

## MASSDOT DESIGN JUSTIFICATION WORKBOOK

WEST SPRINGFIELD - RECONSTRUCTION OF MEMORIAL AVENUE (ROUTE 147)

PROJECT 608374

Sep-21

**PREPARED BY:**

Greenman-Pedersen, Inc.  
181 Ballardvale Street, Suite 202  
Wilmington, MA 01887

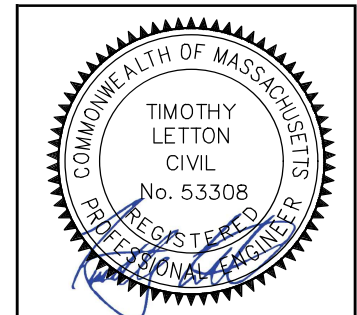
**PREPARED FOR:**

Town of West Springfield

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--- DESIGNER'S CERTIFICATION ---

"I have reviewed this document as it relates to the proposed design and have determined the design to be safe for public health and welfare in conformity with accepted engineering standards."



NAME: Timothy Letton

DATE: 21-Sep-21

TITLE: Executive Vice President

FIRM: Greenman-Pedersen, Inc.

MassDOT Design Justification Workbook

Project: 608374 Description: WEST SPRINGFIELD - RECONSTRUCTION OF MEMORIAL AVENUE (ROUTE 147)

SUMMARY OF JUSTIFICATIONS

The project involves reconstruction of Memorial Avenue (Route 147) from the Memorial Rotary to the Morgan Sullivan Bridge reconstruction project (MassDOT #605384). The street cross-section will be revised from 4-lanes to 3-lanes west of Circuit Avenue and will include a two-way separated bicycle lane, sidewalks and landscape buffers. East of Circuit Avenue, Memorial Avenue will be reconstructed to include two-lanes in each direction with turn lanes at intersections, a buffered bicycle lane, sidewalks, and landscape buffers. Pedestrian crossings of Memorial Avenue will be enhanced with accessibility ramps, detectable warning panels, and pedestrian signals, RRFBs or HAWK beacons. Memorial Avenue is an NHS roadway under the jurisdiction of the Town of West Springfield.

We are requesting design exceptions for Pedestrian Facilities and Shoulder Width, as follows:

Pedestrian Facilities - Crosswalk Removal: Two crosswalks at the uncontrolled intersection with Norman Street are being consolidated into one crossing enhanced with an RRFB. This is proposed to enhance pedestrian safety along a corridor where there have been two pedestrian fatalities in the past 10 years. All pedestrian crossings of Memorial Avenue at uncontrolled locations will be enhanced with RRFBs or HAWK beacons.

Shoulder Width: The project proposes 2-foot shoulders in two specific locations for a total length of approximately 1,100 LF. We believe that the proposed 2-foot shoulders accommodate the necessary functions of the roadway and incorporating 4-foot shoulders would incur impacts and costs for extra width that are not really needed for essential roadway functions.

--- FOR MASSDOT/FHWA USE ONLY ---

APPROVED: Carrie L. Lally  
(Chief Engineer, MassDOT)

DATE: 10/19/21

APPROVED: \_\_\_\_\_  
(FHWA)

DATE: \_\_\_\_\_

APPROVED: Jeffrey Resler  
Jeffrey Resler (Nov 1, 2021 15:09 EDT)  
(Secretary / CEO of MassDOT)

DATE: 11/01/2021

## MassDOT Design Justification Workbook

Project: 608374

Description: WEST SPRINGFIELD - RECONSTRUCTION OF MEMORIAL AVENUE (ROUTE 147)

### PROJECT SUMMARY

Provide an overview of the project, below. (Include additional pages as necessary.)

*The project limits include approximately 7,600 LF (linear feet) along Memorial Avenue and a segment of intersecting Union Street (approximately 800 LF), Bresnahan Street (approximately 500 LF) and Main Street (approximately 500 LF). The project area is primarily an auto-oriented commercial area that is dominated by the Eastern States Fairgrounds property along the southwesterly segment of the project area which hosts the annual Eastern States Expo (a.k.a. 'the Big E') which draws people from around New England. There is also a major intermodal rail facility (CSX Intermodal facility) nearby as well as the Merrick and Memorial residential neighborhoods that are home to environmental justice populations related to income, minority races and English isolation. The intersections of Memorial Avenue (Route 147) with Union Street and Bridge Street are HSIP (Highway Safety Improvement Program) eligible. This project abuts another project at the westerly limit (#605384) which will improve the Morgan-Sullivan Bridge (Route 147) over the Westfield River.*

*The Project Need statement as described in the PNF is as follows: "This is a Complete Streets project for the Memorial Avenue (Route 147) corridor. The project seeks to rehabilitate Memorial Avenue as a civic boulevard which enhances the vibrancy of the surrounding areas as well as the functionality of the roadway to meet existing needs of all users including pedestrians, bicyclists, transit riders, passenger vehicles, trucking and rail freight. The roadway serves a myriad of land uses including residential, retail, restaurant, industrial, the Eastern States Exposition, the adjacent CSX Intermodal Facility and it also serves as a direct connection to the recent MGM Springfield Casino development. The corridor also provides transportation for an Environmental Justice area of the Town. The project consists of safety improvements along the corridor by reconstructing sidewalks, ADA ramps, and providing noted bicycle accommodations, as well as operational improvements at signalized intersections and the reconstruction of a deteriorated roadway surface/subgrade. The inclusion of a potential center left-turn lane as well as access management of retail driveways and transit accommodations will be considered. Innovative flexible design options will be considered to serve all roadway users while being able to accommodate the noted significant increases in vehicle traffic which are experienced on the grounds of the Eastern States Exposition periodically during the year, most notably during the Big E."*

