TRAFFIC STANDARDS

5.00 DESIGN STANDARDS

5.01 PURPOSE

These standards outline and define the current traffic design standards**,** including illumination, signals, bicycle facilities, roundabouts, medians, roadside features, parking design, transit stops, and miscellaneous items for Springfield. These design standards may be subject to revisions by the City Traffic Engineer on a project-by-project basis. All construction standards and drawings for transportation related items are defined in the Springfield Construction Standard Specifications Sections 317, 501, and 502, and Standard Drawings 5-1 to 5-25. All designs shall be performed by an engineer capable of performing such work and licensed by the State of Oregon. Any private streets shall be designed to the public facility standards. All public streets are considered Fire Department emergency apparatus access streets and shall meet the Fire Code minimum design standards. Private streets may or may not be considered Fire Department emergency apparatus access streets as determined by the Fire Marshal.

5.02 GENERAL DESIGN CONSIDERATIONS

5.02.1 Illumination

5.02.1.A General

As part of the public improvement process, a street illumination design shall be included with all project plans submitted to the City as well as a power plan from the Springfield Utility Board (SUB). The street illumination design shall clearly show where the luminaires, conduit runs, junction boxes, service cabinets, and power sources will be located. Each lighting component shall be identified using the Oregon Department of Transportation drafting symbol library and the corresponding legend. Submitted plans shall follow the City of Springfield Standard Specifications and Standard drawings related to illumination.

Lighting plans shall be submitted on a sheet devoted exclusively to street light work. All illumination plans shall be reviewed and approved by the Transportation Section.

5.02.1.B Design Standards

The lighting plan design shall utilize Oregon Department of Transportation (ODOT) drafting standards. The plans shall include symbols indicating such features as: conduit, wiring, junction boxes, power sources, poles, luminaires, luminaire arms, and all the relevant sizes and locations required to accurately construct the lighting system. For street lighting drafting typical, refer to the City's latest edition of Standard Construction Specifications and the ODOT drafting symbol/legend library.

The City standards for street illumination are:

A. Street lighting designs shall be prepared by an engineer capable of performing such work. The engineer shall be licensed by the State of Oregon. Lighting plans shall be submitted on a sheet devoted exclusively to street light work. The lighting plans shall also include wire size calculations and circuit diagrams. Lighting systems shall comply with the provisions of the National Electric Service Code (NESC). A space shall be provided for

a chart listing the specific location (geographic coordinates), address, pole number, pole owner, manufacturer's name and catalog numbers for each type of fixture, lamp, driver and city approved lighting controls including photocell in the project on the plan sheet. This chart shall be completed when preparing the as-built plans. Lighting circuits shall be designed to reduce the number of utility connection points.

B. Lights must be located in accordance with the standards in SDC 4.2-145.C. See the Illumination Standards Table (Table 5-1) for configurations that comply with these standards. In cases that are not defined in Table 5-1, a photometric evaluation of the pole spacing shall be made using accepted procedures and illumination levels in Illuminating Engineering Society, American National Standard Practice for Roadway Lighting – RP-8-14 and these standards.

C. Lighting must meet the following design standards adopted in SDC 4.2-145.C:

1. Lighting must comply with Illuminating Engineering Society, American National Standards Practice for Roadway Lighting – RP-8-14 and applicable National Electrical Safety Code (NESC) and National Electrical Code (NEC) standards.

2. Intersections must be illuminated to a level equal to the sum of the average required illuminance of the two intersecting streets.

3. Mid-block crosswalks that are approved by the City Traffic Engineer must have two times the illumination required for the street.

4. Decorative poles with City-approved LED fixtures and lighting controls must be used on all streets within the Nodal Development Overlay District and where any refinement plan or plan district requires decorative lighting. Decorative poles may be used on streets, paths, and accessways in any other zone at the option of the developer as approved by the Director.

5. City-approved LED fixtures and lighting controls must be used when lighting is required along multi-use paths and accessways.

6. Roadway style poles and "cobra head" fixtures with City-approved LED fixtures and lighting controls must be used along streets in all other locations.

7. Roadway style poles must be steel, fiberglass or aluminum.

8. Where lot frontages are 80 feet or less, poles must be located at property lines unless approved by the Director.

9. The weak point illumination must not be less than 0.1 foot candles.

10. Roadway style poles set behind sidewalks must have eight (8) foot arm length. Roadway style poles set between curb and sidewalk or where no sidewalk exists must have six (6) foot arm length.

