9.0 Benefit/Cost Analysis

9.0 Benefit/Cost Analysis

The examination of the broader regional benefits and costs of the HOV facilities was one of the primary goals of the evaluation. By investigating these comprehensive systemwide benefits and costs, the quantitative value of opening the HOV facilities to all traffic was estimated. This quantitative benefit/cost figure, in combination with customer perceptions of the HOV facilities in the Twin Cities metropolitan area, help provide a comprehensive evaluation of HOV use in the region. This benefit/cost comparison evaluates the systemwide impacts of opening the I-394 and I-35W HOV facilities to all traffic, including impacts from opening future programmed and committed HOV facilities for 2020 to all traffic. Performance measures were identified to estimate the positive and negative impacts of opening the HOV lanes to all traffic, including travel time, safety, travel time reliability, vehicle emissions, and fuel use. The capital and operating and maintenance costs associated with converting the HOV lanes to mixed-use were also quantified for comparison with the benefits.

9.1 Analysis Approach

The identification of the regionwide benefits and costs relied heavily on the findings from the modeling analysis of the two HOV corridors. As mentioned in Section 7.0, the regional travel demand model was used to estimate the travel time and speed, throughput, and mode shift changes. The outputs of the model were input directly into the IDAS software program described previously in Section 7.0. IDAS was used to estimate the safety, emissions, fuel consumption, and travel time reliability impacts.

The benefit/cost analysis was assessed for the morning (6:00 a.m. to 8:00 a.m.) and afternoon (3:00 p.m. to 6:00 p.m.) peak periods for both current conditions and for 2020. The impact results from the two scenarios (with and without HOV lanes) were compared to isolate the incremental benefits/impacts.

9.1.1 Estimation of Benefits

The performance measure estimates produced for the benefit/cost analysis included:

- Average speeds and travel times;
- Travel time reliability (hours of delay saved);
- Crashes by type (fatality, injury, and property damage only);

- Air quality/emissions (hydrocarbons, carbon monoxide, and oxides of nitrogen); and
- Fuel consumption.

These impacts were estimated for the HOV facilities and their adjacent general-purpose lanes, as well as systemwide. The resulting changes in the measures were then summed across the morning and afternoon peak periods for each year.

Established per unit dollar values were then applied to the sum of the changes. For example, the estimated change in vehicle hours of travel was first multiplied with an average vehicle occupancy rate to estimate the change in person hours of travel. A value of travel time ($9.71 per hour) was then applied to the change in person hours of travel to determine the incremental dollar value of the travel time impact. Identical values were applied regardless of the positive or negative nature of the impact. Table 9.1 presents the unit values that were applied to estimate the dollar value of the various impact categories. Most of the values in Table 9.1 are the recommended values for use by the Minnesota Department of Transportation, Office of Investment Management (OIM). Emissions and fuel values are national averages as these were not available from OIM.

Table 9.1 Impact Value Assumptions

Impact Performance Measure	Unit	Value
Travel time	Person hour	$9.71
Travel time variability	Person hour	$9.71
Fatality accidents	Per accident	$3,300,000
Injury accidents	Per accident	$260,000
Property damage only accidents	Per accident	$4,100
Hydrocarbons	Per ton	$1,774
Carbon monoxide	Per ton	$3,731
Oxides of nitrogen	Per ton	$3,889
Fuel consumption	Per gallon	$1.45

The dollar values for each impact category were then summed to estimate the average daily impact value from opening the HOV lanes to all traffic. This figure was multiplied by 247, the number of days per year the HOV lanes are operated, to provide the annual benefit/impact estimate. This annual benefit figure forms the basis for comparison with the costs of opening the HOV lanes to all traffic.

9.1.2 Estimation of Costs

In order to provide a meaningful comparison of costs and benefits, an estimate of the costs associated with opening the HOV lanes to all traffic was required. This study assumed

that only nominal improvements to the facilities themselves would be made if the lanes were opened to all traffic. These improvements include sign removal, pavement marking removal, bus-only signing for the shoulders, and some drainage improvements for bus-shoulder lanes. More detailed analysis would need to be conducted to determine what geometric improvements should be made for optimum utilization of the lanes, as well as to optimize operations and safety. For instance, the access locations to the reversible, barrier-separated section of the HOV lane are constrained by one-lane entrances to a two-lane facility. If the HOV lane was opened to all traffic as is, there would be congestion and weaving problems (safety) at the entrance to the barrier-separated facility. In addition, there may be some pavement improvements necessary for the bus-only shoulder operations. This analysis assumes that the shoulder lanes will not require pavement upgrade. In addition, there are some areas where bus shoulders could only be added at significant cost (the Minnesota River Bridge on I-35W and the barrier-separated section on I-394). Neither the costs of doing this nor the benefits was included in the analysis (a discontinuous shoulder lane was assumed).

