APPENDIX: PUBLIC COMMENTS

The comments, opinions, and statements received from members of the public as part of the public comment period reflect solely the viewpoints of the person or entity providing the public comment and in no way represent the El Paso MPO's viewpoint on any particular issue unless expressly stated otherwise. Furthermore, to the extent that the El Paso MPO responds to public comments, the responses are meant to be general and broad. El Paso MPO responses are not intended to be exhaustive, binding, or legal statements on behalf of the El Paso MPO or the Transportation Policy Board.

PUBLIC COMMENTS AND RESPONSES RECIEVED FOR THE AMENDED REGIONAL MOBILITY STRATEGY (RMS) 2050 METROPOLITAN TRANSPORTATION PLAN (MTP) AND TRANSPORTATION CONFORMITY REPORT (TCR)			
DATE	**NAME/ORGANIZATION**	**COMMENT**	**MPO RESPONSES**
03/01/2024	Michael McElroy El Paso County Planning & Development Department/El Paso County Commissioners Court	Mr. Calvo, At the El Paso County Commissioners Court held on February 26, 2024, the Court voted 5-0 to submit the following public comment to the El Paso Metropolitan Planning Organization's Call for Public Comment regarding the Regional Mobility Strategy (RMS) 2050 Metropolitan Transportation Plan (MTP) Amendment. The County hired a third-party and independent consultant, Smart Mobility, Inc., to evaluate the Downtown I-10 Segment 2 Project data set and related traffic projections. We submitted the initial findings of the report during the RMS 2050 MTP Public Comment period. We obtained updated numbers for our consultant to provide an update to his last report. The findings of the final report are incorporated into this letter and comment as Attachment A. The findings show different improvement recommendations and changes to the construction phases that differ from those that have been proposed. It is the County's intent to foster a thoughtful dialogue with the MPO and the Texas Department of Transportation- El Paso District regarding the data contained within the report to further refine these critical transportation planning activities. Please let me know if you have any questions. You may also contact Daniel Marquez (dani.marquez@epcounty.com) or Jorge Reyes (jo.reyes@epcounty.com) with any questions you or your staff may have. Thank you for all the work you and your agency do. ***(Report attached at bottom of matrix (see Attachment #1)***)	Mr. McElroy, Thank you for your letter. We agree on the offer to keep a "thoughtful dialogue with MPO and the Texas Department of Transportation – El Paso District…" We have reviewed the final report we provide responses to the topics that are relevant to the MPO. Elements of the report that refer specifically with the Downtown10 (Segment 2) project level design details will be deferred to TxDOT. Throughout the report there are statements related to the El Paso MPO travel demand model (TDM) use of a static traffic assignment (STA) technique, instead of a dynamic traffic assignment (DTA). The MPO's TDM uses state of the practice procedures and techniques to develop the TDM and use for transportation planning as well as for air quality (Conformity) purposes. The TDM and all work products are reviewed and approved by federal and state agencies, including FHWA, FTA, EPA, TxDOT, NMDOT, TCEQ, NMED, and others. Section 3 of the report discusses ***"…different types of transportation models used in alternative analysis."*** We agree that the different types of models (macro, meso, and microscopic), or a combination, should be used for different geographic scales of analysis. We believe that the El Paso MPO TDM is well suited for regional (i.e., macro) analysis. We also agree that the TDM is not the best tool to perform detailed analysis of alternatives at the project level. However, all the work performed by the County's consultant was performed using the TDM as stated in page 7: ***"The model results presented in this report are all at the macro scale using the El Paso Metropolitan Planning Organization's regional travel demand model that covers all El Paso County".*** We believe that the consultant's efforts and analysis would have been more meaningful if it was performed using other modeling tools that are better suited for corridor and project level analysis. Specific comments and responses: **Executive Summary, 1)** *"The modeling indicates that widening IH-10 Segment 2 is likely unnecessary, especially before Segment 3 is widened…Traffic congestion in Segment 3 is much worse today that congestion on Segment 2 and is caused by*

			delays at the Spaghetti Bowl for both eastbound and westbound traffic." Response: It is quite clear from the El Paso MPO TDM analysis and from historical data that the traffic volumes along Segment 3 of I-10 are higher than those in Segment 2. However, that is not the only factor that was taken into consideration by TxDOT and the El Paso MPO's Transportation Policy Board to make the strategic decision to prioritize Segment 2. **Page 8 comment:** *"The model is good at matching the speed at the Spaghetti Bowl bottleneck. However, the model significantly overestimates speed just upstream of the Spaghetti Bowl"* Response: The RMS TDM follows state-of-practice guidelines as accepted by FHWA and TxDOT for regional models, and thus, it is validated for traffic volumes (not speeds). **Page 10 comment**: *"The MTP assumes about 3 times as much employment growth"* Response: For socio-demography (SED) control total forecasts, the EPMPO relies on the expertise of the Texas Demographic Center. **Page 10 comment:** *"The model implicitly assumes that the population and housing inputs are more accurate than the employment inputs"* Response: The accepted practice of balancing attractions to productions is not because population and household inputs are more accurate than employment, but rather that household trip rates have typically less variability, due in good part to more robust explanatory variables. **Page 10 comment:** *"The hidden model correction is equivalent to treating all 2050 employment as having a 27% vacancy rate"* Response: Employment allocation acts more as a trip distribution gauge, not a hidden model correction, nor artificially introduced vacancy rates. **Page 10 comment:** *"…prevent modeling unintended disinvestment…"* Response: The "disinvestment" issue was previously identified and notified to the County of El Paso as the result from an incorrect use, by the County's consultant, of SED data from previous models. **Page 11 comment:** *"The model shows 56% of the IH-10 morning peak hour travel in Segment 3D2 as eastbound, i.e., what is today outbound or reverse commuting. This is implausible"* Response: A large enough allocation of employment in any given sector of the urban area could attract enough morning trips as to shift current proportions of inbound vs. outbound.

Attachement #1

IH-10 Segment 2 (Downtown) Alternatives

Prepared by Norman Marshall, President Smart Mobility, Inc.

September 2023

Executive Summary

I have reviewed materials related to the proposed IH-10 Segment 2 (Downtown) expansion including traffic counts, traffic speed data and transportation modeling files, and have modeled five 2050 IH-10 alternatives. Based on this review, I present the following findings:

1) **The modeling indicates that widening IH-10 Segment 2 is likely unnecessary, especially before Segment 3 is widened**. **The modeling further indicates that widening IH-10 Segment 2 before Segment 3 is widened will aggravate the existing Spaghetti Bowl bottleneck and provide little benefit. Segment 3 should be designed and probably constructed before Segment 2 is widened**. The primary traffic congestion issue today in IH-10 Segment 2 is afternoon peak period delays caused by a bottleneck in the Spaghetti Bowl (Segment 3). Traffic congestion in Segment 3 is much worse today than congestion in Segment 2 and is caused by delays at the Spaghetti Bowl for both eastbound and westbound traffic.
2) **All the alternatives modeled include completing frontage roads to the west of Downtown that are needed for reliability and emergency access**.
3) **As an alternative to widening, a collector-distributor system in the eastern part of Segment 2 could replace IH-10 ramps and use frontage roads to divert local traffic from the Spaghetti Bowl and IH-10 Segment 2**. This "CD" alternative performs better than the Full Build alternative in the eastern part of Segment 2 but worse in the western part of Segment 2. A better model would be needed to fully evaluate the tradeoffs between the two alternatives. Adding one general-purpose lane in each direction from Executive Center Drive through the Trench to the CD alternative is not conclusively better than the base CD alternative.
4) **The CD alternatives would not result in significant traffic congestion on other streets** because:
   a. most I-10 through traffic would remain on IH-10,
   b. much of the traffic diverted from IH-10 will be accommodated on the frontage roads – which have excess capacity today,
   c. some of the diverted traffic would have taken circuitous indirect routes that also adds traffic to some local streets, and the street grid has a significant amount of reserve capacity.
5) **At the regional level, all the alternatives perform worse than the No Build on net when accounting for both the monetary value of travel time savings and travel cost, and the Full Build alternative performs the worst of all.**
6) Modeling future traffic realistically requires balanced regional jobs and population inputs. Balanced regional jobs and population inputs also reduces future travel time and cost metrics relative to imbalanced inputs.
7) The regional transportation model cannot represent bottlenecks like the Spaghetti Bowl realistically because it treats every road segment as independent from upstream and downstream road segments. Treating every road segment as independent distorts key model metrics including traffic volumes, travel time, speed, and delay so care must be taken in evaluating them. Regional Dynamic Traffic Assignment ("DTA") modeling would result in more accurate traffic assignments and travel time metrics than are possible with the regional Static Traffic Assignment ("STA") model either by itself or in combination with microsimulation or subarea DTA.

Attachement #1

Table of Contents

1 Introduction

El Paso County contracted with Smart Mobility, Inc. in September 2021 with a scope of:

1) Review Reconstruct alternative modeling – Check base year model by comparing assigned model volumes to traffic counts, assigned model speeds to observed real world speeds, and model origin-destination ("OD") patterns for IH-10 traffic to real- world OD data. If necessary, adjust the base year model and document the changes. Analyze the traffic performance of the future Reconstruct alternative (using the adjusted model if applicable).

2) Conceptual alternatives – develop two conceptual alternatives that would avoid significant widening and provide traffic benefits relative to the Reconstruct alternative. These alternatives would be at a sketch level adequate for regional travel demand modeling, but without full consideration of possible constraints.

3) Model conceptual alternatives – model and analyze the traffic performance of the two conceptual alternatives relative to the Reconstruct alternative and to TxDOT goals.

A final report was submitted in July 2022. However, this work was limited because the El Paso Metropolitan Planning Organization ("EPMPO") had not provided the final transportation modeling files from the 2022 2050 Metropolitan Transportation Plan ("MTP") update. An Addendum to the contract was done in January 2023 to

4) Redo conceptual alternatives modeling with latest El Paso MPO model including the two conceptual alternatives developed in Task 3, a Reconstruct alternative and the MPO MTP 2050 alternative (similar to TxDOT Alternative H). Each of the 4 alternatives will be modeled with both the MPO's forecast 2050 population and employment numbers and the adjusted 2050 population and employment numbers documented in our July 2022 draft report.

5) Prepare a technical report documenting the modeling work and comparing the traffic performance of the four alternatives for each of the two sets of land use inputs. The report will provide detailed data to support recommendations. In addition, a thorough overview of the data will be made to the Commissioners Court. The modeling files also will be bundled and transmitted to the MPO and to TxDOT.

This report documents the work specified in the Addendum. It is focused on IH-10 Segment 2 (Downtown), but also considers traffic interactions between Segments 2 and 3 (shown in Figure 1-1).

Figure 1-1: IH-10 Segments 2 and 3

The EPMPO MTP includes Segment 2 as a single segment but divides Segment 3 into five segments with different costs and schedules. Adding two general purpose lanes and two adaptive lanes to Segment 2 is scheduled for 2027 and extending this same treatment (two general-purpose lanes plus two adaptive lanes) throughout Segment 3 is scheduled from 2031 to 2041 – generally, but not completely progressing from west to east. Also included in the MTP is adding two adaptive lanes to recently widened Segment 1G to match those planned for Segments 2 and 3.

Table 1-1: Planned IH-10 Expansion in the 2022 EPMPO MTP

Segment	From	To	General purpose	Adaptive/ transit	Frontage roads	Cost (millions)	Year
1G	Thorn	Executive Center		+1		$62	2041
2	Executive Center	Copia	+1	+1	+2	$787	2027
3A	Copia	Paisano	+1	+1		$319	2031
3B	Paisano	Airway	+1	+1		$239	2033
3C	Airway	Yarbrough	+1	+1		$433	2041
3D1	Yarbrough	Zaragoza	+1	+1		$337	2041
3D2	Zaragoza	Eastlake	+1	+1		$337	2037

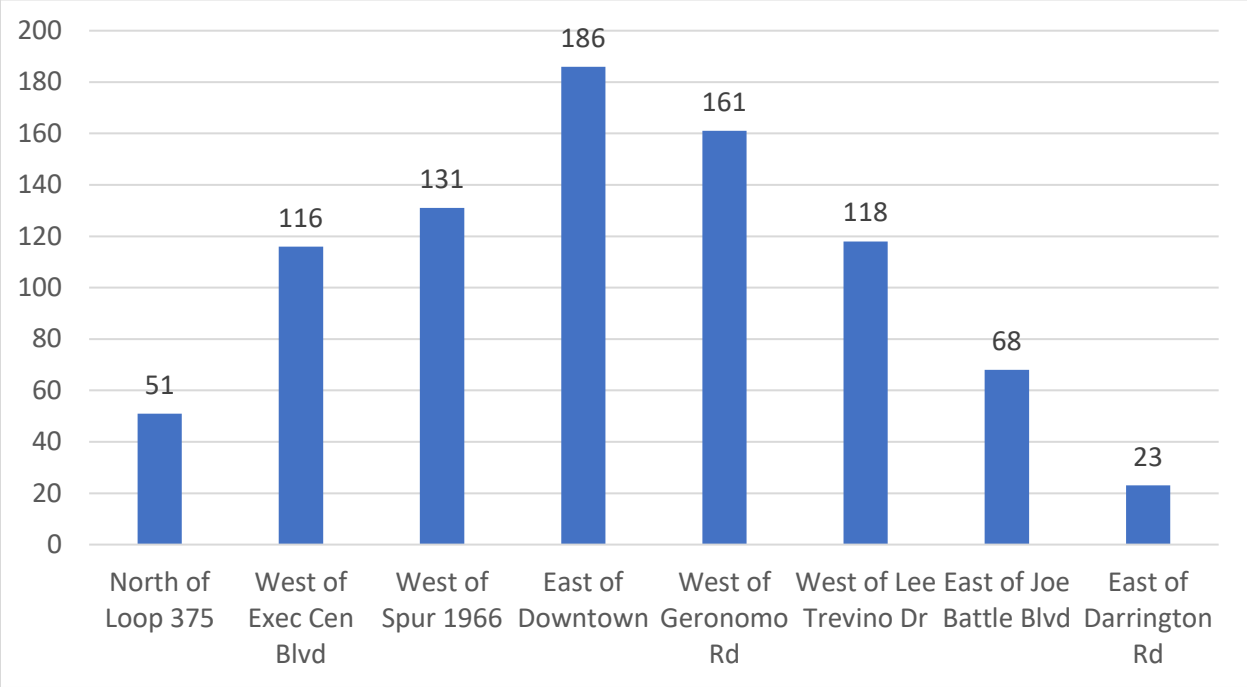
The EPMPO plan for Segment 2, and the way that it is modeled by EPMPO, is generally consistent with TxDOT's Alternative H as presented in public meetings in in February and March of 2021.[1] This report investigates whether there are Segment 2 alternatives that provide satisfactory mobility while avoiding some or all of the impacts of the proposed widening.

[1] https://www.reimaginei10.com/downtown10.html

2 IH-10 Traffic Today

Local traffic comprises most of the traffic on IH-10 in the Downtown section. Figure 2-1 shows daily traffic counts compiled by TxDOT at various IH-10 locations.

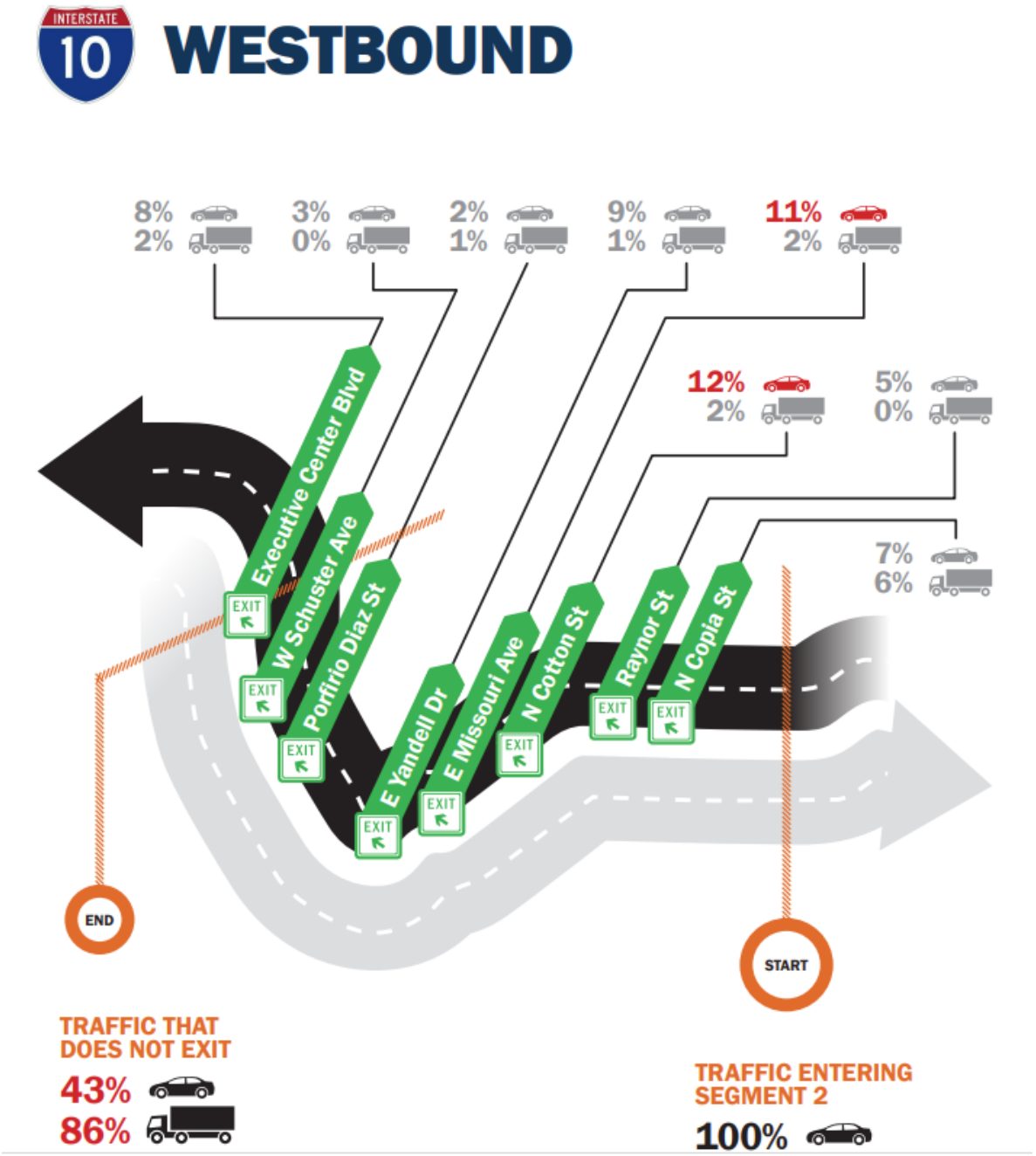
Figure 2-1: IH-10 Daily Traffic Counts (Thousands)



As shown in Figure 2-1, the daily IH-10 traffic volume east of Downtown is almost 4 times as great as it is to the north of Loop 375 and 8 times as great as it is at the southern end of the region. Even at these outer locations, through traffic represents only a small portion of total traffic. Most of this "external" traffic has origins or destinations inside the region.

