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TRANSPORTATION ANALYSIS

DATE: June 23, 2023

TO: Reed Dunbar | City of Eugene

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SUBJECT: Eugene Broadway Lane Reduction Transportation Analysis Project #23027-000

PROJECT BACKGROUND

The City of Eugene is looking to repave Broadway-Franklin Boulevard between Mill Street and 11th Street. This paving project would include the reduction of three travel lanes to two travel lanes in both the eastbound and westbound direction where applicable. The lane reduction would allow for additional curbside, parallel parking in some places and new vegetated stormwater facilities in other areas.

The potential changes due to the proposed land reduction are as follows:

- Reduce existing triple southbound left turn lanes to dual lanes at Broadway and Mill Street
- Reduce existing dual eastbound through lanes to single lane at Broadway and Mill Street
- Reduce existing triple through lanes to dual through lanes on Broadway between Mill Street and Hilyard Street
- Reduce three westbound travel lanes on Broadway-Franklin Boulevard between E 11th Avenue and Hilyard Street to two westbound travel lanes, including the reduction of the two westbound right turn lanes to a single westbound right turn lane
- Upgrade pedestrian hybrid beacon (PHB) at 515 E Broadway to a pedestrian signal

The study intersections are listed below and shown in Figure 1.

- Mill Street & 8th Avenue
- Broadway & Mill Street
- Broadway & Patterson Street
- Broadway & Hilyard Street
- Broadway & Alder Street