Other cost items obtained for this study include additional buses necessary to maintain existing headways due to the travel time increases in the corridors, drivers and operating and maintenance costs for these new buses, annual federal revenue loss to transit providers from operating service in HOV corridors, federal pay-back for the I-35W HOV lane funding, and replacement cost for the I-394 and I-35W environmental impact studies (EISs). Possible litigation costs resulting from these revised EISs were not included.

Certain cost and benefit items have not been included in the analysis as they are considered a societal transfer. In these instances, a particular benefit (or cost) is offset by a corresponding cost (or benefit). While these items may have significant benefits or costs for a specific party or locality, they represent transfers of impacts when viewed at the regional scale. Examples of items considered as transfers in this analysis include:

- **Parking –** An increase in SOV trips will likely result in increased parking revenues for municipalities. This revenue increase is offset by the corresponding increase in parking costs for individuals. In addition, if there is additional demand for parking downtown, the cost of parking may increase for all users or additional parking ramps may need to be constructed. This study does not address any potential parking cost changes due to demand.
- **Transit Fares –** A mode shift of transit riders to personal vehicles will result in decreased farebox revenues for transit agencies. This revenue decrease is offset by decreased transit fare payments by individuals. Increased vehicular-related costs to individuals are captured in the benefits/impacts costs in the fuel consumption value. This fare revenue loss is estimated at over $1.1 million per year.
- **Enforcement/Violation Revenue –** The decrease in HOV-related enforcement revenue is offset by a decrease in the violation payments made by individuals.

To provide additional sensitivity analysis, the benefit/cost comparison was performed for two scenarios: 1) Minnesota would have to pay back the federal funding for construction of the I-35W HOV lane; and 2) federal buy-back would not be required. The results of these analyses are presented in the following sections.

