Memorandum

To:	Robert Doemel Winnebago County	From:	Jeff Roemer, PE
Date:	January 31, 2022		
Project Name:	ID 4636-05-00 City of Oshkosh, CTH I Ripple Ave to 35th Ave Winnebago County	Project #:	WIS-21007788-A0
Subject:	CTH I Reconstruction Design Criteria		
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Summary

This memorandum presents the Design Criteria used to set the roadway typical section and design constraints for CTH I at the 10% Level.

Background

The project is located along CTH I from Ripple Avenue to Waukau Avenue in the City of Oshkosh and Towns of Black Wolf and Nekimi. The existing roadway from south of Ripple Avenue to 35th Avenue is a two-lane rural roadway with gravel shoulders. From 35th Avenue to Waukau Avenue, the existing roadway is a four-lane undivided urban roadway. The existing pavement is in poor condition, utilities will be replaced along the corridor, and the roadway is in need of modernization.

From south of Ripple Avenue to 35th Avenue, it is proposed to modernize CTH I to a three-lane roadway with on-road bicycle lanes. The typical section will include two travel lanes, center two-way left-turn lane, and bicycle lanes. From 35th Avenue to Waukau Avenue, it is proposed to diamond grind the existing concrete pavement to improve the driving surface.

The purpose of this memorandum is to evaluate the design criteria required to modernize CTH I and to document decisions early in the design phase of the project. Design criteria to be evaluated include two-way left-turn lanes, on-road bicycle accommodations, lateral clearances, number of lanes and widths, and posted/design speeds.

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Design Criteria Summary

FDM 11-25-5.4.2 Two-Way Left-Turn Lane (TWLTL)

Two-way left-turn lanes (TWLTLs) consist of a traffic lane in the median area, 14-16 feet in clear width, delineated by pavement marking strips. The lane serves as a separation for opposing lanes of travel and an acceleration lane for vehicles turning left to enter the street from midblock driveways. TWLTLs are intended for use by vehicles traveling in either direction for deceleration and refuge while making a midblock left-turn maneuver.

Consider installing a two-way left-turn lane (TWLTL) in existing commercial or residential areas where the existing roadway is undivided (flush median) and where there is a combination of traffic congestion and numerous left-turn maneuvers.

Two Way Left Turn Lane Design Criteria

1. Posted Speed:
    a. Only use on roads with posted speeds <=45 mph
2. TWLTL Widths:
    a. 14.0-ft Typical; 12.0-ft Lower Minimum; 16.0-ft Maximum
3. Design Year AADT:
    a. 3-Lane TWLTL: between 8,000 and 17,500 vpd
4. Length of TWLTL:
    a. The length of the TWLTL should have sufficient length to operate properly at the posted speed. Site conditions and the types of intersection treatments will also influence the length of the TWLTL. Use the following guidelines: - Posted speed of greater than 30 mph: 1000-feet lower minimum uninterrupted length.
5. Intersection Treatment:
    a. At signalized intersections and at non-signalized intersections/driveways with left-turning turning volumes > 100vph, convert a TWLTL to an exclusive left-turn lane (see FDM 11-25-2.3 for guidance on turn bay length). Use a raised median at intersections and driveways with a high concentration of left turning vehicles and at other locations as needed for pedestrian and bicycle refuge.
    b. If turning volumes to a non-signalized minor street/driveway are low, it is not necessary to convert the TWLTL to an exclusive left-turn lane. However, pedestrians and bicyclists may still need median refuge.
6. Operational/Safety Factors:
    a. For traffic to move safely through intersections, drivers need to be able to see stop signs, traffic signals, and oncoming traffic in time to react accordingly. Do not locate a TWLTL where there is inadequate stopping sight distance. Provide decision sight distance, where practical, in advance of stop signs, traffic signals, and roundabouts. Appropriate design speed intersection sight distance should be provided for the drivers of vehicles that are stopped, waiting to cross or enter a through roadway. - Marking and Signing: Mark and sign TWLTLs in accordance with the Manual on Uniform Traffic Control Devices to identify the lane and regulate its proper use. Additional delineation is possible by either using a different type of pavement material with contrasting color or texture, or a mountable raised median.