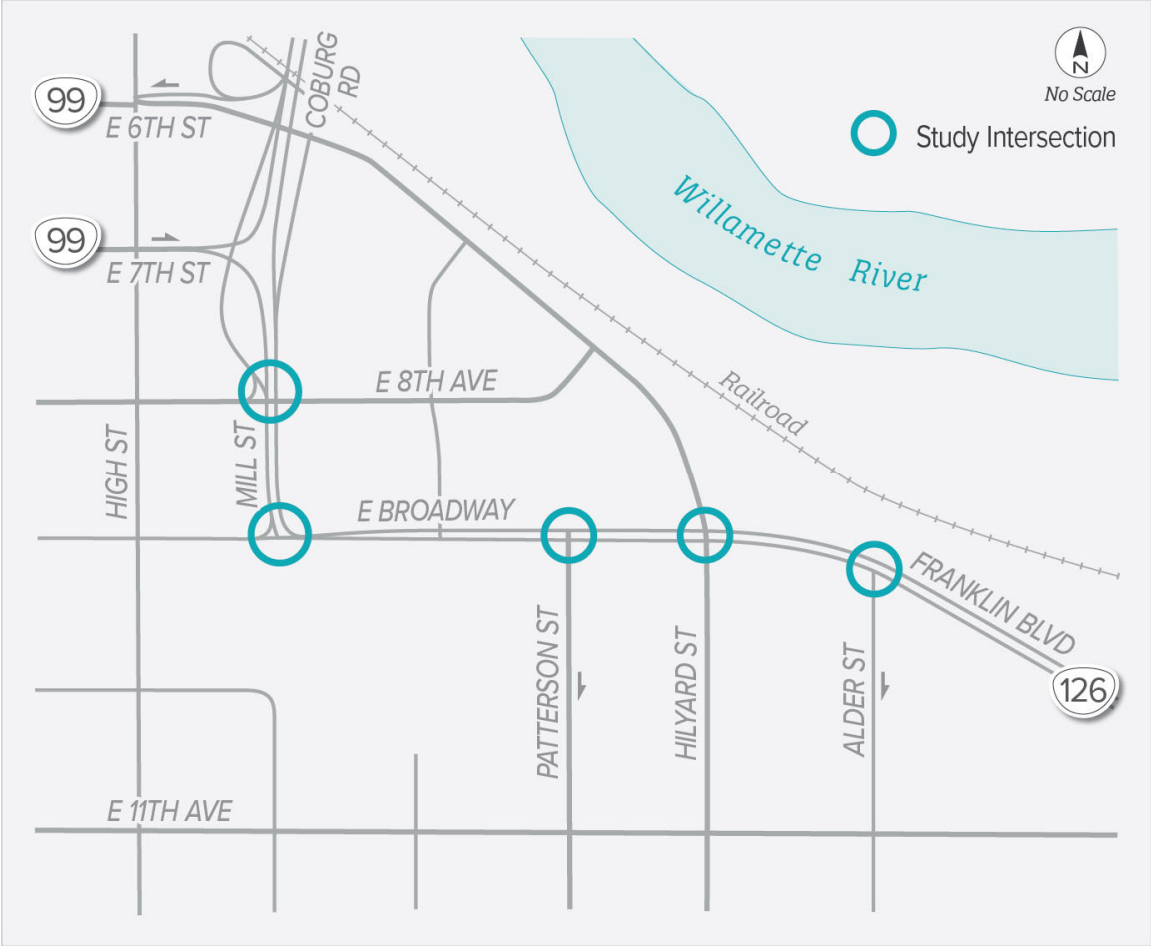

FIGURE 1: STUDY AREA

EXISTING CONDITIONS

EXISTING TRAFFIC VOLUMES

Weekday AM and PM peak hour turning movement counts (7:00-9:00 am and 4:00-6:00 pm) were collected at the study intersections in February and April 2023. The existing traffic volumes are shown in Figure 2.

The 2023 traffic volumes were compared to historic 2017 traffic volumes at the same locations and were found to be an average of 10% lower than 2017 conditions in the AM peak hour and 6% lower in the PM peak hour.