11. Pole handholes must be used instead of junction boxes where feasible. Junction boxes for street lighting must only be utilized for street crossings or where necessary to comply with electrical code standards cited above.

12. Pole Height.

    a. Lights on arterial and major collector streets outside of a residential zone must have a 35-foot fixture mounting height.

    b. Lights on local streets with a curb-to-curb width of 28 feet or greater and collectors within residential zones must have a 30-foot fixture mounting height.

    c. Lights on local streets with a curb-to-curb width of less than 28 feet must have a 25-foot fixture mounting height.

    d. Decorative poles must be 12 feet tall, except that 16-foot tall decorative poles may be approved by the Director when the required illumination levels cannot be achieved with 12-foot tall decorative poles.

    e. Lighting on local streets must be installed on the same side of the street and on the side of the street first constructed, except where necessary to be consistent with the existing lighting design and placement.

    f. Light poles must not be placed on the outside of curves with less than a 1000-foot radius.

D. When roadway style poles are used, they shall be direct bury fiberglass, or steel or aluminum on concrete foundations.

   Direct bury fiberglass poles must be used as replacements or infill in areas with existing wood poles.

E. Poles shall be placed at least 3 feet from the face of curb. Luminaire arms shall be aligned at right angles from the curb line.

F. Conduits shall be electrical PVC with a minimum size of 1 inch and be in whole inch sizes only. Street crossings shall have a 2 inch minimum diameter. All conduit runs shall

be clearly indicated on the plans showing the route from the power source (typically a SUB vault) to the street light.

G. All electrical conductors shall be copper.

H. A manufacturer's specification 'catalog cut sheet' shall be submitted for all materials for city review and approval prior to installation.

I. All new City street light poles shall have City pole tags installed on the pole 6 feet from ground level and facing the street or multi-use path that the light is on. The pole tags are provided by the City by contacting the Springfield Transportation Section. Use approved methods and materials for attachment.

J. Electrical Circuit Identification
A tag shall be attached to each conduit entering underground junction boxes. The following information shall be written on the tag with permanent marker: Voltage – 120 or 208 or 240; Circuit – Alpha or Numeric as shown on the plan set; Power Source – Utility name and pole or transformer number, distance from power source, and compass direction to source. The proposed street lighting design shall include a note directing the contractor to include lighting circuit identification tags.

Approved manufacturer: Brady – Yellow Color-Code Plasti-Tags Catalog # 56926, 3-1/2" H x 2-1/2" W, 10 Mil Plastic, with nylon tie.

Table 5-1: Average Maintained Horizontal Illuminance[1]
For Street and Pedestrian Facilities (Residential Zones Only)

Classification	Fixture Height	Foot Candles Required	Ave/Min	Lamp Spacing
Local 20' Curb to Curb (Poles on Same Side)	**25**	**0.5**	**6 : 1**	**200'**
Local 28' Curb to Curb (Poles on Same Side)	**30**	**0.5**	**6 : 1**	**200'**
Local 36' Curb to Curb (Poles on Same Side)	**30**	**0.5**	**6 : 1**	**200'**
Minor Collector 34' Curb to Curb (Poles on Same Side)	**30**	**0.6**	**4 : 1**	**200'**
Minor Collector 42' Curb to Curb (Poles on Same Side)	**30**	**0.6**	**4 : 1**	**140'**
Minor Collector 50' Curb to Curb (Poles on Same Side)	**30**	**0.6**	**4 : 1**	**140'**
Arterials and Major Collectors > 50' Curb to Curb (2 poles opposite)	**35**	**0.9**	**3:1**	**200'**

Areas with curbside sidewalk 8 foot arm length
Areas with no sidewalk or setback sidewalk 6 foot arm length

5.02.1.D Conduit Size

A. Conduits shall be sized according to the requirements of the National Electrical Service Code (NESC) current edition.

B. All conduit runs shall be as direct from point to point as possible, shall remain within the right-of-ways, and maintain as straight an alignment as possible.

C. The minimum conduit size shall be 1 inch. All conduits under the street shall be a minimum of 1.5 inches in diameter. Conduits placed on SUB utility poles shall require 'stand-off' mountings and need to be specified in whole inch diameters.

