# Street Design

SELECTED LINKS TO SECTIONS WITHIN THIS DOCUMENT



## SECTION 1
## INTRODUCTION – STREETS

(Last revised 7/24/06)

The following division has been established to assist developers and engineers with the design of streets (private and public) within the jurisdiction of the City of Jacksonville. The methods, procedures, design factors, formulas, graphs, and tables presented in this division are intended to establish minimal guidelines for residential and commercial pavement design. The City of Jacksonville believes that the following design criteria are sufficient to insure the welfare and safety of the general public and to protect the economic investment of the citizens of our City.

Alternative design methods may be considered by the Engineer/Designer on a case-by-case basis; however, there should not be extensive variations from the criteria and procedures within this division without the expressed approval of the Public Services Director.

### 1.1 CITY OF JACKSONVILLE PUBLIC SERVICES DIRECTOR

The Public Services Director shall be responsible for interpretation and implementation of the pavement design criteria for the City of Jacksonville. Approval from other applicable agencies may be required.

### 1.2 CITY OF JACKSONVILLE PAVEMENT POLICY

It is the policy of the City of Jacksonville that all developed land within the City Limits has adequate streets and parking lots. The City may accept roadway systems for maintenance if they have been designed and constructed in accordance with the provisions of this specification or as otherwise instructed in writing by the Public Services Director.

### 1.3 ACKNOWLEDGEMENTS

This division has been prepared by Appian Consulting Engineers, P.A. of Rocky Mount, North Carolina, in cooperation with the City of Jacksonville, North Carolina. However, the content of this division is largely derived from the *AASHTO Guide for Design of*

*Pavement Structures* [AASHTO, 1986] and the *Asphalt Pavement Design System* [Taylor, 1993]. The AASHTO method looks at total volume of traffic over the life span of the pavement, not just daily which helps in cases where traffic is very seasonal or does not occur on weekends etc. The AASHTO method also allows for acceptance of pavement deterioration as an economic decision. When correctly used, especially in conjunction with a good model of traffic numbers and wheel loads, the method provides reasonable results. These manuals were particularly important because of their format, quality, completeness, and because they represent generally accepted criteria.

# SECTION 2
# STREET/SUBDIVISION DESIGN

The purpose of this division is to define the policy of the City of Jacksonville with respect to the design, construction, and maintenance of public streets within the City's jurisdiction.

All streets within the City of Jacksonville and the City's jurisdiction shall meet all the requirements of the City of Jacksonville Manual of Specifications, Standards and Design, latest revision.

The following shall be considered the *minimum* standards of design for streets within the City of Jacksonville.

## 2.1 SUBDIVISION STREETS

**Table 2.01 Required Improvements**

| Public Improvement | Required |
|---|---|
| Graded Streets | X |
| Underground Drainage | X |
| BMP's | X |
| Curb and Gutter | X |
| Public Water and Hydrants | X |
| Public Sewer | X |
| Paved Streets | X |
| Sidewalks | Both side of Residential and Commercial except not required on cul-de-sacs having 6 or less lots on the cul-de-sac right-of-way. |
| Street lights | X |
| Street trees | Not required but recommended |
| Underground Power | Not required but recommended |

In every new subdivision or development, the street system shall conform to the City of Jacksonville Urban Area Thoroughfare Plan Map. In areas where the Urban Area Thoroughfare Plan Map does not apply, streets shall be designed and located in proper relation to existing and proposed streets, topography, natural features, tree growth, public convenience, public safety, and the proposed use of land to be served by such streets. All proposed streets shall provide for the appropriate protection of principal streets in surrounding areas and provide reasonable access for surrounding acreage tracts.

In the case that a subdivisions borders along an existing or proposed major thoroughfare, no direct driveway access will be permitted to the thoroughfare. When subdividing residential properties adjacent to a major thoroughfare, all lots should back onto the major thoroughfare and shall be required to have frontage on another public road or approved private street. When subdividing commercially zoned property, the developer shall create a marginal access street adjacent to the major thoroughfare right-of-way or shall provide some other form of access, which does not entail direct driveway access onto the major thoroughfare.

Right-of-way and pavement widths shall comply with **standard detail 401.01**, *Typical Street Cross Section (Geometric Properties)*.

### 2.1.1 Street Classifications/Definitions

A. **Alley:** A roadway that affords only a secondary means of access to abutting property and not intended for general traffic circulation.

B. **Street:** A thoroughfare which affords the principal means of access to abutting property, including avenue, place, way, drive, lane, boulevard, highway, road, and another thoroughfare except an alley.

C. **Collector Streets**: Streets, which carry traffic from minor streets to the system of major streets.

D. **Cul-De-Sac:** A short street or combination of streets designed to have the end permanently closed; the closed end terminated by vehicular turn around. See **standard detail 401.02.**

E. **Thoroughfare:** A travel or passage way intended for the movement of vehicles from one location to another.

F. **Minor Thoroughfare**: Those routes whose primary function is to move traffic to major thoroughfares; average daily trips typically exceed 5,000; often provide access to abutting property (as delineated on the most recently adopted Jacksonville Urban Area Thoroughfare Plan Map).

G. **Major Thoroughfare:** Those routes whose primary function is to move traffic; average daily trips typically exceed 12,000; access to abutting property should be strictly regulated (as delineated on the most recently adopted Jacksonville Urban Area Thoroughfare Plan Map).

H. **Marginal Access Streets:** Minor streets that are parallel to and adjacent to major streets and highways; and which provide access to abutting properties and protection from through traffic.

I. **Minor Streets:** Streets that are used primarily for access to the abutting properties.

### 2.1.2 Widening of Existing Streets

Widening of streets in existing neighborhoods will be considered on a case-by-case basis, taking into consideration the effects on the neighborhood, traffic, and parking requirements.

### 2.1.3 Paving

In all cases, the subdivider shall be responsible for the cost and installation of the street foundation and paving of all streets on the approval of the final plat in accordance with the Manual of Specifications, Standards, and Design, latest revision, and the North Carolina Department of Transportation, as may be applicable.

### 2.1.4 Pavement Design

Pavement sections/thicknesses shall conform to the minimum cross-sectional thicknesses shown on **standard detail 401.01**. However, at the developers/Engineer's option for cul-de-sac, minor and marginal streets, an alternate pavement section can be submitted to the Public Services Director for consideration that has been based on a Geotechnical investigation of the site by a Geotechnical Engineer utilizing the design procedures outlined in *Section 3, Pavement Design* for a 20-year design life. The thickness shall be determined by either the average insitu or soaked laboratory CBR value for the street or roadway section.

**When a Geotechnical Investigation is required:**

A. All Collector, Minor Thoroughfare, and Major Thoroughfares shall conform to the minimum pavement sections shown on **standard detail 401.01** except that the section shall be confirmed as to adequacy by a Geotechnical Investigation taking into consideration the projected volume and type of traffic for the corridor in consideration.

B. If, in the opinion of the Public Services Director, soils appear to be weak or have inherent problems, such as a high mica content or a seasonal high or perched groundwater condition, the Public Services Director may require that the services of a Geotechnical Engineer be utilized in the design of the street or pavement in question to confirm or alter the minimum section as may be necessary. Improvements may include, but are not necessarily limited to, subsurface drainage, subgrade stabilization with a Geotextile fabric, lime or cement, increased pavement thickness, etc.

C. **Pavement Design Life:** Pavement must be designed in accordance with the procedures in Section 3, *Pavement Design*. The minimum pavement design life for streets within the jurisdiction of the City of Jacksonville shall be 20 years but may be increased at the discretion of the Public Services Director. The thickness shall be determined by either the average in-situ or soaked laboratory CBR value for the street or roadway section. However, the minimum asphalt pavement section thickness shall be no less than that shown on **standard detail 401.01** for the applicable classification.

All design modifications are subject to approval by the Public Services Director.

## 2.2 VERTICAL ALIGNMENT

### 2.2.1 Grades

Unless necessitated by exceptional topography and subject to the approval of the Public Services Director, street grades shall not exceed 10% percent unless approved by the Public Services Director. In all cases, street grades shall not be less than 0.5% percent.

Grades approaching intersections shall not exceed 5% percent for a distance of at least 100 feet from the centerline of the intersection.