9.2 Analysis Findings

9.2.1 Year 2000 Analysis

Benefits of Opening the HOV Lanes to All Traffic

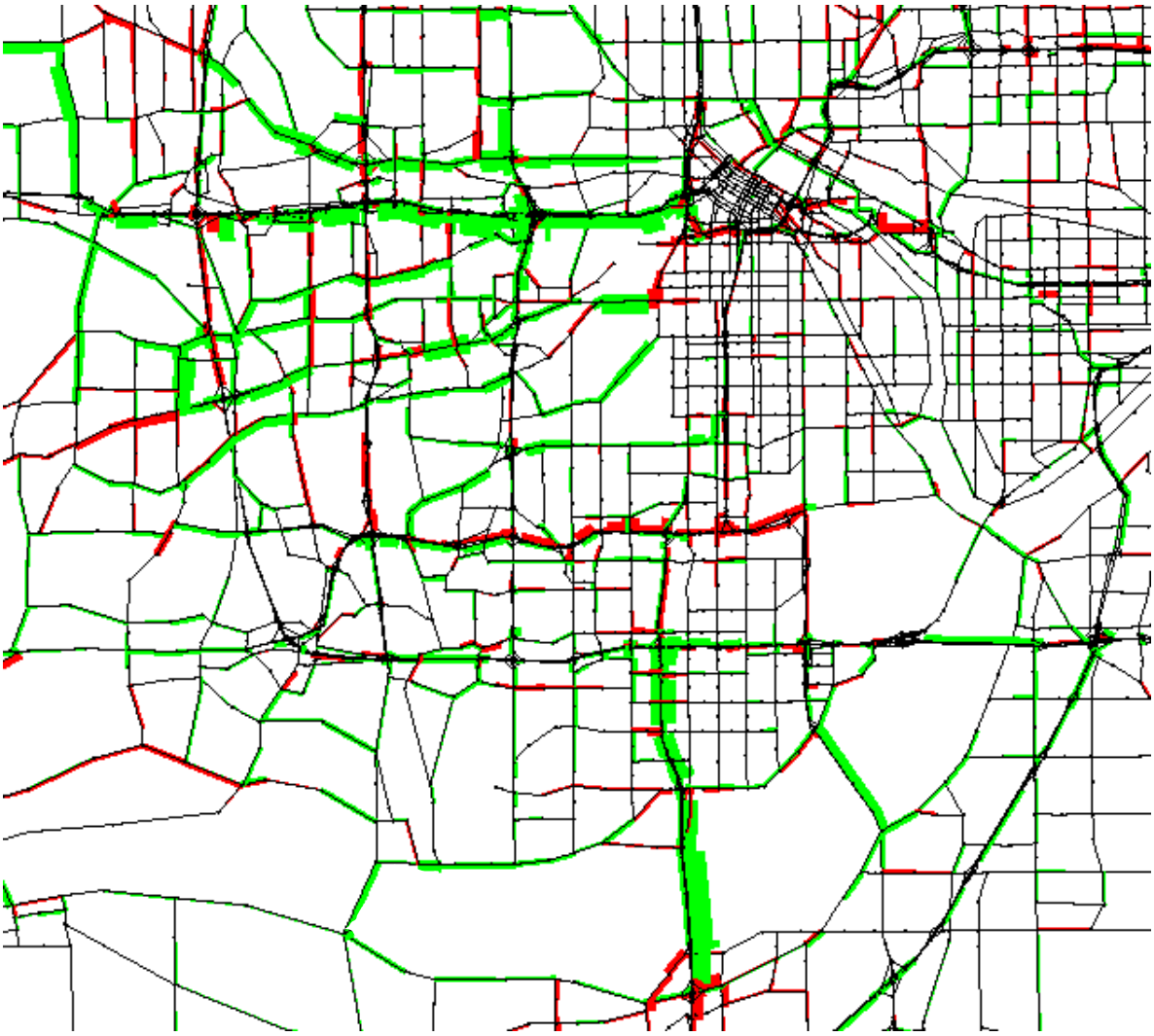
From the changes in systemwide performance characteristics due to opening the HOV lanes to all traffic, impacts were estimated for travel time, travel time reliability, safety, emissions, and fuel use. The analysis year from the model is 2000. However, the benefits identified in this section reflect 2001 dollars.

The analysis resulted in positive benefits estimated for most of the performance measures. Overall, when all of the impact categories are summed, the impacts of opening the HOV lanes to all traffic are positive and reflect approximately $10 million in benefits per year in 2000. Most of these benefits result from the positive effects of improved travel time and, hence, reductions in vehicle hours of travel more than outweighing the increase in vehicle miles of travel (VMT) resulting from the diversion of some trips from HOV and transit to SOV mode. Each of the impact categories is discussed in further detail below.

Travel Time Impacts – The model estimates that the improved travel speeds for the SOVs on the freeway facilities, as well as the improved speeds on other roadways in the region, more than offset the reduced speeds for the carpoolers and transit riders in the two corridors – resulting in a systemwide reduction of 831,000 person hours of travel time per year in 2000. Outside of the study corridors themselves, there are two effects: 1) improved speed on parallel arterial and trunk highways as commuters divert back to the added highway capacity; and 2) decreased speeds on access routes to and from the study corridors as more vehicles will likely be traversing these routes due to the diversion of traffic to the corridors and the increase in total number of vehicles resulting from mode shift from HOV and transit to SOV. These counterbalancing tendencies can be seen in Figure 9.1. This net change in travel time and speed represents savings of over $8 million in 2000. The travel time impact to the region is estimated to be the greatest benefit in the benefit/cost analysis in 2000.

Travel Time Reliability Impacts – Travel time reliability is a measure of the expected range in travel time and provides a quantitative measure of the predictability of travel time. Reliability of travel time is a significant benefit to travelers as individuals are better able to predict their travel times and, therefore, budget less time for the trip. While the travel time performance measure presented above quantifies changes in travel time on average or "normal" travel days, travel time reliability is a more appropriate quantification of the unexpected, non-recurring delays that result from incidents, special events, bad weather, or excessive congestion. Being on time for day care, a meeting, a flight, or a delivery are typical examples of commuter expectations for reliable travel time.