*Memorial Avenue from the westerly project limit at Gate #1 to Circuit Avenue will provide an 11-foot travel lane in each direction separated by a 12-foot TWLTL, 6-foot sidewalks and an 8-foot two-way separated bike lane with a 4.5-foot buffer along the southerly side of the street and a 5-foot bike lane with a 2-foot buffer on the northerly side of the street. Existing on-street parallel parking on the northerly side of the street between Exposition Avenue and Norman Street will remain. Between Circuit Avenue and the easterly project limit two 11-foot travel lanes in each direction with dedicated turn lanes will be provided. This segment of roadway will have 6-foot sidewalks and 5-foot bike lanes with a 3-foot buffer. Improved bus stops with turn-outs and shelters will be provided to accommodate transit patrons along the entire corridor. A segment of Main Street will be reconfigured as a parking area with through traffic routed to Bresnahan Street.*

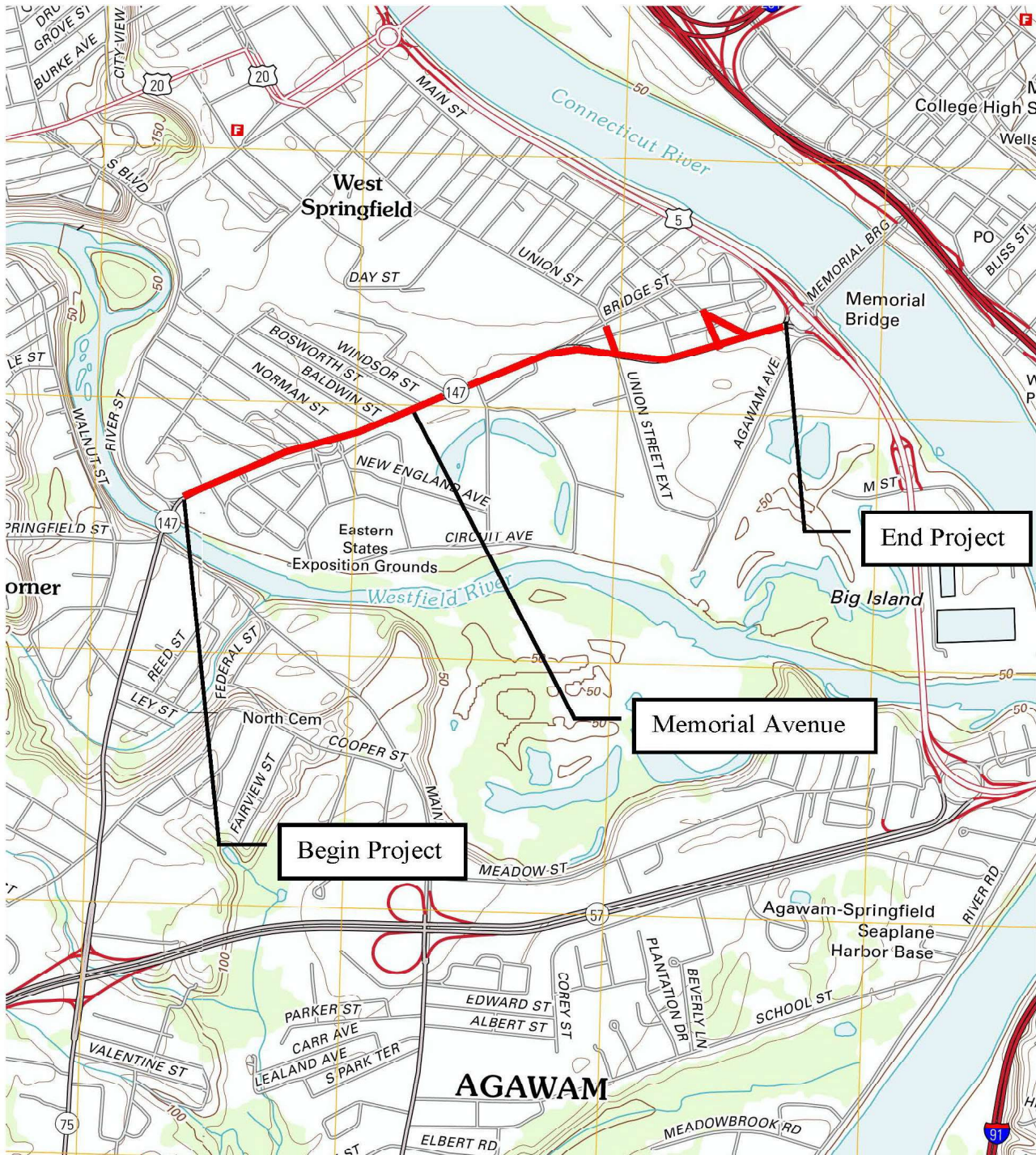
*Pedestrian crossings of Memorial Avenue will be enhanced by pedestrian signals at signalized intersections and RRFBs or HAWK beacons at uncontrolled locations. Signal equipment will be upgraded and signal timing will be adjusted to improve operations. ADA compliant ramps will be provided at all pedestrian crossings throughout the project area. The roadway resurfacing work will consist of a combination of full-depth reconstruction. Adjustments to the drainage infrastructure will be completed as needed to accommodate roadway modifications and utility pole locations will be adjusted as necessary to accommodate the new street configuration. Throughout the limits of the project area new or improved signage and pavement markings are proposed.*

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Project: 608374

Description: WEST SPRINGFIELD - RECONSTRUCTION OF MEMORIAL AVENUE (ROUTE 147)

LOCUS MAP



**MassDOT Design Justification Workbook**

Project: 608374      Description: WEST SPRINGFIELD - RECONSTRUCTION OF MEMORIAL AVENUE (ROUTE 147)

FACILITY INFORMATION

Facility: Memorial Avenue (Route 147)

NHS: Yes      Design Speed: 30 MPH      Functional Classification: PRINCIPAL ARTERIAL  
 Roadway Owner: Town of West Springfield

Based on this information, the following design criteria are considered Controlling Criteria for this facility.  
 (This list will also add or remove entries based on the responses in other sheets.)

Pedestrian Facilities	Not met	Shoulder Width	Not met
Bicycle Facilities			
Transit Accommodation			
Design Speed			
Lane Width			

*(Any criteria that is not considered a "Controlling Criteria" is still a design criteria; the applicable worksheet should still be filled out to document the Designer's decision-making process when selecting these values.)*

*(After completing the workbook, this sheet will serve as a summary for any Controlling Criteria not met.)*

Provide a description of the existing roadway and its context, and summarize why the Controlling Criteria above cannot be met. Provide information on alternatives considered; comparison of the safety and operational performance of the roadway and other impacts such as right-of-way, community, environmental, cost, and usability by all modes of transportation; proposed mitigation measures; and compatibility with adjacent sections of roadway. Attach additional pages as necessary.

