IH-35 Operational Analysis

Analysis Process Description

The CTR team has carried out a traffic operational analysis of the No Build Alternative and two alternative improvement schemes for the I-35 section from south of the William Cannon intersection to the Ben White interchange (about 3.2 miles). To forecast traffic volumes for the No Build Alternative and the two alternative improvements, the team performed Dynamic Traffic Assignments (DTA's) for all three geometric cases using 2017 trip tables describing the AM and PM peak time frames. That is, this analysis consisted of six total assignments that include two times of day and three geometric cases using the VISTA DTA model. The modeling effort used the six county CAMPO network, which has been extensively upgraded to include essentially all streets and highways in the greater Austin City area. Using forecasted traffic volumes from the DTA assignments, the team developed a micro-simulation analysis of three geometric cases and two times of day using the CORSIM micro-simulation system.

The DTA process consists of incrementally assigning small fractions of trips to the minimum time paths from trip origins to trip destinations, updating travel times in response to the assigned traffic using a meso-simulation technique, finding new minimum time paths, and assigning the next fraction of traffic to the new minimum time paths. The DTA assignment repeats this process for the entire network many times producing something that approximates a user-equilibrium assignment where all paths between each origin and destination have equal and minimal travel time. The assumptions inherent in the process are that all travelers are aware of the minimum time path for their trip when they enter the network, and they choose to use the minimum time path between their origin and destination. Unlike static assignment methods, the DTA method used by VISTA will not assign more traffic to any facility than the capacity of that facility. Since DTA responds sensitively to network characteristics, it may be the best available tool for predicting the traffic volume levels that can be expected for the two proposed improvement alternatives for the I-35 study section. The DTA process produces estimated traffic volumes for all links in the network along with measures of effectiveness including total system time (sum of travel times for all assigned traffic), vehicle miles traveled for the network, link travel times and path travel times (sums of link travel times). Since VISTA produces travel times through meso-simulation, we conducted a secondary CORSIM microsimulation to produce higher resolution travel time information for the No Build Alternative and two study alternatives.

Comparison for AM and PM Peak Travel

The Dynamic Traffic Assignment process used here included traffic for the three hours surrounding the AM Peak hour and three hours surrounding the PM Peak hour for the assignment process. The DTA process produces total travel time accumulated by all vehicles in the six county network, otherwise known as Total System Travel Time (TSTT) measured in hours. Figure 1 presents comparisons of TSTT for:

1) The No Build Alternative, where no modification is proposed to improve the existing structure;

2) Alternative 1 (A1): refers to the IH-35 improvement schematic introducing additional two managed lanes (each direction) at grade;

3) The Proposed Build Alternative, where two elevated managed lanes (in each direction) are proposed.

The two additional managed lanes are open to all traffic in the model and are not restricted to 2+ occupants. Additionally, the mesoscopic nature of the model does not provide a lane by lane breakdown of volumes within a link. Therefore, the VISTA analysis provides a holistic view of increasing capacity on the IH-35 corridor.

Figure 1(a) indicates Alternative 1 compared to the No Build Alternative saved 5601 hours of travel time and the Proposed Build Alternative saved 8211 hours of travel time compared to the No Build Alternative configuration during the AM peak period. Figure 1(a) shows a similar comparison for trucks with a similar pattern, however, no attempt was made to verify the validity of the numbers of trucks included in the simulation, so the truck savings comparison is likely underestimated.

Alternative 1 produced slightly more TSTT savings compared to the Proposed Build Alternative during the PM peak. Figure 1(b) provides the TSTT comparison for the PM Peak condition. The figure shows that the difference in TSTT savings between the two scenarios is 284 hours in the PM peak.

Adding the TSTT savings for the AM and PM Peak conditions indicates about 13,654 hours might be saved by implementing Alternative 1. However, the Proposed Build Alternative implementation could save 15,980 hours per day. Comparing Alternatives 1 and the Proposed Build Alternative in terms of TSTT yields a daily savings of 2,326 hours more for the elevated Proposed Build Alternative versus Alternative 1.