Figure 9.1 Estimated Speed Changes When HOV Lanes Opened to All Traffic – 2000 A.M. Peak



Note: Red (dark shading) equals decreases in speeds and green (light shading) represents improvements in speed.

The travel time reliability estimated for this study only includes the reliability on the freeway facilities in the region. It does not include arterial roadways or the reliability for the bus-only shoulder operations if the lanes were opened to all traffic. However, it is important to consider that the current HOV facility provides reliability at 55 mph, whereas if bus-only shoulders were used, it would only be reliable at a maximum of 35 mph. In addition, operation of the bus-only shoulder lanes is apt to be less reliable than bus operation in an HOV lane as it is very susceptible to weather- and incident-related disruptions.

It was estimated that opening the HOV lanes to all traffic would produce a benefit of about $100,000 in the year 2000. This equates to an estimated 44 less hours of unexpected delay per day.

Safety Impacts – The safety analysis estimated an increase in crashes if the HOV lanes were opened to all traffic. The result is an estimated increase of approximately seven-vehicle accidents per year in 2000. The majority of these accidents are anticipated to be injury or property damage only crashes. On an annual basis, the estimated increase in accidents results in a disbenefit of $1.2 million in 2000. This is a very small change and is largely due to the overall increase in regional VMT. The safety analysis for this study was limited to the model estimates. It does not take into account safety impacts resulting from the operation of bus-only shoulders or the operation of the barrier-separated lanes as general-purpose lanes, including the following:

- Weaving and bottlenecks which would result from the one-lane entry and exit constraints of the two-lane reversible, barrier-separated facility;
- Weaving and merging for use of the bus-only shoulders by transit vehicles; and
- Elimination of the speed differentials between the HOV concurrent flow sections and the general-purpose lanes.

Emissions Impacts – The analysis of the emissions impacts of opening the HOV lanes to all traffic produced mostly positive benefits, but some negative impacts in 2000. Emissions of hydrocarbons and carbon monoxide were anticipated to decrease, while oxides of nitrogen emissions increased slightly. The emission values were estimated in IDAS using Mobile5A emission rates. Overall, the sum of emissions benefits is positive at approximately $1.5 million in 2000.

Fuel Use – The improved travel speeds are expected to result in a reduction in fuel usage. This is estimated to be more than 4,000 gallons saved per day in 2000. This fuel use decrease equates to a benefit of $1.5 million.

Table 9.2 presents the annual estimates of impacts for each of the performance measures as a result of opening the HOV lanes to all traffic.

Costs

The majority of the capital costs associated with opening the lanes to all traffic involve an up-front, one-time capital outlay cost. The only exception to this is the number of additional buses necessary to maintain current headway levels. In the case of the additional buses, the useful life of the buses is 12 years. It was assumed that Minnesota would obtain a 20-year bond (consistent with the 20-year time horizon of the study) with an estimated yield to maturity of five percent to fund the capital costs. Therefore, a bus replacement cycle would be required.

Table 9.2 2000 Benefits of Opening the Lanes to All Traffic (2001 Dollars)

Performance Measure	Annual Change	Value
Travel time	831,200 hours saved	$8,071,200
Travel time reliability	10,800 hours saved	$105,300
Fatality accidents	0.1 additional accidents	($317,100)
Injury accidents	3.4 additional accidents	($887,200)
Property damage only accidents	3.5 additional accidents	($14,200)
Hydrocarbons	33 tons saved	$59,100
Carbon monoxide	370 tons saved	$1,438,800
Oxides of nitrogen	5 tons added	($16,800)
Fuel use	1,040,600 gallons saved	$1,508,900
Total annual benefit		**$9,947,900**

The estimated costs of opening the HOV lanes to all traffic include sign and pavement striping removal, bus-only signing removal, drainage improvements in the shoulder lanes, additional buses to maintain current headways, pay-back of federal funds for the I-35W HOV lane, replacement cost of the EIS on I-394 and I-35W, annual federal revenue loss to Metro Transit, and drivers and operations and maintenance for the new buses.

HOV Lane Costs – If the HOV lanes are opened to all traffic, some of the costs associated with operating the HOV facilities will be eliminated. However, the majority of the operating and maintenance costs will remain, as the reversible, barrier-separated lanes will still require operating costs for changing travel direction. This cost is assumed to be nominal.