### 2.2.2 Vertical Curves

All changes in street grade shall be connected by vertical curves. The following formula shall be used for determining the length of vertical curve required to provide minimum sight distance:

$$L = KA$$

$L$ = Length of vertical curve in feet
$K$ = Rate of vertical curvature in feet per percent of $A$ (Table 2.01)
$A$ = Algebraic difference in grades in percent

**Table 2.01 Minimum $K$ Values**

| Street Type | $K$ | |
|---|---|---|
| | **Sag** | **Crest** |
| Major Thoroughfare | 100 | 140 |
| Minor Thoroughfare | 40 | 30 |
| Collectors | 30 | 20 |
| Minor, Marginal | 30 | 30 |
| Cul-de-sac | 30 | 30 |

### 2.2.3 Superelevation

Superelevation shall only be utilized on major thoroughfares except when widening NCDOT streets. Superelevation for shoulder sections shall not exceed 0.08 feet/foot of width. For curb and gutter sections, superelevation shall not be less than 0.02 feet/foot of width or more than 0.06 feet/foot of width.

### 2.2.4 Grading

Grading and filling shall be undertaken to insure that:

A. The street is centered in the right-of-way.

B. Adequate shoulders and space for future sidewalks are provided.

C. Allowance is made for roadside ditches, curbs and gutters, and storm sewers for street drainage.

D. Street grades shall be established wherever practicable in such a manner as to avoid excessive grading, the promiscuous removal of ground cover, tree growth and the general leveling of the topography.

## 2.3 HORIZONTAL ALIGNMENT

### 2.3.1 Curves

Where a street centerline deflection of 10 or more degrees occurs a curve shall be introduced having a radius of curvature of not less than the following:

**Table 2.02 Minimum Horizontal Curve Radii**

| Classification | Minimum Radii |
|---|---|
| Major Thoroughfare | *600* |
| Minor Thoroughfare | *310* |
| Collectors | 310 |
| Minor, Marginal | 230 |
| Cul-de-Sac | 230 |

A tangent of not less than one hundred (100) feet shall be provided between reverse curves on all streets.

### 2.3.2 Intersections

Street intersections shall be designed in the following manner:

A. No more than two streets shall intersect at one point.

B. Streets shall intersect as nearly as possible at right angles, and no street shall intersect any other street at an angle of less than 75 degrees.

C. Street jogs with centerline offsets of less than 125 feet on minor and major thoroughfares are prohibited.

D. Property lines at street intersections shall be rounded with a minimum radius of twenty (20) feet.

E. Intersections with a minor thoroughfare shall be at least 600 feet apart.

F. Intersections with major thoroughfares shall be at least 1,000 feet apart.

All proposed connections to NCDOT roads shall meet the applicable criteria of the NCDOT "Subdivision Roads Minimum Construction Standards," latest revision, and the "Policy on Street and Driveway Access to North Carolina Highways," latest revision.

### 2.3.3 Cul-de-Sacs

Permanent dead-end streets, or cul-de-sacs, shall be no longer than 750 feet and shall be provided with a turn around at the closed end. The length of a cul-de-sac shall be measured from the centerline of it's' intersection with a road with multiple points of access to the centerline intersection of the vehicle turn around as shown in **standard detail 401.02**.

### 2.3.4 Blocks

A. **Proposed Use:** Blocks shall be laid out with special consideration given to the type of land use proposed within the block.

B. **Length:** Blocks (streets providing multiple points of access, NOT cul-de-sacs) shall not exceed 1,500 feet in length nor shall they be less than 500 feet in length, as measured from centerline to centerline.

C. **Width:** Blocks shall have sufficient width to provide for two tiers of lots of appropriate depth except where otherwise required to separate residential development.

## 2.4 DRAINAGE

Inlet design and spacing to be designed in accordance with paragraph 5.6, *Curb Inlet Design* of the *Storm Drainage Design* section.

Streets shall be designed such that storm runoff will not cross the approach of intersections. Storm drainage structures should be used to avoid storm runoff crossing through street intersections. Directional arrows must be shown on plans to reflect surface drainage flow. This is particularly important around curb returns. Valley gutters shall not be used unless approved in writing by the Public Services Director.

Unless otherwise permitted by the Public Services Director, pipe penetration or cutting down the back of the curb and gutter for drainage purposes will not be permitted.

On strip-paved streets, the absolute minimum shall consist of shoulders graded to allow water to run off the street and collect in such a manner that it will not return in the subsurface to the base of the street. When soil conditions permit, the property owner desires, or when used as a BMP, roadside drainage may consist of water ponding off the strip-paved street until it is absorbed in the ground if, in the opinion of the Public Services Director, said ponding will not adversely affect the life of the street.

## 2.5 STREET SECTION TYPES

### 2.5.1 Strip Paved Streets (Shoulder Sections/Roadside Ditches)

Width for shoulder/swale section where appropriate is shown on **standard detail 401.01**, sheet 2 of 3. No on-street parking would be permissible for this cross section. This design would only be appropriate for low-density development.

The absolute minimum shall consist of shoulders graded to allow water to run off the street and collect in such a manner that it will not return in the subsurface to the base of the street. When soil conditions permit, the property owner desires, or when used as a BMP, roadside drainage may consist of water ponding off the strip-paved street until it is absorbed in the ground if, in the opinion of the Public Services Director, said ponding will not adversely affect the life of the street.

In all subdivisions where there is no curb and gutter, side ditches, which require protection for erosion caused by excessive velocity, shall be lined with sod or approved erosion control material.

### 2.5.2 Curb and Gutter

All curb and gutter shall be constructed according to **standard detail 402.01** of the City of Jacksonville Manual of Specifications. Allowable sections shall be the standard 30” vertical curb and gutter (preferred) and the 24” or 30” mountable

curb and gutter type. 24" or 30" mountable curb and gutter type is allowed where approved by the Public Services Director.

## 2.6 SIDEWALKS AND DRIVEWAYS

### 2.6.1 Sidewalks – General

Sidewalk minimum width shall be as specified in the Comprehensive Sidewalk Plan.

Sidewalks shall be constructed on the street right-of-way on both sides of Residential and Commercial except that sidewalk is not required on cul-de-sacs having six or less lots on the cul-de-sac right-of-way.

**Table 2.03 Sidewalks per Facility**

| Facility | Both Sides of Street |
|---|---|
| Major Thoroughfare | Yes |
| Minor Thoroughfare | Yes |
| Frontage Road | Yes |
| Residential Collector | Yes |
| Minor, Marginal | Yes |
| Cul-de-sacs w/ 6 or more lots on cul-de-sac right-of-way | Yes |
| Cul-de-sac w/ less than 6 lots on cul-de-sac right-of-way | No |

Sidewalks should generally link residential areas with employment, commercial and public areas and should interconnect with the City Greenway Plan when possible.

When required, a trail and greenway shall be installed in lieu of the sidewalk. See **standard detail 403.04**.

Multi-family and planned developments shall provide sidewalks for interior movement of pedestrians and for interior to connect to public sidewalk system.

The subdivider shall bear the expense of all sidewalk construction.

Sidewalk construction shall meet the applicable ADA provisions.

### 2.6.2 Handicap Ramps

**Properly installed ADA (Americans with Disabilities Act) approved handicap ramps provide both easier access for persons in wheelchairs and a warning to the visually impaired that are entering a vehicular traffic flow area.**

**When new sidewalks are constructed by either the City or the individual property owner, ADA approved handicap ramps will be installed at all street intersections and commercial drives. In areas that have existing sidewalks, the handicap ramps will be brought to current City standards by the City**

**when it is doing a sidewalk project in that area or by the individual adjacent commercial property owner when he/she is making improvements to their property and a new or revised plan is required.**

### 2.6.3 Brick Sidewalks

A. **Allowable Locations and Installation**: Installation and maintenance of brick sidewalks shall be permitted only:

1) Where an existing sidewalk is brick and is being replaced or repaired; or

2) In an area designated as an historic district; or

3) Adjacent to an historic property; or

4) Where proposed for an entire block and all property owners agree to brick installation; or

5) Where a streetscape plan has been approved by City specifying brick sidewalk. In such areas, brick sidewalk may be installed on a lot-by-lot basis.

B. **Construction Methods for Brick Sidewalks**

1) **Subgrade Preparation**: The subgrade for sidewalks shall be shaped to the proper cross-section and thoroughly compacted by rolling or tamping. Tree roots shall be removed to a depth of 12-inches below subgrade for the full width of the walk. All soft and spongy material shall be removed and replaced with suitable material that shall be compacted in layers not exceeding 6-inches in thickness.