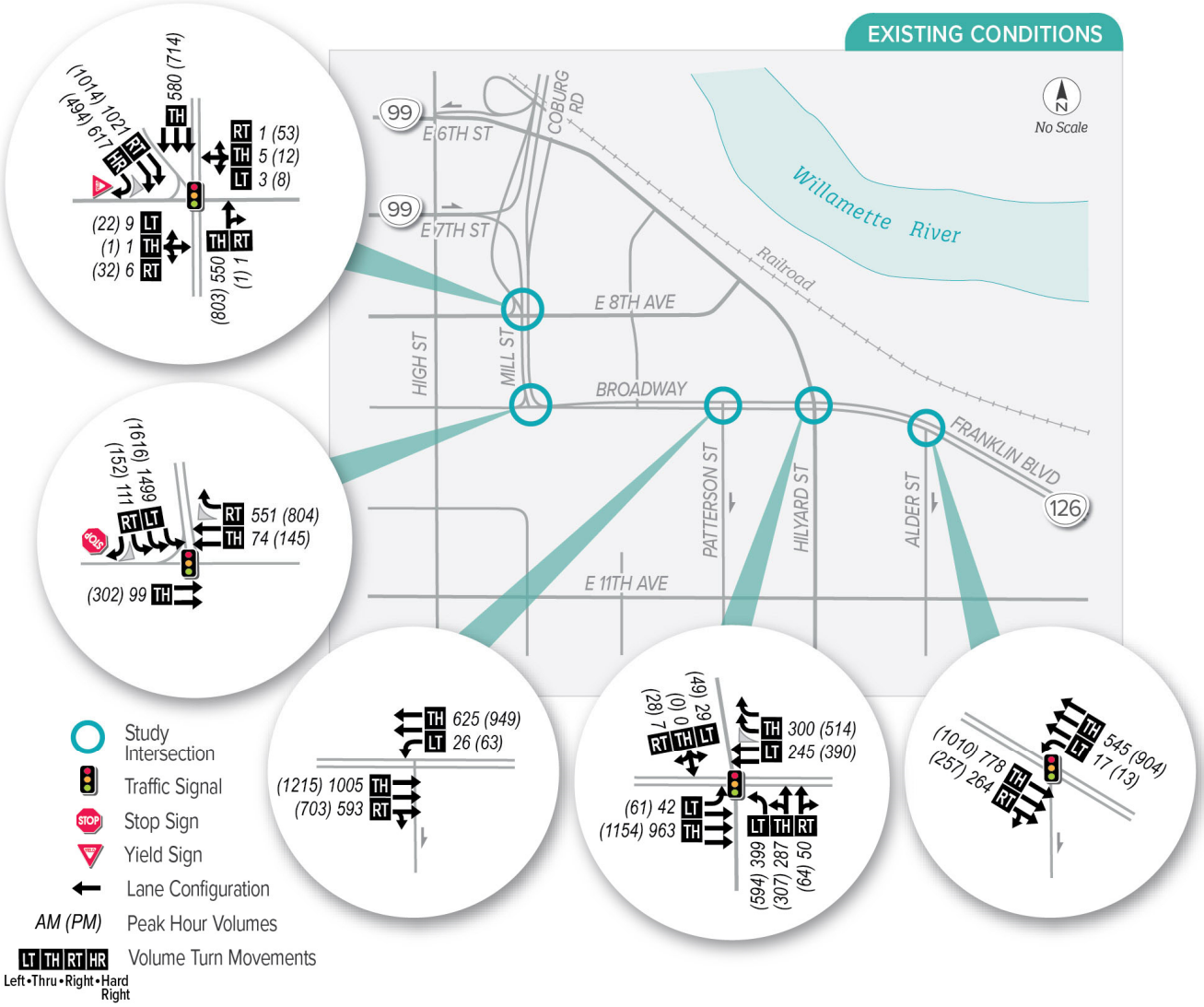

FIGURE 2: EXISTING VOLUMES & LANE CONFIGURATIONS

INTERSECTION PERFORMANCE MEASURES

Level of service (LOS) ratings and volume-to-capacity (v/c) ratios are two commonly used performance measures that provide a good picture of intersection operations.

- **Level of Service (LOS):** A "report card" rating (A through F) based on the average delay experienced by vehicles at the intersection. LOS A, B, and C indicate conditions where traffic moves without significant delays over periods of peak hour travel demand. LOS D and E are progressively worse operating conditions. LOS F represents conditions where average vehicle delay has become excessive and demand has exceeded capacity.

- **Volume-to-capacity (v/c) ratio:** A decimal representation (typically between 0.00 and 1.00) of the proportion of capacity that is being used at a turn movement, approach leg, or intersection. It is determined by dividing the peak hour traffic volume by the hourly capacity of

a given intersection or movement. A lower ratio indicates smooth operations and minimal delays. As the ratio approaches 1.00, congestion increases, and performance is reduced. If the ratio is greater than 1.00, the turn movement, approach leg, or intersection is oversaturated and usually results in excessive queues and long delays.

REQUIRED OPERATING STANDARDS

The study intersections are located within the City of Eugene's jurisdiction. Per the City of Eugene Transportation System Plan (TSP), the minimum operation standards during the morning and evening peak hours for intersections is LOS E.[1]

EXISTING OPERATING CONDITIONS

Existing traffic operations at the study intersections were determined for the AM and PM peak hours based on the Highway Capacity Manual (HCM) 2000 methodology.[2] Because Synchro's HCM 6th Edition analysis does not support the analysis of a pedestrian signal phase or five-leg intersections, both the existing and build operating conditions were analyzed using Synchro's HCM 2000 methodology at all intersections for consistency. The results were then compared with the City of Eugene's minimum acceptable operating standards. Table 1 lists the estimated v/c ratio, delay, and LOS for the five study intersections. As shown, existing operations at the study intersections meet the City's operating standards.

