State of Maine Department of Transportation MEMORANDUM

To:Joyce Taylor, Darryl BelzDate: April 14, 2015

From: Ed Hanscom, Transportation Analysis Section

Subject: Manchester 3-Lane Conversion Pre-Trial Analysis

In anticipation of a paving project on US 202 in Manchester, MaineDOT is considering conversion of a 3-lane section from two eastbound lanes and one westbound lane to one eastbound lane, one westbound lane, and a center two-way left-turn lane (TWLTL). Approximately one mile in length, the section extends eastward from Old Winthrop Road (near J&S Oil) to Pelton Hill Road. To test the effectiveness of the proposed change in lane configuration, MaineDOT plans to implement the change on a trial basis by restriping the section of US 202 this spring. The purpose of this memorandum is to summarize the results of a pre-trial analysis of this proposed conversion.

The analysis approach is to evaluate existing safety and mobility conditions on the section and predict the impacts of the conversion in terms of crashes, capacity, speed, and level of service. Crash history was obtained for the three years 2010 through 2012. A speed-delay study was conducted for both eastbound and southbound directions during three weekday time periods: AM peak, early PM, and PM peak. The floating car method was used to record travel times and speeds on ten runs in each direction for each time period. Seven checkpoints were used: Granite Hill Rd, Old Winthrop Rd, Bowdoin St, Range Way, cemetery west driveway, Pelton Hill Rd, and Prescott Rd. Highway Safety Manual techniques were used to predict the impact of the proposed change on crashes and crash costs. Highway Capacity Manual techniques were used to predict the impact of the proposed to predict the impact on capacity, speed, and level of service.

Existing Conditions

While not classified as a high crash location, this segment of US 202 experienced 31 crashes in 2010 through 2012 between Old Winthrop Road and Pelton Hill Road. Eight of these involved personal injury. The dominant type of crash involved an eastbound or westbound vehicle waiting to turn left from US 202 being rear-ended by another vehicle.

In terms of traffic volume, this segment of US 202 carries over 20,000 vehicles on an average day. The eastbound volume on weekdays peaks around 7:30 AM, with close to 1200 vehicles per hour. The westbound volume on weekdays peaks around 4:30 PM, with close to 1400 vehicles per hour. With two eastbound lanes, the eastbound capacity is more than adequate for the volume of traffic. The westbound direction

experiences traffic flow that is close to capacity, with a v/c ratio of 0.92, as the following table shows.

US 202 Current Hourly Volumes and Capacities					
Posted Speed: 45 mph		Current Lanes			
		1 WB, 2 EB			
		Eastbound	Westbound		
AM Peak	Volume (vph)	1180	458		
	Capacity (vph)	2993	1191		
	V/C Ratio	0.39	0.38		
Early PM	Volume (vph)	679	741		
Capacity (vph)		2517	1412		
	V/C Ratio	0.27	0.52		
PM Peak	Volume (vph)	680	1382		
	Capacity (vph)	2725	1496		
	V/C Ratio	0.25	0.92		

The speed-delay study of this segment, conducted on April 1 and 2, provided observations of existing speeds and levels of service, which are based on the percentage of the posted speed attained by traffic. Between Old Winthrop Road and Pelton Hill Road, the posted speed is 45 mph. Beyond those intersections, the posted speed is 35 mph. The following criteria were used to determine level of service:

% of Posted Speed	LOS
91.7 or more	А
83.3 to 91.7	В
75.0 to 83.3	С
66.7 to 75.0	D
0.0 to 66.7	Е
V/C Ratio greater than 1.00	F

As the following tables show, the levels of service (LOS) on US 202 range from A to E. In the 45 mph segment, the eastbound LOS is mostly A, with LOS B between the cemetery and Prescott Rd in the AM peak. This portion of the three-lane segment has several commercial driveways on the north side of the roadway. In the westbound direction, the 45 mph segment has mostly LOS is A on most portions, except west of the cemetery in the PM peak, when the LOS is B to Old Winthrop Rd. West of Old Winthrop Rd, where the speeds are influenced by signal delays in Manchester village, the LOS is E during the PM peak.

