazard potential include:

1. A water table greater than 20-feet below the pavement surface.
2. Natural moisture content in the frost zone low in comparison to the saturation level.
3. Presence of seepage barriers between the water supply and the frost zone.
4. Existing pavements or sidewalks in the vicinity, with similar soil and water supply conditions and without constructed frost protection measures that have not experienced frost damage.
5. Pavements on embankments with surfaces more than 3 to 6-feet above the adjacent grades.

If the soil is identified as having a high frost hazard potential, then designer must include measures to mitigate the frost action. Some of these measures may include:

1. Partial Removal of Frost-Susceptible Material. This method is commonly used in combination with better drainage.
2. Limit Water Supply by methods such as paved shoulders, side ditching, edge drains, and sub-drains. An attempt to improve drainage is essential in controlling the damage caused by frost action.
3. Cover Subgrade with Sufficient Depth of Non-Frost-Susceptible Material. This method is commonly used in combination with better drainage. Removal or covering should be to a minimum of 70-percent of the predicted frost depth.

SECTION 7.2
TESTING OF MATERIALS

A deflection test must be performed on the subgrade before geotextile or base material is placed. Any soft or pumping areas must be removed and replaced with granular borrow at the City Engineer's judgment. Density tests of the subbase and asphalt material must be performed in accordance with APWA specifications. Final proof roll of road base must be performed by Developer and witnessed by Developer's Geotechnical Engineering Consultant and City Inspector. Developer's Geotechnical Engineer must analyze and recommend stabilization of any subbase material. Asphalt placement between October 15th and March 15th must have City Engineer's approval.

A: Asphalt Pavement Tolerances

Reference Table 4 – Roughness Tolerance of Section 3.6 of Asphalt Paving 32 12 16 of the APWA 2012 Manual of Standard Specifications

SECTION 7.3
CURB, GUTTER AND SIDEWALK

A: Curb:
High back Curb will only be allowed! If slip forming, an expansion joint is required every 300 feet and at point of curvature (PC) and point of tangency (PT). If hand forming, expansion is required at PC and PT, and every 100'. Expansion joints are required every 30' to 40' on a curve. Road base under the curb and gutter must match the road base thickness under the asphalt (with a minimum of at least 8" thick) and be compacted to 96% of maximum density. A 6.5 bag mix will be used along with a coating of white pigment curing compound. A 7.5 bag mix must be used (at engineering inspectors discretion), when nighttime temperatures start to approach freezing. At the handicap ramp where it butts up against the road, there will be a 6' portion of no lip and a 6'wing from the no lip to match the high back curb elevation. There will be no ponding allowed. Before placement of asphalt, a flow test

must be performed at engineering inspectors discretion. Sections that do not flow, or where ponding occurs, will be removed and replaced.

On all Construction sites contractor must notify engineering inspector 24 hours prior to pouring any concrete and verify proper location.

B. Sidewalk:
Compact subgrade to 96% of maximum density. 6" of base, compacted to 96% of maximum density is required. Concrete thickness will be 5". Sidewalk will be scored to depth of between ½" to ¾" deep every 6' for a 6' wide sidewalk, or score lines shall be placed at intervals equal to the width of the sidewalk. An expansion joint will be placed in the sidewalk at 42-foot intervals. If sidewalk boarders curb it must comply with handicap standards of 1 foot to 12 feet maximum fall on all approaches and handicap accesses. All handicap ramps require an ADA and APWA approved detectable warning surface. Material of detectable warning surface shall be gray, cast-in-place, ribbed panel (as shown on the APWA standard plans), or cast-in-place replaceable tactile (a homogenous glass and carbon colorfast UV stable composite, secured with heavy duty steel hex head bolts and anchors or glass-reinforced thermoset composite with stainless steel fasteners and bottom docking anchors) or approved equivalent by City Engineer.

C. Stamped / Colored Concrete: Coloring of concrete shall be done in two parts; base color of concrete and color release. Base color shall be added at the batch plant prior to delivery in accordance with manufacturer's guidelines. Color release shall enhance or accent the base color. The base color and color release shall be shown on the engineering drawings and approved by the City. Stamping of concrete shall be done in accordance with manufacturer's specifications. Cure and seal finished surface in accordance with manufacturer's specifications.