Figure 1(a). Comparison of AM Peak Total System Travel Time

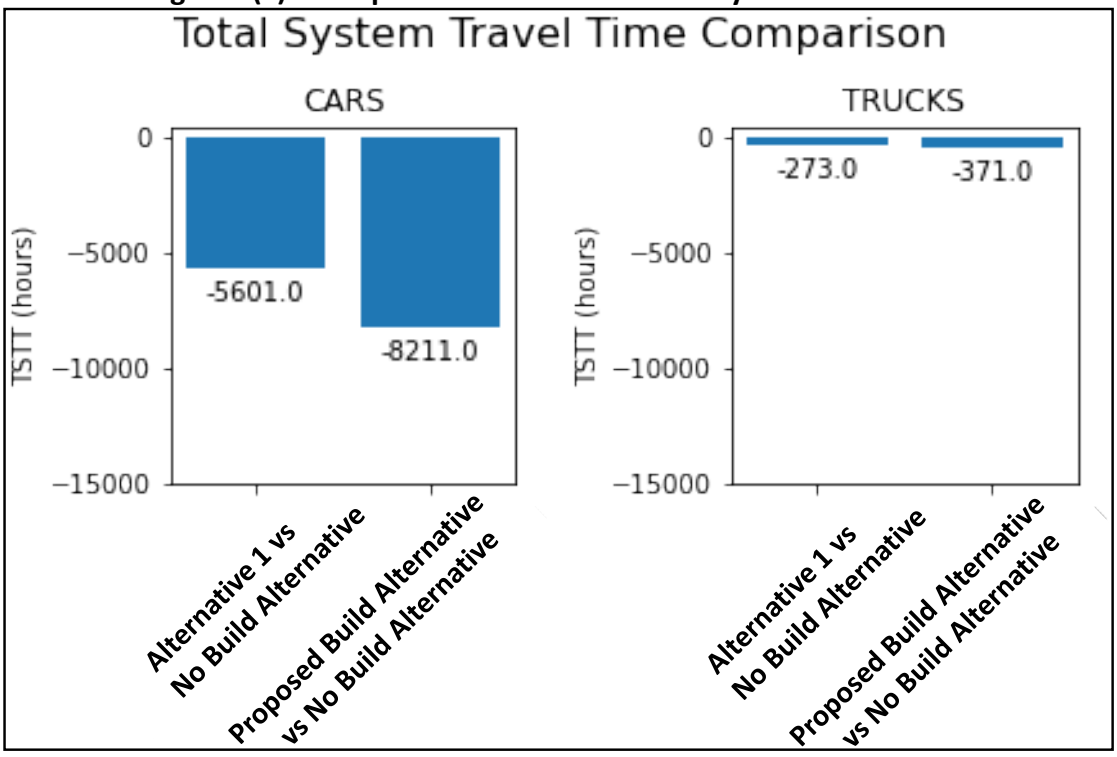
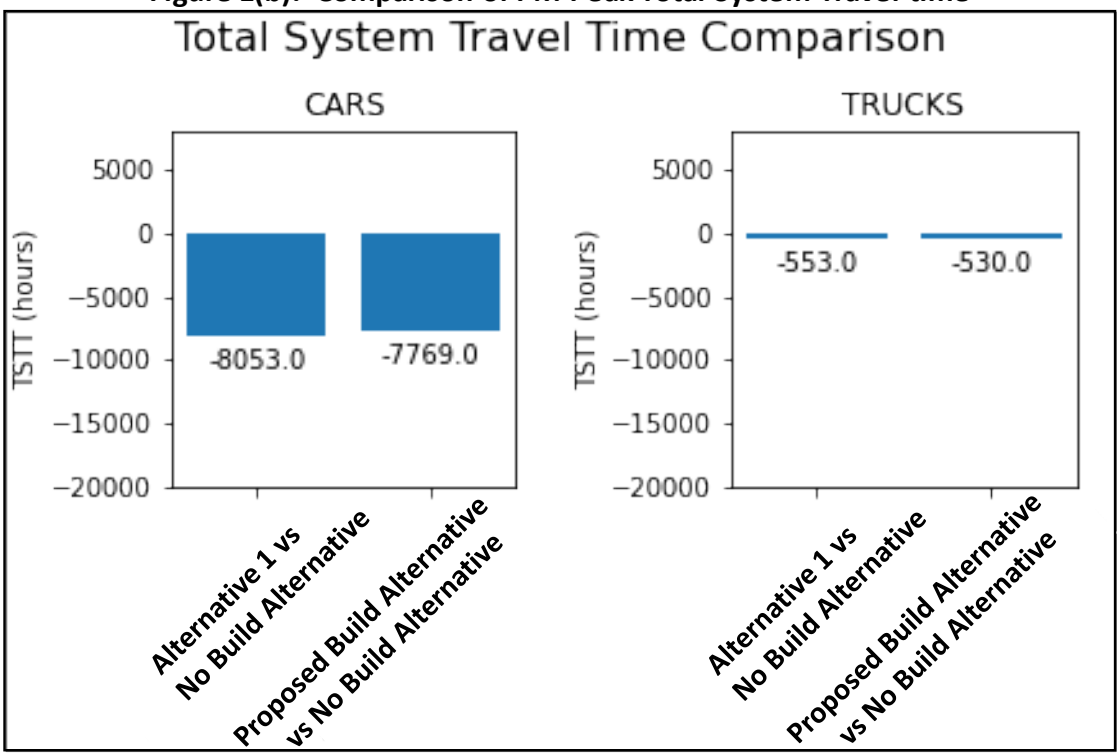