As reproduced as Figure 2-2, IH-10 Downtown materials prepared by TxDOT illustrate that only 43% of cars entering Segment 2 from the east continue past the end of Segment 2 at Executive Center Boulevard. More than half (57%) exit in the greater Downtown area. A third of the traffic entering from the east exits at East Yandell Drive, East Missouri Avenue or North Cotton Street.

Figure 2-2: TXDOT Illustration That Majority of Cars Entering Segment 2 from the East Exit in the Greater Downtown Area

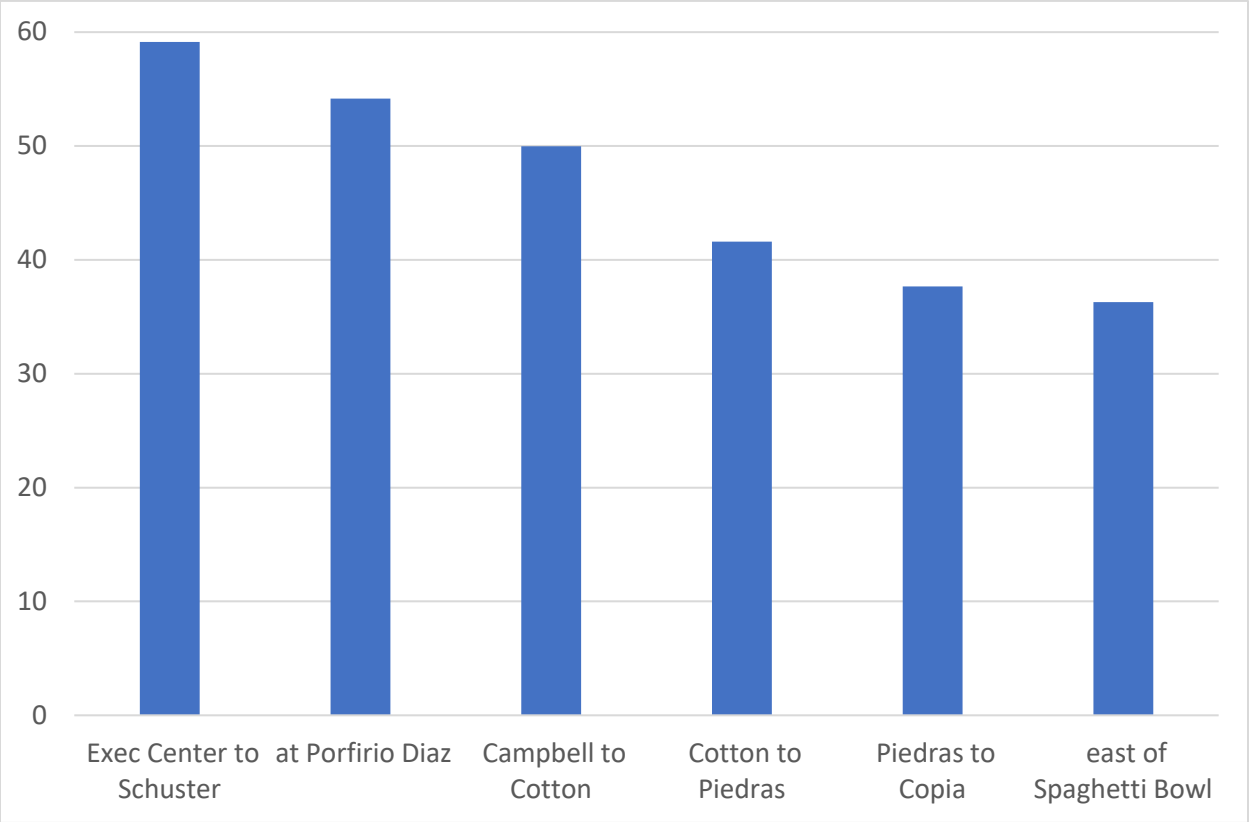


Source: https://www.reimaginei10.com/docs/TxDOT_EPCS_Boards.pdf

Most IH-10 Segment 2 traffic is local.

24/7 speed data for IH-10 has been collected from cell phones and other electronic devices. Relying on 2019 (pre-pandemic) speed data, the primary bottleneck on IH-10 Segment 2 is eastbound in the afternoon peak period and begins in the Spaghetti Bowl (Segment 3) as shown in Figure 2-3.

Figure 2-3: 2019 Average Weekday Eastbound Speed Afternoon Peak Period (2:30 – 6:30 p.m.)



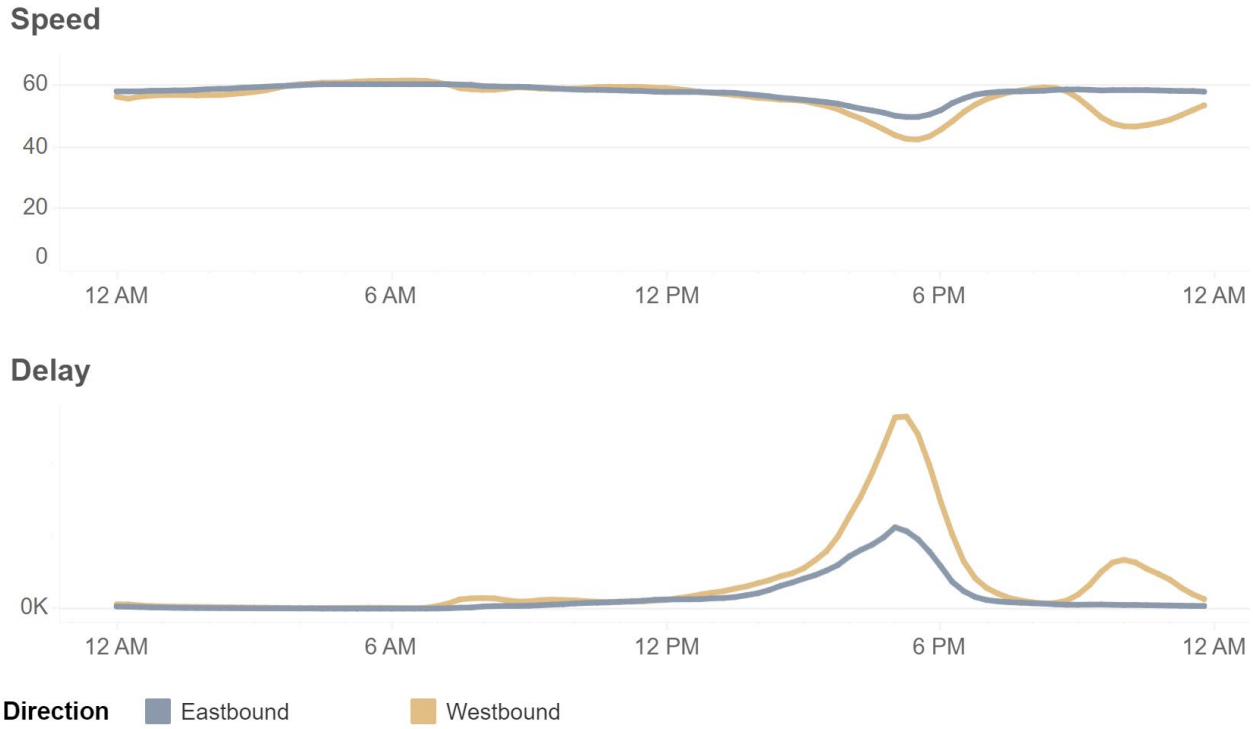
The data in Figure 2-3 suggests that traffic backs up upstream of the Spaghetti Bowl in the weekday afternoon peak period but that the western end of Segment 2 is uncongested most days.

There is no similar bottleneck westbound in Segment 2 at any time of day.

The primary traffic congestion issue today in IH-10 Segment 2 is afternoon peak period delays caused by a bottleneck in the Spaghetti Bowl (Segment 3).

The Texas A&M Transportation Institute compiles an annual list of the 100 most roadway segments in Texas. In the 2022 list, the only segment of IH-10 in El Paso to make the list is the section to the east of the Spaghetti Bowl, between US 54 and Hawkins Boulevard. As shown in Figure 2-4, congestion is primary in the afternoon peak hour. However, in this section, the worst congestion in the afternoon peak hour is westbound (reverse commute), i.e., again indicating that the Spaghetti Bowl is the primary IH-10 bottleneck.

Figure 2-4: 2019 Average Weekday Eastbound Speed Afternoon Peak Period (2:30 – 6:30 p.m.) for IH-30 Between US 54 and Hawkins Boulevard (in Segment 3) [2]



Speed: *Average speed for the 15 minute period (Miles per Hour).*
Delay: *Yearly extra travel time for all users (Person-Hours).*

The data in Figure 2-4 are for a portion of IH-10 Segment 3. Segment 2 does not match up precisely with the Texas congested roadways data. North Mesa Street and US 54 also includes the congested approach to the Spaghetti Bowl (in Segment 3) and is ranked 163th. The section west of North Mesa continues to SL 375 and is ranked 191st.

Congestion in Segment 3 is much worse today than congestion in Segment 2 and is caused by delays at the Spaghetti Bowl for both eastbound and westbound traffic.

[2] https://mobility.tamu.edu/texas-most-congested-roadways/

3 Modeling Today's IH-10 Traffic

"All models are wrong, but some are useful." (George Box)

Transportation model outputs are too often presented without providing important context about model error and bias. When these issues are acknowledged, generally a simple caveat is added such as "the model results should be taken with a grain of salt." I go further and provide both model results and a discussion of model limitations. The intention is to highlight what can be confidently learned from the model vs. model information that is less reliable.

There are three different types of transportation models used in alternatives analyses:

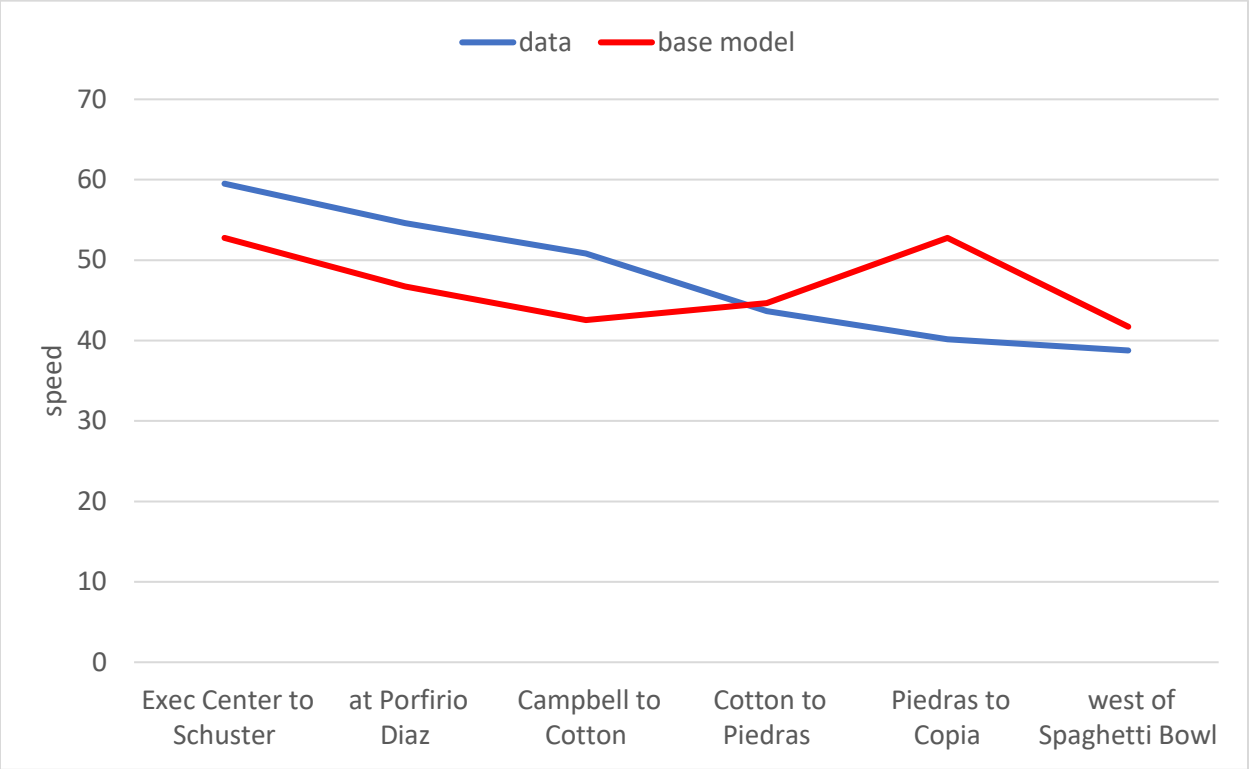
- macro scale – modeling roadway segments as independent from each other – Static Traffic Assignment ("STA"),
- mesoscale – modeling road segments as interconnected so that traffic queues spill back to upstream segments ("DTA"), and
- microsimulation – modeling individual vehicles.

These three model types often are correlated with geographic scale, with the macro models applied regionally, the microsimulation models applied in small subareas, and the mesoscale models at an intermediate geographic scale. Microscale models require much more data and computation time so would be costly to apply regionally, but it is practical to apply mesoscale models as is discussed in Section 9 of this report.

The model results presented in this report are all at the macro scale using the El Paso Metropolitan Planning Organization's regional travel demand model that covers all El Paso County.

As discussed in the previous section, traffic data show that in the afternoon peak hour, the Spaghetti Bowl is a bottleneck in the eastbound peak direction traffic that impacts traffic upstream Segment 2 eastbound traffic. The macro model cannot fully represent the Spaghetti Bowl bottleneck because it uses a static traffic assignment ("STA") algorithm that treats every road segment as independent, i.e., upstream traffic is not affected by the downstream bottleneck in the model – no matter how bad the bottleneck is. This is illustrated in Figure 3-1 comparing modeled base year (2017) model speeds to speed data.

Figure2-7: 2019 Afternoon Peak Period (3:30 – 7:30 p.m.) Modeled Speeds vs. Data



The model speeds are in the right general ballpark. The model is good at matching the speed at the Spaghetti Bowl bottleneck. However, the model significantly overestimates speed just upstream of the Spaghetti Bowl. The model also underestimates speeds away from the bottleneck (the west half of Segment 2).

The regional transportation model cannot represent bottlenecks like the Spaghetti Bowl realistically because it treats every road segment as independent from upstream and downstream road segments.