The following is an example of a color combination that has been accepted on previous projects: base color: Yosemite Brown (per Davis Colors Chart) / color release: Dark Gray (per Brickform standard color selection guide). Developer or Engineer should match the color of the concrete with adjacent architectural elements of the project.

SECTION 7.4
PARK STRIPS

A. Park strips shall have a minimum cross slope of 2% and a maximum cross slope of 33% unless otherwise approved by the City Engineer.

B. Stairs are allowed in the park strip as long as they comply with section 1009 of the International Building Code (IBC) and receive prior approval from the City Engineer.

SECTION 7.5
STREET REPAIR / REPAVING POLICY

A. The following is the policy for the repair and repaving of streets that are cut or excavated. These requirements fall in line with the City adopted LTAP Program for street maintenance. Street Age shall be based on when the street was first constructed, re-constructed, or receives an asphalt overlay. In other words a reconstruction or an overlay of a street shall bring the street to a new condition.

   All roadwork/cuts in concrete streets shall require full panel removal of the concrete slab(s) that are being cut or damaged and replacement of that complete concrete slab.

   After the roadwork/cuts have been repaired and/or repaved, the repaired surface is required to match the existing road surface.

7.5.1 REPAIR AND REPAVING

A. Street Age: <u>0 through 5 years old</u>

   1. Street shall require an overlay over the full width of the street. The thickness of the overlay shall be a minimum of two (2) inches, paving fabric is required, milling/grinding is required (see standard drawing 3010). The distance of the overlay beyond the trench repair shall be per the requirement of the City Engineer. The City Engineer may modify this requirement as the site conditions may dictate.

B. Street Age: <u>6 years through 10 years old</u>

   1. Street shall require a minimum Type II slurry seal over the full width of the street. The distance of the slurry seal will be per the requirement of the City Engineer or designee.

   2. Prior to the slurry seal the trench will be reconstructed per City Standards (see standard drawing 3010).

C. Street Age: <u>11 years old and beyond</u>

   1. Reconstruct the trench per City Standards (see standard drawing 3010).

SECTION 7.6
STREET WIDENING

A development that widens an existing street shall be required to remove the pavement to centerline of the side of the street that is being widened. The street shall be re-constructed (this includes road base and asphalt) to centerline along the length of the development. The purpose of the reconstruction is to ensure that the cross section of the road from centerline to the new curb and gutter meets City Standards. This condition may be waived by the City Engineer if the developer's Civil Engineer shows that the installation of the new curb & gutter and asphalt pavement strip will meet the City Standards for the cross section of the roadway from centerline to the new curb and gutter.

It should be noted that if there are cuts in the roadway beyond the pavement work the pavement shall be as per the requirements listed above depending on the age of the street.

SECTION 7.7
STREET SIGNS

A. General - All street signs shall comply with the current edition of the Manual of Uniform Traffic Control Devices (MUTCD) per the current edition adopted by UDOT and approved by the City of South Jordan.

B. The street sign contractor shall obtain street names and block numbering from the Planning Department prior to construction.

7.7.1 MATERIALS

Sign components such as sheeting, EC film, inks, letters and boarders are all required to be from the same manufacturer.

A. Sheeting

1. Retro reflective Sheeting shall meet ASTM D 4956 standard specification.

2. Non retro reflective sheeting shall be as specified in accordance with the manufacturer recommendations.

3. Traffic signs and traffic control devices shall meet or exceed ASTM Type IV sheeting.

B. Film

1. Only Acrylic EC film may be used to achieve color. Vinyl EC film in not accepted.

C. Post

1. Refer to standard drawing S-3

D. Base

1. All signs larger than 36” X 36” or 1296 square inches per sign pole shall be mounted on a Slip Base system per UDOT standard drawing SN 10B (detail drawing attached to standard drawings) with a “Z” bar backing. Signs of this size are not allowed to be mounted on a yielding pole.

All components and warranties shall be compatible with substrates used by the City of South Jordan, including Aluminum ASTM B 209 5052-H38 or 6061-T-6

7.7.2 WARRANTY

All sign suppliers are required to warranty permanent street signs they supply for a period of eight (8) years after the time of installation against workmanship, and material failures. Contractor is required to do each of the following:

1. Affix to each sign a one inch high, two digit number representing the manufacture year, to the front bottom left corner of each sign. Numerals are to be in contrast to the color of the sheeting. (For example 2011 shall be represented as “11” and so forth)

2. Affix to each sign and device a two inch by two inch impermeable, non-fading, weather resistant, self-adhesive label. Attach label where it will not obscure sheeting. The label shall contain the month and year of manufacturer, sheeting manufacturer, sheeting type, and supplier’s name.