Figure 1(b). Comparison of PM Peak Total System Travel time



Figures 2(a) and 2(b) present another network level measure of effectiveness, Vehicle Miles Traveled (VMT). Reductions in VMT are a desirable result of any improvement scenario since VMT reduction likely reduces emissions, fuel consumption, and improve network efficiency. Figure 2(a) compares VMT for the two alternative improvement scenarios during the AM Peak condition and it shows Alternative 1 increases VMT by more than 10,600 miles compared to the No Build Alternative condition while the Proposed Build Alternative reduces VMT by more than 3,700 miles. Figure 2(b) shows the VMT comparison for the PM Peak condition and it indicates Alternative 1 reduces VMT by 30,968 miles while the Proposed Build Alternative decreases VMT by almost 22,748 miles. Adding the AM and PM Peak VMT savings for the two Alternative improvement scenarios produces a net reduction of approximately 20,316 miles for Alternative 1 and approximately 26,448 miles for the Proposed Build Alternative.

The Total System Travel Time and Vehicle Miles Traveled statistics represent summary data for the entire network and while the savings are impressive, as noted earlier, to produce a proper analysis of Alternatives 1 and the Proposed Build Alternative, I-35 north of the Ben White interchange was characterized as the ultimate geometric configuration. That is, two additional main lanes were added to each I-35 direction from Ben White to the US 183 interchange. Since both Alternatives 1 and the Proposed Build Alternative include the ultimate I-35 improvements, comparisons of the relative changes between the Alternatives are appropriate. Comparing Alternative 1 and the Proposed Build Alternative in terms of Total System Travel Time, the Proposed Build Alternative implementation would save approximately 2,300 more travel time hours than Alternative 1. Regarding VMT savings and referring to Figure 2, the Proposed Build Alternative would save approximately 6,132 more vehicle miles travelled than Alternative 1.