*Memorial Avenue is an urban principal arterial roadway that is aligned in generally a east-west direction and has an overall right of way width ranging between 80 and 100-feet. The roadway is an NHS facility under the jurisdiction of the Town of West Springfield. Memorial Avenue generally consists of two general purpose lanes in each direction with directional flow separated by a striped double yellow line and reinforced with a raised concrete median around the large curve west of Union Street. The statutory speed limit is 30 miles per hour (MPH) in both directions. Concrete sidewalks typically separated by grassed buffers are provided along both sides of Memorial Avenue through the project area, however there are some gaps in the sidewalk. On-street parking is only allowed on the northerly side of the street between Norman and York Streets. Traffic volumes (2015) on Memorial Avenue ranged from 16,400 to 20,600 ADT with higher traffic volumes occurring east of Union Street. There are numerous curb cuts to serve commercial properties along Memorial Avenue.*

*Memorial Avenue from the westerly project limit at Gate #1 to Circuit Avenue will provide an 11-foot travel lane in each direction separated by a 12-foot TWLTL, 6-foot sidewalks and an 8-foot two-way separated bike lane with a 4.5-foot buffer along the southerly side of the street and a 5-foot bike lane with a 2-foot buffer on the northerly side of the street. Existing on-street parallel parking on the northerly side of the street between Exposition Avenue and Norman Street will remain. Between Circuit Avenue and the easterly project limit two 11-foot travel lanes in each direction with dedicated turn lanes will be provided. This segment of roadway will have 6-foot sidewalks and 5-foot bike lanes with a 3-foot buffer. Improved bus stops with turn-outs and shelters will be provided to accommodate transit patrons along the entire corridor. A segment of Main Street will be reconfigured as a parking area with through traffic routed to Bresnahan Street. (cont.)*

FACILITY INFORMATION (continued)

The proposed street section was developed after considering several alternatives and the unique traffic conditions posed by the activity at the Eastern States Fairgrounds. Due to high traffic volumes a separated bicycle facility is warranted. Pedestrian crossings of Memorial were carefully considered, given that two pedestrian fatalities have occurred along this stretch of roadway in the past 10-years. Safety of pedestrian crossings of Memorial Avenue at uncontrolled locations will be enhanced by RRFBs or HAWK beacons. To accommodate safer crossings, two existing pedestrian crossings of Memorial Avenue at Norman Street are proposed to be consolidated into a single crossing enhanced with an RRFB. The two crossings are separated by 40-feet. We believe that the inconvenience to pedestrians resulting from the removal of the crosswalk is minor, and the safety benefit is extremely important.

An exception is also requested for 2-foot shoulders in specific locations; for approximately 800 LF in the EB direction (STA 112+00 to STA 120+00) in order to accommodate existing on-street parking on the northerly side of Memorial Avenue and for approximately 300 LF in the EB direction (STA 134+00 to STA 137+00) in order to accommodate two through lanes in the EB direction and a TWLTL at the approach to Circuit Avenue. Accommodating 4-foot shoulders in these locations would require either: 1) approximately 2200 square feet of ROW takings; or 2) narrowing of the buffer between the sidewalk and the separated bike lane. Additional ROW takings would impact the frontage of the Eastern States fairgrounds including the need to relocate a plaque/monument and an extensive length of fencing. The latter option would result in utility poles impinging into the sidewalks by approximately 1.5-feet. The primary purpose of the shoulder in this location is to accommodate roadway drainage. Given the limited extent of the 2-foot shoulders, we recommend that a consistent sidewalk/buffer section be maintained. In the area with 2-foot shoulders, the catch basin spacing will be designed to be adequate to limit ponding in the travel lane to the maximum spread width allowed by the highway design guide for this classification of roadway.

We note that sharrows and a 5-foot bike lane with no buffer are provided in the eastbound direction west of Circuit Avenue. These facilities are provided *in addition to* the Separated Bike Lane which is fully separated from traffic and provides a high comfort facility for bicyclists. Because the Separated Bike Lane is provided, bike lane and sharrows do not require an exception.

**MassDOT Design Justification Workbook**

Project: 608374

Description: WEST SPRINGFIELD - RECONSTRUCTION OF MEMORIAL AVENUE (ROUTE 147)

**FIGURES AND PHOTOGRAPHS**



Memorial Avenue (Route 147) at Exposition Terrace looking east.