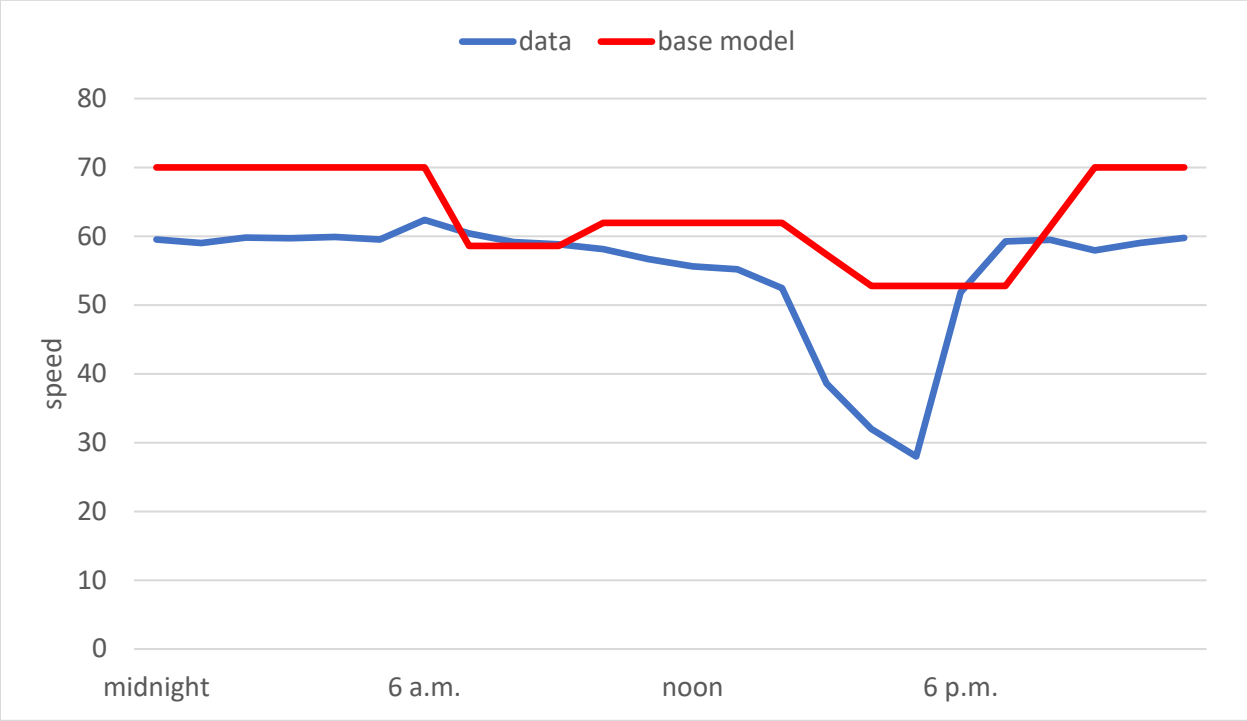
The issues presented in Figures 3.1 and 3.2 focus on the primary bottleneck in IH-10 Segment 2, but these issues are present for all bottlenecks in the region, and for other likely bottlenecks that would horizon by the model horizon year of 2050. In every case, the model fails to properly account for delays upstream of bottlenecks because the road segments are modeled as independent.

Another critical problem with STA models that frequently is present in analyses of future alternatives (particularly in regions more congested than the El Paso region) is that the model does not constrain traffic volumes to roadway capacity. Rather than limit throughput at highway bottlenecks to capacity,

the model allows impossibly high throughput, and these traffic overestimates also distort forecasts for upstream and downstream road segments.

Upstream of the Spaghetti Bowl bottleneck, model speeds match data poorly across the 24-hour day as illustrated in Figure 3-2 for IH-10 eastbound between Piedras and Copia.

Figure 3-2: Piedras to Copia Eastbound 2019 Speed vs. 2017 Base Year Model by Hour



Model differences shown in Figure 3-2 include:

- overestimating overnight period (7:30 p.m. – 7:00 a.m.) model speeds as 65 mph when actual speeds average 60 mph,
- showing morning period (7:00 – 10 a.m.) speeds as lower than overnight speed when the data show no decline in speed and even a slight increase, and
- mostly missing the afternoon effects of the Spaghetti Bowl bottleneck on this segment. (Note: the dip in Figure 3.2 looks much more dramatic than in Figure 3.1 because Figure 3.1 averages the speed over a four-hour period.)

These types of errors distort travel time and delay metrics, particularly for modeled road segments upstream of bottlenecks. These issues with the EPMPO regional travel model are typical of those

Treating every road segment as independent distorts key model metrics including traffic volumes, travel time, speed, and delay so care must be taken in evaluating them.

present with the regional models maintained by almost all U.S. MPOs. It is important to understand these problems when reviewing any STA model outputs involving congested highways.

4 Modeling Future IH-10 Traffic

The horizon year in the EPMPO model is 2050, i.e., 27 years from today and 33 years from the 2017 model base year. Modeling traffic in 2050 requires detailed housing and employment estimates at the Transportation Analysis Zone ("TAZ") level for 2050. Any errors in these inputs will compound errors in the transportation modeling.

The process that developed these 2050 housing and employment inputs is documented in the EPMPO's MTP Appendix G. The forecasts include a moderate 25% increase in regional population between 2017 and 2050, with most of the increase to the east of Highway Loop. Despite the moderate assumed population and worker growth, the MTP assumes about 3 times as much employment growth, 69% between 2017 and 2050. Again, most of this growth is forecast to be located east of Highway Loop 375.

I call this "nominal" employment growth because the transportation model treats unbalanced workforce and jobs inputs as errors that are corrected automatically within the model. The model implicitly assumes that the population and housing inputs are more accurate than the employment inputs and treats the adjusts the excess employment through "balancing attractions to productions." In the transportation model, the 25% increase in population translates into a slightly lower 23% increase in work trips relative to 2017, i.e., one third of the increase in nominal jobs. The hidden model correction is equivalent to treating all 2050 employment as having a 27% vacancy rate (over and above the normal real-world vacancy rate). This vacancy rate applies to all employers in central El Paso including UTEP, medical centers, etc. Furthermore, this adjustment doesn't just affect work trips. Medical centers are modeled with 27% fewer patient visits in the model today given the same future employment. Shopping centers have 27% fewer visits with the same employment. These lost trips are not made up from increased external visitors because external trips are treated as separate in the model.

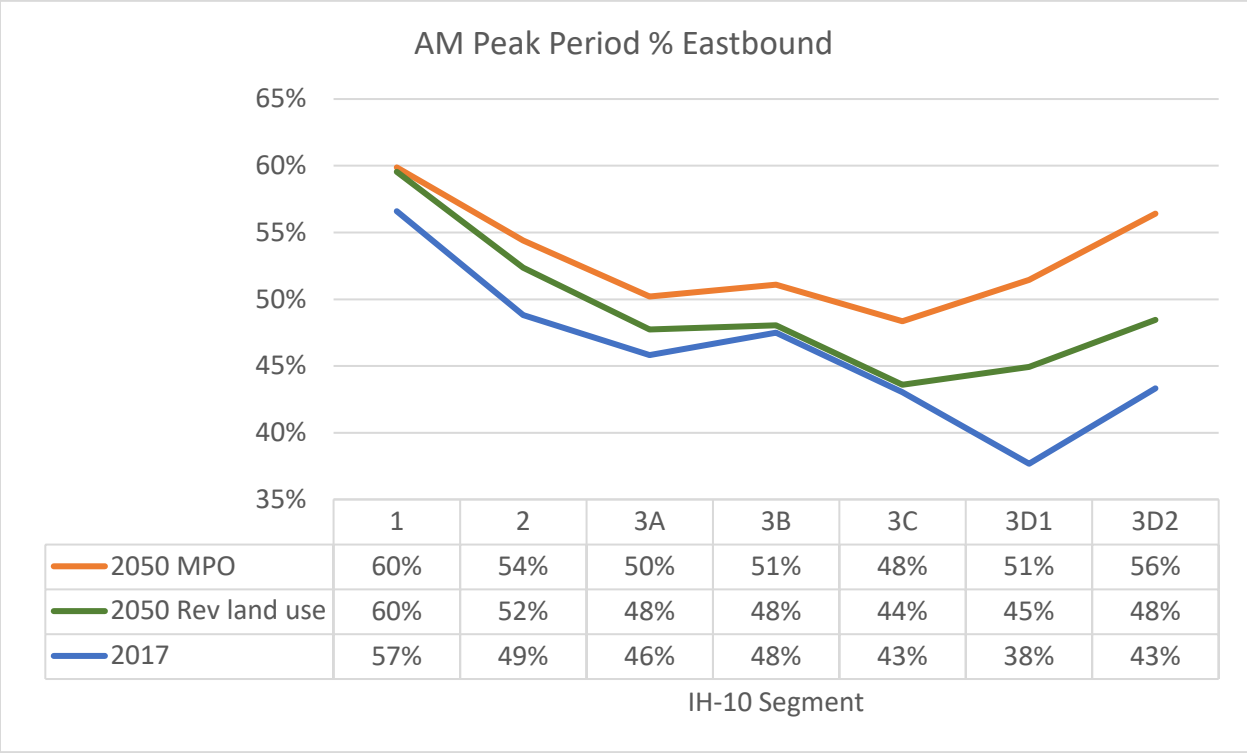
This issue was brought to the EPMPO's attention last year and they stand by their forecasts. However, valid modeling requires balanced jobs and work trip inputs to prevent modeling unintended disinvestment in today's employment centers. I have corrected this problem by multiplying every nominal new job in the MPO forecast by 33.5% to make the jobs and work trips balance.[3]

Modeling future traffic realistically requires balanced regional jobs and population inputs.

[3] In the July 2022, a second land use issue also was discussed. When comparing the MPO's 2050 land use inputs to the 2017 land use inputs from the previous MTP process, it appeared there were also jobs and housing decreases in TAZs throughout the region. When the new modeling files were obtained, it turned out that the changes were between the 2017 inputs in the two MTPs rather than between 2017 and 2050 in the new MTP.

Even with corrected 2050 land use inputs, the amount of growth forecast east of Highway Loop 375 would have significant effects on the direction of weekday per period traffic. Figure 3-3 shows modeled morning peak period travel by direction. In the 2017 base model, 57% of IH-10 morning peak period travel in Segment 1 (west of Downtown) is eastbound, i.e., inbound. In Segment 3D2 (Zaragosa to Eastlake), 57% of IH-10 morning peak period travel is westbound, i.e., also inbound (because Figure 3-3 shows 43% as eastbound).

Figure 3-3: Piedras to Copia Eastbound 2019 Speed vs. 2017 Base Year Model by Hour



	1	2	3A	3B	3C	3D1	3D2
2050 MPO	60%	54%	50%	51%	48%	51%	56%
2050 Rev land use	60%	52%	48%	48%	44%	45%	48%
2017	57%	49%	46%	48%	43%	38%	43%

With the MPO land use inputs, so much of the nominal employment is shifted to the east that the model shows 56% of the IH-10 morning peak hour travel in Segment 3D2 as eastbound, i.e., what is today outbound or reverse commuting. This is implausible. The modeling with the revised 2050 land use shows a higher share of eastbound travel in the morning peak hour than in the base year 2017 model, but the effects are much more moderate.

As specified in our scope, alternatives modeling was done both with the MPO land use inputs and the corrected inputs. The results with the corrected inputs are presented in the main body of the report, and the results with the MPO land use inputs are presented in Appendix A.

There are significant differences in total time and cost between the two land use alternatives. Comparing the metrics for the MPO Build alternatives, the model with the MPO land use has significantly higher time and cost than the one with the balanced land use – equivalent to an additional $1.3 million a day in cost plus monetarized time per day. The unrealistic shift of job origins and destinations to the far east necessitates longer trips in the model. This is a much larger number than the cost plus monetarized time differences between alternatives with either land use scenario documented in Section.8.

5 2050 Widening Alternatives

The primary IH-10 alternative modeled is the 2050 MTP alternative that is like TxDOT Alternative H and includes an additional general-purpose lane in each direction plus an adaptive lane in each direction.

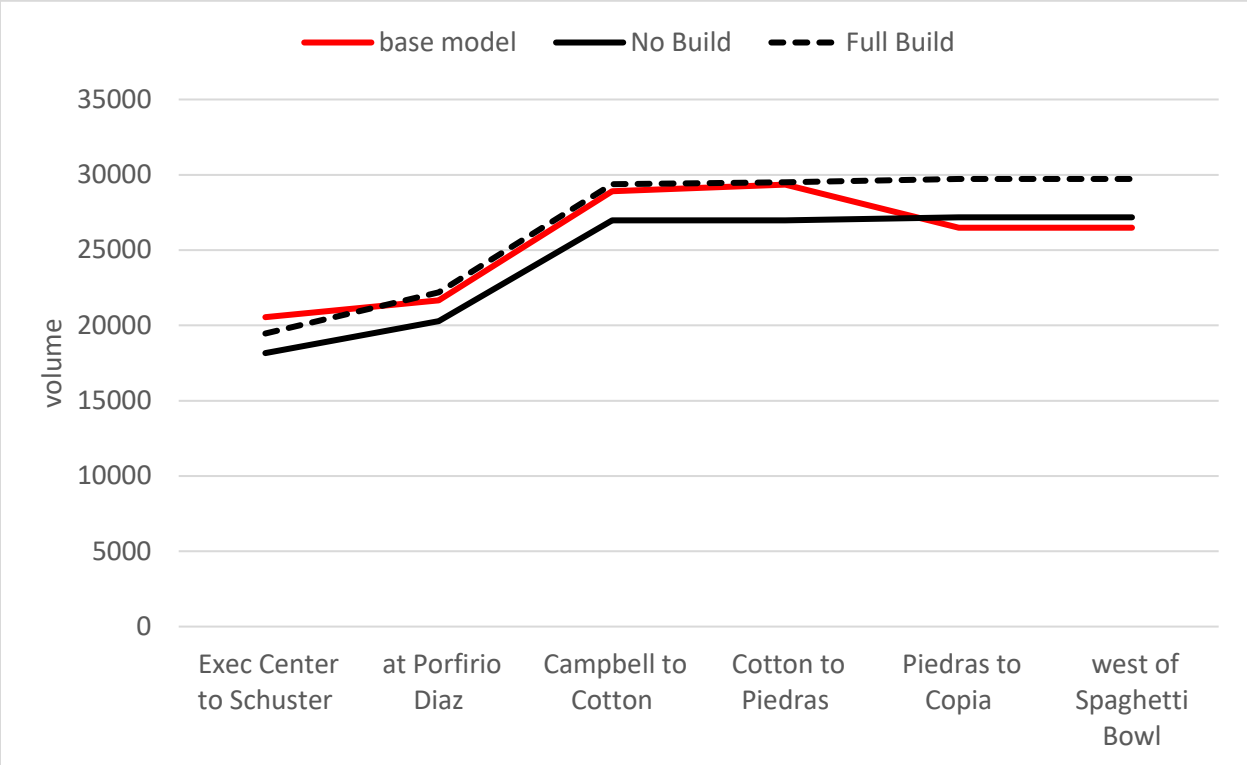
The purpose of the adaptive lanes has not been established, and the model makes them available to all vehicles without charge or delay for entering or exiting. Therefore, the model essentially adds two general-purpose lanes in each direction. If usage were restricted, e.g., only HOV allowed and/or prohibiting trucks, the modeling results would be different.

An alternative was modeled where only Segments 1 and 2 are completed. Segment 2 is scheduled in the RTP in 2027 and Segment 3A is not scheduled until 2031. Therefore, it is probable that a network with only Segments 1 and 2 will be in place for a significant time. Furthermore, this time could be extended if priorities and/or available funding change.

This report focuses on afternoon peak period traffic because that is where the congestion issue is present today and is likely to continue to be the most significant issue. Figure 5-1 shows modeled afternoon peak period IH-10 traffic volumes for the base year (2017), a No Build alternative (Segments 2 and 3) and a Full Build alternative (Segments 2 and 3).

All the alternatives modeled include completing frontage roads to the west of Downtown that are needed for reliability and emergency access as an alternative to the IH-10 freeway lanes.

Figure 5-1: Modeled IH-10 Eastbound Afternoon Peak Period Traffic Volume (3:30-7:30 p.m.)



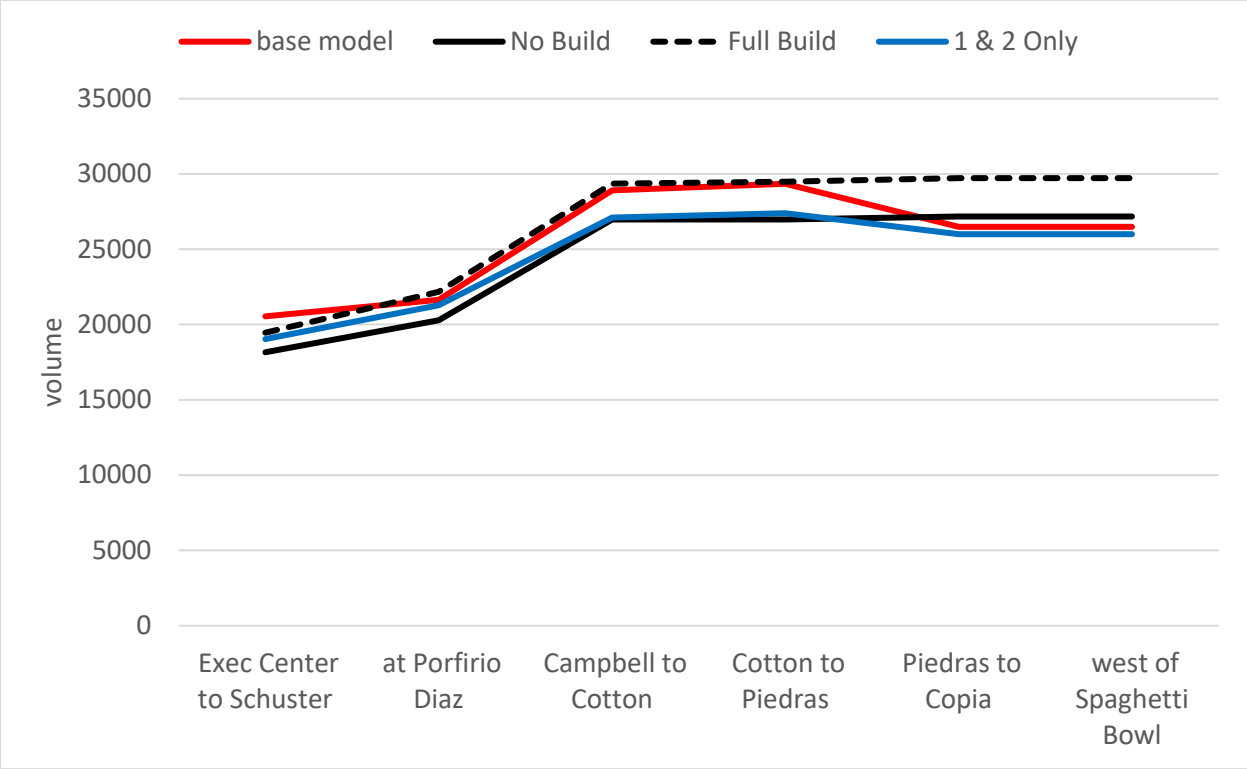
As shown in Figure 5-1, the modeled No Build traffic volume is generally lower than the volume in the 2017 base year model. There are three reasons for this:

1) only moderate population growth is assumed between 2017 and 2050 (25 percent),
2) most of this the population and employment group is forecast to be well to the east of the IH-10 segments shown in Figure 5-1 (Segments 2 and 3A), and
3) the growth in the far east would slow modeled IH-10 traffic to the east of Segment 3A and somewhat suppress IH-10 traffic volumes in Segments 2 and 3A.