2) **Base**: Base to be 4-inch thick 3,000 psi concrete with 2-inch thick stone screenings or sand. When crossing driveways concrete shall be 6-inches thick.

3) **Sidewalk Width & Material**: Except when repairing a non-conforming brick sidewalk, the width shall be as specified in the City Comprehensive Sidewalk Plan (conforming to ASTM C902) shall be laid to grade with a smooth uniform surface with a slope of ¼-inch per foot toward the street.

4) **Filling Voids**: The voids between the brick shall be filled with a mixture of sand and cement broomed into the voids. The sand-cement ratio shall be 1/3 cement and 2/3 sand well mixed before brooming into the voids. After the voids are well filled, the brick surface shall be cleaned of all excess sand and cement.

**2.6.4 Driveways:** Every entrance and/or exit to serve vehicular traffic to or from property fronting a public or private street.

A. All driveways for houses to be built in the subdivision shall be cut and graded to provide a minimum of 12-foot wide driveways. See **standard details 404.01 and 404.02**.

B. **Access to Major and Minor Thoroughfares**: Whenever a subdivision borders on or contains an existing or proposed major thoroughfare, no direct driveway access may be approved from the lots within this subdivision onto the major thoroughfare. No lot shall have direct driveway access to a minor thoroughfare unless otherwise approved by the City Council.

C. **Access to Residential Collector Streets:** A lot or lots in a subdivision which front a collector street shall not have direct driveway access to the collector street, unless otherwise approved by the City Council.

### 2.6.5 Pedestrian Easements or Walkways

Pedestrian easements or walkways may be provided through the interior of blocks. Pedestrian easements shall be at least 10 feet wide and shall be laid out along front, side or rear property lines.

### 2.6.6 Greenways & Bikeways

A. **Greenways**: When required, Greenways shall be provided with an easement as required by the Pedestrian Circulation Plan but no less than that shown on **standard detail 403.04**, as applicable.

B. **Bikeways**: When required, the bikeways shall be designed in accordance with the NCDOT's *North Carolina Bicycle Facilities Planning and Design Guidelines*, latest revision. Refer to **standard detail 403.04** for typical section and tie-in detail at roadways/streets.

## 2.7 STREET NAMES

Street names shall be subject to the approval of the City Council. New names shall not duplicate or be similar to existing street names. Existing street names shall be projected whenever possible (see City Code).

# SECTION 3
# PAVEMENT DESIGN

## 3.1 PAVEMENT DESIGN

To fully understand the methods of pavement design that will be outlined in the following sections it is necessary to establish standard terminology. It is noted that many considerations are required to assure that a pavement structure is reliable. For example, material requirements, construction requirements, and quality control will significantly influence the ability of the pavement structure to perform according to design expectations.

### 3.1.1 Standard Definitions

**Average Daily Traffic ($ADT$):** The average daily traffic using the pavement section at full development.

**California Bearing Ratio (CBR):** The CBR is the penetration resistance of a soil relative to standard crushed rock.

**Design Average Daily Traffic ($\overline{ADT}$):** The average daily traffic over the design life of the pavement.

**ESAL (Equivalent Single Axle Load)**: Number of standard axle load (typically 18,000 lbs) applications that causes the same damage as mixed traffic.

**Pavement Design Life:** All pavement structures for the City of Jacksonville shall be designed with a pavement design life of 20 years.

**Soil Support Value ($SSV$):** This value reflects the structural strength of a particular type of soil.

**Structural Number ($SN$):** The structural number is an abstract number that reflects the structural strength of the pavement required for soil support and traffic loads.

**Traffic Growth Factor ($G$):** This number, typically between 0.00 and 0.07, allows the designer to assume an annual percentage growth rate in the traffic volume and is used to determine the design average daily traffic.

**Trip Factor:** The number of vehicles that can be assumed for a particular type of land use. This information is derived from the ITE Trip Generation latest version.

**Truck Factor ($\overline{N}$):** This quantity adjusts the design average daily traffic ($\overline{ADT}$) to account for the percentage of single frame and multiple frame trucks expected along a particular pavement section.

## 3.2 PAVEMENT DESIGN PROCEDURE

### 3.2.1 Pavement Design Life

All pavement structures for the City of Jacksonville shall be designed with a pavement design life of 20 years.

### 3.2.2 Determine the Design Average Daily Traffic $(\overline{ADT})$:

From Table 3.01, locate the best description of the land use for which the proposed pavement section will serve and determine the total number of trips per day per unit. Multiply the trips per day per unit by the total number of units using the street at full development. This total number of trips per day is the average daily traffic ( $ADT$ ) at full development. The figures below shall be the minimum; however, the latest edition of the Institute of Traffic Engineer's *Trip Generation* shall apply.

**Table 3.01 Trips per Day According to Land Use (for pavement design only)**

| *Description of Land Use* | *Trips/ Day/ Unit* | *Unit* |
|---|---|---|
| ***Residential*** | | |
| • Apartments | 6.29 | DU |
| • Condominiums | 5.69 | DU |
| • Mobile Homes | 4.77 | DU |
| • PUD | 6.96 | DU |
| • Retirement Home | 3.3 | DU |
| • Single Family Homes | 9.53 | DU |
| | | |
| ***Lodging*** | | |
| • Hotel | 8.93 | Room |
| • Motel | 5.63 | Room |
| • Nursing Home | 2.0 | Bed |
| | | |
| ***Retail*** | | |
| • New Car Sales | 38.72 | 1,000 gsf |
| • Convenience Store (24 hr) | 758.79 | 1,000 gsf |
| • Restaurant (Quality) | 92.55 | 1,000 gsf |
| • Restaurant (High-Turnover) | 158.37 | 1,000 gsf |
| • Restaurant (w/Drive Thru) | 623.19 | 1,000 gsf |
| • Restaurant (w/o Drive Thru) | 778.18 | 1,000 gsf |
| • Building & Lumber Store | 28.80 | 1,000 gsf |
| • Special Retail Center | 37.97 | 1,000 gla |
| • Discount Store | 70.56 | 1,000 gsf |
| • Hardware/Paint Store | 58.23 | 1,000gsf |
| • Garden Center | 44.51 | 1,000 gsf |
| • Shopping Center | 82.00* | 1,000 gla |
| • Furniture Store | 4.67 | 1,000 gsf |
| • Shopping Center (0 to 50,000 sf) | 115.8 | 1,000 sf |
| • Shopping Center (50,000 to 100,000 sf) | 79.1 | 1,000 sf |
| • Shopping Center (100,000 to 200,000 sf) | 60.4 | 1,000 sf |
| • Shopping Center (200,000 to 300,000 sf) | 49.9 | 1,000 sf |
| • Shopping Center (300,000 to 400,000 sf) | 40.4 | 1,000 sf |

**Table 3.01 Trips per Day According to Land Use (Continued)**

| *Description of Land Use* | *Trips/ Day/ Unit* | *Unit* |
|---|---|---|
| • Shopping Center (400,000 to 500,000 sf) | 47.6 | 1,000 sf |
| • Shopping Center (500,000 to 1,000,000 sf) | 34.5 | 1,000 sf |
| • Shopping Center (Greater than 1,000,000 sf) | 26.5 | 1,000 gsf |
| • Supermarket | 172.02 | 1,000 gsf |
| | | |
| ***Industrial*** | | |
| • Light Industrial | 5.26 | 1,000 gsf |
| • Industrial Park | 5.44 | 1,000 gsf |
| • Manufacturing | 3.05 | 1,000 gsf |
| • Mini Warehouse | 2.45 | 1,000 gsf |
| • Warehousing | 3.77 | 1,000 gsf |
| | | |
| ***Port and Terminal*** | | |
| • Aviation Airport | 1.98 | Av. Flts/day |
| • Truck Terminal | 62.48 | Acre |
| | | |
| ***Recreational*** | | |
| • Golf course | 8.18 | Acre |
| • Athletic/ Fitness/ Gym | 10 | 1,000 sf |
| • Racquet Club | 17.14 | 1,000 gsf |
| ***Institutional*** | | |
| • Elementary School | 10.72 | 1,000 gsf |
| • High School | 10.90 | 1,000 gsf |
| • Community College | 1.6 | Student |
| • University | 2.4 | Student |
| • Library | 39.75 | 1,000 gsf |
| • Church | 13.28 | 1000 gsf |
| • Day Care Center | 58.33 | 1,000 gsf |
| | | |
| ***Office*** | | |
| • General Office | 15.00 | 1,000 gsf |
| • Corp. Headquarters Bldg. | 6.27 | 1,000 gsf |
| • Medical Office Building | 25.91 | 1,000 gsf |
| • Office Park | 8.50 | 1,000 gsf |
| • Research Center | 5.93 | 1,000 gsf |
| • Business Park | 10.89 | 1,000 gsf |
| | | |
| ***Medical*** | | |
| • Hospital | 15.25 | 1,000 gsf |
| | | |
| ***Services*** | | |
| • Bank (Walk-In) | 190.44 | 1,000 gsf |
| • Bank (Drive-In) | 201.56 | 1,000 gsf |

GSF = Gross Square Feet; GLA = Gross Leasable Area; D.U. = Dwelling Unit
Note: Tip Rate based on a daily average calculated over one week.
Source: Institute of Transportation Engineers. Trip Generation – latest version.