Converting the HOV lanes to all traffic would require significant capital outlay costs. Signs and pavement markings would need to be removed and advance notice overhead signs for the I-394 reversible lanes would need to be modified. These costs (updated from 1999 dollars) were estimated by Mn/DOT to be the following: I-35W sign removal – $17,110; I-35W "diamond" pavement marking removal – $5,360; I-394 concurrent flow sign removal – $14,670; I-394 concurrent flow "diamond" pavement marking removal – $6,210; and I-394 reversible lanes sign removal – $24,340. This totals nearly $68,000.

This study assumed that bus-only shoulders would be implemented in the sections of the HOV facility that will be opened to all traffic wherever "feasible." This would be a one-time expenditure and would include bus-only signing, design, drainage, and labor. Areas where bus-only shoulders were not deemed feasible would need to be studied in more detail by Mn/DOT, and would likely result in substantial costs to design and construct (particularly I-394 between TH 100 and downtown and bridge widening on I-35W across the Minnesota River). The quality of the pavement on the shoulder is uncertain and would also require additional study. Bus-only shoulder signing costs were estimated by Mn/DOT to be $79,730 per mile and $26,580 per mile for drainage structure improvements (2001 dollars).

Minnesota would likely need to prepare new environmental studies for both corridors, and I-35W may require pay-back of federal funds for construction of the HOV facility. The costs for the environmental studies are estimates from the original I-394 EIS beginning in 1974, converted to 2001 dollars. Mn/DOT estimated the cost to be approximately $1.4 million in 1974, increasing to approximately $4.7 million each in 2001 dollars. In addition to (or in place of) the EIS cost, Minnesota may face a legal challenge over the existing or new EISs. Minnesota may also face repayment of the federally-funded portion of the I-35W HOV lanes. This cost was estimated by Mn/DOT staff to be approximately $18 million over three phases, approximately $20.9 million in 2001 dollars.

More detailed analysis would need to be conducted to determine what geometric improvements should be made for optimum utilization of the lanes as well as to minimize crashes.

Transit Costs – This study assumed that current transit-route headways would need to be maintained, regardless of transit ridership increases or decreases as a result of the HOV lanes being opened to all traffic. Methodologies for estimating the change in the number of buses required to accommodate maintaining bus headways were developed in coordination with the transit representatives in the TWG. The estimated additional buses were discussed and approved by the transit agency representatives.

For the benefit/cost analysis, the changes in number of buses and operators were monetized. For this effort, we obtained average annual operating costs (driver and vehicle operation and maintenance) and capital costs (vehicle) for each transit operator, as well as any other agency costs or revenues, such as National Transit Database (NTD) Federal Funds.

It was estimated that 15 additional transit buses would be necessary to maintain current headways for the transit providers in the HOV corridors. This equates to approximately $4.6 million. Since the average useful life of a transit vehicle is 12 years, a replacement cycle for the buses was included in the cost analysis.

Opening the HOV lanes to all traffic will also result in federal funding losses to the transit operators. Metro Transit estimated the annual federal loss to be $1,167,300 from HOV fixed-guideway/infrastructure, and funds from operating service in HOV corridors versus mixed-flow. This value does not account for the loss of revenue from HOV projects yet to be completed (I-35W HOV lane extension to 46th Street).

Parking Costs – Opening the HOV lanes to all traffic was estimated to result in decreases in transit and HOV use and increases in SOV. This may result in increases in parking costs for many commuters. The change in parking costs due to mode shifts was estimated using the market research surveys. For this study, it was assumed that there is adequate parking supply at either end of the trip, and that nominal parking costs will remain the same. As presented in Table 6.1 previously, the average parking cost for carpoolers on I-35W was approximately $52 and $43 for I-394 carpoolers. Average parking costs for SOVs were $80 and $117, respectively. This results in an average increase in parking cost from HOV to SOV of $28 on I-35W and $74 on I-394. This increase in SOV trips would result in increased parking revenues for municipalities. This revenue increase is offset by

the corresponding increase in parking costs for individuals. Therefore, this cost was not included in the benefit/cost analysis.

Table 9.3 presents the costs in 2001 dollars. If the lanes were opened to all traffic, the initial capital outlay cost plus first year operating costs would be approximately $44.2 million.