Figure 2(a). Comparison of AM Peak Vehicle Miles Traveled

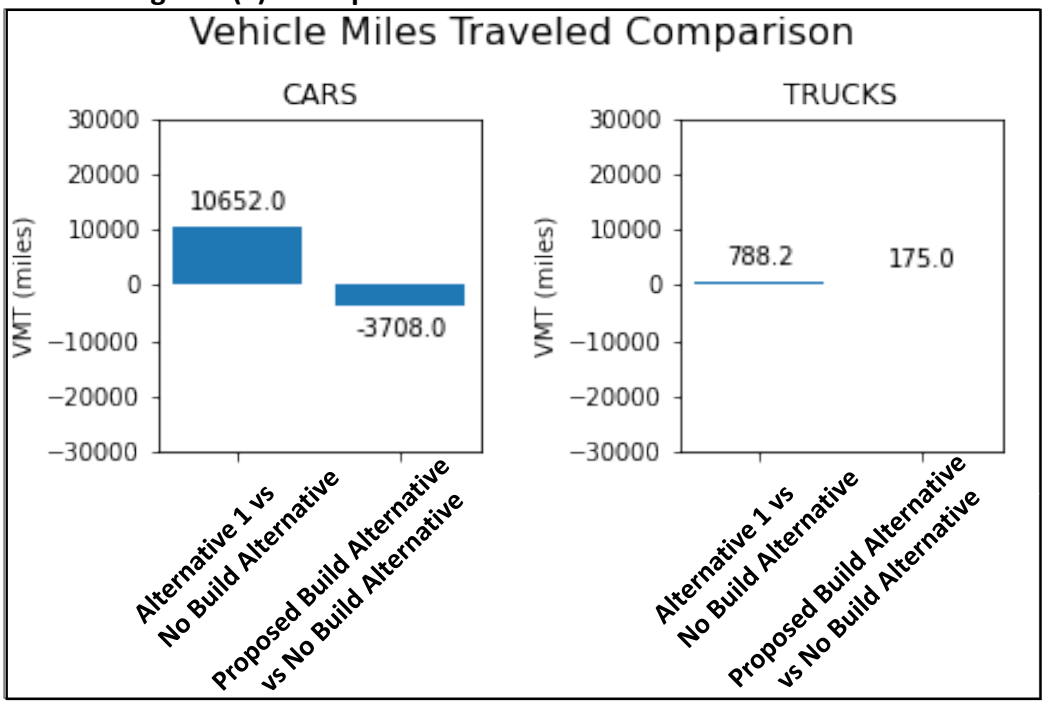
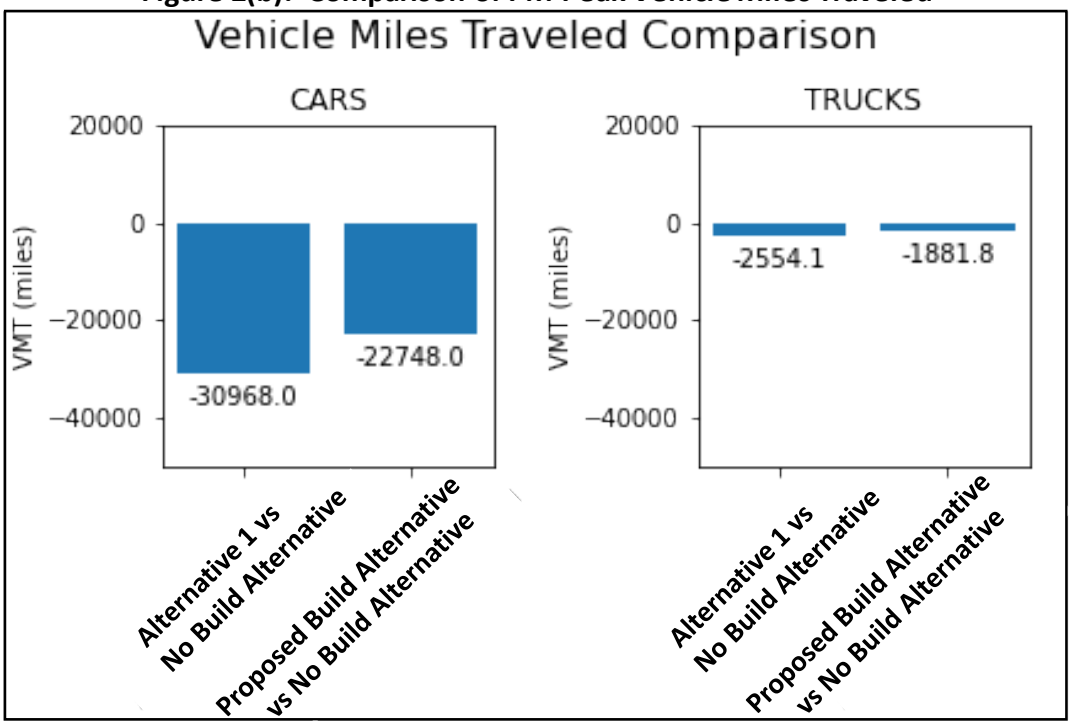