In the Full Build alternative (with two additional lanes in each direction), this third reason is largely eliminated, but the Full Build traffic volumes are almost identical to the 2017 volumes from Executive Center to Piedras, with significant traffic growth only at the east of Segment 2 and in Segment 3A.

Figure 3-A adds a line for an alternative where only Segments 1 and 2 are constructed. In this case the modeled volume is lower than the 2017 base year scenario for all of Segment 2.

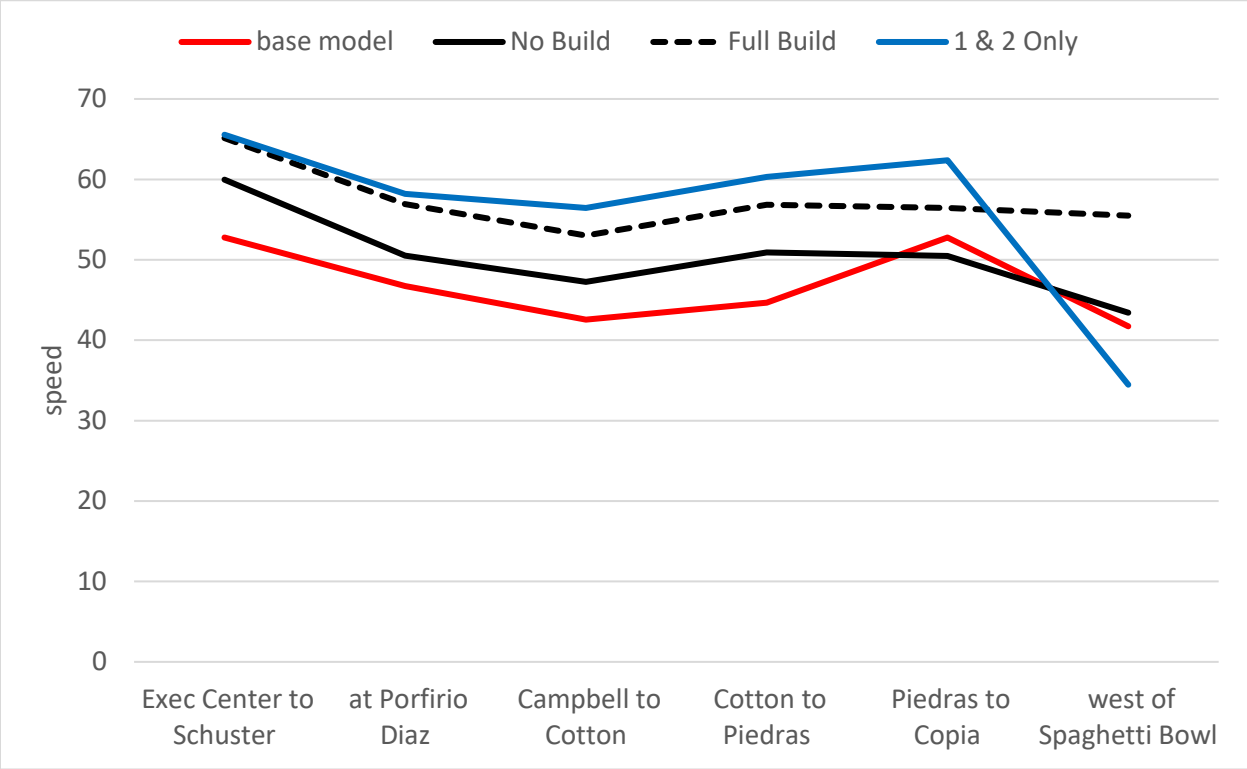
Figure 5-2: Modeled IH-10 Eastbound Afternoon Peak Period Traffic Volume (3:30-7:30 p.m.) including Alternative with Segments 1 and 2 Only



The modeling indicates that widening IH-10 Segment 2 is likely unnecessary, especially before Segment 3 is widened.

Figure 5-3 shows modeled eastbound peak period speeds for the same alternatives shown in Figure 5-2.

Figure 5-3: Modeled IH-10 Eastbound Afternoon Peak Period Speed (3:30-7:30 p.m.) including Alternative with Segments 1 and 2 Only



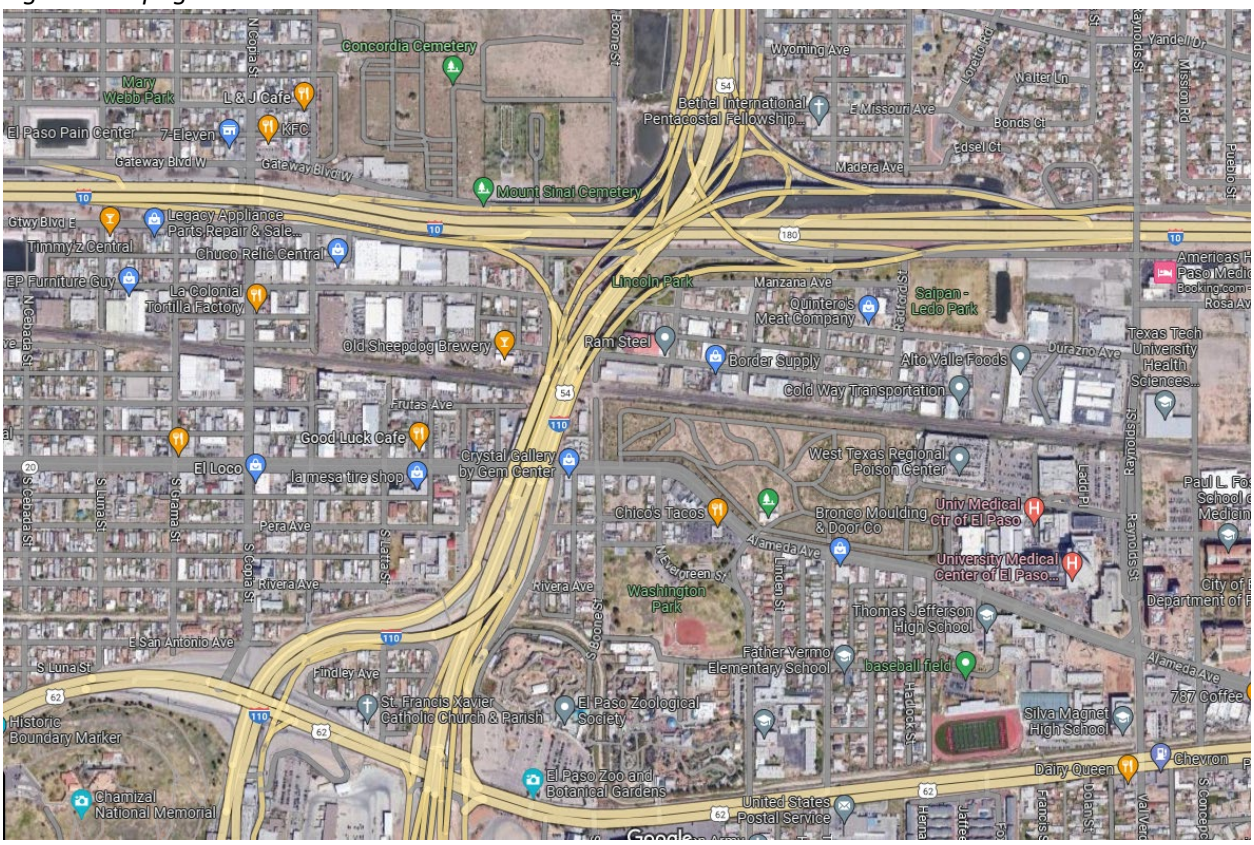
As shown in Figure 5-3, modeled 2050 No Build alternative speed is generally higher in Segment 2 than in the base year 2017 alternative except for the eastern segment from Piedras to Copia where it is slightly higher. The Build alternative speeds are significantly higher than the No Build speeds through Segments 2 and 3A. However, in the alternative where only Segments 1 and 2 are constructed, the modeled speed in Segment 3A to the west of the Spaghetti Bowl is significantly lower than it is in the base year model.

The model underestimates the impacts of this bottleneck because, as was discussed earlier, it treats every road segment as independent of other road segments. In reality, the modeled delays in Segment 3A would also dramatically slow traffic in Segment 2.

The modeling indicates that widening IH-10 Segment 2 is before Segment 3 is widened will aggravate the existing Spaghetti Bowl bottleneck and provide little benefit.

As shown in Figure 5-4, the Spaghetti Bowl is an extremely complex interchange.

Figure 5-4 Spaghetti Bowl Arial Photo



The Spaghetti Bowl design is to concentrate traffic, including a lot of local traffic, into this single interchange and to support movements between every entering road to every exiting road. This provides efficient traffic operations when traffic volumes are below roadway capacity, but is not resilient with high traffic volumes. When the Spaghetti Bowl becomes congested, some local trips shift to the street system.

Anthony Downs wrote about this general traffic phenomenon in 1992, coining the term *triple convergence* to describe how peak period traffic congestion is inevitable in urban areas because drivers will compensate for capacity increases by (a) shifting routes, (b) shifting travel time of travel, and (c) shifting travel mode.[4] After capacity expansion, the new equilibrium will be just as congested as the old equilibrium. Downs describes how drivers will choose "limited-access roads that are faster than local streets if they are not congested", but the attractiveness of such routes will cause them to become congested "to the point where they have no advantage over the alternate routes" (i.e., to non-freeway streets).

[4] A. Downs. *Stuck in traffic: Coping with peak-hour traffic congestion*. Brookings Institution, Washington DC (1992)

No vibrant urban area in the U.S. has been able to build itself out of peak period freeway congestion. When freeways are congested, the local street system helps bail them out during peak traffic periods. This works best where the street grid is robust.

In the future, there likely will be more of this shifting from IH-10 to streets during peak traffic periods – especially without widening but even with widening. Increasing capacity through the Spaghetti Bowl may require more than just adding mainline lanes (general-purpose and/or adaptive), but also may require adding ramp lanes, or even reconfiguring the interchange completely. As shown in Figure 5.5, the limited cross-section today and the existing structures will make adding the adaptive and general-purpose lanes extremely complicated and costly. In addition, there are many ramps that need to be designed and rebuilt. It is unlikely that the interchange capacity will be increased enough to eliminate all future congestion.

Figure 5-5 Spaghetti Bowl Street View

Segment 3 should be designed and probably constructed before Segment 2 is widened.

6 Collector-Distributor Alternatives

The simplest Segment 2 non-widening alternative is the No Build alternative, and as discussed above, it s a viable alternative given the limited traffic growth forecast. The No Build alternative would avoid the problems documented above where only Segments 1 and 2 are widened before widening Segment 3, or if Segment 3 is never widened.

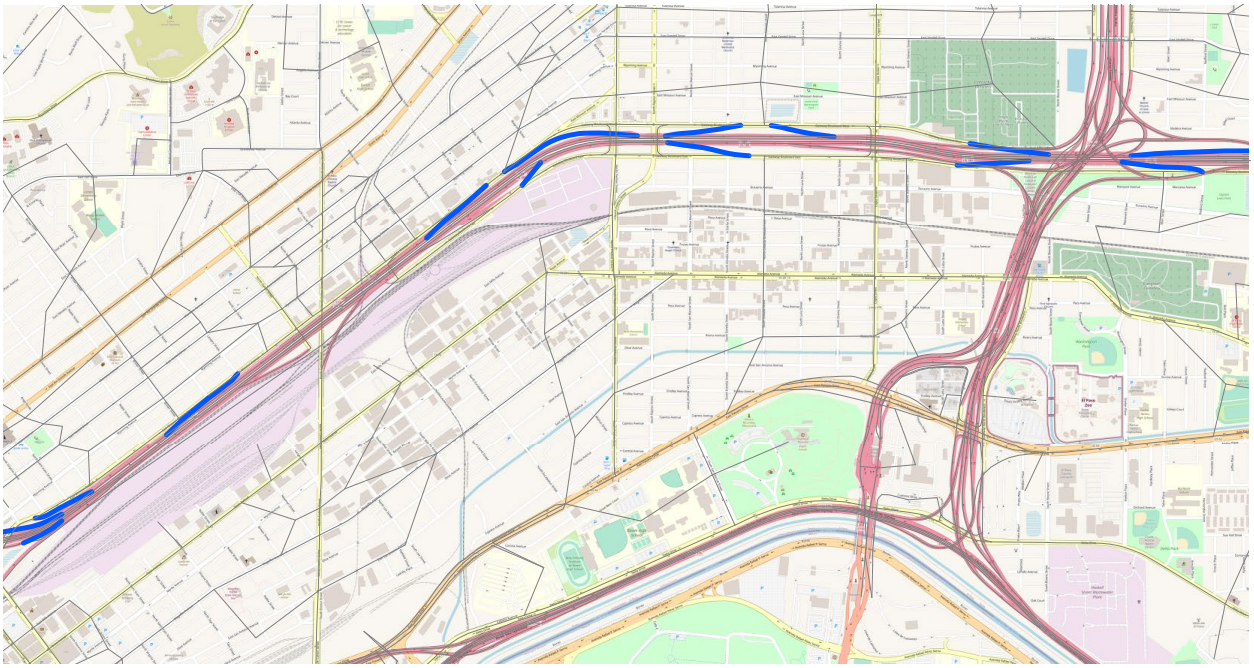
I developed two more non-widening alternatives intended to improve the upon the No Build alternative. These alternatives:

a) divert traffic away from the Spaghetti Bowl, and
b) remove some local traffic from IH-10.

This would be accomplished by closing ramps and moving Downtown IH-10 traffic to a frontage road collector-distributor system. The basic plan is unchanged from the previous report. In this report, a second alternative has been added with partial IH-10 Segment 2 widening – adding a general-purpose lane in each direction from Executive Center Boulevard through the Trench.

Figure 6-1 shows the existing ramps that would be closed.

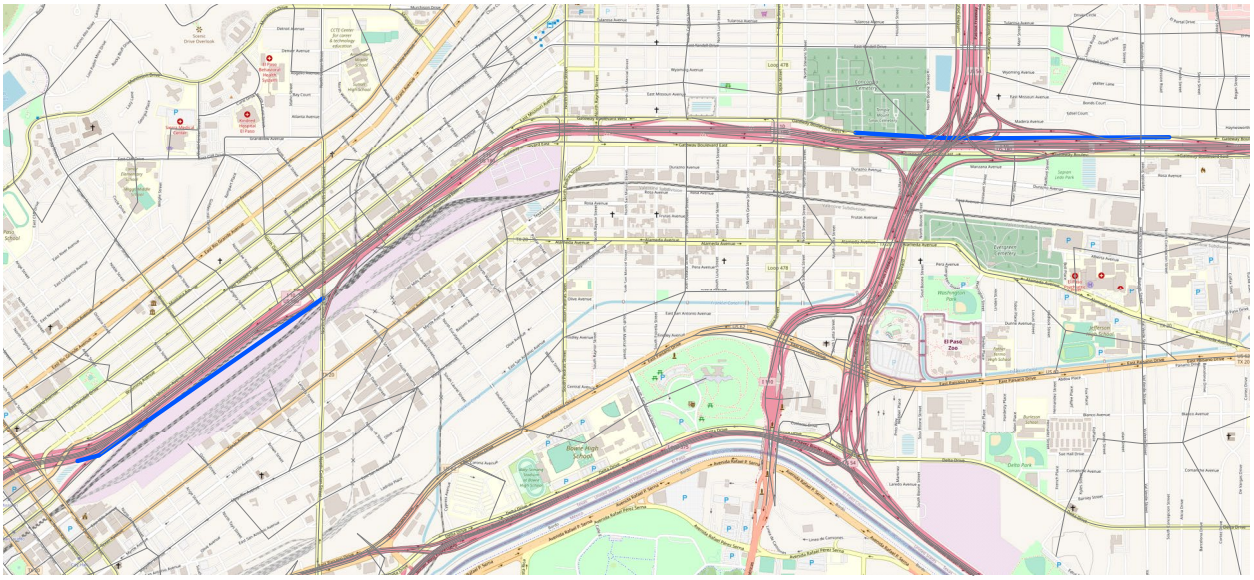
Figure 6-1: IH-10 Ramps That Would be Closed in the Collector-Distributor Alternatives



All ramps between US 54 and Downtown are removed because keeping only some of them would concentrate too much traffic at those locations and undermine the overall strategy.