TABLE 1: EXISTING (2023) OPERATING CONDITIONS

INTERSECTION	OPERATING STANDARD	AM PEAK HOUR			PM PEAK HOUR		
		V/C RATIO	DELAY (SECS)	LOS	V/C RATIO	DELAY (SECS)	LOS
SIGNALIZED							
MILL STREET / 8TH AVENUE	LOS E	0.69	12.2	B	0.83	20.6	C
BROADWAY / MILL STREET	LOS E	0.60	6.9	A	0.76	12.3	B
BROADWAY / HILYARD STREET	LOS E	0.58	16.2	B	0.73	20.4	C
BROADWAY / ALDER STREET	LOS E	0.30	1.8	A	0.35	2.2	A
UNSIGNALIZED							
BROADWAY /PATTERSON STREET*	LOS E	0.08	15.8	C	0.29	25.8	D

SIGNALIZED INTERSECTION:
Delay = Average Intersection Delay (secs)
v/c = Total Volume-to-Capacity Ratio
LOS = Total Level of Service

UNSIGNALIZED (TWO-WAY STOP CONTROLLED) INTERSECTION:
Delay = Critical Movement Approach Delay (secs)
v/c = Associated Movement Volume-to-Capacity Ratio
LOS = Level of Service
*Note: Delay shown is for westbound left turn

[1] Eugene 2035 Transportation System Plan, February 2017.

[2] Highway Capacity Manual, Transportation Research Board, 2000.

EXISTING QUEUING ANALYSIS

A queuing analysis was performed using SimTraffic to evaluate queues for existing conditions at four of the study intersections. The 95th percentile queue lengths are shown in Table 2 rounded up to the nearest 10 feet.

TABLE 2: QUEUING ANALYSIS (EXISTING)

INTERSECTION	MOVEMENT	EXISTING STORAGE LENGTH (FT)	AM PEAK HOUR	PM PEAK HOUR
			95TH PERCENTILE QUEUE (FT)	
BROADWAY / MILL STREET	EB TH (Dual)	400	70	130
	WB TH (Dual)	1000	60	70
	WB R	250	0	0
	SB L (Triple)	330	210	310
	SB R	100	**120**	**130**
BROADWAY / PATTERSON STREET	EB TH (Dual)	700	40	40
	EB TH-R	700	160	190
BROADWAY / HILYARD STREET	EB L	90	70	100
	EB TH (Triple)	470	160	190
	WB TH (Dual)	510	100	150
	WB R (Dual)	325	60	130
BROADWAY / ALDER STREET	WB TH (Triple)	1000+	70	120
	WB L	240	40	40

Length (feet) = 95th percentile queue exceeds existing storage length

As shown, existing queue lengths on all approaches of the intersections are contained within the available storage except the southbound right approach at Broadway & Mill Street. However, this is due to the queues in the southbound left turn lanes blocking vehicles from entering the right turn lane.

PROJECT IMPACTS

The transportation analysis in this report evaluates the vehicle operations and queuing at the study intersections to determine the impacts of the lane reduction in both directions on Broadway. Build changes include the following and are depicted in Figure 3:

- Reduce existing triple southbound left turn lane to dual lanes at Broadway and Mill Street
- Reduce existing dual eastbound through lanes to single lane at Broadway and Mill Street
- Reduce existing triple eastbound through lanes to dual lanes on Broadway at Patterson Street and Hilyard Street
- Reduce three westbound travel lanes on Broadway-Franklin Boulevard at Alder Street
- Reduce the dual westbound right turn lanes on Broadway at Hilyard Street to a single right turn lane