The next step in determining the design average daily traffic is to determine the traffic growth factor ($G$). This number, typically between 0.00 and 0.07, allows the designer to assume an annual percentage growth rate in the traffic volume. If significant future development is expected to occur along the proposed corridor, then future potential traffic should be accounted for and can be accommodated for by using a percentage increase in traffic volume. If there is no significant future development expected due to saturation or because there are no other possible inlets or outlets, the percent of growth should be close to "0."

The traffic growth factor shall be obtained from Equation 3.01.

$$G = (1+i)^n \qquad \text{Equation 3.01}$$

Where, $G$ = Traffic growth factor
$i$ = fractional rate of yearly increase, from Table 3.02
$n$ = Design Life of Pavement, years

**Table 3.02 Traffic Growth Rate for Pavement Design**

| Facility Description | Estimated Yearly Increase |
|---|---|
| Dead End Street | 0.01 |
| Connector Street | 0.02 |
| Subdivision Street | |
| • Fully Developed | 0.005 |
| • 50% Developed | 0.04 |
| Industrial Service Road | |
| • Undeveloped | 0.06 |
| • 50% Developed | 0.04 |

Source: "Manual of Specifications," City of Rocky Mount, NC, 1991.

The Design Average Daily Traffic ($\overline{ADT}$) shall then be calculated according to the following formula:

$$\overline{ADT} = \frac{ADT + (G \times ADT)}{2} \qquad \text{Equation 3.02}$$

Where, $\overline{ADT}$ = Average Daily Traffic (trips/ day)
$G$ = Traffic growth factor, as described above

### 3.2.3 Determine the Truck Factor

The truck factor adjusts the design average daily traffic ($\overline{ADT}$) to account for the percentage of single frame and multiple frame trucks expected along a particular pavement section. Single frame trucks refer to those trucks with dual wheels on the rear axle, such as delivery trucks. Multiple frame trucks refer to tractor-trailers, semi-trailers, and garbage trucks (which have very high loadings per tire compared to most vehicles). If the designer does not have information to estimate these percentages, 4% single frame trucks ($x$=0.04) and 1% multiple

frame trucks ( $y$ =0.01) may be used. Table 3.03 lists equivalent truck factors for various design average daily traffic quantities at these percentages.

$$\overline{N} = \overline{ADT}\,(0.25x + 0.60y) \qquad \text{Equation 3.03}$$

Where, $\overline{N}$ = Truck Factor
$x$ = Percentage Single frame trucks
$y$ = Percentage Multiple frame trucks

**Table 3.03 Equivalent $\overline{N}$ and $\overline{ADT}$ ***

| $\overline{ADT}$ | $\overline{N}$ |
|---|---|
| 12,500 | 200 |
| 6,250 | 100 |
| 5,000 | 80 |
| 2,500 | 40 |
| 1,875 | 30 |
| 1,562 | 25 |
| 1,250 | 20 |
| 937 | 15 |
| 625 | 10 |
| 312 | 5 |
| 250 | 4 |
| 187 | 3 |
| 125 | 2 |
| 63 | 1 |

*Tabulated values assume 4% single frame and 1% multiple frame traffic.
Source: "Manual of Specifications," City of Rocky Mount, NC, 1991.

### 3.2.4 Determine the Soil Support Value (*SSV*)

The designer may choose one of following three methods to determine the soil support value (*SSV*).

3.2.4.1 Measure the CBR of soils and calculate the *SSV*
3.2.4.2 Measure the CBR of Soils to be used as fill and calculate the *SSV*
3.2.4.3 Assign a *SSV* from the Soil Classification of the County Soil Map

#### 3.2.4.1 Measure the CBR of soils and calculate the *SSV*

This is the most accurate method to determine the actual characteristic of the subgrade base material because it is based on an actual laboratory CBR (California Bearing Ratio) test that has been performed by a soils laboratory. The CBR test should be performed in accordance with AASHTO designation T193, *The California Bearing Ration* (latest edition) with the exception that if the required soil compaction density to be used during construction is known, only one specimen needs to be tested at the required density for each soil type.

Certification and report of tests performed by an approved soils laboratory shall be submitted to the City of Jacksonville Public Services Director.

Although the following minimum testing is required, a sufficient number of CBR tests shall be made to determine the consistency of the soil conditions in the area to be paved.

- Soil Borings – Perform soil borings with a maximum spacing of 500 linear feet and with at least four borings in each separate street area and with at least one boring in each soil type area identified in the soil survey map of the applicable county, if available. Each boring shall extend at least 2 feet below the proposed finished subgrade elevation. The City may require more depth as the conditions warrant.

- CBR Tests – A CBR test shall be performed on each soil type that will be within 2 feet of the finished subgrade elevation. If off-site soils are used as fill, CBR tests shall also be performed on each soil type that will occur in the upper 2 feet below pavement subgrade.

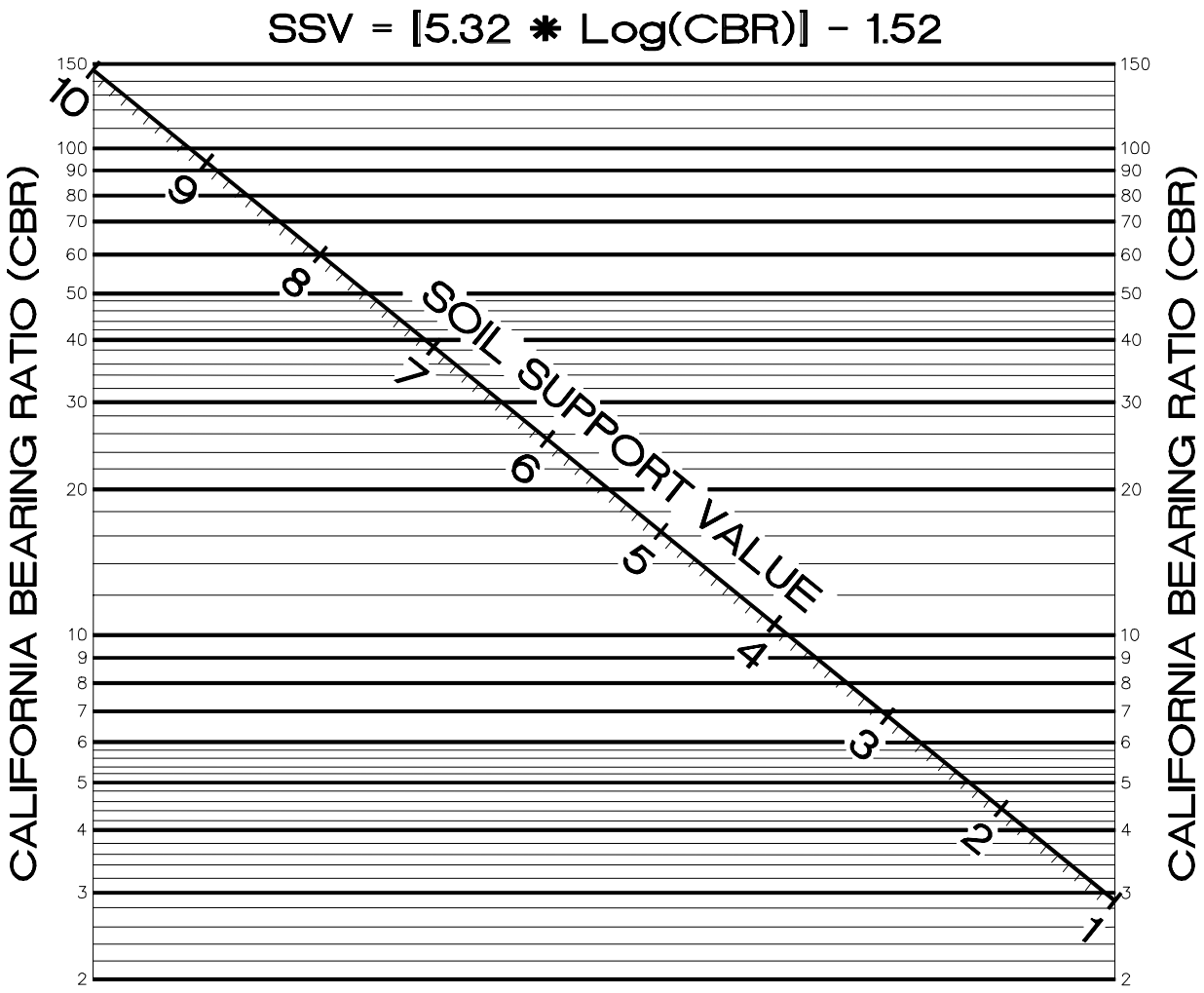
  The CBR value shall then be substituted in Equation 3.04 to obtain the soil support value (*SSV*).