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Urban On-Road Bicycle Accommodations without Parking

FDM 11-46-1 Bicycle and Pedestrian Elements Affecting Complete Streets

Federal legislation currently requires that bicycle and pedestrian needs must be given due consideration under Federal Surface Transportation law (23 U.S.C. 217(g)(1)), and this should include, at a minimum, a presumption that bicyclists, pedestrians, and persons with disabilities will be accommodated in the design of new and improved transportation facilities. In the planning, design, and operation of transportation facilities, bicyclists, pedestrians, and persons with disabilities should be included as a matter of routine, and the decision to not accommodate them should be the exception rather than the rule. There must be exceptional circumstances for denying bicycle and pedestrian access (23 U.S.C 217(g)(1)).

Federal Highway Administration (FHWA) policy requires the inclusion of bicycle and pedestrian accommodation on all modernization projects, with three exceptions:

1. Bicyclists and pedestrians are prohibited by law from using the roadway.
2. The cost of establishing bikeways would be excessively disproportionate to the need or probable use. Excessively disproportionate is defined by FHWA and state statutes as bicycle and pedestrian facilities together exceeding 20 percent of the cost of the larger transportation project.
3. Sparsity of population or other factors indicate an absence of need.

FDM 11-46-15.3 discusses Urban On-Road Bicycle Accommodations. An urban on-road bicycle accommodation can be a bike lane, an urban paved shoulder, a wide outside lane or a combined parking/bike lane. Requirements for on-road bicycle accommodations depend on whether there is parking or no parking as well as traffic volumes and speeds. Give due consideration to on-road bicycle accommodations on urban and suburban projects that use state or federal funding. Most cyclists will be most comfortable and feel safest when separation markings are used with wider bicycle accommodations, equating to higher use. Minimum bikeway widths should not be used unless cost or land constraints prevent additional widths. WisDOT provides a sequential preference and dimensions needed for bicycle accommodations (bike lanes, urban paved shoulders or wide outside lanes for urban roadways without parking.

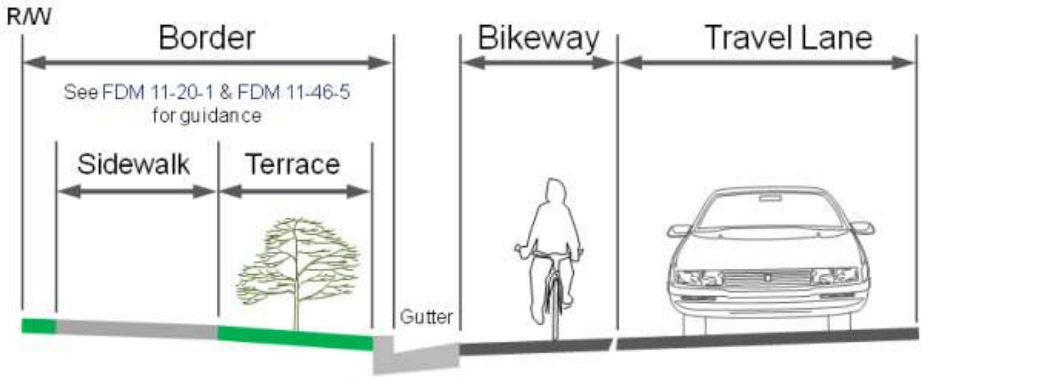

Figure 15.1 Urban Bicycle Accommodations without Parking (in order of preference)

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Lateral Clearances

On urban roadways without roadside barriers, lateral clearances should be provided from the edges of driving lanes to at least a small distance behind the faces of curbs. On urban roadways with roadside barriers, provide the required lateral clearances between the edges of driving lanes and the faces of the barriers. FDM 11-20-1.9.1 Lateral Clearance for Urban Roadways Table 1.5 shows lateral clearance design criteria.