Table 9.3 2000 Costs for Opening the HOV Lanes to All Traffic in 2000

Cost Item	Cost (2001 dollars)
One-time capital costs	
HOV sign and pavement marking removal	$64,700
Bus-only shoulder signing and drainage improvements	$2,874,600
Additional buses to maintain current headways	$7,810,200
I-35W federal pay-back for HOV lane funding	$20,893,600
I-394 and I-35W replacement cost of EIS or litigation costs	$9,444,200
Potential litigation on new EIS	Unknown
Subtotal	*$ 41,090,200*
Total annual capital cost including federal pay-back (financed through bonding)	*$ 3,297,200*
Total annual capital cost excluding federal pay-back (financed through bonding)	*$ 1,620,600*
Annual operating and maintenance costs	
Annual federal revenue loss to transit from operating in HOV corridors	$1,167,300
Drivers and operations/maintenance for new buses	$1,946,200
Subtotal	*$ 3,113,500*
Total annual cost including federal pay-back	**$ 6,410,700**
Total annual cost excluding federal pay-back	**$ 4,734,100**

Comparison of Benefits and Costs

The benefit/cost analysis provides a snapshot analysis of the current benefits and costs related to opening the HOV lanes to all traffic. The results from the 2000 benefit/cost analysis are presented in Table 9.4. The estimated benefits of opening the HOV lanes to all traffic outweigh the costs and result in a net benefit of approximately $3.9 million per year, assuming Minnesota would have to pay back federal funding of the I-35W HOV lanes. If pay-back is not necessary, the net benefit is $5.6 million. The benefit/cost ratio indicates that benefits are approximately 1.56 or 2.11 times greater than the cost of the

system, respectively. However, potential litigation associated with preparing the new environmental documents could lessen or negate these benefits.

Table 9.4 Comparison of 2000 Costs and Benefits

Measure	With Buy-Back	Without Buy-Back
Annual benefits	$9,948,000	$9,948,000
Annual costs	$6,385,900	$4,709,300
Annual net benefit (benefits–costs)	$3,562,100	$5,238,700
Benefit/cost ratio	1.56	2.11

9.2.2 Year 2020 Analysis

The following presents the results of the benefit/cost analysis for the year 2020 of opening the HOV lanes to all traffic. The benefits identified in this section reflect 2001 dollars. The year 2020 results should not be compared to the 2000 results as 2000 contains current HOV facilities, whereas 2020 results include the extension of the I-35W HOV lanes to 46th Street. The comparisons should be "with" or "without HOV," and not by year. In addition, it is difficult to compare the two different years due to the increased level of congestion in 2020. Particularly, emissions and fuel consumption rates are greater at slower speeds so improvements of one mile per hour in 2000 at higher speeds are not as significant as one mile per hour improvements at slower speeds in 2020. The average speed for the region in 2000 is approximately 28 mph; this decreases to 17 mph in 2020.

This 2020 benefit/cost analysis presents a snapshot of 2020 conditions if the HOV lanes (with the I-35W extension plans to 46th Street) are opened to all traffic.

Benefits of Opening the HOV Lanes to All Traffic

The analysis resulted in positive benefits estimated for most of the performance measures. The estimated impact of opening the HOV lanes to all traffic is approximately $13 million in 2020. Most of these benefits result from the improved travel time, emissions, and fuel consumption; and these more than outweigh the increase in VMT resulting from the diversion of some trips from HOV and transit to driving alone. Each of the impact categories is discussed in further detail below.

- **Travel Time Impacts –** The model estimates that there is an improvement in person hours of travel time at 568,400 hours per year in 2020. The net change in travel time and speed represents a savings of about $5.5 million in 2020.

- **Travel Time Reliability Impacts –** It was estimated that opening the HOV lanes to all traffic would produce a benefit of about $530,000 in the year 2020. This equates to an estimated reduction in unexpected delay of 221 hours per day in 2020.

- **Safety Impacts –** The safety analysis estimated an increase in crashes if the HOV lanes were opened to all traffic. The result is an estimated increase of approximately 14 additional crashes in 2020. The majority of these accidents are anticipated to be injury or property damage only crashes. On an annual basis, the estimated increase in accidents results in a disbenefit of $2.8 million in 2020. This is largely due to the overall increase in regional VMT. The safety analysis for this study was limited to the model estimates. It does not take into account safety impacts resulting from the operation of bus-shoulder lanes or the operation of the barrier-separated lanes as mixed-flow lanes.