D. A junction box shall be included at each end of street conduit crossings.

5.02.1.E Conductor Size

A. A catalog cut sheet with maximum starting and operating amperages information shall be included in the plans submittal to verify the wire sizing calculations.

B. A circuit diagram and load calculations shall be included on the plan sheets at the end of the lighting construction drawings.

C. The maximum voltage drop shall be two percent from the utility to the service equipment and three percent from the service to the farthest load.

D. Any suitable method for calculating voltage drop and conductor sizes may be used. Provide reference to any source of information.

5.02.2 Signals

5.02.2.A General

Signals shall be designed as specified in this Section. Consultants shall perform traffic signal designs using current National Electric Code (NEC), AASHTO, the Manual on Uniform Traffic Control Devices (MUTCD) and the Oregon Supplement to the MUTCD. This work shall consist of furnishing and installing a complete and functional traffic control system of controllers, signals and appurtenances as required by Springfield (See Division 500 of the Springfield Standard Construction Specifications based on ODOT Standards). The locations of signals shown on the plans can be approximate; the exact locations shall be established by the Engineer of Record in the field, unless relocated by the City Traffic Engineer. Please see section 5.04 regarding intersection analyses.

5.02.2.B Signal Design Standards

The traffic signal design shall be submitted on a separate sheet of the project plans. The design shall clearly show the following:

A. Existing and proposed topography including edge of pavement or curb line, center lines with stationing, lane use, striping, signing, sidewalks, sidewalk ramps, right-of-way lines, street names, driveways, adjacent lots, existing and proposed trees, and other topographical features as needed.

B. Existing lighting, poles, wiring, vehicle signals, pedestrian signals, overhead signs, traffic signal controller, service equipment, and all other equipment that needs to be removed. General notes shall state what is to be removed.

C. The location and specification of traffic signal poles, underground conduit, traffic signal loops or detection zones, traffic signal wiring, junction boxes, vehicle signals, pedestrian signals, pushbuttons, pushbutton instruction signs, overhead signs, traffic signal controller, service equipment, pre-emption devices, existing power sources, and all other equipment needed to install the signal.

D. A loop detector wiring diagram showing loop number, phase, function, slot number, and notes for symbols and details used and/or video camera detection details.

E. A normal phase rotation diagram and fire preemption operation diagram for the intersection.

F. Interconnect cable.

G. Bus rapid transit priority equipment.

H. Radio communication equipment.

Each signal component shall be identified using the ODOT drafting symbol library and the corresponding legend. Submitted plans shall follow the Springfield Standard Specifications, Drafting Standards Section 9, and Standard drawings related to traffic signals.

All public signal designs shall be prepared by an engineering firm capable of performing such work. The engineer shall be licensed by the State of Oregon.

5.02.2.C Induction Loops

Induction loops shall be constructed as specified in Standard Drawing 5-12.

A. Loops shall not be cut into the final lift of new asphalt.

5.02.2.D Conduit

A separate conduit shall be used for low voltage and high voltage circuits, such as: signal circuits, detector circuits, service wires, and 240 volt or greater illumination circuits. Metal conduit shall be coated in corrosive soil areas. Schedule 40 PVC conduit shall be used for all signal, interconnect, and lighting designs. Conduit sweeps shall conform to current ODOT standards.

5.02.2.E Junction Boxes

A. Junction boxes shall not be placed in sidewalks or ramps.

B. Junction boxes shall be sized to meet current ODOT standards.

C. Junction boxes located in the travel way shall be traffic load bearing junction boxes.

5.02.2.F Power Source

A. A separate post or pedestal shall be provided for service. Refer to current ODOT standards.

B. Power source shall be underground from power source to meter.

C. Meter and service cabinet shall be mounted as close to the controller as practical.

D. Service equipment shall not be mounted on the controller cabinet.

E. Power shall be run underground from service cabinet to controller.

5.03 BICYCLE FACILITIES

5.03.1 General

All bicycle facilities shall conform to the latest addition of the Oregon Bicycle and Pedestrian Plan, Oregon Bike and Pedestrian Design Guidelines, the Springfield Bicycle Plan, City of Springfield Transportation System Plan, the Regional Transportation System Plan, AASHTO guidelines, and applicable Sections of the Springfield Development Code (SDC).

5.03.2 Design Standards

A quick reference table on bike lane and multi-use path design standards is shown below.