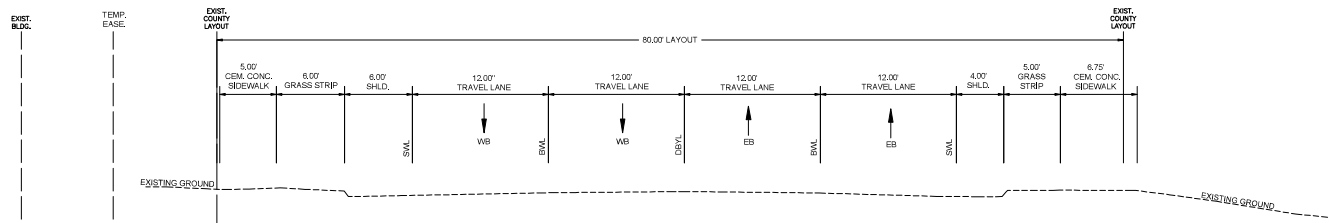


Memorial Avenue (Route 147) approaching Bresnahan Street looking west

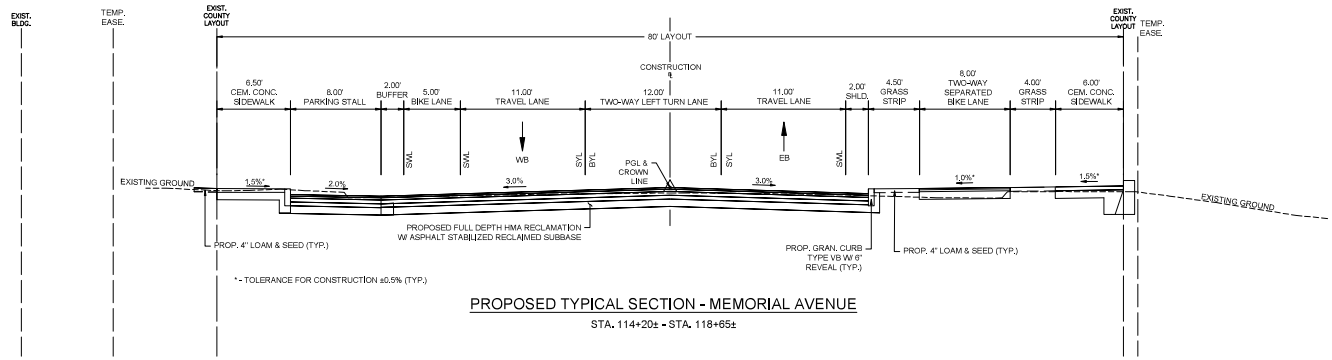
WEST SPRINGFIELD  
MEMORIAL AVENUE (ROUTE 147)

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			1
			2
PROJECT FILE NO.		689314	

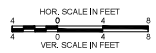
TYPICAL SECTIONS  
MEMORIAL AVENUE



**EXISTING TYPICAL SECTION - MEMORIAL AVENUE**  
STA. 114+20± - STA. 118+85±



**PROPOSED TYPICAL SECTION - MEMORIAL AVENUE**  
STA. 114+20± - STA. 118+65±

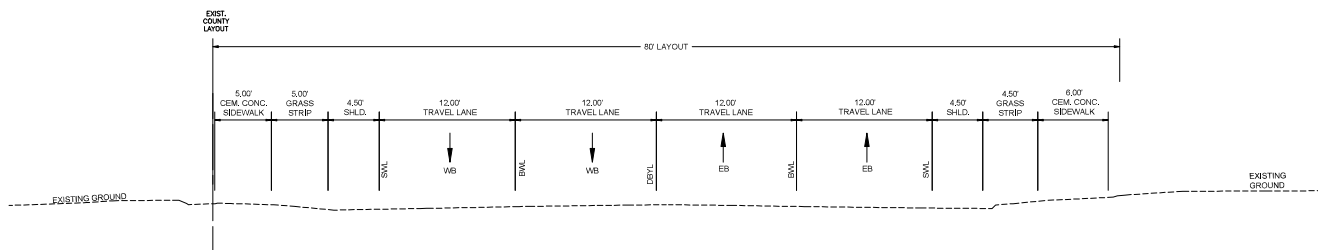


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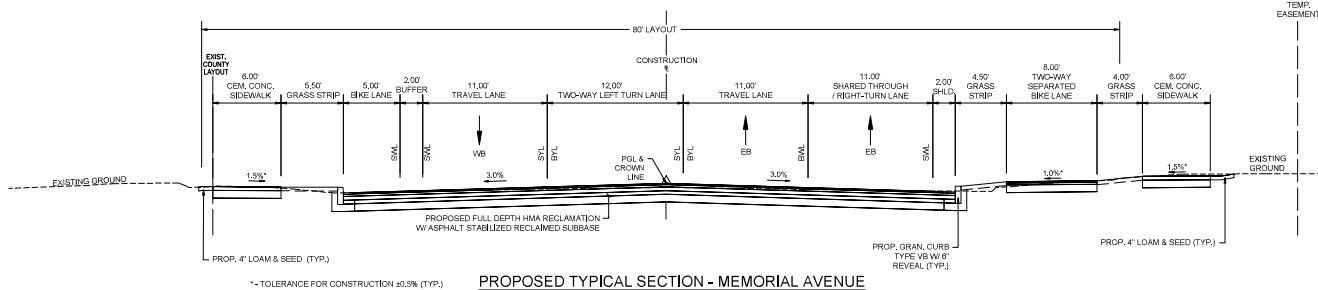
WEST SPRINGFIELD MEMORIAL AVENUE (ROUTE 147)			
STATE	FED. PROJECT NO.	SHEET NO.	TOTAL SHEETS
MA	-	2	2
PROJECT FILE NO.		60934	

TYPICAL SECTIONS  
MEMORIAL AVENUE



**EXISTING TYPICAL SECTION - MEMORIAL AVENUE**

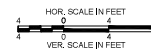
STA. 134+20± - STA. 136+60±



**PROPOSED TYPICAL SECTION - MEMORIAL AVENUE**

STA. 134+20± - STA. 136+60±

\* - TOLERANCE FOR CONSTRUCTION ±0.5% (TYP.)



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Project: 608374 Description: WEST SPRINGFIELD - RECONSTRUCTION OF MEMORIAL AVENUE (ROUTE 147)

PEDESTRIAN FACILITIES

Standard not met.

Facility: Memorial Avenue (Route 147)

If pedestrians are not legally allowed on the facility, check this box and do not fill out this sheet.

(Fill in information about the proposed Pedestrian Accommodations on this facility.)
(For the purposes of this Workbook, the entries for this criterion have been split into several "subcriteria".)

Type of Pedestrian Accommodation: SIDEWALK

Subcriterion: Width

Minimum: 5.0 FT Existing: 5.0 FT Proposed: 6.0 FT
(If the width varies, provide a minimum.)

Source used for minimum: MassDOT Controlling Criteria

Justify the proposed width.

Six-foot sidewalks are proposed in consideration of the land use context which is lower-density auto-oriented commercial development with the Eastern States Exposition which attracts high volumes of pedestrians during events.

Subcriterion: Presence

Pedestrian facilities exist on BOTH SIDES of the facility.
Pedestrian facilities are proposed on BOTH SIDES of the facility.

(Check the boxes if any of the following apply:)

- The roadway is in an urbanized area, an urban cluster, or a rural village.
The project involves work on or underneath a bridge.
The roadway is identified as having a High Potential of Walkable Trips in the Pedestrian Plan.

Justify the proposed number of sidewalks.

Sidewalks are provided on both sides of the roadway to provide pedestrian access to developments on both sides of the roadway.