Table 1.5 Lateral Clearance from Edge of Driving Lane for Modernization of Urban Streets [A]

Parking Condition	Urban Roadway Type	WITHOUT roadside barrier [B]	WITH roadside barrier at curb face [C]
With Parking	ALL	**Parking lane width + 4-feet** [D] (Lower Value) (Parking lane width + 2 feet [D])	**Should not allow parking where roadside barrier is used**
Without Parking	HIGH SPEED and TRANSITIONAL	**The Larger of** **6 feet** ***OR*** **the offset from edge of driving lane to face of curb + 4 feet [E]** (Lower Value) (The offset from edge of driving lane to face of curb + 2 feet [E])	**The Larger of** **6 feet** ***OR*** **the offset from edge of driving lane to face of curb[E]** (Lower Value) (The GREATER of 1.8 feet *OR* the offset from edge of driving lane to face of curb[E])
	LOW SPEED AND TURNING LANES	**The Larger of** **4 feet** ***OR*** **the offset from edge of driving lane to face of curb + 2 feet [E]** (Lower Value) (The offset from edge of driving lane to face of curb + 2 feet [E])	**The Larger of** **4 feet** ***OR*** **the offset from edge of driving lane to face of curb[E]** (Lower Value) (The GREATER of 1.8 feet *OR* the offset from edge of driving lane to face of curb[E])

Lateral clearance computations for urban roadway without parking and without roadside barrier are:

Design Standard Low Speed Urban (<=40 MPH Posted Speed)
Larger of 4 feet from edge of trave lane or 2 feet from f/c

Design Standard Transitional Urban (=45 MPH Posted Speed)
Larger of 6 feet from edge of trave lane or 2 feet from f/c

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Design Criteria Summary

FDM Criteria

Roadway design criteria is based on FDM 11-20 for urban roadways. The two tables shown below present criteria based on posted speed limits of proposed roadway.

Urban Streets Modernization Roadway Design Criteria for Posted Speed Limits of 40 mph or Less

Functional Class	Design Year ADT Thresholds at Levels of Service C, D & E [1]				Design Basis	Roadway Criteria [9]						
						Travel Lanes			Roadway (Face of Curb to Face of Curb) Width (feet)[4]			
									No Parking[6,7]		Parking [6,7]	
	Scenarios	C[2] LOS 4.0 ADTs (DHVs)	D LOS 5.0 ADTs (DHVs)	Middle E LOS 5.5 ADTs (DHVs)	Urban Design Class [Design Speed] (mph)[3]	No.	Lane Widths (feet)[5]	Median Widths (feet)	Range of Normal Widths[8]	Range of Widths including Bike Accommodations/ Lanes	Range of Normal Widths[8]	Range of Widths including Bike Accommodations/ Lanes
Locals	N/A	Low Volume Residential (0-250 ADT)			1a [20-25]	1	12	No	N/A	N/A	28	N/A
		Volume not a consideration			1b [25-30(20)]	2	10-12 (9)	No	24-28 (22)	32-36 (30)	36-40 (32)	46-56 (44)
Arterials and Collectors	N/A	≤ 4,500 ADT (660 DHV)			2a [30-45]	2	11-12 (10)	No	34-36 (24)	34-36 (32)	46-48 (34)	48-56 (46)
	Worst Best	6,500 (1086) 20,000 (2260)	7,500 (1170) 22,500 (2475)	8,000 (1216) 25,000 (2700)	2b [30-45]	2	11-12 (10)	No	34-36 (24)	34-36 (32)	46-48 (34)	48-56 (46)
	Worst Best	16,000-(1888) 41,000 (4100)	17,500 (2048) 47,000 (4610)	18,000 (2088) 50,500 (4900)	3 [30-45]	4	11-12 (10)	No	48-60 (44)	56-60 (52)	68-72 (54)	70-80 (66)