Table 5-2: Quick Reference Bike lanes and Multi-Use Path Design Standards

Bike Lane	6 feet
Shoulder Bike Lane	6 feet
Multi-Use Path	10 feet with 2 foot wide gravel shoulders on each side (see SDC 4.2-150), unless otherwise specified in Springfield Transportation System Plan
Bike Lane Stripe	8 inches
Shoulder Stripe	4 inches
Vertical Clearance	10 feet
Pavement Thickness	Shall be designed to withstand an 80,000lb load and withstand frost heave

5.03.3 Bike Lanes

Bike lanes are required on arterial and non-residential collector streets. SDC 4.2-105.C and Table 4.2-1. Bike lanes shall have an 8 inch lane stripe and thermoplastic bike stencils. Motorists are not permitted in the bike lanes for driving or parking, but may use the bike lanes for emergency maneuvers or breakdowns.

The standard width of a bike lane is 6 feet, measured from the center of the stripe to the edge of pavement. See SDC 4.2-105.C and Table 4.2-1. Bike lanes wider than 6 feet may be required in areas of very high use, on high-speed facilities where wider shoulders are warranted, or where they are shared with pedestrians. Adequate markings shall be used to discourage motorists from using the bike lane as a travel-way or parking lane. At a minimum, bike lane pavement markings designating the facility to discourage automobile use must be placed at all street intersections in both directions.

Where a bike lane is to be designed adjacent to a parking lane, its location will be reviewed and evaluated by staff on a case by case basis as there may be a variety of elements that may need to be taken into consideration.

Bike lanes on one-way streets shall be on the right side of the street, except in the case where a left-side bike lane would cause fewer conflicts, and the bicyclist can return to the right safely. See SDC 4.2-105.C and Table 4-2.1, footnote (3).

5.03.4 Bicycle Parking

Refer to the SDC Sections 3.4-270G.13 and 14, and 4.6-140-155 for the minimum required bicycle parking spaces and additional bicycle parking standards.

5.03.5 Multi-Use Paths

A. A multi-use path must be paved a minimum width of 10 feet. See SDC 4.2-150.C.

B. The path design must include a 2 foot or greater clear distance on both sides of the multi-use path. This area must be at the same slope as the path. See SDC 4.2-150.C.

C. The overhead clearance must be a minimum of 10 feet, unless additional overhead clearance is required for fire access as determined by the Fire Marshal.

D. Where a path is parallel and adjacent to a street, there must be a 5 foot or greater width separating the path from the edge of the street, or a physical barrier of sufficient height must be installed. See SDC 4.2-150.D.

E. Multi-use paths must be strong enough to support maintenance vehicles and emergency vehicles.

F. The maximum grade shall be 5 percent for bicycle use.

G. If a fence or railing is used along a path, the height, openings in the railing, and rub-rail requirements shall comply with AASHTO standards. Lighting shall be installed on multi-use paths. See SDC 4.2-150.E and the lighting standards for recommended illumination in Section 5.02.

5.03.6 Striping and Signing

A. Plastic bike stencils must be placed at all street intersections in both directions.

B. Additional stencils may be placed on long sections of street with no intersections. The correct spacing in feet is equal to the designated travel speed (mph) multiplied by 40.

C. All bicycle striping going through an intersection or crossed by high volume traffic shall be thermoplastic striping.

D. Signs shall have a 3 foot lateral clearance from the edge of the path. The bottom of signs shall be 5 feet above the path. Signs placed over a path shall have a minimum vertical clearance of 8 feet.

5.03.7 Protected Bike Lanes

Protected bike lanes or "cycle tracks" must be reviewed and approved by the City Traffic Engineer.

5.03.8 Other Bicycle Facilities

Other bicycle facilities may be designed such as but not limited to bicycle boulevards, lanes, routes, parking, and paths but shall be evaluated on a case by case basis to ensure the proper safety for all users.

5.04 INTERSECTION CONTROL

When a project includes reconstructing or constructing new intersections, all intersection control types will be evaluated using Springfield's "Intersection Control Checklist" provided in Appendix 5.A.

5.04.1 Roundabouts

All roundabouts on City streets shall be designed by the City of Springfield Transportation Section staff. Private developers shall arrange for these services from Springfield staff as part of their planning for developments which include a proposed roundabout.

Roundabouts shall be constructed in concrete unless otherwise approved by the City Engineer.