SECTION 7.8
RESIDENTIAL STREET LEVEL OF SERVICE

7.7.1 CITY POLICY AND GUIDELINE

Worsening traffic congestion on arterial and collector roadways continue to divert traffic onto residential streets. Although each lane of a residential street could carry from 1,000 to 1,600 vehicles per hour, the quality of life along a residential street is impacted at far lower traffic levels.

The City’s General Plan states the following, “Preserve peace and quiet in residential areas through circulation design that slows traffic flows and encourages safe driving practices.” Since the City’s General Plan is vague on the desired level of service of

residential streets. Staff (City Traffic Committee) has formulated the Residential Street Level of Service categories shown as Exhibit “A”. This exhibit is based on the desire stated in the General Plan and staff’s experience with residents complaining about quality of life issues along residential streets. These peak hour volume, average daily traffic volume and vehicle speed thresholds closely match the degree of concern expressed to staff regarding the quality of life along residential streets and the relative need for traffic calming under these conditions.

This Residential Street Level of Service standard also will help staff to determine how new development will impact neighborhood streets from a Level of Service Standard or Quality of Life standard.

A Residential Street is defined by City Standards as any street that has a 55 foot right of way or less and/or with 28 feet of pavement width or less.

If new development will significantly lower (as determined by the City Engineer) the LOS as listed, the development will be required to install traffic calming measures as determined by the City Engineer.

The following are the Level of Service (LOS) categories and their descriptions:

LOS “A”

Describes living conditions where a residential street only carries traffic from the adjacent residences. It is very easy to walk across the street, ride bicycles and enter or exit residential driveways. Typical motor vehicle speeds are 25 MPH or less. During the peak traffic hour, one car passes down the street every two minutes. The typical traffic volume is under 300 vehicles per day with only 30 vehicles during the peak travel hour.

LOS “B”

Describes living conditions where a residential street carries traffic from two residential blocks. It is easy to walk across the street, ride bicycles and enter or exit residential driveways. Often residents are concerned about vehicle speeds that have increased to 25-30 MPH. During the peak traffic hour, one car passes down the street every minute. The typical traffic volume is under 600 vehicles per day with 60 vehicles during the peak travel hour.

LOS “C”

Describes living conditions where a residential street carries traffic from four residential blocks. It is relatively easy to walk across the street, ride bicycles and enter or exit residential driveways. Residents are concerned about vehicle speeds that have increased to over 30 MPH. Residents are also uncomfortable with vehicle volumes that have risen to 1,200 vehicles per day with 120 vehicles during the peak travel hour. During the peak traffic hour, one car passes down the street every 30 seconds.

LOS “D”

Describes living conditions where a residential street carries traffic from six residential blocks. Increased caution is necessary when walking across the street, riding bicycles and entering or exiting residential driveways. Residents are very concerned about vehicle speeds that have increased to up to 35 MPH. Residents perceive that commuters are shortcutting on their street due to vehicle volumes up to 1,800 vehicles per day with 180 vehicles during the peak travel hour. During the peak traffic hour, one car passes down the street every 20 seconds.

LOS “E”

Describes living conditions where a residential street carries traffic from eight residential blocks. Due to elevated vehicle speeds and volumes, a high level of caution is necessary when walking across the street, riding bicycles and entering or exiting residential driveways. Vehicle speeds have increased to 35 MPH or more. There is significant commuter shortcutting with up to 2,400 vehicles per day and 240 vehicles during the peak travel hour. It is increasingly difficult to exit driveways during the peak traffic hour with one car passing down the street every 15 seconds.

LOS “F”

Describes living conditions where a residential street carries traffic from significantly more than eight residential blocks. Due to elevated vehicle speeds and volumes, a high level of caution is necessary when walking across the street, riding bicycles and entering or exiting residential driveways. Vehicle speeds have increased to 35 MPH or more. There is significant commuter shortcutting with over 2,400 vehicles per day and 240 vehicles during the peak travel hour. Exiting and entering driveways is difficult and requires approaching vehicles to stop for driveway traffic.