The collector-distributor alternatives also include closing two gaps in the frontage road system (Figure 6-2). The new western frontage road segment shown in Figure 6-2 also is in the TxDOT Build alternative.

Figure 6-2: IH-10 New Frontage Road Segments in the Collector-Distributor Alternatives



As an alternative to widening, a collector-distributor system in the eastern part of Segment 2 could replace IH-10 ramps and use frontage roads to divert local traffic from the Spaghetti Bowl and IH-10 Segment 2.

The robust street grid east of Downtown supports a collector-distributor system to the east of Downtown. The street system is much more limited to the west and northwest of Downtown. The Collector-Distributor+ alternative marries adds an additional travel lane in each direction from Executive Center Boulevard through the Downtown Trench, i.e., 5 lanes in each direction between Executive Center Boulevard and the Trench, and 4 lanes in each direction in the Trench.

Figures 6-3 and 6-4 show modeled afternoon peak period traffic volumes and speeds, adding lines for the Collector-Distributor and Collector-Distributor+ lines to the information in Figures 5-2 and 5-3.

Figure 6-3: Modeled IH-10 Eastbound Afternoon Peak Period Traffic Volume (3:30-7:30 p.m.) including Collector-Distributor Alternatives

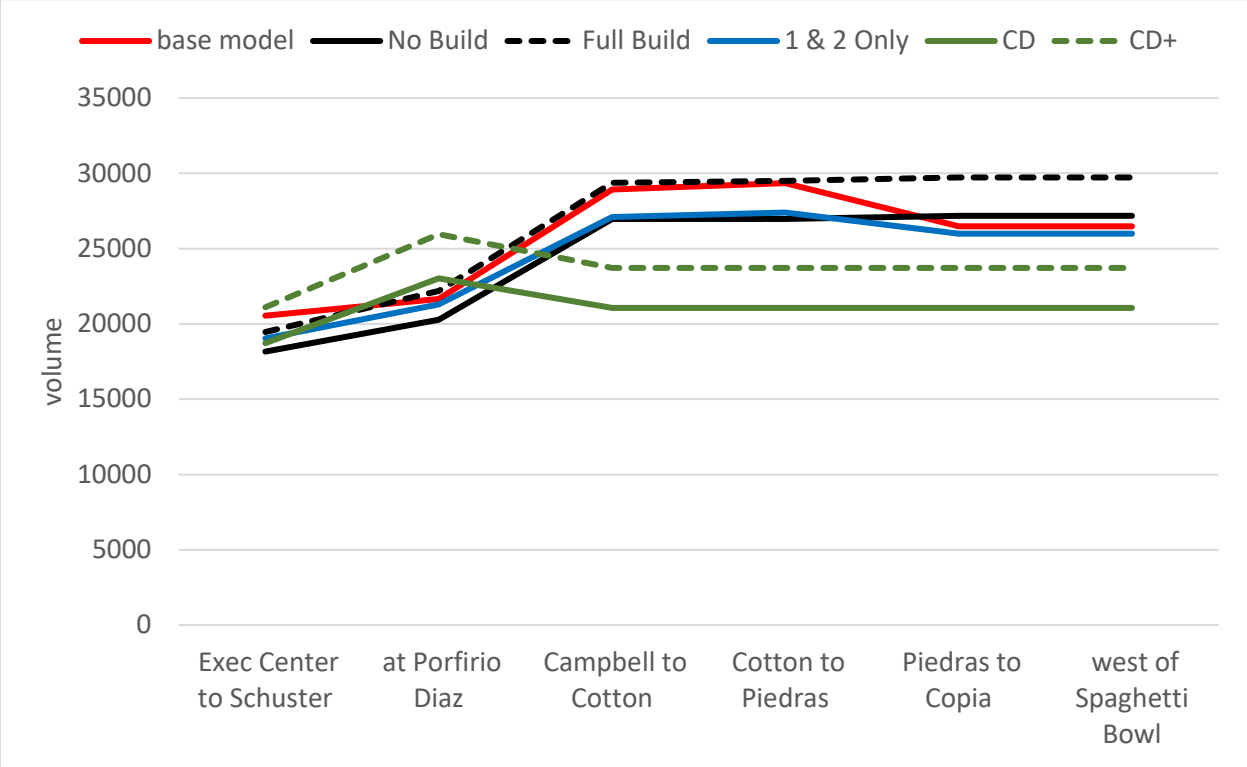


Figure 6-4: Modeled IH-10 Eastbound Afternoon Peak Period Traffic Volume (3:30-7:30 p.m.) including Collector-Distributor Alternatives

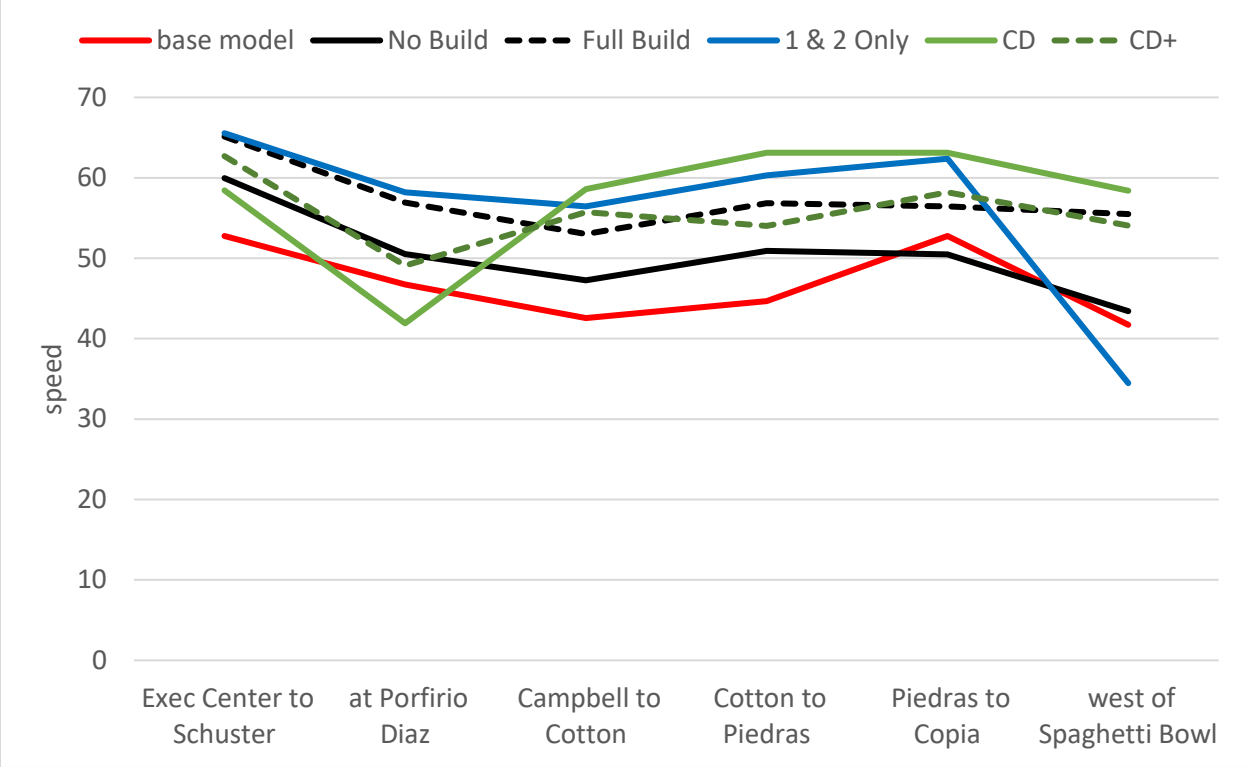


Figure 6-3 shows that the Collector-Distributor alternative is effective in reducing afternoon peak period traffic volume in the eastern part of Segment 2 where the ramps are removed. As shown in Figure 6-4, this produces higher modeled speeds in this part of Segment 2 during the afternoon peak period than any of the other alternatives, including the Full Build alternative. However, these benefits are offset somewhat by lower speeds in the western part of Segment 2.

Relative to the Full Build alternative, the Collector-Distributor performs better in the eastern portion of Segment 2 and worse in the western portion of Segment 2. Given that current traffic congestion is in the eastern part of Segment 2, the Collector-Distributor alternative may outperform the Full Build alternative. However, a better model of the Spaghetti Bowl bottleneck would be required to evaluate this fully. As discussed in Section 9, I recommend regional Dynamic Traffic Assignment ("DTA").

The Collector-Distributor alternative performs better than the Full Build alternative in the eastern part of Segment 2 but worse in the western part of Segment 2. A better model would be needed to fully evaluate the tradeoffs between the two alternatives.

Adding one general-purpose lane in each direction from Executive Center Boulevard through the Trench in the Collector-Distributor+ alternative is intended to address the lower speeds in the western part of Segment 2 in the base Collector-Distributor alternative. However, even this limited widening draws additional traffic onto IH-10 with resulting traffic volumes there higher than in the Full Build alternative – due to improved mobility from Downtown through the Spaghetti Bowl. These high traffic volumes result in only a small improvement in speeds in the west of Segment 2 and lower speeds in the eastern portion of Segment 2 relative to the base Collector-Distributor alternative. In the STA model, widening any sections of IH-10 draws more traffic onto IH-10. A better model is required to evaluate these alternatives fully.

Adding one general-purpose lane in each direction from Executive Center Drive through the Trench to the CD alternative is not conclusively better than the base CD alternative.

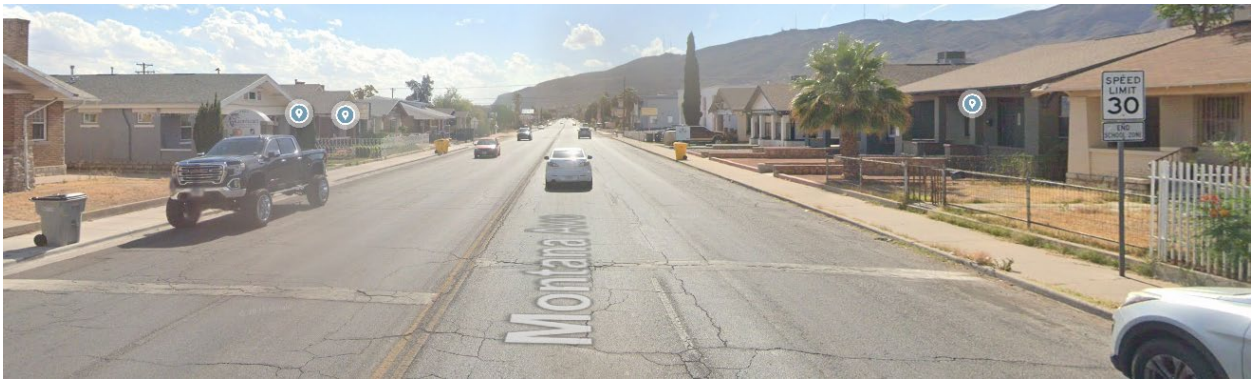
7 Impacts to Streets

When the Collector-Distributor alternative was presented last year, concerns were raised about overloading local streets with IH-10 traffic. These concerns are reasonable, but significant impacts are unlikely for several reasons:

1) most I-10 through traffic would remain on IH-10,
2) much of the traffic diverted from IH-10 will be accommodated on the frontage roads – which have excess capacity today,
3) some of the diverted traffic would have taken circuitous indirect routes that also adds traffic to some local streets, and
4) the street grid has a significant amount of reserve capacity.

The regional model has limited capability to model local streets accurately. Not all streets are included in the model. The ones that are included in the model are represented coarsely. Some streets including Montana Avenue is modeled as a "Principal Arterial" with a free-flow speed of 41 mph between Cotton Street and US 54, but other parallel streets are modeled as "Minor Arterials" with free-flow speeds of 37 mph between Cotton Street and US 54. In fact, most speed limits in this part of the City of El Paso are 30 mph. Figure 7-1 shows a Cotton Street example.

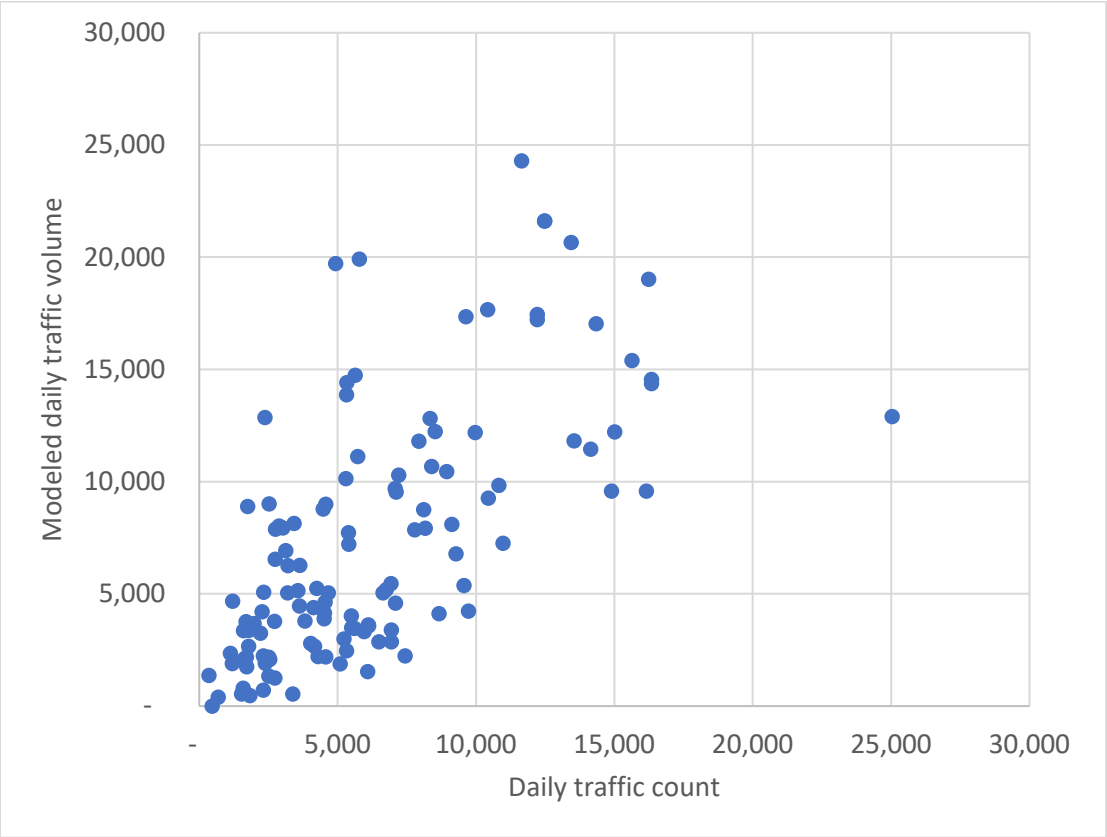
Figure 7-1: 30 MPH Speed Limit on Cotton Street Westbound West of North Grama Street



In suburban and rural areas, the model's hierarchy of road classes including different functional classes works well. In a Downtown grid, these distinctions often fail to predict driver behavior. The model assumes that Montana Avenue is preferable to parallel streets because of the higher speed, but if the speed limits are all 30 mph, there is no incentive to choose one street over another. There may be differences in speeds between parallel streets, but these differences are not accurately represented by the single functional class destination.

Regional travel demand models typically model do a poor job of matching Downtown street traffic volumes because they cannot simulate how drivers choose among parallel streets. Figure 7-2 shows how well the model matches daily traffic volumes Downtown including all street segments with counts in the model database.