$$SSV = 5.32\,(\log CBR) - 1.52 \qquad \text{Equation 3.04}$$

  Where, *SSV* = Soil Support Value
  *CBR* = California Bearing Ratio (as determined by laboratory report or Figure 3.01)

  Figure 3.01 can also be use to quickly determine the CBR for the soil in study.

**Figure 3.01 Soil Support Values (*SSV*) per CBR**




Source: "Manual of Specifications," [City of Rocky Mount, 1991].

### 3.2.4.2 Measure the CBR of Soils to be used as Fill and Calculate the *SSV*

If the characteristics of the existing soils in the area to be paved result in an uneconomical pavement section based on the two preceding methods, the developer may opt to undercut the existing soils to a depth of at least 24 inches below the finished pavement subgrade elevations and backfill with better material. The *SSV* for the proposed pavement section is then determined by performing a CBR test on each soil type used for backfilling (performed in accordance with AASHTO designation T193, *The California Bearing Ratio,* latest edition).

The CBR value determined by laboratory testing shall then be substituted in Equation 3.04 to obtain the soil support value (*SSV*).

### 3.2.4.3 Assign a *SSV* from Soil Classification of the County Soil Map

The soil types may be determined by using, if available, the applicable Soil Survey map prepared by the United States Department of Agriculture, Soil Conservation Service. This method is usually more conservative than designs based on actual laboratory data as described in Section 3.2.4.1 and will generally require a thicker pavement section.

Locate the project on the soil maps and determine the soil types in the areas to be paved. A copy of the soil survey map with the boundaries of the property and areas to be paved shall be submitted to the City of Jacksonville Public Services Department.

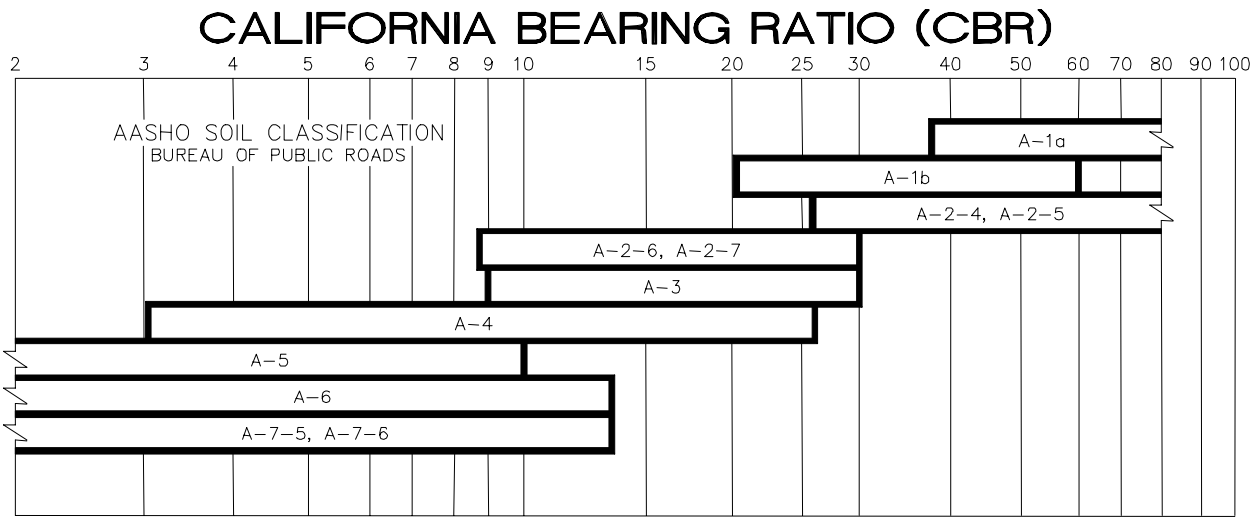
From the Engineering Index Properties Table, determine the AASHTO Classification of the soil types. From this information, use Table 3.04 and/or Figure 3.02 to assign the most appropriate soil support value (*SSV*). The entire paved area shall be designed using the *lowest* *SSV* obtained along any portion of the paved area. The CBR value determined from Figure 3.02 shall then be substituted in Equation 3.04 to obtain the soil support value (*SSV*).

**Table 3.04 Assigned Soil Support Values (*SSV*)**

| AASHTO Soil Classification | Assigned *SSV* |
|---|---|
| A-1-a | 4.2* |
| A-1-b | 4.2* |
| A-3 | 3.5 |
| A-2-4 | 4.2* |
| A-2-5 | 4.2* |
| A-2-6 | 3.4 |
| A-2-7 | 3.4 |
| A-4 | 1.0 |
| A-5 | 1.0 |
| A-6 | 1.0 |
| A-7-5 | 1.0 |
| A-7-6 | 1.0 |

*Suggested Maximum *SSV* by NCDOT without CBR Test, although AASHTO Soil Classification indicates higher value.
Source: "Manual of Specifications," City of Rocky Mount, NC, 1991.

**Figure 3.02 CBR Values per Soil Classification**




Source: AASHTO Bureau of Public Roads.

### 3.2.5 Determine the Structural Number ( $SN$ )

The structural number is an abstract number that reflects the structural strength of the pavement required for soil support and traffic loads. Obtain the structural number ( $SN$ ) for the given soil support value ( $SSV$ ) and truck factor ( $\overline{N}$ ) from Figure 3.03 and/or Equation 3.05.