**Subcriterion: Crosswalks at Signalized Intersections**

Crosswalks ARE provided across every leg of all signalized intersections on the facility.

Justify the proposed value.

**Subcriterion: Existing Crosswalk Removal**

Standard not met.

Existing crosswalks HAVE been removed from this facility.

Justify the proposed value.

*One crosswalk has been removed at the uncontrolled intersection at Norman Street to improve pedestrian safety. In other areas crosswalks have been relocated but not removed (see below).*

*(Check the boxes if any of the following apply:)*

- Facility is a side street and pedestrian facilities are not already present within 1500-ft.
- Project involves work only on pavement markings.
- Pedestrians are not legally allowed on the facility.

Based on the preceding responses, the Pedestrian Facilities criterion has been violated.

Provide additional justification for why this criterion cannot be met.

*Existing Crosswalk Removal (cont.)*

*Memorial Ave. @ Norman Street: Currently there are two crossings of Memorial Ave. at this uncontrolled location. Consolidation of the two crosswalks into one is proposed in order to serve the crossing with an RRFB to enhance pedestrian safety at this uncontrolled crossing location.*

*It is noted that two crossings of Memorial Avenue at the Eastern States Expo Driveway #1 have been consolidated to a single crosswalk as a part of the Morgan Sullivan Bridge project (#605384 - Route 147 over the Westfield River). A HAWK beacon is proposed for this consolidated crossing as a part of this Memorial Avenue improvement project..*

*With the implementation of improvements to Memorial Avenue, all pedestrian crossings will be via an RRFB or HAWK beacon at uncontrolled crossings, or a pedestrian signal at signalized intersections.*

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Project: 608374 Description: WEST SPRINGFIELD - RECONSTRUCTION OF MEMORIAL AVENUE (ROUTE 147)

BICYCLE FACILITIES

Facility: Memorial Avenue (Route 147)

If bicyclists are not legally allowed on the facility, check this box and do not fill out this sheet.

(Fill in information about the proposed Bicycle Accommodations on this facility.)
(For the purposes of this Workbook, the entries for this criterion have been split into several "subcriteria".)

Subcriterion: Type

Type of Bicycle Accommodation: SEPARATED BICYCLE LANE (2-WAY)
Posted or statutory speed of facility: 30 MPH
Facility volume (vehicles per day): 20,600
Number of travel lanes (in each direction): 2 (If this varies, use the higher number.)

The roadway is classified as a corridor with a High Potential for Everyday Biking in the Bike Plan.

Justify the proposed value.

A two-way separated bicycle lane is proposed through the westerly half of the project area, from the westerly project limit to Circuit Avenue (from approximately STA 100+00 to 137+00) at which point the bicycle accommodations transition to a five-foot bicycle lane with a three-foot buffer (from approximately STA 137+00 to 177+00).

Subcriterion: Width

Minimum: 8.0 FT Existing: FT Proposed: 8.0 FT
(Width excludes any buffer areas.)
(If the width varies, provide a minimum.)

Source used for minimum: MassDOT Controlling Criteria

Justify the proposed value.

E-20-01 specifies eight-feet as the minimum width for a two-way separated bike lane.

**Subcriterion: Presence**

Bicycle facilities exist on

NEITHER SIDE

of the facility.

Bicycle facilities are proposed on

EACH DIRECTION OF VEHICULAR TRAVEL

of the facility.

*(If this is a one way road, a one-way facility in the direction of vehicular travel satisfies the requirement for "each".)*

Justify the proposed value.

Separated bike lanes and/or buffered bike lanes are proposed in each direction of travel along the length of the project.

*(Check the boxes if any of the following apply:)*

- Facility is a side street and bicycle facilities are not already present within 1500-ft.
- Project involves work only on sidewalks or curb ramps.
- The roadway has a functional classification of "local".
- Bicyclists are not legally allowed on the facility.

Based on the preceding responses, the Bicycle Facilities criterion has been satisfied.

Additional comments may be provided in the box below.

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**TRANSIT ACCOMMODATION**

Facility:

*(Check the boxes if any of the following apply:)*

- Project is not within the service district of any of the RTAs or of the MBTA.
- There are no existing or proposed RTA/MBTA transit services on the roadway.
- Pedestrians are not legally allowed on the facility.

Service District:

*(Fill in information about the proposed Transit Accommodations on this facility.)  
(For the purposes of this Workbook, the entries for this criterion have been split into several "subcriteria".)*

**Subcriterion: Coordination**

- The 25 Percent Design plans were sent the applicable RTA or the MBTA.

**Subcriterion: Crosswalks**

Crosswalks or other means of facilitating pedestrian access across the road within 250 feet of all bus stops.  provided

Justify the proposed value.

**Subcriterion: Amenities**

*(Check the boxes if any of the following apply:)*

- There is a bus stop present within the project limits with 100 or more boardings per day.
- All bus stops with 100 or more boardings per day have a bench or shelter.

Justify the proposed value.

*Bus shelters are provided at bus stops.*

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**Subcriterion: Transit Priority**

Transit route headways:  (Consider ALL buses that use the corridor, not just a single route.)

Some form of transit priority treatment is provided on the corridor.

Describe the type of transit priority treatments that are provided on the corridor.

*Prioritization treatments are not proposed.*

Justify the proposed value.

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Based on the preceding responses, the Transit Accommodation criterion has been satisfied.

Additional comments may be provided in the box below.

*Bus stop locations were developed in coordination with PVTA.*

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RAMP LENGTH

Criterion not applicable.

Facility: Memorial Avenue (Route 147)

(Check the boxes if any of the following apply:)

- Project does not involve work at an interchange.
- Work on the on- or off-ramp does not constitute *new construction* or *major reconstruction/reconfiguration*.

**Based on the previous responses, Ramp Length is not applicable. Do not fill out this sheet.**

(Fill in information about the proposed Ramp Length on this facility.)

Minimum Ramp Length:  FT

Existing Ramp Length:  FT

Proposed Ramp Length:  FT

Based on the preceding responses, the Ramp Length criterion is not applicable.

Additional comments may be provided in the box below.