5.05 MEDIANS

Section 5.05.1 General median description, 5.05.2A Raised Median Width and Size, and 5.05.2A Length of a Raised Median are requirements adopted in SDC 4.2-105.F. Where these sections conflict with the Springfield Development Code, the Development Code prevails.

5.05.1 General

Medians are provided to deter crashes caused by crossover traffic, head light glare distraction, traffic turning left from through lanes, refuge for pedestrians crossing the street, and to remove turning traffic from through lanes thereby maintaining efficient and safe traffic flow.

A median is defined as an area between traffic lanes for control of vehicle movements or for pedestrian refuge. Within the intersection area, a median or an outer separation is considered to be an island.

Median design and installation must follow the standards in the Manual on Uniform Traffic Control Devices and AASHTO's "A Policy on Geometric Design of Highways and Streets."

5.05.2 Design Standards

Landscaping and irrigation shall be installed when directed by the City Traffic Engineer. A detailed median design plan shall be included in the public improvement plan set on a separate sheet and approved by the City Traffic Engineer.

5.05.2.A Length of Median

The length of a median is determined based on the storage length requirements as determined in the Traffic Impact Study (T.I.S.), based on safety and/or operational efficiency needs of the street first and the access second, and as approved by the City Traffic Engineer.

The usable length of a pedestrian refuge area along a street shall not be less than 8 feet or the width of the crosswalk, whichever is greater. The median length shall not be less than 30 feet.

5.05.2.B Median Width

Elongated medians intended to deter turning movements shall be a minimum of four (4) feet wide and no less than 150 square feet in area. In special cases, where right-of-way is limited, elongated islands may be as narrow as 2 feet, except when used as pedestrian refuge areas.

Pedestrian refuge medians shall be at least 8 feet wide unless special circumstance limits the width possible. In no case shall a pedestrian median be less than 6 feet wide.

5.05.2.C Median Openings

Median openings that allow left turns in both directions shall be not less than 50 feet nose to nose. All median turn lanes and openings shall be designed for at least a WB50 truck, and a WB67 truck on designated truck routes.

5.05.2.D Median Types

The type of median shall be determined by the City Traffic Engineer.

5.05.2.E Visibility

Fixed objects shall not normally be permitted on medians. Planting shall be located so as not to

violate sight distance standards or the turning radius of emergency apparatus.

5.05.2.F Access to Required Fire Features
Where access to an existing fire protection feature (i.e. fire hydrant, fire lane or other required fire protection feature) is limited by a median installation, the Fire Marshal shall be consulted in order to evaluate an equivalent fire protection feature.

5.06 ROADSIDE FEATURES

5.06.1 General
Miscellaneous features included herein shall be developed and constructed to encourage the uniform development and use of roadside features wherever possible. Any roadside facility installed in the public right-of-way shall first be permitted and reviewed by the City Traffic Engineer for safety evaluation.

5.06.2 Design Standards
The design and placement of roadside features included in this Section shall comply with the specific requirements listed for each feature, and must comply with PROWAG standards as applicable.

5.06.3 Mailboxes
A. Mailbox supports shall be 4 inches by 4 inches or 4½-inch diameter wood posts, or a metal post with no greater than a 2 inch-diameter standard strength steel pipe, with a height of 42 inches to the bottom part of box, embedded no more than 24 inches into the ground with a lateral distance of 6 to 12 inches from the edge of curb, or 8 to 12 inches from edge of pavement if there is no curb. For example, a single two-pound-per-foot U-channel support would be acceptable under this structural limitation. Mailbox supports shall not be set in concrete unless the support design has been shown to be safe by crash tests.

B. Mailbox-to-post attachments shall prevent mailboxes from separating from their supports under vehicle impacts.

C. Multiple mailbox installations shall meet the same criteria as single mailbox installations. Multiple support installations shall have their supports separated a minimum distance of 4 feet above ground. This distance shall be 12 inches for a single support.

D. Neighborhood delivery and collection box units are owned by the U. S. Postal Service and are a specialized type of multiple mailbox installation that shall be located outside the clear zone.

See ODOT Standard Drawing RD 100 for Mailbox Installation drawings.

5.06.4 Roadside Traffic Barriers
See *AASHTO, Roadside Design Guide* for Roadside Traffic Barrier design requirements.

5.06.5 Signing
A. See City Standard Drawing 5-18 for sign installation details.

B. See the latest edition of the *Manual on Uniform Traffic Control* (MUTCD) and Oregon Supplements to the MUTCD for specific signs.