FDM 11-20 Attachment 1.5 Transitional and High Speed Urban Roadway Criteria for Posted Speed Limits of 45 - 55 mph

Design Class[1]	Design ADT	No. of Lanes	Lane Widths By Posted Speed[2]		Median Width[3]	Shoulder (Curb Offset) Width Based on Posted Speed[4]				
						45 mph (By Level of Development)			50-55 mph	Bike Lanes[5]
			45-50 mph	55 mph		Undeveloped	Developing[5]	Developed[5]		
Collectors & Locals										
UCL1	0-400	2	**11-12** (10)	**11-12** (10)		**2** (1.8)	**2** (1.8)	**2** (1)	**2**	**5**
UCL2	400-1500	2	**11-12**	**11-12**		**6** (5)	**6** (1.8)	**4-6** (1-1.8)	**6**	**5-6**
UCL3	1500-2000	2	**11-12**	**12**		**6**	**6** (1.8)	**4-6** (1-1.8)	**6**	**5-6**
UCL4	2000-3500	2	**12**	**12**		**6**	**6** (1.8)	**4-6** (1-1.8)	**6**	**5-6**
UCL5	3500-20,000	2	**12**	**12**		**8**	**8** (1.8)	**4-8** (1-1.8)	**8**	**5-8**

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Design Criteria Summary Table

Design Criteria	Existing Value	Design Standard Posted Speed <=40 MPH	Design Standard Posted Speed =45 MPH
Functional Class	Minor Arterial	Minor Arterial - Urban	Minor Arterial - Urban
Design Class		2b	UCL5 (Developing)
AADT	3,700 (WisDOT Map)	6,500 - 20,000	3,500 - 20,000
Posted Speed	45 mph	40 mph	45 mph
Design Speed	50 mph	45 mph	50 mph
Two Way Left Turn Lane **ADT** **Width**	 N/A N/A	 8,000 – 17,500 12-16 feet	 8,000 – 17,500 12-16 feet
Roadway (No Parking) **Rural Section** **Urban Section**	 2-12' Lanes 4-11' Lanes (44' f-f)	 N/A 2-11' Lanes 12' - 14' TWLTL 5' - 6' Bike Lanes (44' - 48' f-f)	 N/A 2-12' Lanes 14' – 16' TWLTL 6' Bike Lanes (54' f-f)
Sidewalk	None	None	None
Curb and Gutter	6" Vertical Face	6" Vertical Face	6" Slope Face
Lateral Clearance	---	4 feet	6 feet

Conclusion

The northern limits of the proposed CTH I modernization project ties into an existing urban section that has four travel lanes, no on-road bicycle accommodations, and is 44 feet wide from face of curb to face of curb. The following decisions need to be made prior to moving forward in preliminary design. The decisions include:

1. Will the roadway from 35th Avenue to Waukau Avenue remain a 4-lane section with no bike accommodations or will it be modernized to a 3-lane section with bike accommodations?
2. For a posted speed limit of 40 mph or less, the minimum width of roadway to accommodate two travel lanes, TWLTL, and on-road bike lanes is 44 feet face to face of curb. The desirable width is 48 feet face to face of curb. Will the posted speed limit be reduced from 45 mph to 40 mph or less? Will the roadway be designed to minimum standards or desirable standards?
3. For a posted speed limit of 45 mph, the minimum width of roadway to accommodate two travel lanes, TWLTL, and on-road bike lanes is 54 feet face to face of curb. Will the roadway from 35th Avenue to Waukau Avenue be widened to 54 feet to match the new proposed typical section?

Recommendation

To meet design standards for modernization of a minor arterial, to accommodate the developing area and future left turn movements, and to accommodate on-road bicycle lanes, it is recommended to design CTH I to desirable standards for a Design Class 2b (48' f-f), reduce the posted speed limit to 40 mph, and change CTH I from 35th Avenue to Waukau Avenue from a 4-lane section to a 3-lane section with on-road bike accommodations.

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