**MassDOT Design Justification Workbook**

Project: 608374 Description: WEST SPRINGFIELD - RECONSTRUCTION OF MEMORIAL AVENUE (ROUTE 147)

**DESIGN SPEED**

Facility:

*(Fill in all known information about the proposed Design Speed on this facility.)*

Minimum Design Speed:  Maximum Design Speed:

Source used for range:

Justify use of this source for the range of design speeds.

*The PDDG is the most appropriate resource for design speed criteria for roadways in Massachusetts.*

Existing Design Speed:  Posted Speed Limit:

Proposed Design Speed:  Statutory Speed Limit:

Based on the preceding responses, the Design Speed criterion has been satisfied.

Additional comments may be provided in the box below.

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**DESIGN LOADING STRUCTURAL CAPACITY**

Criterion not applicable.

Facility:

**If there are no bridges or structures in the project, check this box and do not fill out this sheet.**

*(Fill in information about the proposed Design Loading Structural Capacity on this facility.)*

Minimum Loading:  Proposed Loading:

Source used for minimum:

Justify use of this source for the minimum loading.

Based on the preceding responses, the Design Loading criterion is not applicable.

Additional comments may be provided in the box below.

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Project: 608374 Description: WEST SPRINGFIELD - RECONSTRUCTION OF MEMORIAL AVENUE (ROUTE 147)

LANE WIDTH

Facility: Memorial Avenue (Route 147)

(Fill in information about the proposed Lane Width on this facility.)

Minimum Lane Width: 11.0 FT Proposed Lane Width: 11.0 FT

Maximum Lane Width: 12.0 FT

Source used: MassDOT PDDG, Exhibit 5-14

Justify the value and the use of this source (if not the PDDG) for the lane width.

The PDDG is used for lane width.

Based on the preceding responses, the Lane Width criterion has been satisfied.

Additional comments may be provided in the box below.

Empty box for additional comments.

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Project: 608374 Description: WEST SPRINGFIELD - RECONSTRUCTION OF MEMORIAL AVENUE (ROUTE 147)

SHOULDER WIDTH

Standard not met.

Facility: Memorial Avenue (Route 147)

(Fill in information about the proposed Shoulder Width on this facility.)
(For the purposes of this Workbook, the entries for this criterion have been split into several "subcriteria".)

Subcriterion: Outside Shoulder Standard not met.

Min. RT (Outside) Shoulder Width: 4.0 FT (1) Proposed RT (Outside) Shoulder Width: 2.0 FT
Max. RT (Outside) Shoulder Width: 12.0 FT

Source used for range: MassDOT PDDG, Exhibit 5-12

Function of shoulder: Drainage of Traveled Way

Justify the value, the intended function, and the use of this source (if not the PDDG) for the outside shoulder width.

Exhibit 5-12 of the PDDG was used as guidance for shoulder width as the best source for conditions on Massachusetts roadways. See below regarding the value and intended function of the shoulder.

(1) Along the right side of freeways, 10-foot shoulders should be provided. The right shoulder should be increased to 12 feet when truck and bus volumes are greater than 250 per hour. An additional 2-foot offset from the edge of the shoulder is required to vertical elements over 6-inches in height (such as guardrail).

Subcriterion: Inside Shoulder

Min. LT (Inside) Shoulder Width: 2.0 FT Proposed LT (Inside) Shoulder Width: 2.0 FT

Source used for minimum: MassDOT PDDG, Section 5-12

Justify the value and the use of this source (if not the PDDG) for the inside shoulder width.

Footnote 1 on Exhibit 5-12 of the PDDG requires left shoulders for freeways and other divided roadways and defers to AASHTO. AASHTO guidance does not require left shoulders for urban and rural arterials. Exhibit 5-12 of the PDDG requires a 2-foot off-set from guardrail in addition to any shoulder requirement. Therefore the minimum left shoulder width is assumed to be 2-feet at the guardrail.

Based on the preceding responses, the Shoulder Width criterion has been violated.

Provide additional justification for why this criterion cannot be met.

*Exhibit 5-12 of the PDDG identifies a desirable range of 4-feet to 12-feet for RT (Outside) shoulders for arterial roadways to serve a range of functions. Situations where narrower shoulders may be considered are described in Section 5.3.3.1 as follows: "Minimum 4-foot shoulders are recommended for all arterials and collectors because of the value they provide for bicycle and pedestrian (particularly in rural areas) accommodation, and motor vehicle safety. If a design exception is obtained, shoulders narrower than 4-feet may be used in constrained areas where separate pedestrian accommodation is provided and shared bicycle/motor vehicle accommodation is suitable. Examples of these conditions are where design speeds are less than 45 miles per hour and traffic volumes are relatively low (less than 4,000 vehicles per day), or where the design speed is 30 miles per hour or less."*

*Functions for shoulder widths greater than 2-feet are listed in Exhibit 5-11 of the PDDG, and summarized as follows: Errant vehicles (3-feet); Bicycle and pedestrian use (4-feet); emergency stopping and emergency travel (6-feet); mail delivery and garbage pickup (6-feet); law enforcement (8-feet); large vehicle emergency stopping (10-feet); occasional detours (10-feet); and highway maintenance (10-feet). Memorial Avenue is an urban street within a connected street network and not a limited access highway or freeway, which makes many of these functions irrelevant. Bicycles and pedestrians are accommodated on sidewalks and within a separated bike lane. The overall street cross section of three to four lanes can accommodate emergency operations, stopped vehicles and law enforcement activity and would discourage errant vehicles. Space for mail delivery, garbage pick-up and highway maintenance are not relevant at this location. Necessary detours can be accommodated within the cross section or through the surrounding street network. In this location the primary function of the shoulders is to accommodate roadway drainage. The catch basin spacing will be designed to be adequate to limit ponding in the travel lane to the maximum spread width allowed by the highway design guide for this classification of roadway.*