C. Street name signs:

1. Street name signs shall be erected to identify street intersections in both urban and rural areas. In residential districts at least one sign is required at each intersection. In business districts or on major arterials, street name signs shall be placed on diagonal corners so that they will be on the near left-hand and far right-hand side of the intersection for traffic on the major street.

2. The sign shall be white letters on a green background.

3. Street name signs shall be mounted a minimum of 9 feet above the pavement.

D. Signs shall be placed on street light poles when practicable.

5.07 MISCELLANEOUS

5.07.1 Turn Bay Lengths

The elements of a turn bay are comprised of four components which include:

d_1 = distance traveled during the perception-reaction time
d_2 = distance traveled while driver decelerates and maneuvers laterally
d_3 = distance traveled during full deceleration and coming to a stop
d_4 = storage length

The physical length of the turn bay excludes the distance traveled during perception-reaction time.

- It shall be designed so that a turning vehicle will develop a speed differential of 10 mph or less at the point it clears the through traffic.
- The length of the bay shall allow the vehicle to come to a comfortable stop prior to reaching the end of the expected queue in the turn bay.
- The deceleration/maneuver distance ($d_2 + d_3$) is found in table 5-5.
- The turn bay shall be longer than the queue in the adjacent through lane so that entry is not blocked.

Limiting conditions may only be used if approved by the City Traffic Engineer.

TABLE 5-3: Upstream Functional Intersection Area, Excluding Storage, in Feet[1]

	Desirable Conditions		Limiting Conditions	
Operating Speed (mph)	Maneuver Distance [2] [6] ($d_2 + d_3$)	PIEV[3] Plus Maneuver Dist. ($d_1 + d_2 + d_3$)	Maneuver Distance [4] [6] ($d_2 + d_3$)	PIEV[5] Plus Maneuver Dist. ($d_1 + d_2 + d_3$)
20	70	130	70	100
25	110	185	105	140
30	160	250	145	190

35	215	320	190	240
40	275	395	245	305
45	345	475	300	365
50	425	570	365	440
55	510	670	435	515
60	605	780	510	600
65	710	900	590	685
70	820	1025	680	785

(1) Rounded to 5 feet
(2)10 mph speed differentials, 5.8 fps^2 deceleration while moving from the through lane into the turn lane; 6.8 fps^2 average deceleration after completing lateral shift into the turn lane
(3) 2.0 second perception-reaction time
(4) 10 mph speed differential; 5.8 fps^2 deceleration while moving from through lane into the turn lane; 9.2 fps^2 average deceleration after completing lateral shift into the turn lane.
(5) 1.0 second perception-reaction time
(6) Assumes turning vehicle has "cleared the through lane" (a following through vehicle can pass without physically encroaching on the adjacent through lane) when the turning vehicle has moved laterally 10 ft. Also assumes a 12 ft. lateral movement will be completed in 3.0 seconds.

Source: *Vergil G. Stover and Frank J. Koepke, Transportation and Land Development, Institute of Transportation Engineers, Prentice-Hall, Inc., 1988, 2nd edition in preparation.*

5.07.2 Sight Distance

The minimum sight distance available on a street shall be sufficiently long to enable a vehicle traveling at or near the design speed to stop before reaching a stationary object in its path. Sight distance at every point along the street shall be at least that required for a below-average operator or vehicle to stop in this distance.

Table 5-4: Clear Distance to See Sign[1]

Speed Limit (MPH)	Non-Critical Signs[1] (FT.)	Critical Signs[2] (FT.)
30	150	250
40	200	350
50	250	450
60	300	600

[1] Source: *Vegetation Control for Safety*, USDOT, FHWA

[2] Critical signs are STOP, YIELD, DO NOT ENTER, ONE WAY, WRONG WAY, and other regulatory signs or warning signs. Non-critical signs are destination guide signs, parking regulations, or information signs.

Stopping sight distance shall be designed in accordance with the current standards specified in *A Policy on Geometric Design of Highways and Streets* published by AASHTO.

At intersections, a vision clearance triangle shall be maintained. In addition to AASHTO sight distance requirements, refer to SDC 4.2-130 for requirements.

5.07.3 Bus Turnout

A turnout is a specialized bus stop where passengers who board and de-board a bus can load in an area that is separated from the traffic lanes. Turnouts are appropriate in certain conditions. A properly marked turnout also serves as a reminder of the availability of transit service.