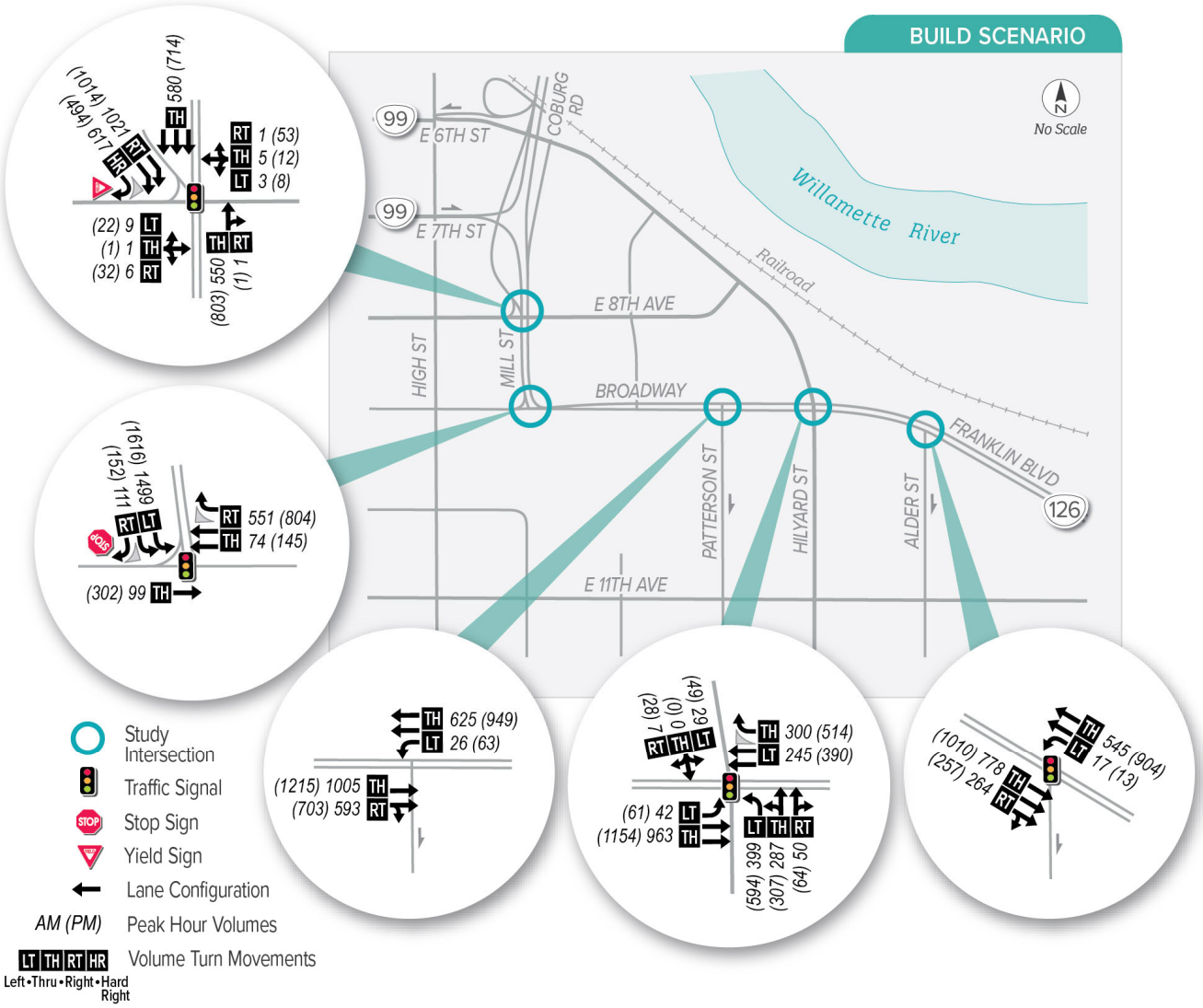

FIGURE 3: BUILD VOLUMES & LANE CONFIGURATIONS

FUTURE OPERATING CONDITIONS

The table below lists the estimated v/c ratio, delay, and LOS for the five study intersections under the build scenario. As shown, build operations at the study intersections meet the City standard of LOS E.

The delay shown for Broadway/Patterson Street represents the westbound left turn movement and actually experiences a decrease in delay with the lane reduction on Broadway. This is due to the left turning vehicles only needing to find a gap in eastbound traffic for two lanes versus three lanes, which is more difficult.