$$SN = \frac{2.41\ (\overline{N})^{0.151}}{(1.14)^{SSV}}$$ Equation 3.05

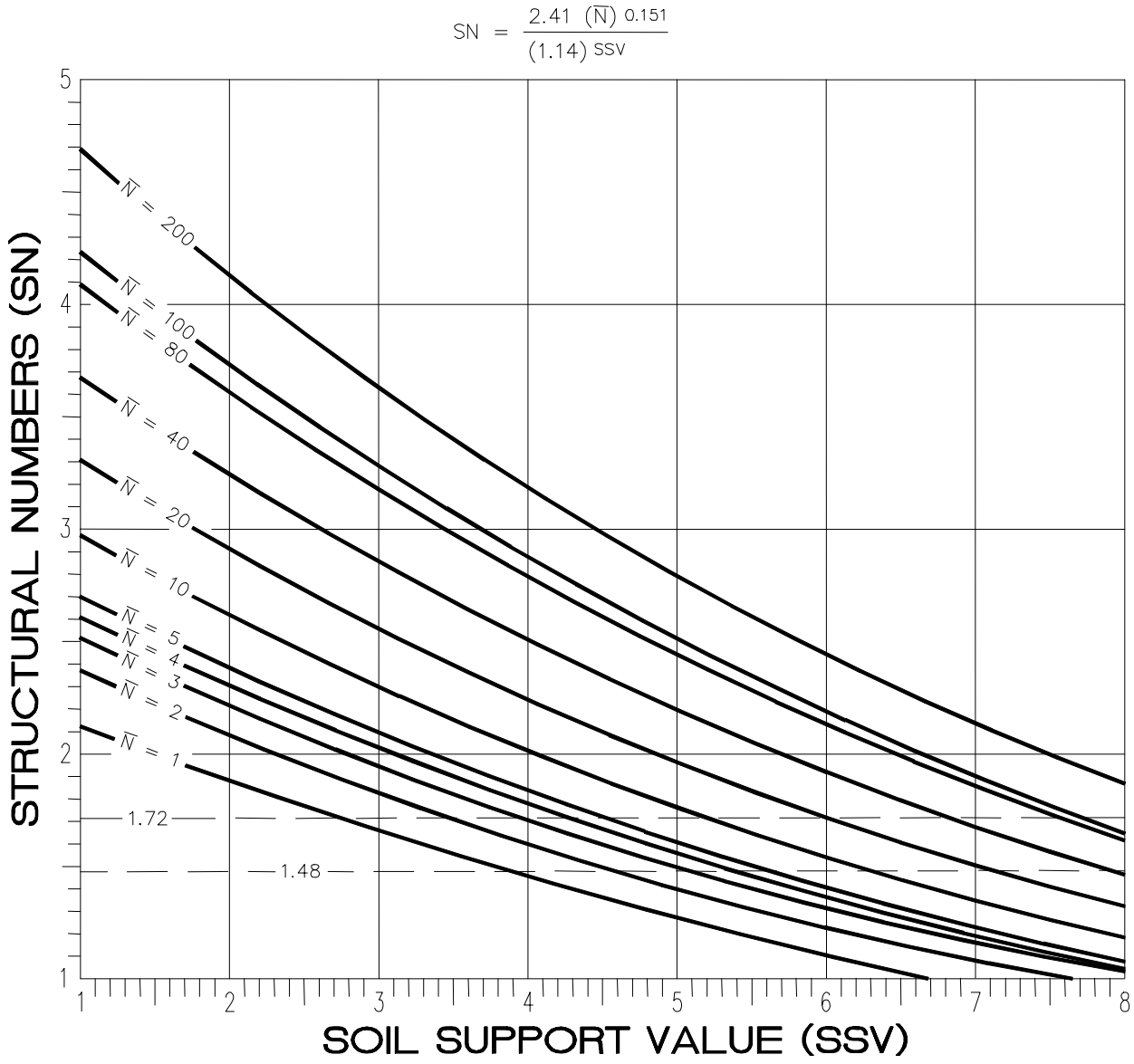
Where,

| | | |
|---|---|---|
| $SN$ | = | Structural Number required for the design pavement section |
| $\overline{N}$ | = | Truck Factor, see Section 3.2.3 |
| $SSV$ | = | Soil Support Value, see Section 3.2.4 |

The designer should not use a $SN$ below 1.72 for poor to fair subgrade soils nor below 1.48 for good to excellent subgrade soils

- For collector streets, add 1.0 to the structural number.
- For minor thoroughfares, add 1.5 to the structural number.
- For major thoroughfares, add 2.0 to the structural number.

**Figure 3.03 Structural Numbers for Pavement Sections**




Source: "Manual of Specifications," [City of Rocky Mount, 1991].

### 3.2.6 Determine the Structural Coefficients

From Table 3.05, determine the structural coefficient for each layer in the design pavement section.

**Table 3.05 Structural Coefficients for Pavement Design**

| Permanent Layer | Type of Material | Structural Coefficient per inch of Thickness |
|---|---|---|
| Surface Courses | Bituminous Concrete Type S 9.5X | 0.44 |
| | Bituminous Surface Treatment | 0.20[a] |
| Binder Course | Bituminous Concrete Type I 19.0X | 0.44 |
| Base Courses | Coarse Aggregate Base Course (ABC) | 0.14 |
| | Bituminous Concrete Type B 25.0X | 0.30 |
| | Cement Treated ABC (CTABC) | 0.23 |
| Subgrade | Cement Stabilized Subgrade (Soil-Cement) | 0.14[b] |
| | Lime Stabilized Subgrade (Soil-Lime) | 0.13[b] |

[a] Bituminous surface treatment. Do not multiply by thickness in calculations.

[b] For design purposes, do not exceed 1.0.

Source: "Paragraph 3.4, *Layer Coefficients*, NCDOT *2002 Asphalt Technology, Construction, Quality Control & Quality Assurance Training manual*."

**Commentary on Subgrade Stabilization and Pavement Section Performance:**

**Lime Stabilized Subgrade**: Pozzolanic materials are siliceous substances that will react with lime in the presence of water. Clays are pozzolanic and react with lime to form cement. Lime (approximately 5%) is worked 7 to 8 inches into the subgrade in order to reduce the plasticity of the subgrade soil. However, lime cannot be used with sand.

**Cement Stabilized Subgrade**: Cement is used with sand to form a Cement Stabilized Subgrade (soil cement). Thickness is generally 7 inches.

**Best Performing Pavement Section**: By monitoring pavement sections under highway traffic, research has found that the best performing pavement section is comprised of asphalt, aggregate base (ABC) and a lime treated subbase (especially areas where clay-type soils are prevalent). This section performed better than full-depth asphalt pavement sections. [7] Subgrade strength is very important to the performance of asphalt pavements (as opposed to concrete pavements).

### 3.2.7 Select Pavement Thickness to Obtain Required Structural Number

Design the pavement section such that the structural number ($SN$) designed is equal to or greater than the number obtained in Section 3.2.5. This design may be done by trial and error. However, the minimum pavement section in the City of Jacksonville shall conform to **standard detail 401.01** (also see paragraph 2.1.4, *Pavement Design* for other requirements pertaining to pavement section thickness). Multiply an initial thickness (in inches) of the various components of the pavement section (surface course, base course, binder course, etc.) by the corresponding structural coefficient and sum the results. The total number must be equal to or greater than the structural number obtained in Section 3.2.5.

The combination of layers and structural coefficients that sum greater than the required structural number is the *minimum* pavement design allowable for the particular area to be paved.

## 3.3 EXAMPLE OF PAVEMENT DESIGN

Design a pavement section for a street accessed by a development consisting of 100 lots in a high-density single family residential subdivision. No CBR test is available, however, soils are found to be type A-3 from the county Soil Survey. Assume normal truck loading. Follow the design procedures in this design manual.

*Solution:*

1. Determine the Design Average Daily Traffic ( $\overline{ADT}$ ):
   - Using Table 3.01 for single family homes (high density),
     $ADT = 9.5\ trips/day/dwelling \times 100\ dwellings = 950\ trips/day$
   - Using Table 3.02 for a subdivision street (fully developed) the estimated yearly increase is 0.5%., so $i$ = 0.005, in Equation 3.01.
   - Assuming a pavement sections is to be designed for a 20 year design life, let $n$ = 20, in Equation 3.01. It follows that:
     $G = (1+i)^n = (1+0.005)^{20} = 1.10$
   - Using Equation 3.02:
     $$\overline{ADT} = \frac{ADT + (G \times ADT)}{2} = \frac{950 + (1.10 \times 950)}{2} = 998\ trips/day$$

2. Determine the Truck Factor, assuming 4% single frame trucks and 1% multiple frame trucks:
   $\overline{N} = \overline{ADT}\,(0.25x + 0.60y) = 998\,[(0.25)(.04) + (0.60)(0.01)] = 16 \pm$

3. Determine the $SSV$. Although a CBR is not available, the county soil survey classifies the soils in the area as type A-3. From Table 3.04, for A-3 soils, it is found that:
   $SSV = 3.5$

4. Determine the Structural Number ($SN$). Substituting the known values into Equation 3.05,
   $$SN = \frac{2.41\,(\overline{N})^{0.151}}{(1.14)^{SSV}} = \frac{2.41\,(16)^{0.151}}{(1.14)^{3.5}} = 2.32$$

5. Determine Structural Coefficients. Choose an S 9.5B asphalt layer over an ABC layer over the subgrade for the pavement section. From Table 3.05, S 9.5B coefficient is 0.44 and ABC coefficient is 0.14.