Figure 2(b). Comparison of PM Peak Vehicle Miles Traveled



The Total System Travel Time and Vehicle Miles Traveled network comparisons only tells part of the comparative story. Most designers as well as highway users expect improvements to an important arterial facility like I-35 to attract new traffic. The DTA process assigns the same traffic to the No Build Alternative, Alternative 1, and the Proposed Build Alternative scenarios and for each assignment, travelers seek their own minimum time paths.

To facilitate a fair comparison of the Alternatives, the resulting statistics of the managed lanes and at-grade existing lanes are shown together. The mesoscopic simulation shows volumes per link and cannot provide volumes for each lane within a link. Additionally, we understand that the managed lanes will require two or more occupants per vehicle, however, we have no algorithm for predicting which vehicles have 2+ passengers. Therefore, we have provided predicted traffic volumes for Alternatives 1 and the Proposed Build Alternative as totals without indicating volume fractions on the managed lanes. Since the choice of managed or main lanes by travelers is, in the DTA process, based on a minimum time path algorithm, rather than which vehicles are qualified to use the managed lanes, we feel that showing managed lane volumes would carry the risk of misleading readers.

As expected, during the AM Peak time total traffic volumes on the I-35 study section increase significantly as shown in Table 1. Total volumes (sum of both directions) increase from 10,133 vph in the No Build Alternative to 13,622 for Alternative 1 and 14,084 vph for the Proposed Build Alternative. These increased volumes occur because an increasing number of travelers shift their paths to I-35 when it features the Alternative 1 configuration compared to the No Build Alternative and still more choose I-35 when configured as the Proposed Build Alternative. In Table 1, the increasing volumes for the Alternatives compared to the No Build Alternative indicate that more people are taking advantage of the improved I-35 conditions thereby reducing the Total

System Travel Time as shown in Figure 1. The PM Peak result indicates approximately the same magnitude of increasing traffic for Alternative 1 compared to the AM Peak.

Table 1. Traffic Volume Comparisons

AM Peak

Network-Wide Average Statistics	Direction	No Build Alternative	Alternative 1	Proposed Build Alternative
Average Volume (veh)	NB I-35	5,249	8,444	8,247
	SB I-35	4,884	5,178	5,836
	Total	***10,133***	***13,622***	***14,084***
Total Time (min/veh)	NB I-35	3.61	3.44	3.60
	SB I-35	3.27	3.09	3.08

PM Peak

Network-Wide Average Statistics	Direction	No Build Alternative	Alternative 1	Proposed Build Alternative
Average Volume (veh)	NB I-35	4,744	5,519	4,832
	SB I-35	5,393	7,749	8,074
	Total	***10,137***	***13,268***	***12,906***
Total Time (min/veh)	NB I-35	3.28	3.18	3.37
	SB I-35	7.33	4.19	5.12

