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MEMORANDUM

To: Mitch Steckler, NDDOT

From: Shawn Birst, UGPTI-ATAC

Date: December 20, 2001

Re: User Cost Analysis of State Street/Boulevard Avenue (Bismarck, ND)

After reviewing the memorandum dated November 13, 2001, the NDDOT requested some information related to potential delay costs on possible diversion routes. As mentioned in the original memo, it is difficult to calculate the road user costs for traffic diverting from the work zone since there are several possible roadways for motorists to traverse depending upon their origins and destinations. However, it was decide to analyze two potential routes that would divert traffic around the State Street/Boulevard Avenue work zone (note Figure 1):

- Diversion Route #1: 16th Street ø 19th Street ø Century Avenue
- Diversion Route #2: Washington Street ø Century Avenue

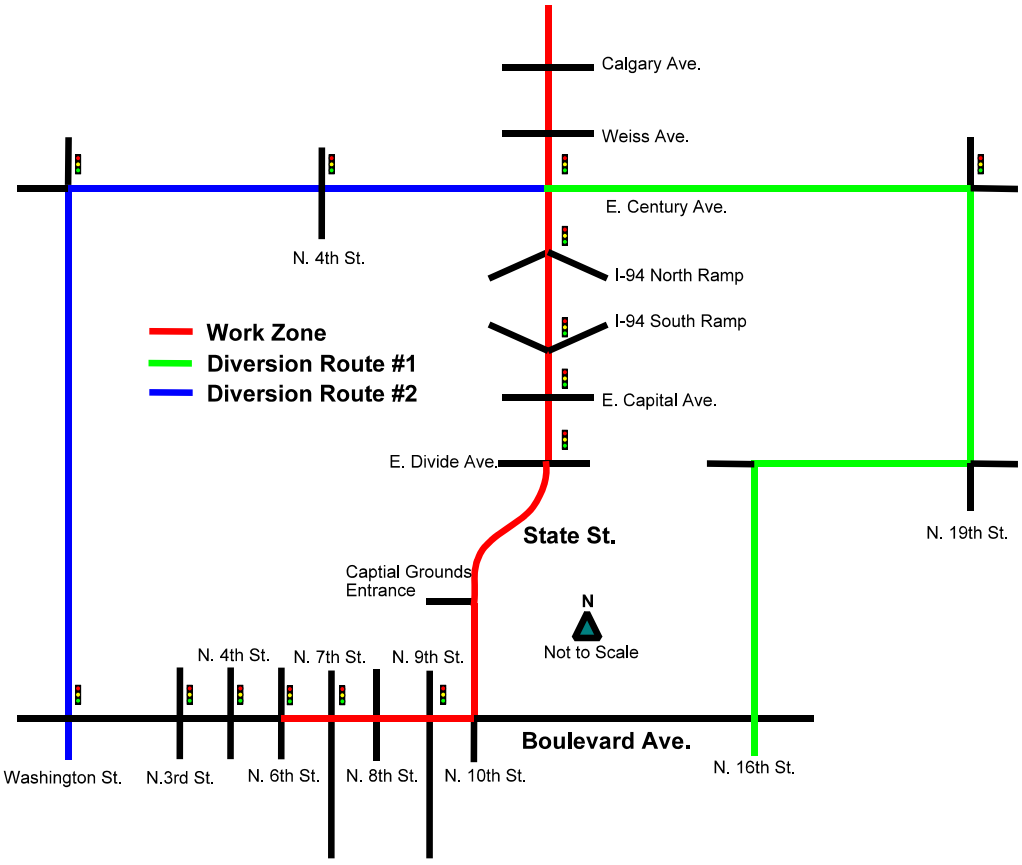

Figure 1. Analysis Network

The five scenarios were simulated for 16 hours using the INTEGRATION simulation model, including the Base Case, Construction Base Case, Construction 10%, Construction 20%, and Construction 30%. The Base Case consisted of the current (preconstruction) conditions of the corridor, while the construction cases simulated the proposed lane reductions along with work zone diversion percentages of 0, 10, 20, and 30 percent. In addition, the additional traffic was added to the diversion routes, which correlated to the work zone diversion percentage.

The diverted traffic from the work zone was equally split between the two diversion routes. The average daily traffic (ADT) traveling northbound on the southern portion of State Street was 10,200, while the southbound traffic on the northern portion was 9,300. Although it is difficult to determine the traffic that is traveling completely through the work zone, this analysis diverted the specified diversion percentages from the northern and southern ADT values. Therefore, a 10% diversion would increase the traffic along both diversion routes by 510 and 465 in the northbound and southbound directions, respectively.

Similar to the initial study, the construction scenarios did not generate all of the vehicles due to congestion problems. Deferred traffic for the Construction Base Case, Construction 10%, Construction 20%, and Construction 30% scenarios equaled 9%, 6%, 3% and 2% of the intended traffic, respectively. Therefore, construction cases were modified to show the actual diversion rates.

The original analysis used a simulation network consisting of the roadways in Figure 1, however, the diverted traffic from the work zone was not rerouted to the possible diversion routes. Therefore, the original travel time comparisons for the work zone were diluted by vehicles traveling on the diversion routes. The updated analysis separated the travel time output into work zone, diversion routes, and the total network categories.

Based on the numerical output, the increase in travel time on the work zone ranged from 17 to 138 percent (Table 1). The delay increases for the diversion routes ranged from -2 to 27 percent. The -2 percent was caused by excess delays on the Construction Base Case that deferred vehicles from entering the network. The total network delay as a result of the road construction ranged from 20 to 89 percent, equating to $15,469 to $67,651 per day in user costs.

Table 1. Road User Costs Per Day.

	Travel Time (veh-hr)	% Increase	User Cost
Base Case			
State St. & Boulevard Ave.	4,150	--	$49,410
Diversion Routes	2,230	--	$26,549
Total Network	6,380	--	$75,958
Construction Base Case 9%*			
State St. & Boulevard Ave.	9,873	138	$117,542
Diversion Routes	2,190	-2	$26,068
Total Network	12,063	89	$143,610
Increased User Costs	**$67,651**		
Construction 16%*			
State St. & Boulevard Ave.	7,912	91	$94,187
Diversion Routes	2,364	6	$28,147
Total Network	10,276	61	$122,334
Increased User Costs	**$46,375**		
Construction 23%*			
State St. & Boulevard Ave.	7,097	71	$84,493
Diversion Routes	2,593	16	$30,875
Total Network	9,691	52	$115,369
Increased User Costs	**$39,410**		
Construction 31%*			
State St. & Boulevard Ave.	4,853	17	$57,776
Diversion Routes	2,827	27	$33,652
Total Network	7,680	20	$91,427
Increased User Costs	**$15,469**		

*Percentages reflect the amount of traffic that was diverted compared to the Base Case.
Assumptions: Heavy vehicle percentage = 3%, automobile operating cost = $11.50/hour, Heavy vehicle operating cost $25.00/hour.

If you have any questions regarding this memo, please contact me at (701)231-1063.

cc: Ricky Schatz, NDDOT
Mark Berg, City of Bismarck