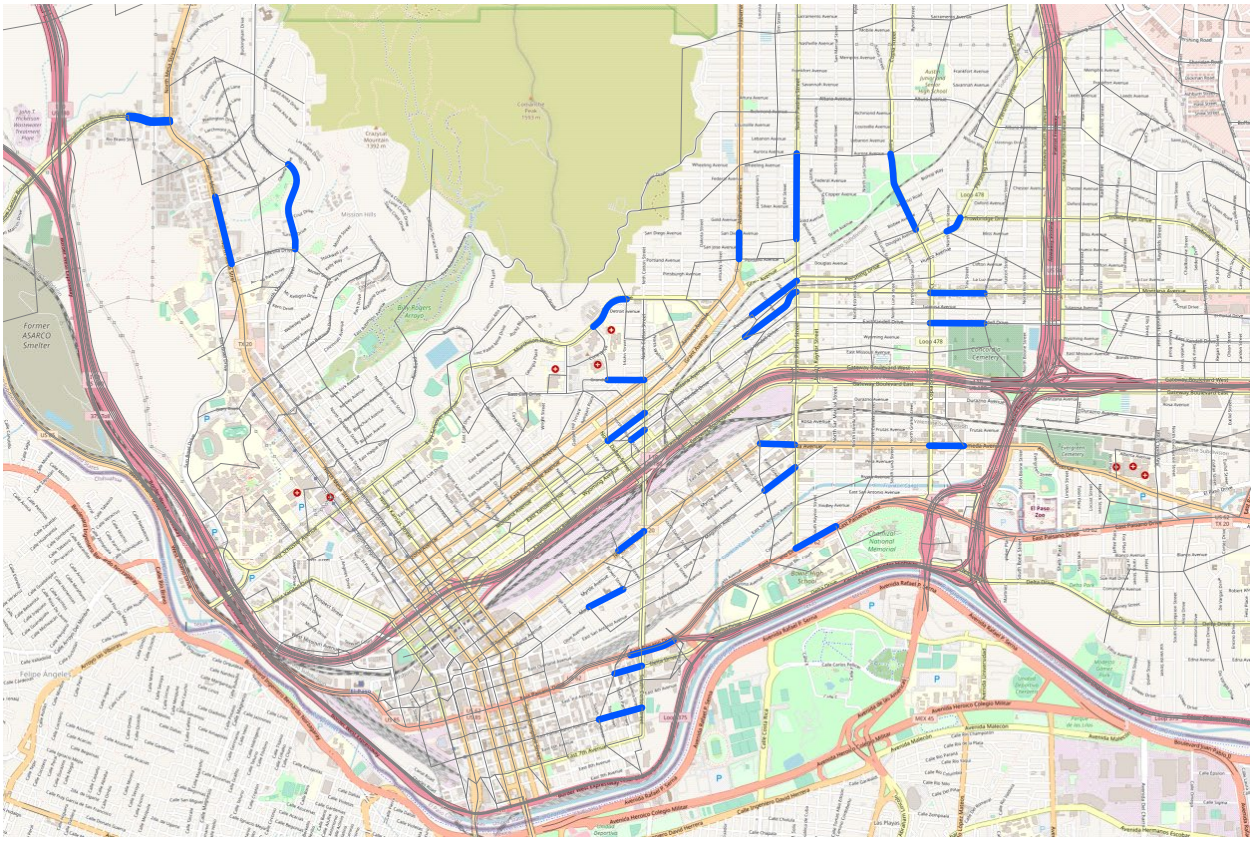
Figure 7-2: Modeled Daily Traffic Volumes vs. Traffic Counts (Base Year)



There is a weak correlation between modeled and actual traffic volumes, and the total is about right, but there are significant errors for many segments. These problems are typical of modeled downtowns in regional models.

In evaluating the impacts of alternatives on the local street system, a subset of road segments with base year counts were selected to focus on routes in and out of the Downtown area (Figure 7-3).

Figure 7-3: Preliminary Street Impact Evaluation Set



The evaluation set was further refined only to include street segments where the model daily traffic assignment is within +/- 30% of the counted traffic volume. There were enough street segments meeting these criteria to estimate assigned volume-to-capacity ratios for three screenlines:

- north south,
- east-west at Copia, and
- east-west at Piedras.

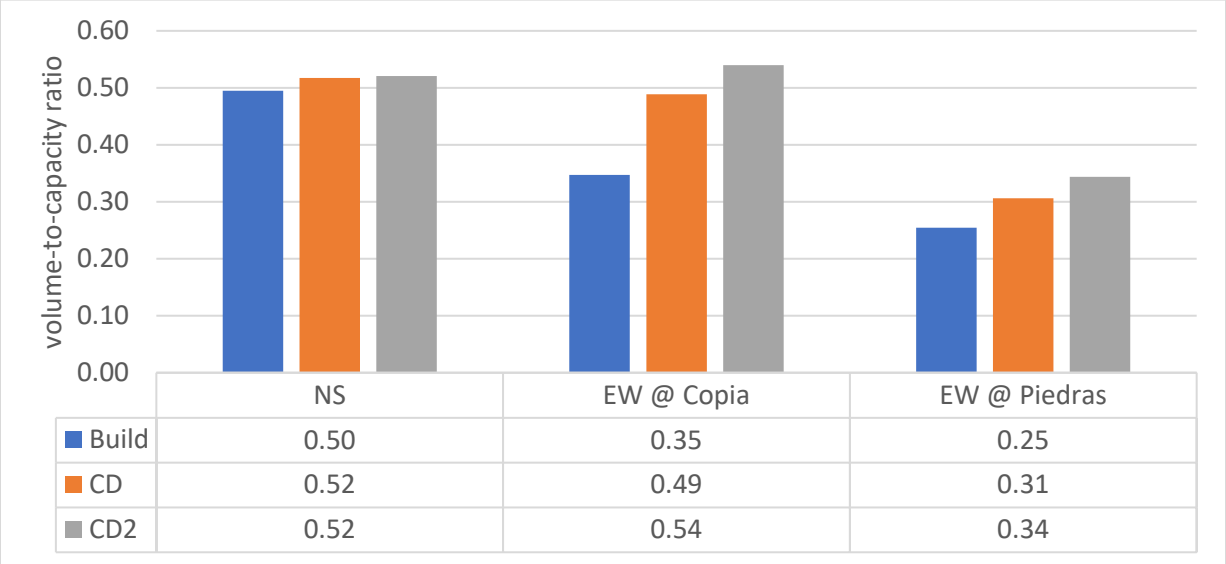
In each case, the volume-to-capacity ratios were calculated for the peak direction during peak periods, i.e., toward Downtown in the morning and away from Downtown in the afternoon.

Calculating the volume-to-capacity ratios required:

- adjusting the raw model outputs by multiplying by the ratio of the daily traffic count to the daily assigned traffic volume,
- summing the adjusted assigned traffic volumes in each group,
- summing the model capacities for each group
- calculating the volume-to-capacity ratio for the group.

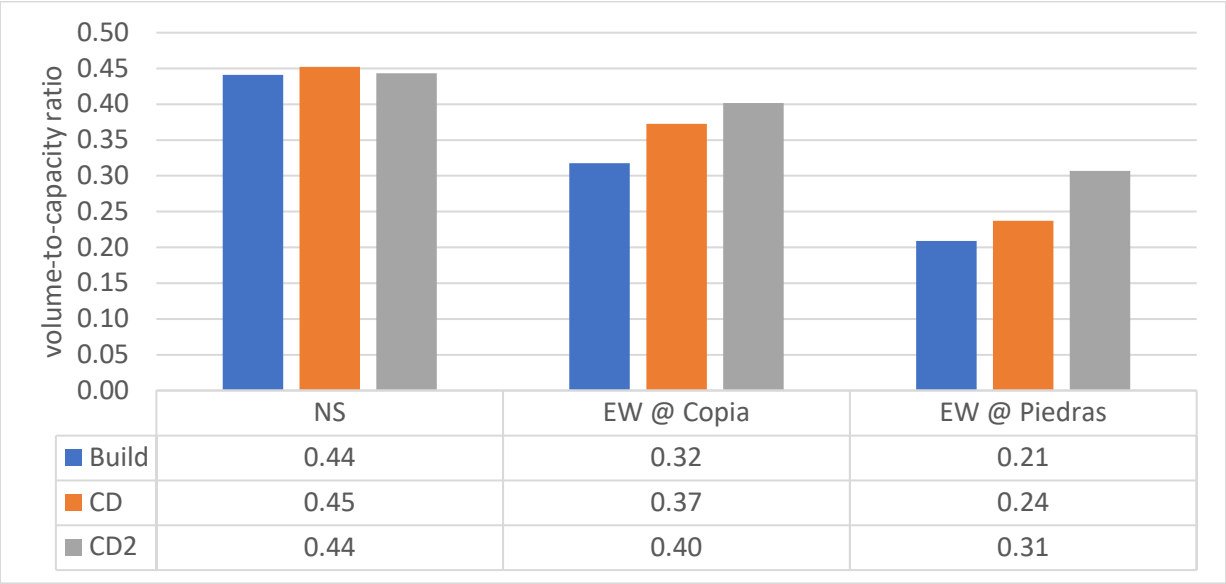
Figures 7-4 and 7-5 show the resulting volume-to-capacity ratios.

Figure 7-4: Volume to Capacity Ratios for the Morning Peak Period (Inbound to Downtown)



	NS	EW @ Copia	EW @ Piedras
Build	0.50	0.35	0.25
CD	0.52	0.49	0.31
CD2	0.52	0.54	0.34

Figure 7-5: Volume to Capacity Ratios for the Afternoon Peak Period (Outbound from Downtown)



	NS	EW @ Copia	EW @ Piedras
Build	0.44	0.32	0.21
CD	0.45	0.37	0.24
CD2	0.44	0.40	0.31

As shown in Figures 7-4 and 7-5, the additional street traffic in the Collector-Distributor alternatives is only a small part of the remaining street capacity, with the highest volume-to-capacity ratio of 0.54 for the morning peak hour at Copia (relative to a maximum of 1.00).

Neither of the CD alternatives would result in significant traffic congestion on other streets.

8 Regional Metrics

Region-wide vehicle miles traveled ("VMT") and vehicle hours traveled ("VHT") were summed across all roads, segmented between trucks (including medium and heavy trucks) and light-duty vehicles (cars and light trucks).

The VMT was used to calculate operating cost and VHT was used to calculate the monetary value of time – in both cases using multipliers developed by the U.S. Department of Transportation.[5]

The operating cost multipliers are:

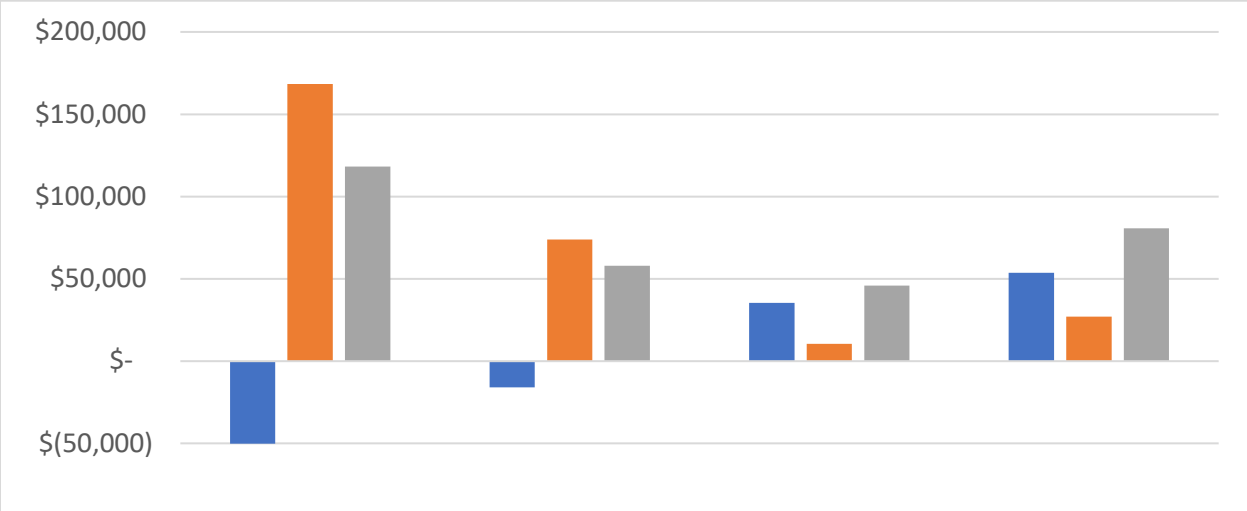
- Trucks $1.01 per mile
- Light-duty vehicles $0.46 per mile (omitting ownership costs that are included in some other multipliers including those estimated by AAA)

The value of time multipliers are:

- Truck drivers $32.40 per hour
- Light-duty vehicles $18.80 per person hour x 1.48 persons/vehicle = $27.82 per hour in peak periods and $18.80 per person hour x 1.58 persons/vehicle = $29.70 per hour in off-peak periods (both higher than often assumed, especially outside high-income regions)

Figures 8-1, 8-2 and 8-3 show the cost and monetized time metrices relative to the No Build alternative for light vehicles, trucks, and all vehicles.

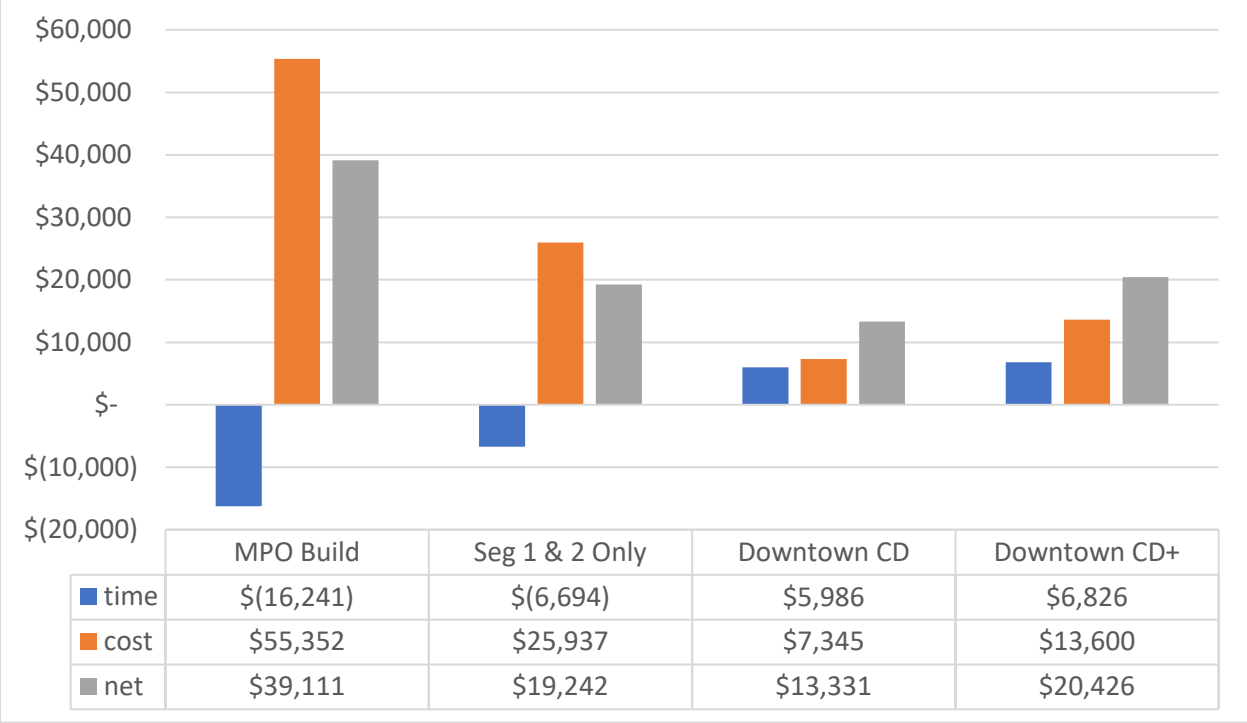
Figure 8-1: Cost and Monetized Time Relative to No Build Alternative – Light Vehicles



	MPO Build	Seg 1 & 2 Only	Downtown CD	Downtown CD+
time	$(50,080)	$(15,969)	$35,469	$53,617
cost	$168,288	$73,988	$10,530	$26,998
net	$118,208	$58,020	$45,998	$80,615

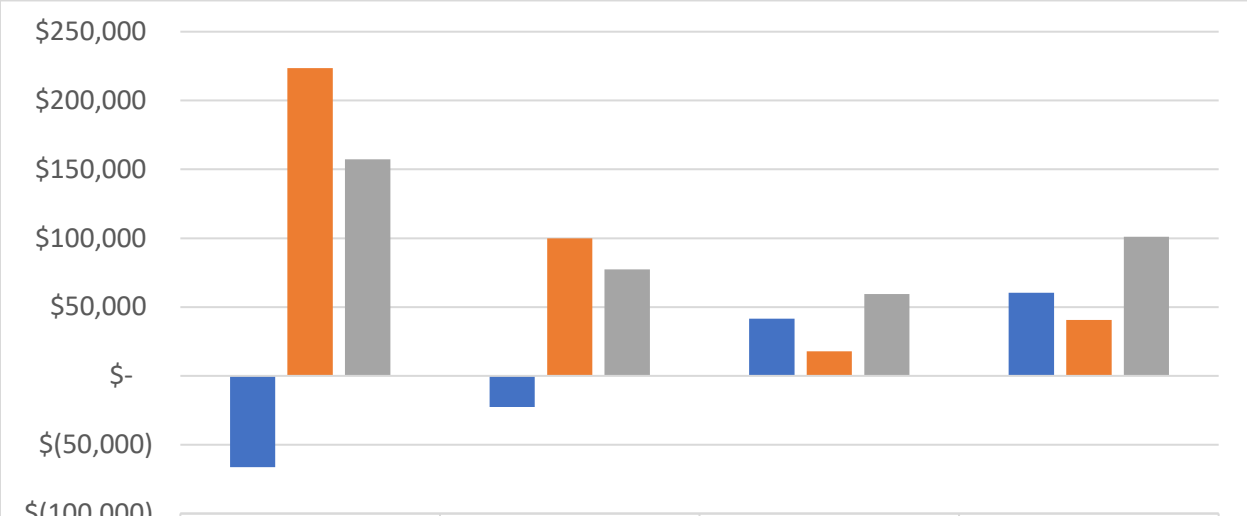
[5] U.S. Department of Transportation. Benefit-Cost Analysis Guidance for Discretionary Grant Programs. January 2023.