TABLE 3: BUILD (2023) OPERATING CONDITIONS

INTERSECTION	OPERATING STANDARD	AM PEAK HOUR			PM PEAK HOUR		
		V/C RATIO	DELAY (SECS)	LOS	V/C RATIO	DELAY (SECS)	LOS
SIGNALIZED							
MILL STREET / 8TH AVENUE	LOS E	0.75	13.5	B	0.83	21.2	C
BROADWAY / MILL STREET	LOS E	0.84	13.1	B	0.93	28.0	C
BROADWAY / HILYARD STREET	LOS E	0.72	19.2	C	0.86	24.5	C
BROADWAY / ALDER STREET	LOS E	0.30	2.0	A	0.37	2.2	A
UNSIGNALIZED							
BROADWAY/PATTERSON STREET*	LOS E	0.08	16.3	C	0.27	24.5	C

SIGNALIZED INTERSECTION:
Delay = Average Intersection Delay (secs)
v/c = Total Volume-to-Capacity Ratio
LOS = Total Level of Service

UNSIGNALIZED (TWO-WAY STOP CONTROLLED) INTERSECTION:
Delay = Critical Movement Approach Delay (WBL, secs)
v/c = Associated Movement Volume-to-Capacity Ratio (WBL)
LOS = Level of Service (WBL)
*Note: Delay shown is for westbound left turn

BUILD QUEUING ANALYSIS

A queuing analysis was performed using SimTraffic to evaluate queues for existing conditions at four of the five study intersections. The 95th percentile queue lengths are shown in Table 4 rounded up to the nearest 10 feet.

TABLE 4: QUEUING ANALYSIS (BUILD)

INTERSECTION	MOVEMENT	EXISTING STORAGE LENGTH (FT)	AM PEAK HOUR	PM PEAK HOUR
			95TH PERCENTILE QUEUE (FT)	
BROADWAY / MILL STREET	**EB TH**	400	120	**550**
	WB TH (Dual)	1000	150	260
	WB R	250	10	60
	SB L (Dual)	330	**380+**	**390+**
	SB R	100	**290**	**220**
BROADWAY / PATTERSON STREET	**EB TH**	700	30	70
	EB TH-R	700	110	140
BROADWAY / HILYARD STREET	EB L	90	80	90
	EB TH (Dual)	470	180	210
	WB TH (Dual)	510	90	130
	WB R	325	60	150
BROADWAY / ALDER STREET	WB TH (Dual)	1000+	100	160
	WB L	240	40	40

MOVEMENT = different from existing conditions

Length (feet) = 95th percentile queue exceeds existing storage length

As shown, existing queue lengths on all approaches of the intersection are contained within the available storage except the southbound and eastbound approaches at Broadway & Mill Street. The reduction in southbound lanes on Mill Street (from three to two lanes) causes the vehicle queues to spill back into the intersection at 8th Avenue. The reduction in eastbound through lanes on Broadway Street (from two to one) causes the vehicle queues to increase 4-fold and spill back through the High Street intersection (400 feet upstream). Therefore, due to the proposed lane reduction project, queuing impacts can be expected at the Broadway & Mill Street intersection. It is recommended that the eastbound through lanes be maintained at two lanes and not reduced to a single lane due to the queuing estimates. If two eastbound lanes are provided, queues would be similar to existing conditions.

At the Patterson Street intersection, the lane reduction in the eastbound direction (three lanes to two lanes) does not result in any significant queuing impacts. In fact, the queues generated in the simulation model indicate that queues will be reduced with the project build. This is likely due to the lane reduction at Broadway & Mill Street acting as a "meter" for eastbound traffic on Broadway. A dedicated eastbound right turn lane at Patterson Street is not needed based on vehicle operations or queuing.

Similarly, the eastbound vehicle queues at Hilyard Street are also shorter compared to existing queues due to the "bottleneck" at the Mill Street intersection.

The westbound right turn lane vehicle queues at Hilyard Street are anticipated to be similar between the reduction from two turn lanes to one turn lane (130 feet). Therefore, no queuing impacts are expected at the Broadway & Hilyard Street intersection due to the proposed lane change. It is recommended that the single westbound right turn lane be a length of 250 – 300 feet.