US 202 Eastbound Observed Speeds and Levels of Service								
		Granite Hill Rd	Old Winthron	Boundoin St	Range War	Cennetery	Pelton Hill Ro	Prescott Rd
Posted S	peed	35	45	45	45	45	35	
								Overall
AM	Speed	39.4	45.7	49.2	48.9	39.8	30.6	41.1
Peak	LOS	А	А	А	А	В	В	
Early	Speed	34.6	43.3	49.4	43.4	48.3	39.1	43.3
РМ	LOS	А	А	А	А	А	А	
PM	Speed	33.3	43.9	49.2	43.7	48.8	38.6	43.2
Peak	LOS	А	А	А	А	А	А	

US 202 Westbound Observed Speeds and Levels of Service								
		Granite Hill Rod	Old Winthron	Boundoin St	Range War	Cennetery	Pelton Hill Ro	Prescott Rd
Posted S	beed	35	45	45	45	45	35	
								Overall
AM	Speed	26.3	40.7	45.4	43.4	49.0	38.9	40.9
Peak	LOS	С	В	А	А	А	А	
Early	Speed	25.1	41.5	46.2	45.7	48.3	37.7	40.9
РМ	LOS	D	А	А	А	А	А	
PM	Speed	18.3	40.7	41.0	38.1	41.8	38.4	35.8
Peak	LOS	E	В	В	В	А	A	

Proposed Conditions

Conversion of the inside eastbound lane to a TWLTL would have an impact on traffic safety and eastbound capacity. Both directions of traffic should benefit from the reduced likelihood of rear-end crashes involving left turns. Eastbound capacity on US 202 would be reduced by about 50%, but, as the following table shows, the remaining capacity should be adequate for AM peak eastbound volumes.

US 202 Proposed Hourly Volumes and Capacities					
Posted Speed: 45 mph		Proposed Lanes			
		1 WB, 1 TWLTL, 1 EB			
		Eastbound Westbou			
AM Peak	Volume (vph)	1180	458		
	Capacity (vph)	1496	1191		
	V/C Ratio	0.79	0.38		
Early PM	Volume (vph)	679	741		
	Capacity (vph)	1259	1412		
	V/C Ratio	0.54	0.52		
PM Peak	Volume (vph)	680	1382		
	Capacity (vph)	1362	1496		
	V/C Ratio	0.50	0.92		

Eastbound travel speeds would also likely to be affected by the conversion. Because eastbound passing lane would be eliminated, traffic speeds would be moderated in those portions of the segment where speeds are relatively high. Little change would be expected in the speed of westbound vehicles.

Potential Benefits

The lane conversion can be expected to provide significant safety benefits for travelers on US 202. The frequency of crashes would be expected to be reduced by at least 20% in the eastbound direction and 5% in the westbound direction, based on national experience with implementation of TWLTLs. Because of the dominance of left-turn rear-end crashes on this segment of US 202, the crash reduction from the conversion could be higher.

The table below shows the predicted reduction in crashes from the TWLTL conversion and the estimated annual safety benefits. Based on an overall 12% reduction in crashes, the crash costs could be reduced by \$37,000 per year.

Maine Crash Summary (2010	-12)						
EB and WB Combined			(2007 values)	Existing	3TWLTL	3TWLTL	
	Observed	Observed	(2010 HSM)	3 Lanes	Predicted	Predicted	
	Crashes	Crashes	Crash Cost by	Annual	Annual	Annual	
	2010-12	Annual	Collision Type	Crash Costs	Crashes	Crash Costs	
Fatal (K)	0	0.0	\$4,810,700	\$0	0.0	\$0	
Incapacitating injury (A)	0	0.0	\$259,200	\$0	0.0	\$0	
Nonincapacitating injury (B)	7	2.3	\$94,800	\$218,040	2.0	\$191,875	Overall
Possible injury (C)	1	0.4	\$53,900	\$21,560	0.4	\$18,973	Cost Reduction
Property damage only (PD)	23	7.7	\$8,900	\$68,233	6.7	\$60,045	12%
TOTALS	31	10.4		\$307,833	9.1	\$270,893	\$36,940
% Injury	26%	26%			26%		
(from Clearinghouse)	EB (.95) & WE	3(.80) combined					
(AII)=	0.88	Injury=	0.88	PDO=	0.88		

Trial Implementation and Follow-Up

The trial implementation of the TWLTL with the spring 2015 restriping of US 202 should provide valuable information on the effectiveness of the conversion before MaineDOT commits to a long-term implementation. The trial will demonstrate how the TWLTL and the change in eastbound capacity would affect travel speeds and levels of service on US 202. Depending on the length of the trial, it could also provide indications on changes in travel patterns. While the trial is in progress, Transportation Analysis recommends that a follow-up speed-delay study be conducted to allow a before-and-after comparison of the effects of the conversion.