Figure 8-2: Cost and Monetized Time Relative to No Build Alternative – Trucks



	MPO Build	Seg 1 & 2 Only	Downtown CD	Downtown CD+
time	$(16,241)	$(6,694)	$5,986	$6,826
cost	$55,352	$25,937	$7,345	$13,600
net	$39,111	$19,242	$13,331	$20,426

Figure 8-3: Cost and Monetized Time Relative to No Build Alternative – All Vehicles



	MPO Build	Seg 1 & 2 Only	Downtown CD	Downtown CD+
time	$(66,321)	$(22,663)	$41,454	$60,443
cost	$223,640	$99,925	$17,875	$40,598
net	$157,319	$77,262	$59,329	$101,041

As shown in the figures above, the Build alternative reduces regional VHT relative to the No Build alternative, but the value of these time savings is more than outweighed by the additional cost from the higher VMT. The Segments 1 and 2 Only alternative has similar results but of lesser magnitude.

The Collector-Distributor alternatives increase both time and cost relative to the No Build alternative. Time is increased because of the traffic diverted from IH-10 to slower streets. Cost is increased because reducing delay on IH-10 induces more travel. Nevertheless, both CD alternatives outperform the Build alternative on net.

At the regional level, all the alternatives perform worse than the No Build on net when accounting for both the monetary value of travel time savings and travel cost, and the Full Build alternative performs the worst of all.

The Build alternative likely would perform even worse than shown in the above figures because the model only estimates about half of the induced travel that is calculated using the Rocky Mountain Institute's SHIFT Calculator. If the SHIFT Calculator is correct, the cost increases would be about twice what is shown, and the travel time savings would be less than what is shown because the induced travel also would increase delay.

Cost and time are the largest metrics that can be monetarized, but there are other metrics that could be included. Some alternatives analyses estimate crashes, and typically forecast a reduction in crashes with highway expansion. Urban freeways generally have lower total crash rates per vehicle mile than local streets, but often have higher fatality rates per vehicle mile due to higher speeds. USDOT's benefit-cost guidance estimates that the cost of a fatal crash ($13 million) is 44 times the average cost of an injury crash ($308,000) and over 3,000 times the $4,000 average cost of a no-injury crash. This makes doing benefit-cost calculations for alternatives very challenging because it would require forecasting not only crashes but crashes by type.

The USDOT benefit-cost guidance also estimates external costs per mile for noise, and emission costs per ton. These metrics could be included in a comprehensive alternatives analysis.

9 Other Modeling Methods

The regional Static Travel Assignment (STA) model described above often is only part of the alternatives modeling process, and has been discussed above, it is not necessarily very accurate. Therefore, it is important to understand other model types and how the models interact. Other modeling that may be part of the process includes:

- trend extrapolation,
- regional STA + small area microsimulation,
- regional STA + subregion Dynamic Traffic Assignment ("DTA"), and
- regional DTA

Trend extrapolation

In other TXDOT projects, including the Austin I-35 Capital Express Central project, regional modeling forecasts have been reviewed, but the alternatives analyses are primarily based on extrapolating past traffic growth trends. Trend extrapolation is much less sophisticated and reliable than even a mediocre regional STA model as it fails to account for:

- future land use,
- capacity constraints,
- mode changes, and
- diversion to less congested routes – particularly in a No Build alternative.

Regional STA + small area microsimulation

As discussed above, two major problems with regional STA models are:

1) every road segment is treated as independent, so that bottlenecks do not affect upstream traffic flow in the model, and
2) vehicle throughput is not constrained to roadway capacity, and bottleneck segments and upstream and downstream highway segments are assigned impossibly high traffic volumes.

Microsimulation models every vehicle separately and addresses these two STA model deficiencies. However, microsimulation is data intensive and is generally applied only to small subareas. Common practice is to feed the subarea microsimulation with the impossibly high traffic volumes from the STA model. This results in very long delays for the No Build alternative as vehicles are stacked up in the model waiting to get into the subarea. This is just useless "garbage in – garbage out" modeling because the inputs are impossible, and grossly exaggerate traffic problems in the No Build alternative.

Regional STA + subarea Dynamic Traffic Assignment ("DTA")

DTA model road segments as interconnected so that traffic queues spill back to upstream segments. The majority of current DTA work involves detailed modeling of intersections within a subarea. This is useful for understanding today's traffic and for short-term traffic analyses, e.g., planning for a construction period. However, it is no more useful for horizon year alternatives analyses as the regional STA + microsimulation approach because it also involves taking impossibly high traffic forecasts from the unconstrained STA model and entering them as inputs to a capacity constrained DTA model.

Regional Dynamic Traffic Assignment ("DTA"):

Linking two models in sequence is inherently problematic when there are critical inconsistencies between the two models as there are between STA and either microsimulation or DTA.

A better approach is applying DTA at the regional level so that only a single model is needed. In my peer-reviewed journal article: *Forecasting the impossible: The status quo of estimating traffic flows with static traffic assignment and the future of dynamic traffic assignment*[6], I document that replacing STA with DTA at the regional scale practical today, especially for smaller and medium-sized regions, including the El Paso region.

Alan Horowitz, co-author of dozens of reports on modeling for the U.S. Department of Transportation and the National Cooperative Highway Research Program ("NCHRP") wrote this about my paper on his blog.

- Choose DTA over STA whenever possible.
- If you must use STA, do not publish any alternative/scenarios with facilities loaded beyond a v/c ratio of 1.1.
- If an alternative/scenario is forecasting over-capacity conditions, look for the problem in other modeling steps and fix it.
- If you cannot fix it within the model, then modify or discard the alternative/scenario.[7]

The maximum volume-to-capacity ratio of 1.1 (110%) is to provide some margin of error. However, it would be erroneous to enter any volume-to-capacity ratio of greater than 1.0 (100%) into either microsimulation or DTA.

Regional Dynamic Traffic Assignment ("DTA") modeling would result in more accurate traffic assignments and travel time metrics than are possible with the regional Static Traffic Assignment ("STA") model either by itself or in combination with microsimulation or subarea DTA.

[6] https://www.sciencedirect.com/science/article/pii/S2210539517301232?via%3Dihub
[7] http://ajhassoc.com/index.php/2019/03/28/comments-on-forecasting-the-impossible/#more-483

10 Conclusions

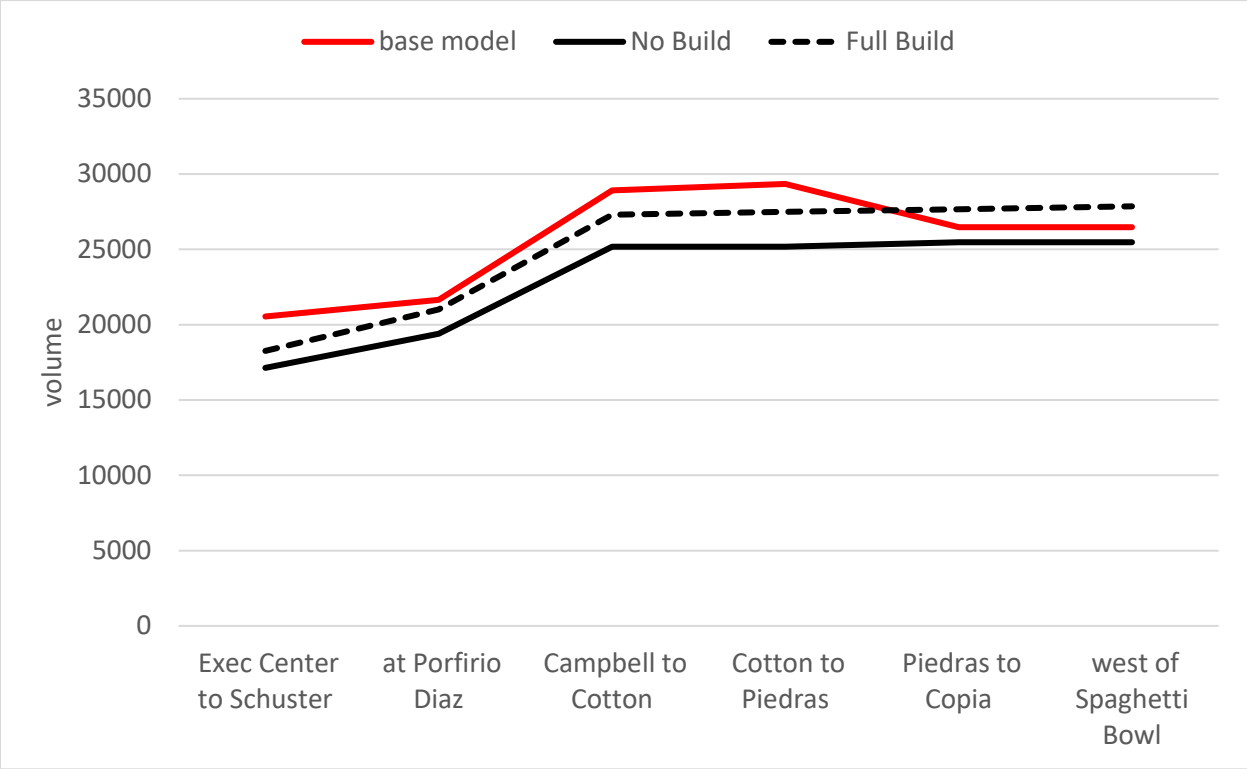
I have reviewed materials related to the proposed IH-10 Segment 2 (Downtown) expansion including traffic counts, traffic speed data and transportation modeling files, and have modeled five 2050 IH-10 alternatives. Based on this review, I present the following findings:

1) **The modeling indicates that widening IH-10 Segment 2 is likely unnecessary, especially before Segment 3 is widened**. **The modeling further indicates that widening IH-10 Segment 2 before Segment 3 is widened will aggravate the existing Spaghetti Bowl bottleneck and provide little benefit. Segment 3 should be designed and probably constructed before Segment 2 is widened**. The primary traffic congestion issue today in IH-10 Segment 2 is afternoon peak period delays caused by a bottleneck in the Spaghetti Bowl (Segment 3). Traffic congestion in Segment 3 is much worse today than congestion in Segment 2 and is caused by delays at the Spaghetti Bowl for both eastbound and westbound traffic.
2) **All the alternatives modeled include completing frontage roads to the west of Downtown that are needed for reliability and emergency access**.
3) **As an alternative to widening, a collector-distributor system in the eastern part of Segment 2 could replace IH-10 ramps and use frontage roads to divert local traffic from the Spaghetti Bowl and IH-10 Segment 2**. This "CD" alternative performs better than the Full Build alternative in the eastern part of Segment 2 but worse in the western part of Segment 2. A better model would be needed to fully evaluate the tradeoffs between the two alternatives. Adding one general-purpose lane in each direction from Executive Center Drive through the Trench to the CD alternative is not conclusively better than the base CD alternative.
4) **The CD alternatives would not result in significant traffic congestion on other streets** because:
   a. most I-10 through traffic would remain on IH-10,
   b. much of the traffic diverted from IH-10 will be accommodated on the frontage roads – which have excess capacity today,
   c. some of the diverted traffic would have taken circuitous indirect routes that also adds traffic to some local streets, and the street grid has a significant amount of reserve capacity.
5) **At the regional level, all the alternatives perform worse than the No Build on net when accounting for both the monetary value of travel time savings and travel cost, and the Full Build alternative performs the worst of all.**
6) Modeling future traffic realistically requires balanced regional jobs and population inputs. Balanced regional jobs and population inputs also reduces future travel time and cost metrics relative to imbalanced inputs.
7) The regional transportation model cannot represent bottlenecks like the Spaghetti Bowl realistically because it treats every road segment as independent from upstream and downstream road segments. Treating every road segment as independent distorts key model metrics including traffic volumes, travel time, speed, and delay so care must be taken in evaluating them. Regional Dynamic Traffic Assignment ("DTA") modeling would result in more accurate traffic assignments and travel time metrics than are possible with the regional Static Traffic Assignment ("STA") model either by itself or in combination with microsimulation or subarea DTA.

Appendix 1: Modeling Results with MPO Land Use Inputs

Note: The figure numbers match those in the main body of the report to facilitate comparison. None of the conclusions in the report are different if the MPO land use inputs are used instead of the adjusted land use inputs.

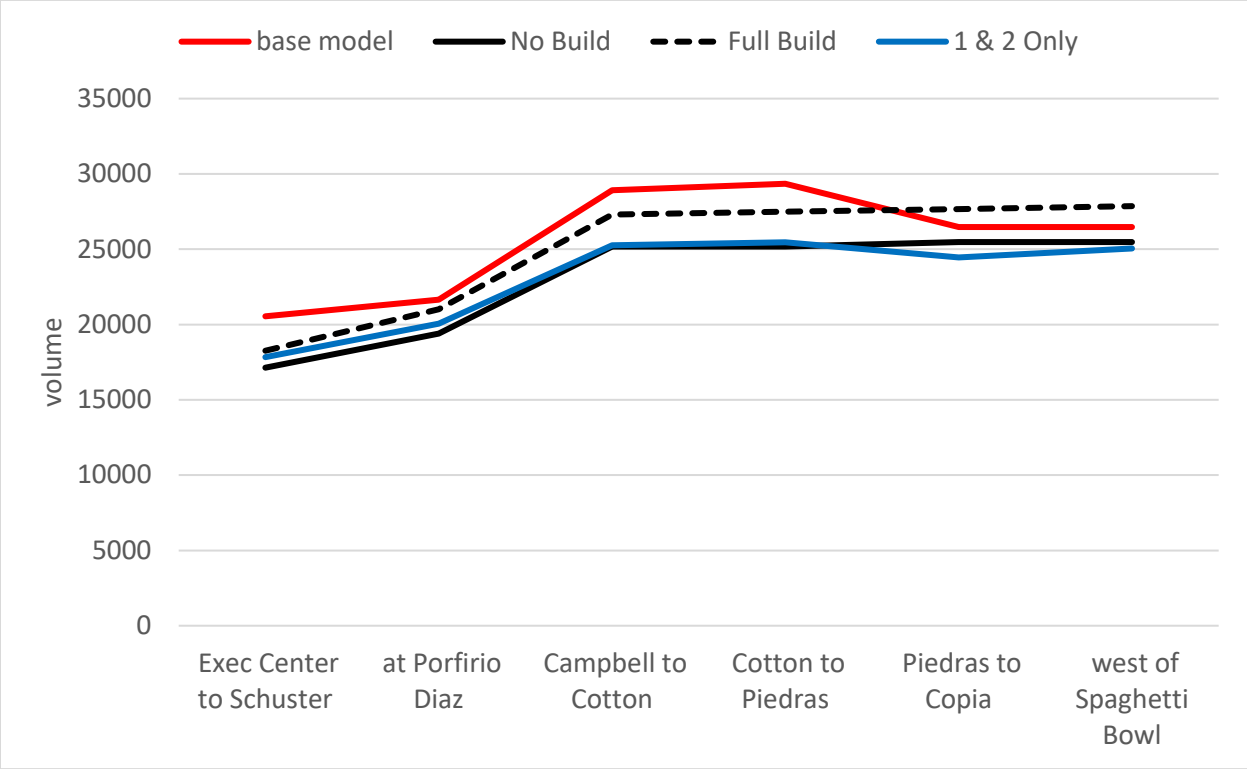
Figure A1-5-1: Modeled IH-10 Eastbound Afternoon Peak Period Traffic Volume (3:30-7:30 p.m.)



Relative to the balanced jobs and housing model, the MPO model volumes for both the No Build and Full Build alternatives are lower because the MPO land use shifts traffic farther east (beyond Segment 2) and shifts afternoon traffic in Segment 2 to the westbound direction.

The modeled No Build traffic volume is lower than the volume in the 2017 base year model. The Full Build traffic volumes are also lower than the 2017 volumes from Executive Center to Piedras, with moderate traffic growth only at the east of Segment 2 and in Segment 3A.