PEDESTRIAN SAFETY RECOMMENDATIONS

With the replacement of the pedestrian signal at 515 E Broadway and the reduction of eastbound through lanes from three to two lanes, there are opportunities to improve pedestrian safety at the crossing location.

As part of the lane reduction, the southernmost, eastbound travel lane will be converted to on-street, parallel parking where feasible. It is recommended that a curb extension be installed at the south end of the pedestrian crossing so that the crossing distance is reduced, similar to what is currently provided on the north end of the crossing. This will also provide additional waiting space for pedestrians to queue and will improve sight distance for drivers and pedestrians. As observed during a field visit and based on collected count data, there were over 50 pedestrian crossings during the evening peak hour at this location with consistent crossings throughout the day due to its proximity to the university. If modified, curb ramps should be constructed to meet ADA standards.

ACCESS MANAGEMENT & SAFETY

In order to maximize the addition of on-street parallel parking on Broadway, it is recommended that access management strategies be considered that would reduce the number of driveways along Broadway. Access management strategies can help promote efficient and safe movement by reducing conflicts between vehicles and other modes of travel.

- Close driveways on Broadway for land uses with existing access points on Ferry Lane or Patterson Street
- Combine or consolidate driveways (i.e., shared access)

Applying these access management strategies will reduce the number of driveways along Broadway and increase the amount of potential parking. Reducing the number of driveways along Broadway can also result in a reduction of rear-end crashes.

SUMMARY OF FINDINGS & RECOMMENDATIONS

The following list summarizes the findings for the proposed changes on Broadway in Eugene, Oregon.

- **Reduce existing triple southbound left turn lane to dual lanes at Broadway and Mill Street**
  - Finding: Southbound vehicle queues on Mill Street are estimated to extend past the 8th Street intersection. Vehicle operations will meet the City's LOS E standard.
- **Reduce existing dual eastbound through lanes to single lane at Broadway and Mill Street**
  - Finding: Eastbound vehicle queues on Broadway were estimated to increase 4-fold and spill back through the High Street intersection (400 feet upstream). It is recommended that this approach be maintained as two travel lanes to reduce vehicle queue impacts for both eastbound and southbound. Having two eastbound travel lanes will allow more green time to be allocated to Broadway reducing queuing impacts to the southbound approach. Vehicle operations will meet the City's LOS E standard.
- **Reduce existing triple eastbound through lanes to dual lanes on Broadway at Patterson Street and Hilyard Street**
  - Finding: Eastbound queues will be shorter at both intersections with the proposed lane reduction. This is due to the lane reduction at Broadway & Mill Street acting as a "meter" for eastbound traffic on Broadway. Vehicle operations at this intersection will meet the City's LOS E standard.
- **Reduce three westbound travel lanes on Broadway-Franklin Boulevard at Alder Street**
  - Finding: Westbound queues will not exceed available storage due to the proposed lane reduction. Vehicle operations at this intersection will meet the City's LOS E standard.
- **Reduce the dual westbound right turn lanes on Broadway at Hilyard Street to a single right turn lane**
  - Finding: Westbound queues are anticipated to be approximately 150 feet with the lane reduction. Therefore, no queuing impacts are expected at the Broadway & Hilyard Street intersection due to the proposed lane change. It is recommended that the single westbound right turn lane be maintained at a length of 250 – 300 feet to improve safety of traffic backing into through lanes and to accommodate potential longer queues in the future.

- It is recommended that a curb extension be installed at the south end of the pedestrian crossing at the future pedestrian signal so that the crossing distance is reduced, similar to what is currently provided on the north end of the crossing.
- It is recommended that access management strategies be considered as part of the proposed project. These strategies would reduce the number of driveways along Broadway, which can increase the amount of on-street parking and reduce rear-end crashes.