6. Select pavement thickness to obtain required structural number. Try different sections.
   - Try 6" ABC + 2.5" S 9.5B: 6 x 0.14 = 0.84; 2.5 x 0.44 = 1.10; 1.94 < 2.32, Design *INSUFFICIENT* ☹
   - Try 6" ABC + 3.5" S 9.5B: 6 x 0.14 = 0.84; 3.5 x 0.44 = 1.54; 2.38 > 2.32, Design *SUFFICIENT* ☺
   - Try 8" ABC + 3" S 9.5B: 8 x 0.14 = 1.12; 3 x 0.44 = 1.32; 2.44 > 2.32, Design *SUFFICIENT* ☺

The designer may choose the sufficient pavement section that is preferred. For the given situation, ***choose 3" S 9.5B asphalt over 8" ABC over compacted subgrade as the design pavement section.***

# SECTION 4
# SUBGRADE PREPARATION AND TESTING

The purpose of this division is to provide a guide for the subgrade preparation of paved areas within the City of Jacksonville.

## 4.1 SUBGRADE INSPECTION – CBR TESTING

If the soils at the site were tested to obtain the CBR and $SSV$ as described in Section 3.2.4.1 and Section 3.2.4.2, the soils below the proposed pavement subgrade must be compacted during construction to a density equal to or greater than the density at which the CBR test was performed. Unless backfilling is involved, the upper 24 inches of soil below the proposed pavement section must be compacted.

If backfilling is involved, the entire fill section of soil below the pavement section must be compacted. In this case, in-place density tests must be performed on each paved area in accordance with AASHTO designation T191, T204, T205, T238 (latest edition) by an approved soils laboratory. The test results shall be submitted to and approved by the City of Jacksonville Engineering Division *before the street is paved.*

## 4.2 SUBGRADE INSPECTION – PROOFROLLING

No pavement shall be placed in the City of Jacksonville without prior inspection and approval by the City of Jacksonville Public Services Department. The inspection shall include, but not be limited to, proof-rolling the prepared subgrade with a rubber-tired proof-roller (**fully loaded** dump truck) that has a minimum gross weight of at least 30,000 pounds (15 tons) under the observation of a representative of the City. The only alternative is as described below. The developer shall bear the costs of proof-rolling, which must be done within 10 days prior to placement of the asphalt. All areas of the subgrade shall be covered by the wheels of the proof-roller operating at walking speed (two or three miles per hour). Proofrolling shall be performed in lengths of not less than 1 block as measured from center intersection to center of intersection, from center of intersection to end of cul-de-sac, or 750 linear feet.

The soil sub-grade must pass a “zero-tolerance” proof-roll prior to the placement of the rock base course or the concrete curb and gutter. The rock base course must in turn pass a proof-roll prior to the placement of any asphalt on the road. The placement of eight (8) inches of rock in the area of the curb and gutter and no more than two (2) inches of rock on the remainder of the road will be allowed but is not required prior to proof-rolling the soil sub-grade.

Any areas that rut or pump excessively under the wheels of the proof-roller shall be repaired by the developer before the street is paved. Should the developer disagree with the representative of the Public Services Department about the need for repairs to the subgrade, the developer or his project engineer may hire a Licensed Professional Engineer to perform CBR tests on the prepared subgrade. If the Engineer certifies that the full width and length of the subgrade will provide adequate support for the design pavement section and the anticipated loading for the design life of the paved area, the area may be paved without making repairs to the subgrade.

All construction and testing of materials shall be in accordance with the City of Jacksonville Manual of Specifications.

## 4.3 INSPECTIONS

### 4.3.1 Minimum Inspections:

The following shall be the minimum inspections required by the City:

A. **Proof roll Curb & Gutter**
B. **Proof roll subgrade** – if stone is used to help stabilize subgrade, the proof roll must be at subgrade elevation. See paragraph 4.2 above for proof rolling procedure.
C. **Cross-fall on subgrade** from crown to curb shall be checked with a string line prior to placement of base course.
D. **Base course** shall be proof rolled just prior to placement of asphalt. Cross-fall on base course, from crown to curb, shall be checked with a string line prior to placement of asphalt.
E. **Curb & Gutter** concrete samples must be taken for slump and strength (as specified by design engineer).
   The initial test (from first ready mix truck) is to be taken after the second yard is dispatched from the mixer and is to consist of the following:
   1) One slump test
   2) Pull, prepare, and store three cylinders on-site for 24 hours.
   3) Temperature

   **Subsequent tests**: after the above tests are pulled from the initial truck, every fifth truck thereafter is to be tested in the same manner as noted above. The Inspector may require two additional tests per truck if he/she feels the condition of the concrete has changed.
F. **Paving lifts**: If the depth of asphalt exceeds the maximum layer depth shown in Table 4.01 below, the asphalt must be placed in **two lifts;** the first lift having a thickness of not less than minimum single lift depth shown in Table 4.01 below. Asphalt cores must be taken to confirm thickness and compaction. See paragraph 4.4, TESTING below. Recommended thickness shall be per the current SuperPave standards.
G. **Sidewalk** forms and subgrade shall be checked prior to pouring. Slump and strength tests shall be required. See paragraph 4.4, TESTING, below.
H. All **driveway** forms must be checked prior to pouring. If a ditch and shoulder section is used, culvert inverts must be checked.
I. **Grade and Alignment**: The City is not responsible for ensuring proper grade and alignment.

### 4.3.2 Certificate of Occupancy (CO) Inspections

Before a CO will be granted, the following shall be the minimum inspections required by the City:

A. Broken or defaced Curb & Gutter,
B. Broken or defaced Sidewalk,
C. Broken or defaced driveway aprons,
D. Sewer cleanout set as shown on **standard detail 533.03** and with a brass plug,

E. Water meter box set per **standard detail 515.01**,
F. Grade right-of-way per **standard detail 401.01**,
G. As-built drawings to be provided to the Public Services Department as outlined in *Water and Sewer Inspection and Acceptance For Maintenance,* paragraph 1.2.4, *Items applicable to both Water and Sewer*.
H. Ensure all drainage structures are installed per plan

### 4.3.3 Geotechnical Engineering Inspection Services:

The services of a Geotechnical Engineer shall be required in all cases where unusual soil conditions have been found during construction such as high groundwater elevation, springs, soft or yielding soils, unsuitable soils (e.g. expansive soils).

### 4.3.4 Inspection Fee

**All inspections, which fail, are subject to a re-inspection fee**.

### 4.3.5 Inspection Procedure

Warranty, maintenance during warranty period, inspection procedure, repairs, utility cuts, etc. are covered under **Street Policy, Section 5** of this Module.

## 4.4 TESTING

### 4.4.1 Concrete Testing:

The initial test (from first ready mix truck) is to be taken after the second yard is dispatched from the mixer and is to consist of the following:

A. One slump test
B. Pull, prepare, and store three cylinders on-site for 24 hours.
C. Temperature

Subsequent tests: after the above tests are pulled from the initial truck, every fifth truck thereafter is to be tested in the same manner as noted above. The Inspector may require two additional tests per truck if he/she feels the condition of the concrete has changed.

| APPLICATION | ALLOWABLE SLUMP |
|---|---|
| Curb and Gutter | 3 ½” |
| Sidewalk | 4” |
| Other Applications | as specified |

### 4.4.2 Asphalt Testing:

**Compaction:** Testing for asphalt density is to follow NCDOT *Standard Specifications for Roads and Structures*, Section 609-5D, “Field Compaction Quality Control,” latest revision.

**Thickness:** The minimum frequency of coring for thickness testing shall be based on test sections consisting of not more than 200 linear feet of lay down width, exclusive of intersections and irregular areas. The test sample is to be a 6-inch cored sample. The sample is to be numbered and logged for identification purposes. If it is found that the thickness of the asphalt is less than that required, a maintenance fee may be accepted in lieu of rejection. If less than 85% of the required thickness is present, the project must be rejected until the proper thickness is achieved.

**Contractor's Quality Control System:** Follow NCDOT "Standard Specifications for Roads and Structures," Section 609-5. "Contractor's Quality Control System," latest revision

**Mixture and Job Mix Formula Adjustments:** Follow NCDOT *Standard Specifications for Roads and Structures*, Section 609-4, "Field Verification of Mixture and Job Mix Formula Adjustments," latest revision.

**General:** All other applicable sections of Section 609 of the NCDOT *Standard Specifications for Road and Structures* shall apply relating to Quality Control Plan, mix design, control limits, corrective action, equipment, and measurement.