*There are two locations where 2-foot shoulders are proposed: between STA 112+00 to STA 120+00 in the EB direction (800 LF) in order to maintain on-street parking in the WB direction; and between STA 134+00 to STA 137+00 in the EB direction (300 LF) in order to provide two through lanes and a TWLTL at the approach to Circuit Avenue. At these locations the project provides 6-foot sidewalks and an 8-foot two-way separated bike lane to accommodate bicycles and pedestrians out of the roadway. There are landscape buffers between the travel lane and the bike lane and between the bike lane and sidewalk. The landscape spaces create comfort for bicyclists by providing separation them from the busy traffic and discouraging pedestrians from walking in the bike lane. The landscape spaces also create a "Boulevard" character—a Town design objective noted in the Purpose and Need statement. Finally, utility poles are located in the 4-foot buffer between the sidewalk and protected bike lane. (Cont.)*

SHOULDER WIDTH (continued)

The AASHTO Guide for the Development of Bicycle Facilities recommends a 2-foot lateral clearance from vertical obstructions for bicycle paths. Providing a 4-foot shoulder would entail either: 1) a taking of 2,200 square feet to widen the roadway; or 2) revising the section to reduce the 4-foot buffer between the sidewalk and the separated bike lane. This change would cause utility poles to impinge into the sidewalk space by approximately 1.5-feet, narrowing the sidewalk to 4.5-feet at utility poles and would also result in the loss of limited landscape space. One segment includes 800 LF segment along the Eastern States Fairgrounds which attracts large numbers of pedestrians for events. The segment near Circuit Avenue would impinge into limited landscape buffers that separate parking areas from the sidewalk. As bikes and pedestrians are accommodated outside of the shoulders the primary concern is accommodating drainage out of the travel lane. The catch basin spacing will be designed to be adequate to limit ponding in the travel lane to the maximum spread width allowed by the highway design guide for this classification of roadway. It is our judgement that the 2-foot shoulders proposed for these limited segments of Memorial Avenue are adequate to accommodate necessary roadway functions while best meeting the objectives of the project to improve safety, accessibility and multi-modal accommodations.

Quantified design standards for left (LT) shoulders for urban arterials are not specified in either the PDDG or AASHTO. Footnote 1 on Exhibit 5-12 of the PDDG requires left shoulders for freeways and other divided roadways and defers to AASHTO for guidance. AASHTO provides extensive guidance on left shoulders for freeways, however quantified standards are not provided for urban and rural arterials. Section 7.3.3.3 Arterials in Urban Areas - Curbs and Shoulders states: *“Shoulders may be desirable on high-speed (50 to 60 mph) arterials in urban areas...[T]he use of shoulders on arterial streets is generally limited by restricted right-of-way and the need to use the available right-of-way for travel lanes, parking lanes, transit lanes, bicycle lanes, pedestrian facilities, and other needs...”* Memorial Avenue is not a high-speed arterial and the right of way is limited.

Along Memorial Avenue there is a variable width raised median reinforced with guardrail at one location. Exhibit 5-12 of the PDDG requires a 2-foot offset for guardrail in addition to shoulder widths for right shoulders. A 2-foot shoulder is proposed along the raised center median to provide an offset from the guardrail and a consistent shoulder treatment along the median.

MassDOT Design Justification Workbook

Project: 608374 Description: WEST SPRINGFIELD - RECONSTRUCTION OF MEMORIAL AVENUE (ROUTE 147)

HORIZONTAL CURVE RADIUS

Criterion not applicable.

Facility: Memorial Avenue (Route 147)

If there are no horizontal curves in the project, check this box and do not fill out this sheet.

(Fill in information about the proposed horizontal curvature on this facility.)

Min. Horizontal Curve Radius 353 FT Proposed Horizontal Curve Radius 360.0 FT

(If there are multiple curves, provide the smallest radius used and attach the alignment report.)

Source used for minimum: AASHTO Table 3-13

Justify use of this source for the horizontal curve radius.

AASHTO was used for guidance on a low-speed urban street with a 3% cross slope. This guidance is not provided in the PDDG.

Based on the preceding responses, the Curve Radius criterion is not applicable.

Additional comments may be provided in the box below.

Large empty box for additional comments.

MassDOT Design Justification Workbook

Project: 608374 Description: WEST SPRINGFIELD - RECONSTRUCTION OF MEMORIAL AVENUE (ROUTE 147)

SUPERELEVATION RATE

Criterion not applicable.

Facility: Memorial Avenue (Route 147)

If there are no superelevated curves in the project, check this box and do not fill out this sheet.

*(Fill in information about the proposed Superelevation Rate on this facility.)*

Maximum Superelevation Rate:  % Proposed Superelevation Rate:  %

*(If there are multiple superelevated curves, provide the largest rate used and attach the alignment report.)*

Source used for minimum:

Justify use of this source for the superelevation rate.

Based on the preceding responses, the Superelevation criterion is not applicable.

Additional comments may be provided in the box below.



**MassDOT Design Justification Workbook**

Project: 608374 Description: WEST SPRINGFIELD - RECONSTRUCTION OF MEMORIAL AVENUE (ROUTE 147)

**STOPPING SIGHT DISTANCE**

Criterion not applicable.

Facility: Memorial Avenue (Route 147)

*(Fill in information about the proposed SSD on this facility.)*

*(For the purposes of this Workbook, the entries for this criterion have been split into several "subcriteria".)*

**Subcriterion: SSD**

Minimum SSD: 200.0 FT

Proposed SSD: 734.0 FT

Source used for minimum: MassDOT PDDG, Exhibit 3-8

Justify the use of this source for the stopping sight distance.