Comparisons from Micro-Simulation

The team developed CORSIM micro-simulations for the No Build Alternative and two Alternatives to produce higher resolution measures of effectiveness. Table 2 shows comparative measures of effectiveness. All these statistics, except for VMT, represent only the study section and not the entire network. Analyses of the AM Peak condition shows average speeds increasing slightly for Alternatives 1 and the Proposed Build Alternative compared to the No Build Alternative condition. The PM Peak condition shows significant average speed improvements from approximately 37 mph for the No Build Alternative to almost 43 mph for Alternative 1 and almost 50 mph for the Proposed Build Alternative. For the AM Peak, both Alternatives compared to No Build Alternative only slightly reflect the impact of larger volumes of traffic using the Alternatives. For AM Peaks, these statistics tend to show very little operational difference between Alternative 1 and the Proposed Build Alternative, but both are superior to the No Build Alternative. Once again, the Proposed Build Alternative helps more travelers than Alternative 1 (larger traffic volume), so despite similar values for speeds and delays, the Proposed Build Alternative benefits the traveling public more than Alternative 1. For the PM peak, the Proposed Build Alternative experiences less VMT, less delay, and higher average speeds compared to Alternative 1.

Table 2. Comparative Measures of Effectiveness

AM Peak

Network-Wide Average Statistics	No Build Alternative	Alternative 1	Proposed Build Alternative
Vehicle miles traveled (VMT) (veh-mile)	38,912.81	50,951.71	51,705.07
Move Time (veh-hour)	595.29	766.03	790.62
Delay (veh-hour)	111.93	94.96	102.35
Delay (sec/veh)	24.21	17.37	17.84
Total Time (veh-hour)	707.22	860.99	892.97
Total Time (min/veh)	2.55	2.62	2.59
Average Speed (mph)	55.02	59.18	57.90
Move Time/Total Time ratio	0.84	0.89	0.89
Delay Time (min/mile)	0.17	0.11	0.12
Total Time (veh-hour)	1.09	1.01	1.04

PM Peak

Network-Wide Average Statistics	No Build Alternative	Alternative 1	Proposed Build Alternative
Vehicle miles traveled (VMT) (veh-mile)	57,421.24	54,979.45	50,435.59
Move Time (veh-hour)	891.60	934.13	762.21
Delay (veh-hour)	662.67	352.68	253.88
Delay (sec/veh)	143.36	64.50	44.26
Total Time (veh-hour)	1554.27	1286.81	1016.09
Total Time (min/veh)	6.04	4.48	3.65
Average Speed (mph)	36.94	42.73	49.64
Move Time/Total Time ratio	0.57	0.73	0.75
Delay Time (min/mile)	0.69	0.39	0.30
Total Time (veh-hour)	1.62	1.40	1.21

Economic Analysis

As noted, the Proposed Build Alternative could reduce Total System Travel Time by 15,980 hours daily, compared to the No Build Alternative (sum of AM and PM Peak TSTT). Valuing user travel time at $30.12 per hour (TxDOT current estimate), the saved travel time for each day would have a value of $481,318. If one assumes 20 working days per month, the monthly sum would be $9,626,360 and the annual value $115,516,320. If the Proposed Build Alternative improvements cost $350 million, the savings in travel time would equal the construction cost in slightly less than 3 years. This is a conservative estimate since it only includes AM and PM peak times. Other times of day would likely contribute to the savings, and this calculation only includes working

days (20 days per month). However, one must remember that the assumption of the ultimate IH-35 cross section consisting of two additional lanes each direction from Ben White to US 183 facilitates the performance of both Alternatives.

Impacts on Other Network Facilities

The noted improvement in Total System Travel Time on I-35 for the Alternative scenarios indicate that traffic using other facilities has chosen new paths that may include I-35. That is, parallel arterial paths including South Congress Avenue, South First Street, and South Lamar could benefit from reduced traffic volumes due to travelers choosing the improved I-35. The VISTA traffic assignment process produces reasonable estimates of traffic volumes on these and other facilities but the time frame for this analysis did not allow quantitative analysis of parallel facilities.