**Testing Cost:** Project owner is responsible for cost of testing.

## 4.5 SETUP PERIOD

Unless otherwise waived by the Public Services Director, for all new areas to be paved, the developer shall be required to wait at least 6 months before the final lift of asphalt is placed. This setup period includes the winter months through February.

Existing streets that are to be rebuilt or reconstructed will not be required to meet this setup period and may be paved when the specifications in this manual are met and approved.

## 4.6 MAINTENANCE

For warranty, maintenance during warranty period, inspection procedure, repairs, utility cuts, etc. see *Street Policy*, Section 5.

## 4.7 WARRANTY

Warranty, maintenance during warranty period, inspection procedure, repairs, utility cuts, etc. are covered under Street Policy, Section 5.

# SECTION 5
# STREET POLICY

## 5.1 GENERAL REQUIREMENTS:

A. Prior to commencing construction, all approvals including plan approval and all permits and encroachments shall be obtained. Site grading only may be performed upon issuance of a Sedimentation and Erosion Control permit from the City. All other construction must await the issuance of all remaining permits.

B. Prior to the issuance of a certificate of occupancy for any dwelling, an Engineer's certification must be received by the City, addressed to NCDENR, for both water and sewer extensions. Additionally, as-built drawings must be in hand and the gravity sewer lines confirmed to be within the permitted tolerances.

C. The developer is responsible for the maintenance and repair of streets for 18 months after acceptance by the City for warranty. At the end of 18 months, the City of Jacksonville will accept permanent responsibility. If a significant failure occurs, requiring extensive maintenance at any time during the warranty period, the City's Public Services Director shall suspend the 18-month warranty until the failure is repaired to an acceptable condition.

D. The developer is responsible for the maintenance and repair of all paved areas other than streets.

E. No Contractor shall permit mud or construction debris to accumulate in any paved street that is maintained or is proposed to be maintained by the City of Jacksonville.

## 5.2 INSPECTIONS

A. Upon completion of construction, the developer shall request a final inspection. Upon completion of all punch list items, the provision of a set of acceptable record drawings, the submission of Engineering's certifications, and acceptance by City Council, an 18-month warranty period shall commence.

B. During the 18-month warranty period the developer shall repair any latent defects that occur. Prior to the end of the 18-month warranty period, the developer shall request a warranty inspection. Upon successful completion of all warranty items, the developer shall be released from maintenance responsibilities for the warranted construction.

C. All inspections must be scheduled the day prior to when needed. Inspections will be performed in the order received. Every effort will be made to accommodate the time of request; however, this cannot be guaranteed.

D. **All inspections, which fail, are subject to a re-inspection fee**.

## 5.3 MAINTENANCE

### 5.3.1 Existing Streets

The City will assume all maintenance responsibility on all existing paved streets. If an individual owner wishes to pipe an existing roadside ditch and/or install curb and gutter in front of their property, the City's Public Services Director shall make a determination whether it is favorable to do so. If the City allows these improvements, it shall require the owner to bear the full cost.

## 5.4 NEW STREETS

All streets constructed as part of a new subdivision or other development shall be constructed at the sole expense of the developer.

### 5.4.1 Warranty/Repairs Performance Guarantee

Upon completion of construction of new streets, the developer shall request a final inspection. Upon completion of all punch list items, the developer shall submit to the Public Services Director a set of acceptable record drawings. Upon approval of these materials by City Council, an 18-month warranty period shall commence.

During the 18-month warranty period, the developer shall repair any latent defects that occur. At the end of the 18-month warranty period, the developer shall request an end of warranty inspection. Upon successful completion of all warranty items, the developer shall be released from maintenance responsibilities for the warranted construction.

A. Warranty repairs to the following common problems shall be as follows:

1) Trench failures in pavement shall be repaired in accordance paragraph 5.5 **Utility Cuts**, below.

2) The Public Services Director may require a 1-inch overlay over any segment of street in which there trench failures. A trench failure shall be defined as a depression of ½ inch or greater at the deepest point over a trench width. The extent of resurfacing shall be as determined by the Public Services Director.

3) Structural cracks in sidewalk and/or curb and gutter shall be repaired by removing and re-pouring such sections as necessary;

4) Pavement, sidewalk, or curb and gutter failures caused by latent subsurface problems shall be repaired in accordance with the recommendations of an approved Geotechnical Engineer.

5) All storm sewer systems, ditches, sanitary sewers, and streets shall be free of debris, dirt or silt.

6) All water, sewer, storm sewer, drainage, and street appurtenances shall be in perfect condition and properly exposed (particularly water meters and sewer cleanouts).

7) All other defects shall be corrected in accordance with the recommendations of the Public Services Director or his/her representative.

If a developer fails to complete warranty items, future projects of the developer shall not be reviewed by the Department of Public Works and Utilities. In addition, the City may take additional legal action against the developer.

B. **Performance Guarantee**

Following installation of erosion controls, the developer may proceed with preparation of the final plat and installation of all required improvements in accordance with the approved construction plat and the regulations of this ordinance. In lieu of installation of such improvements, the subdivider shall provide sufficient guarantee that such improvements will be installed as follows:

1) **Performance Guarantee**: In lieu of prior construction of the improvements required by this ordinance, the subdivider shall guarantee that such improvements will be carried out according to the City of Jacksonville's specifications at his expense. Such guarantee may be in the form of a surety made by a surety company licensed to do business in North Carolina or certified check drawn in favor of the City of Jacksonville, or cash deposited with the City of Jacksonville, or a letter of credit from a local bank for the amount of the improvements to be installed. Such guarantees shall be in an amount of not less than 100 percent or more than 110 percent of the estimated cost of the construction of the required improvements. This amount shall be determined by Public Services Director. The developer must complete improvements within 36 months of the approval of the performance guarantee.

2) **Warranty and Defects Guarantee**: Upon the acceptance of facilities, utilities or streets for permanent maintenance, an 18-month warranty for all improvements shall become effective. This warranty must be satisfactory to the City of Jacksonville.

For the purposes of this section, the term "defects" refers to any condition in publicly dedicated facilities, utilities or streets that requires the City to make repairs to such improvements over and above the normal amount of maintenance that they would require. If such defects appear, the warranty may be enforced regardless of whether the facilities, utilities, or streets were constructed in accordance with the requirements of this ordinance.

## 5.5 UTILITY CUTS

A permit will be required for any utility company wishing to excavate or place utilities in the City right-of-way. Pavement cuts in streets made by the utility company or the City shall be repaired in either of the following ways:

A. Repair in accordance with **standard detail C01.01**, or

B. Backfill cut with flowable fill concrete to within 2 inches of the pavement surface and top with 2 inches of S 9.5B asphalt. Excavatable flowable fill shall have a compressive strength of no less than 30 psi but no more than 100 psi. There shall be a minimum waiting period of 24 hours after backfilling with flowable fill before paving can commence. See Part 2-*Products*, paragraph 2.1.1C, Division 02275, *Trenching, Backfilling, and Compaction of Utilities* for more information relating to flowable fill concrete.

C. Select Fill shall be placed and vibrated on top of pipe to within 1 foot of the pavement surface after which 6 inches of ABC, 4" of I 19.0B Binder and 2 inches of S 9.5B asphalt is placed. All edges shall be over-excavated 6 inches on each side of the cut and a 2-inch depth of S 9.5B asphalt and 6 inches of I 19.0B binder shall be placed in the remaining cut area. All pavement joints shall be tacked and sealed with an approved sealer.

## 5.6 USE OF EASEMENTS – HARD IMPROVEMENTS

All public easements including sewer, water, storm sewer, and electric are to remain clear of obstructions. No buildings, fences, trees, shrubs or other obstructions shall be placed in any easement. However, unless otherwise permitted by the Public Services Director, fences may be allowed transversely but not longitudinally across utility easements. Fences across utility easements shall be required to provide a 12-foot wide vehicular gate. Driveways, walkways, asphalt and parking lots may be permitted in easements; however, the City reserves the right to remove such asphalt, concrete, base course and sod as necessary to access its facility in the case of emergency. Pavement or concrete will be replaced with a patch. Sod will be replaced by seeding, or at the City's option, sod. The City will not be responsible for replacing a property owner's sod after repairing a utility line.

# SECTION 6
# BIBLIOGRAPHY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