It is important that turnouts be properly designed with sufficient length to allow for easy and safe flow by the bus in and out of traffic. If there is a high traffic volume on the street, efficient bus operation may require that the timing of nearby traffic signals be designed to ensure that there will be sufficient gaps in the traffic to allow the bus to pull back into the traffic flow.

Safety and traffic flow are important considerations in deciding whether to install a turnout. Turnouts may be helpful on streets that function with higher speeds (over 35 miles per hour) because there is less risk of a rear-end collision while the bus is stopped to board or deboard passengers. A bus stopped at a turn out, will also not impede traffic flow, which could be a significant advantage for traffic operation on the street, particularly if the stop time is long due to high passenger activity or boardings by people who use wheelchairs and other mobility devices.

Installing turnouts on streets that function with speeds of 35 mile per hour or less shall be approached with caution. If there is high volume traffic (exceeding 600 vehicles per hour) for all or part of the day, with few gaps in traffic flow, it may take an extended amount of time for the bus to safely enter the travel lane after a stop, resulting in longer travel time for transit riders and higher operational costs. This could be mitigated by the use of traffic control signals, or queue jumpers at a nearby intersection.

Bus turnouts shall be designed as specified in the current standards in "A Policy on Geometric Design of Highways and Streets", "Guide for Design of High-Occupancy Vehicle and Public Transportation Facilities*",* and "Guidelines for the Location and Design of Bus Stops*"* published by AASHTO. The following standards are from "A Policy on Geometric Design of Highways and Streets".

The interference between buses and other traffic can be considerably reduced by providing turnouts on arterials. The bus turnout shall include a deceleration lane or taper, a standing space long enough to accommodate the maximum number of vehicles expected to occupy the space at one time, and a merging lane to reenter the travel way.

The deceleration lane shall be tapered at an angle flat enough to encourage the bus operator to pull completely clear of the through lane before stopping. A taper of 8:1, longitudinal to transverse is a desirable minimum.

The boarding area shall provide 50 feet of length for a standard bus and 60 feet of length for an articulated bus. When two or more buses that use the stop at the same time use the equation; [50'+65'(x-1)], x = number of buses. The width shall be at least 10 feet, preferably 12 feet. The merging or reentry taper shall not be sharper than 8:1.

5.07.4 Bus Stop Locations

A. A transit or bus stop is a designated place along a transit route where a public transit vehicle stops to allow passengers to board and deboard. General decisions about where to locate a stop are based on the following criteria:

1. Distance between Stops: The standard distance between bus stops on a standard local route is 750-1300 feet. Bus stops shall be installed when service is needed in each direction at the same intersection where practicable. Lane Transit District (LTD) can operate service most effectively by balancing customer convenience and accessibility to the service with the need to retain operational speed and efficiency.

2. Safety for Passengers: Stops are placed in areas where passengers can have a safe and direct access to sidewalks, walkways, and waiting areas. Stops shall be placed so that there is adequate sight distance between bus operators and waiting customers. A safe environment shall also be provided for all necessary operational movements. It is important for passengers with disabilities, or other needs, especially those who use wheelchairs, mobility devices or have children in strollers to have an accessible route to and from the bus door.

3. Convenient Access: In order for public transit to be effective, passengers must be able to access service that is close to major passenger destinations. It should also be easy for passengers to transfer from one bus to another, either at the same bus stop or to one on a nearby cross street.

4. Operational Characteristics: A properly developed bus stop allows for safe movement by the bus into and out of the traffic flow with minimal delay. If the stop is on a heavily used transit corridor, there may be a need to accommodate two or possibly more buses using the stop at the same time. Turnouts may be desirable in some cases.

B. The actual position of a bus stop from a street intersection can depend on transit operations, safety, bus riders' needs, traffic flow, parking, physical roadside constraints (trees, poles, driveways, etc.) and property concerns. There are three basic types of bus stop locations along a street: far-side, near-side, and mid-block bus stops.

Far-Side Bus Stop: A bus stop that is located immediately following an intersection and is recommended for use when:

1. Traffic in the direction the bus is traveling is heavier approaching the intersection than leaving the intersection.

2. There is a high demand for right turns in the direction the bus is traveling.

3. The crossing street is a one-way street where traffic flows from left to right.

4. A preferred bus stop length is 90 feet measured from the crosswalk to the bus stop sign.

Near-Side Bus Stop: A bus stop that is located immediately before an intersection and is recommended for use when:

1. Traffic in the direction the bus is traveling is heavier leaving the intersection than approaching the intersection.

2. The cross street is one-way where traffic flows from the right to left.

3. The location is one that offers a clear advantage for transit riders by providing improved access to a major destination or to other intersecting bus routes.