*The PDDG is the best resource for design guidance on Massachusetts roadways.*

**Subcriterion: SSD Middle Ordinate**

Minimum SSD: 200.0 FT

Proposed SSD: 228.0 FT

*(If the middle ordinate is not applicable, leave blank.)*

Source used for minimum: MassDOT PDDG, Section 4.2.2

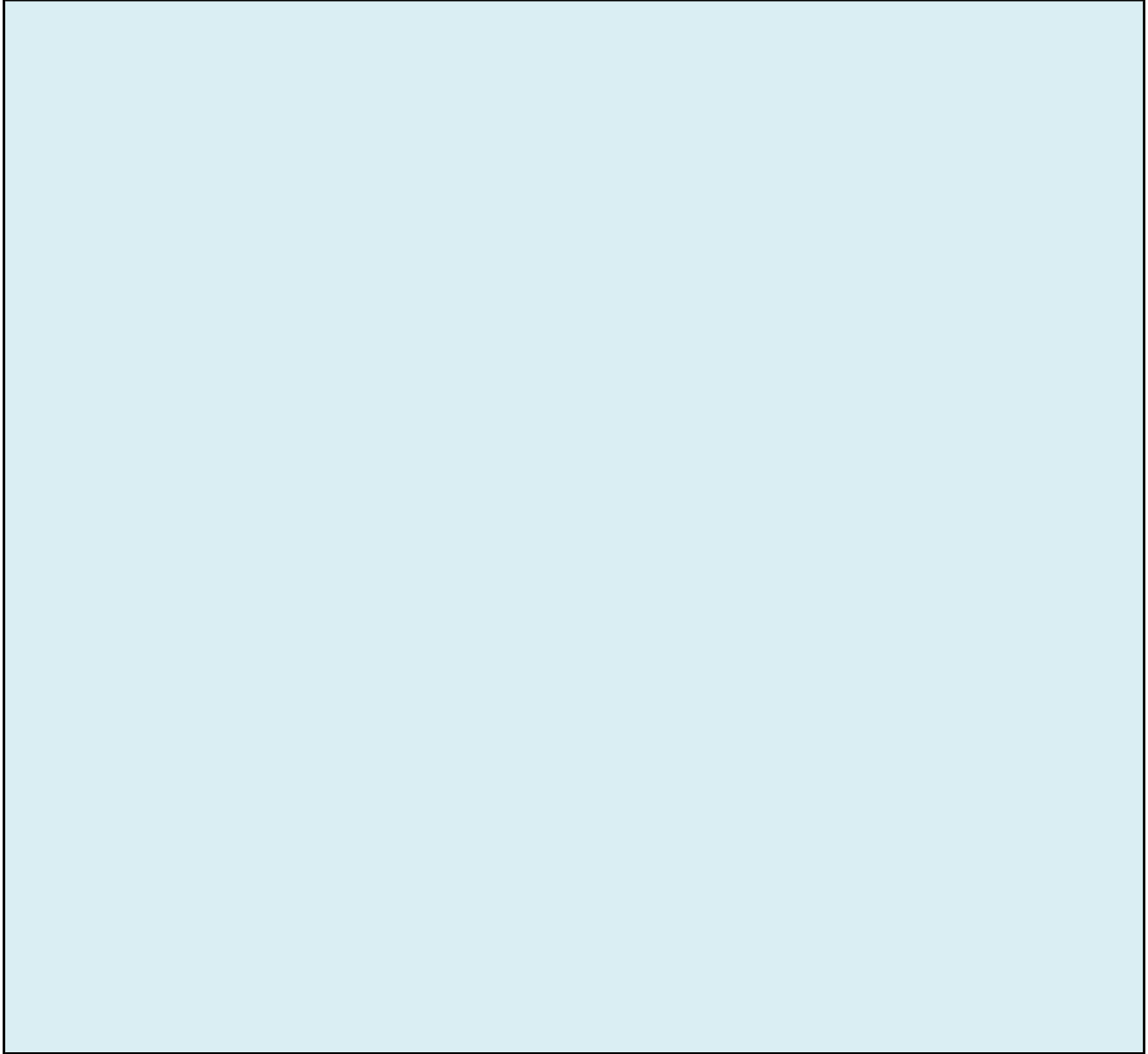
Justify use of this source for the SSD middle ordinate.

*The PDDG provides the best reference regarding stopping sight distance standards on Massachusetts highways.*

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Based on the preceding responses, the SSD criterion is not applicable.

Additional comments may be provided in the box below.



**MassDOT Design Justification Workbook**

Project: 608374 Description: WEST SPRINGFIELD - RECONSTRUCTION OF MEMORIAL AVENUE (ROUTE 147)

**MAXIMUM GRADE**

Criterion not applicable.

Facility:

*(Fill in information about the proposed grade on this facility.)*

Maximum Grade:

Proposed Grade:

*(Where the grade varies, provide the maximum value used.)*

Source used for minimum:

Justify use of this source for the grade.

*The PDDG is the best resource for guidance on maximum grades for roadways in Massachusetts.*

Based on the preceding responses, the maximum grade criterion is not applicable.

Additional comments may be provided in the box below.

MassDOT Design Justification Workbook

Project: 608374 Description: WEST SPRINGFIELD - RECONSTRUCTION OF MEMORIAL AVENUE (ROUTE 147)

CROSS SLOPE

Criterion not applicable.

Facility: Memorial Avenue (Route 147)

(Fill in information about the proposed roadway cross slope on this facility.)

Maximum Cross Slope (HMA): 2.0 %

Maximum Cross Slope (Conc): 1.6 %

Proposed surface: HMA

Proposed Cross Slope: 3.0 %

(Where the grade varies, provide the maximum value used.)

Source used for minimum: MassDOT PDDG, Section 5.5.2

Justify use of this source for the cross slope.

The PDDG provides the best resource regarding design standards for Massachusetts roadways.

Based on the preceding responses, the cross slope criterion is not applicable.

Standard not met.

Additional comments may be provided in the box below.

A 3% cross slope is proposed due to the flat road profile. In discussions with MassDOT and the Town of West Springfield it was decided to improve the cross slope to the maximum extent practicable. A 3% cross-slope is proposed to drain the runoff out of the travel lanes and into the gutter as quickly as possible.

**MassDOT Design Justification Workbook**

Project: 608374 Description: WEST SPRINGFIELD - RECONSTRUCTION OF MEMORIAL AVENUE (ROUTE 147)

**VERTICAL CLEARANCE**

Criterion not applicable.

Facility:

**If there are no bridges or structures in the project, check this box and do not fill out this sheet.**

*(Fill in information about the proposed Vertical Clearance on this facility.)*

Minimum Vertical Clearance:  FT Proposed Vertical Clearance:  FT

*(If there are multiple structures, provide the lowest value.)*

Source used for minimum:

Justify use of this source for the vertical clearance.

Based on the preceding responses, the vertical clearance criterion is not applicable.

Additional comments may be provided in the box below.