- **Emissions Impacts –** The analysis of the emissions impacts of opening the HOV lanes to all traffic produced positive benefits in 2020. Overall, the sum of emissions benefits is approximately $5.5 million in 2020.

- **Fuel Use –** The improved travel speeds are expected to result in a reduction in fuel usage. This is estimated to be about 12,300 in 2020 equating to a benefit of $4.4 million.

Table 9.5 presents the individual annual estimates of impacts for each of the performance measures as a result of opening the HOV lanes to all traffic.

Table 9.5 2020 Benefits of Opening the Lanes to All Traffic (2001 Dollars)

Performance Measure	Annual Change	Value
Travel time	568,400 hours saved	$5,519,300
Travel time reliability	54,600 hours saved	$529,900
Fatality accidents	0.2 additional accidents	($797,700)
Injury accidents	7 additional accidents	($1,934,800)
Property damage only accidents	6 additional accidents	($25,600)
Hydrocarbons	166 tons saved	$294,100
Carbon monoxide	1,350 tons saved	$5,247,200
Oxides of nitrogen	1.3 tons saved	$5,000
Fuel use	3,037,800 gallons saved	$4,404,900
Total annual benefit		**$13,242,100**

Costs

Year 2020 costs were assumed to be the same as year 2000 costs with one exception. It was estimated that in the year 2020, 36 additional buses would be necessary to maintain the current headway levels. Therefore, the capital costs associated with these buses, as well as any increases in operations and maintenance costs, will differ from the year 2000 costs. All other assumptions and cost findings are the same. Similarly to the 2000 analysis, it was assumed that Minnesota would obtain a 20-year bond with an estimated yield to maturity of five percent to fund the capital costs. Table 9.6 presents the estimated year 2020 costs in 2001 dollars.

Table 9.6 2020 Costs for Opening the HOV Lanes to All Traffic

Cost Item	Cost (2001 dollars)
One-time capital costs	
HOV sign and pavement marking removal	$64,700
Bus-only shoulder signing and drainage improvements	$2,874,600
Additional buses to maintain current headways	$18,395,800
I-35W federal pay-back for HOV lane funding	$20,893,600
I-394 and I-35W replacement cost of EIS or litigation costs	$9,444,200
Potential litigation on new EIS	Unknown
Subtotal	*$ 51,675,900*
Total annual capital cost including federal pay-back (financed through bonding)	*$ 4,146,600*
Total annual capital cost excluding federal pay-back (financed through bonding)	*$ 2,470,000*
Annual operating and maintenance costs	
Annual federal revenue loss to transit from operating in HOV corridors	$1,167,300
Drivers and operations/maintenance for new buses	$4,714,800
Subtotal	*$ 5,882,200*
Total annual cost including federal pay-back	**$ 10,028,800**
Total annual cost excluding federal pay-back	**$ 8,352,200**

Comparison of Benefits and Costs

The 2020 benefit/cost analysis provides a snapshot analysis of the future benefits and costs related to opening the HOV lanes to all traffic. The results from the benefit/cost analysis are presented in Table 9.7. In 2020, the estimated benefits of opening the HOV lanes to all traffic outweigh the costs and result in a net benefit of approximately

$3.2 million per year, assuming Minnesota would have to pay back federal funding of the I-35W HOV lanes. If pay-back is not necessary, the net benefit is $4.9 million. The benefit/cost ratio indicates that benefits are approximately 1.32 or 1.59 times greater than the cost of the system, respectively. Potential litigation associated with preparing the new environmental documents could lessen or negate these benefits. It is important to note that this benefit is estimated, assuming HOV lanes in 2020 on I-35W would extend to 46th Street and that a subsequent opening of the HOV lanes to mixed-flow traffic would include this extension.

Table 9.7 Comparison of 2020 Costs and Benefits

Measure	With Buy-Back	Without Buy-Back
Annual benefits	$13,242,100	$13,242,100
Annual costs	$10,028,800	$8,352,200
Annual net benefit (benefits–costs)	$3,213,300	$4,889,900
Benefit/cost ratio	1.32	1.59