4. The preferred length is 90 feet measured from the crosswalk to the bus stop sign.

Mid-Block Bus Stop: A bus stop that is generally located 100 feet or more before or beyond an intersection and is recommended for use when:

1. Traffic or physical street characteristics prevent siting a stop close to an intersection.

2. The distance between intersections will far exceed the standard for bus stop spacing.

3. The bus stop serves large businesses, housing developments or other significant trip generators. Generally, activity is limited to the bus stop side of the street. If there is a mid-block crosswalk, the stop shall be placed on the far side of the crosswalk so motorists and pedestrians can have clear sight lines.

4. The preferred length is 100 feet measured from the crosswalk to the bus stop sign.

C. Even if a chosen bus stop location fits a recommended description for one of the types than others, both LTD and Springfield need to consider the advantages and disadvantages in their location decision. Common advantages and disadvantages of each type are listed below.

Table 5-5: Bus Stop Locations

Near-Side

Advantages	Disadvantages
Minimizes interferences when traffic is heavy on the far side of the intersection.	Conflicts with right turning vehicles are increased.
Passengers access buses closest to crosswalk.	Stopped buses may obscure curbside traffic control devices and crossing pedestrians.
Intersection available to assist in pulling away from curb.	Sight distance is obscured for crossing vehicles stopped to the right of the bus.
No double stopping.	The through lane may be blocked during peak periods by queuing buses.
Buses can serve passengers while stopped at a red light.	Increases sight distance problems for crossing pedestrians.
Gives bus operator the opportunity to look for oncoming traffic including other buses with potential passengers	

Far-Side

Advantages	Disadvantages
Minimizes conflicts between right turning vehicles and buses.	Intersections may be blocked during peak periods by queuing buses.
Provides additional right turn capacity by making curb lane available for traffic.	Sight distance may be obscured for crossing vehicles.
Minimizes sight distance problems on approaches to intersection.	Increases sight distance problems for crossing pedestrians.
Encourages pedestrians to cross behind the bus.	Stopping far side after stopping for a red light interferes with bus operations and all traffic in general.
Requires shorter deceleration distances for buses.	May increase number of rear-end accidents since drivers do not expect buses to stop again after stopping at a red light.
Gaps in traffic flow are created for buses re-entering the flow of traffic at signalized intersections.	

Mid-Block

Advantages	Disadvantages
Minimizes sight distance problems for vehicles and pedestrians.	Requires additional distance for no-parking restrictions.
Passenger waiting areas experience less pedestrian congestion.	Encourages patrons to cross street at midblock (jaywalking).
	Increases walking distance for patrons crossing at intersections.

D. Operating convenient, safe, and efficient transit service means that there shall be sufficient service and sufficient amounts of curb space for bus stops. Aligning a bus

parallel to a curb or street edge is important for boarding and deboarding riders, especially those who use wheelchairs, mobility devices such as walkers, child strollers or carts. Bus stop location and design must comply with the PROWAG standards.

E. If a stop is located at a mid-block location on a collector or arterial street, a pedestrian actuated control device and street lighting may be required to be installed at the discretion of the City Traffic Engineer.

5.07.5 Bus Stop and Shelter Layout

Bus stop sign poles shall be located a minimum of 1 foot 6 inches, with 2 feet preferred, from the curb face to assure both visibility and clearance from passing vehicles.

Passenger shelters are generally placed in bus stop locations where there are 30 or more boardings per day.

5.08 RESERVED

5.09 ON STREET PARKING

On street parking shall be designed to aid in the safe and efficient mobility of pedestrians, bicyclists, and vehicles. When designing on street parking, please refer to the AASHTO 'A Policy On Geometric Design of Highways and Streets', ITE guidance, the Springfield Downtown Parking Study, the Institute of Traffic Engineers design guidance, the Springfield Development Code, and any relevant refinement plans.

When parking is only allowed on one side of the street, parking shall be located on the side of the street that has pedestrian amenities.

New or altered on-street parking must comply with the PROWAG standards.