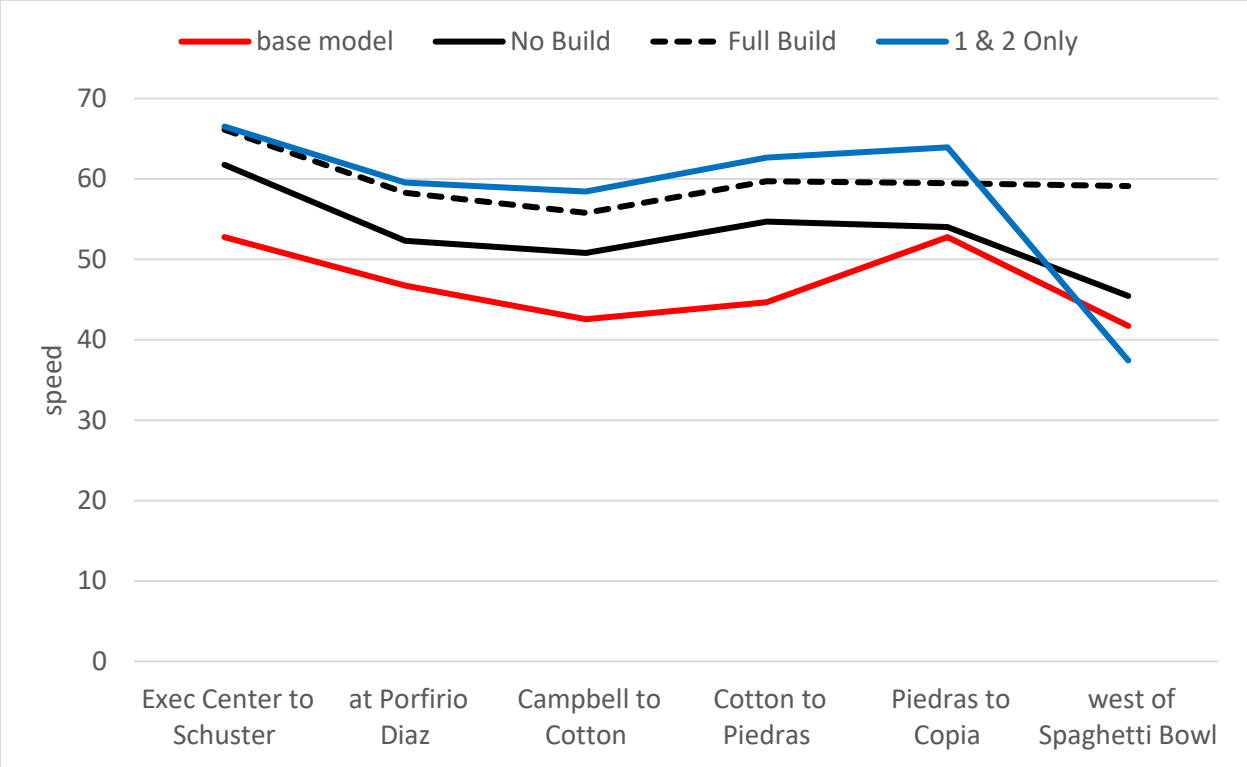
Figure A1-5-2: Modeled IH-10 Eastbound Afternoon Peak Period Traffic Volume (3:30-7:30 p.m.) including Alternative with Segments 1 and 2 Only



Relative to the balanced jobs and housing model, the MPO model volumes for both the Segments 1 and 2 Only alternatives also are lower because the MPO land use shifts traffic farther east (beyond Segment 2) and shifts afternoon traffic in Segment 2 to the westbound direction.

The lower volumes for all three future alternatives result in somewhat higher modeled speeds with the MPO land use compared to the balanced jobs and housing land use, but the pattern is the same. The Segments 1 and 2 Only alternative performs very badly at the approach to the Spaghetti Bowl.

Figure A1-5-3: Modeled IH-10 Eastbound Afternoon Peak Period Speed (3:30-7:30 p.m.) including Alternative with Segments 1 and 2 Only



The performance of the two Collector-Distributor ("CD") alternatives is similar in both land use scenarios. The Collector-Distributor alternative performs better than the Full Build alternative in the eastern part of Segment 2 but worse in the western part of Segment 2. A better model would be needed to fully evaluate the tradeoffs between the two alternatives. Adding one general-purpose lane in each direction from Executive Center Drive through the Trench to the CD alternative is not conclusively better than the base CD alternative.

Figure A1-6-3: Modeled IH-10 Eastbound Afternoon Peak Period Traffic Volume (3:30-7:30 p.m.) including Collector-Distributor Alternatives

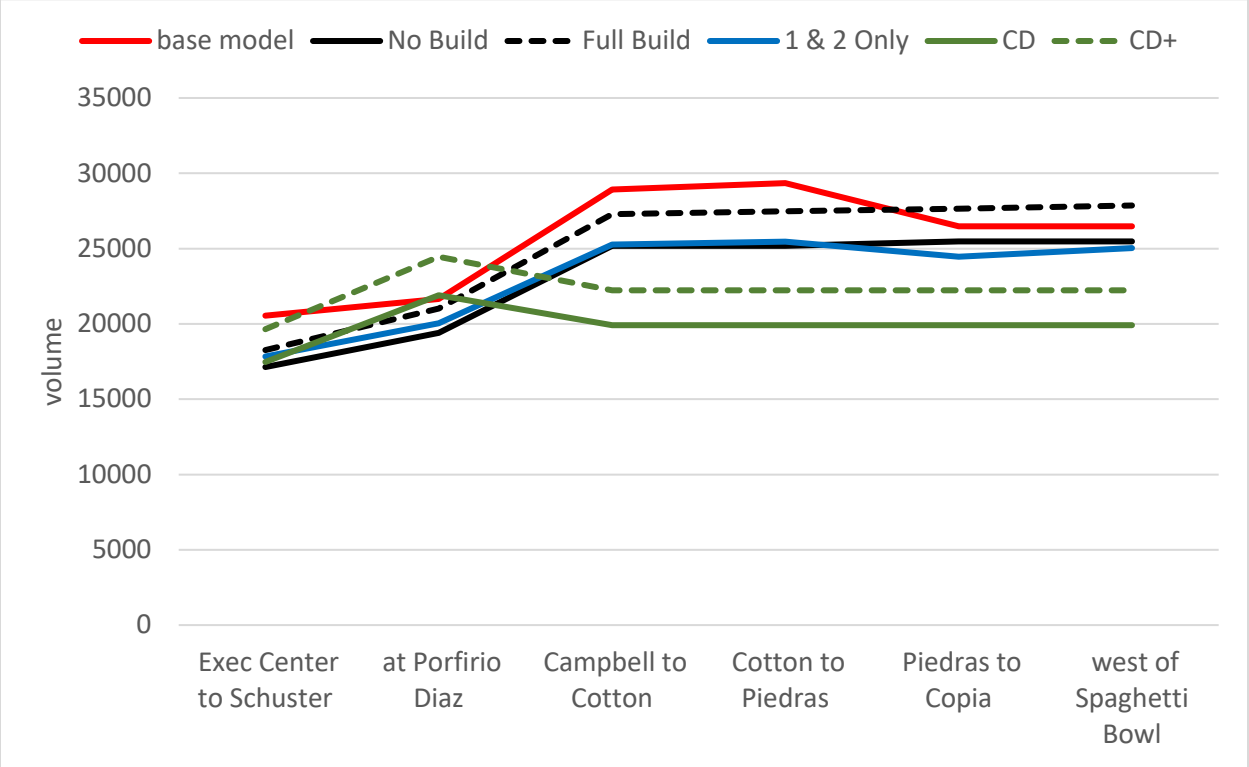
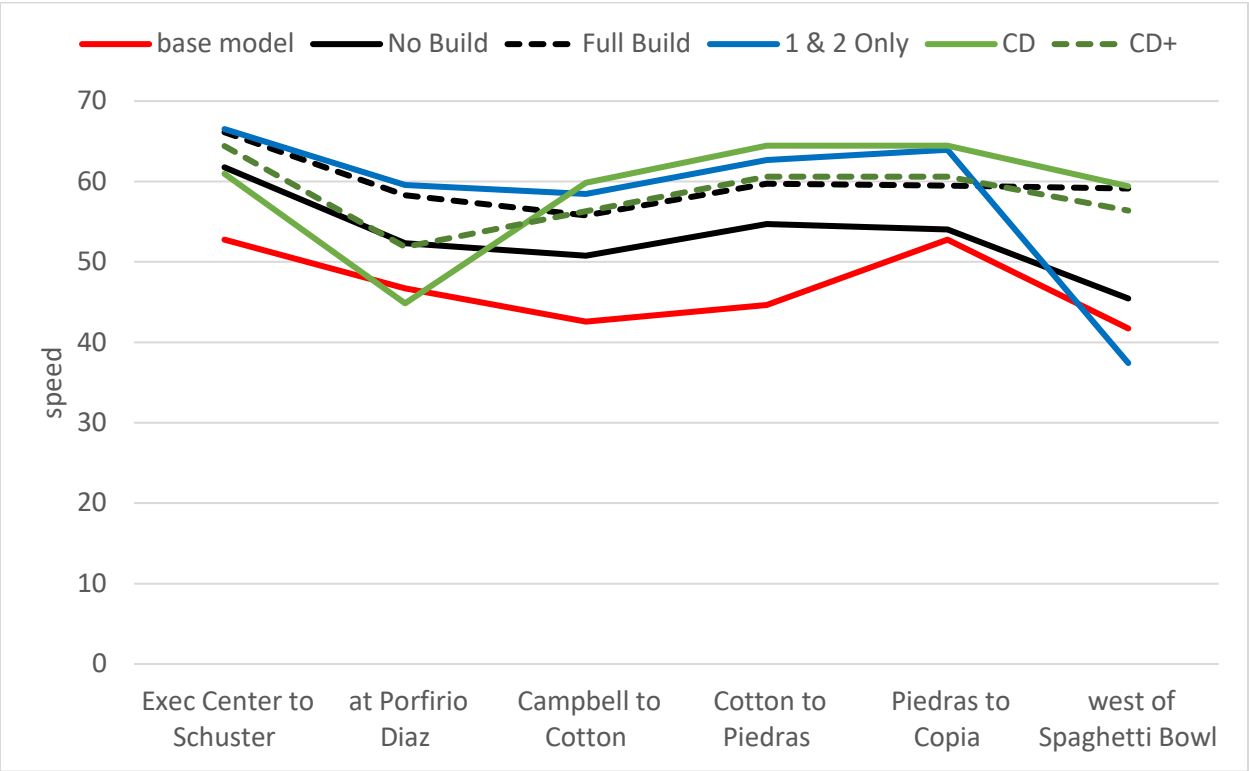
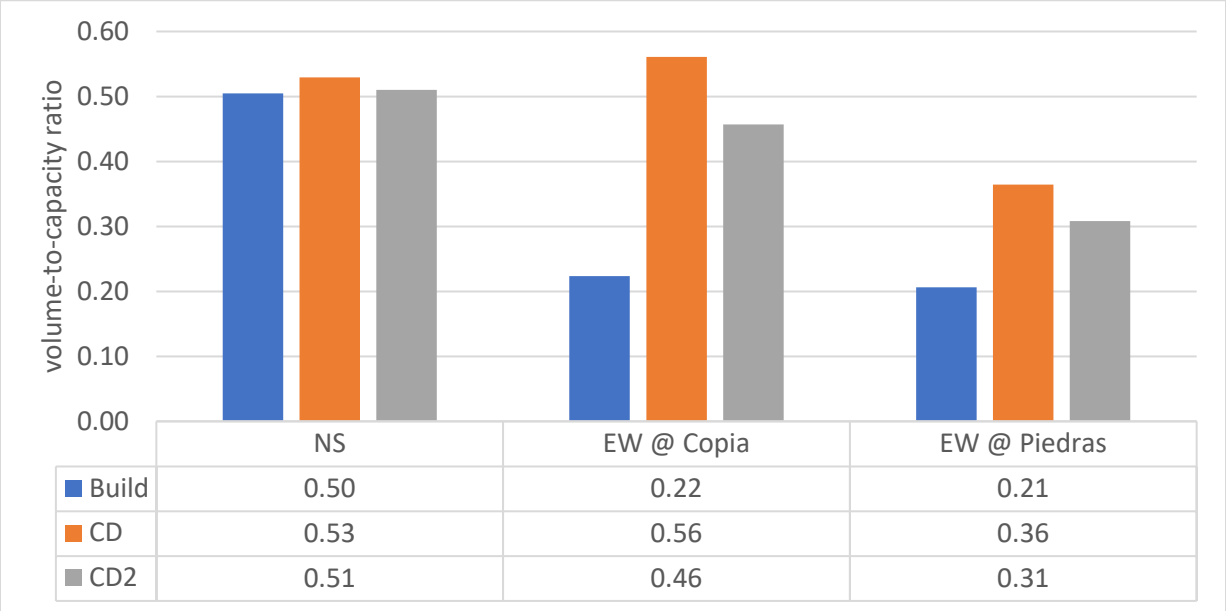


Figure A1-6-4: Modeled IH-10 Eastbound Afternoon Peak Period Traffic Volume (3:30-7:30 p.m.) including Collector-Distributor Alternatives



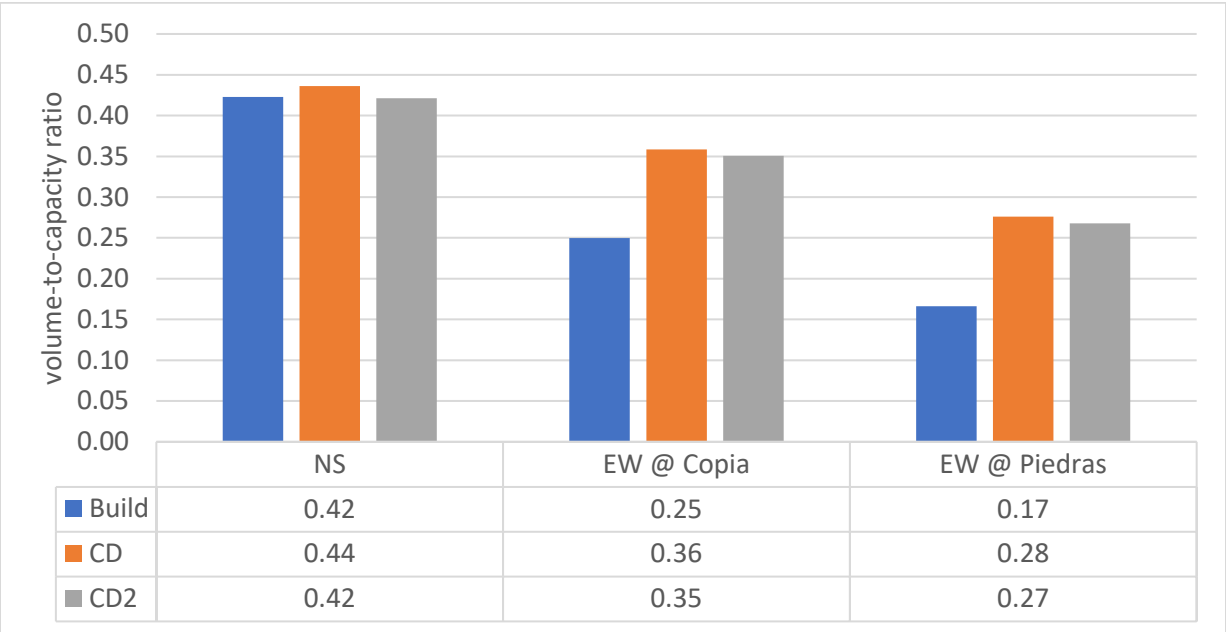
With the MPO land use scenario, neither of the CD alternatives would result in significant traffic congestion on other streets – the same result as with the balanced jobs and housing scenario.

Figure A1-7-4: Volume to Capacity Ratios for the Morning Peak Period (Inbound to Downtown)



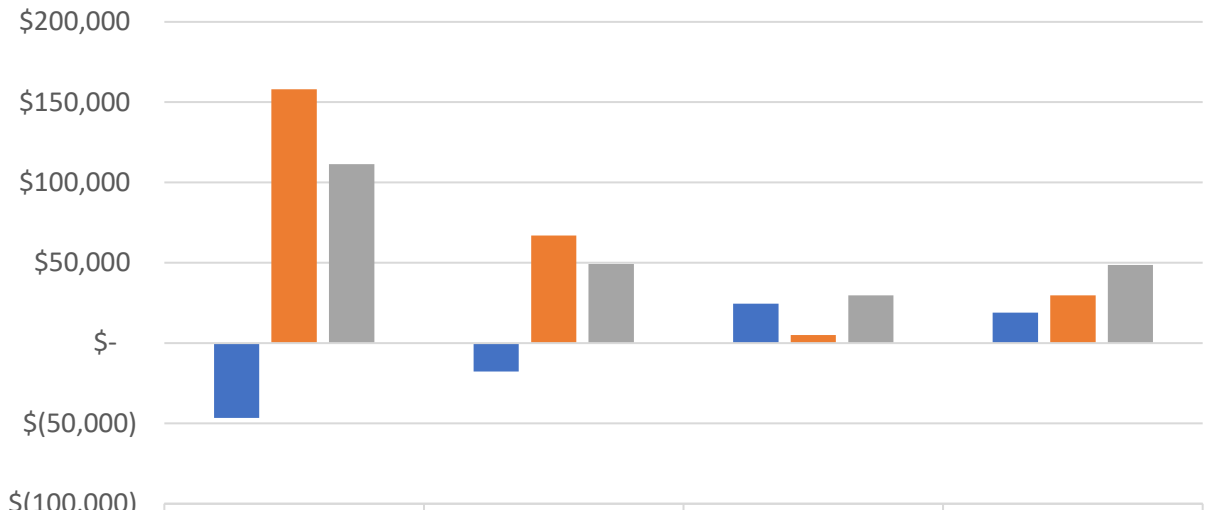
	NS	EW @ Copia	EW @ Piedras
Build	0.50	0.22	0.21
CD	0.53	0.56	0.36
CD2	0.51	0.46	0.31

Figure A1-7-5: Volume to Capacity Ratios for the Afternoon Peak Period (Outbound from Downtown)



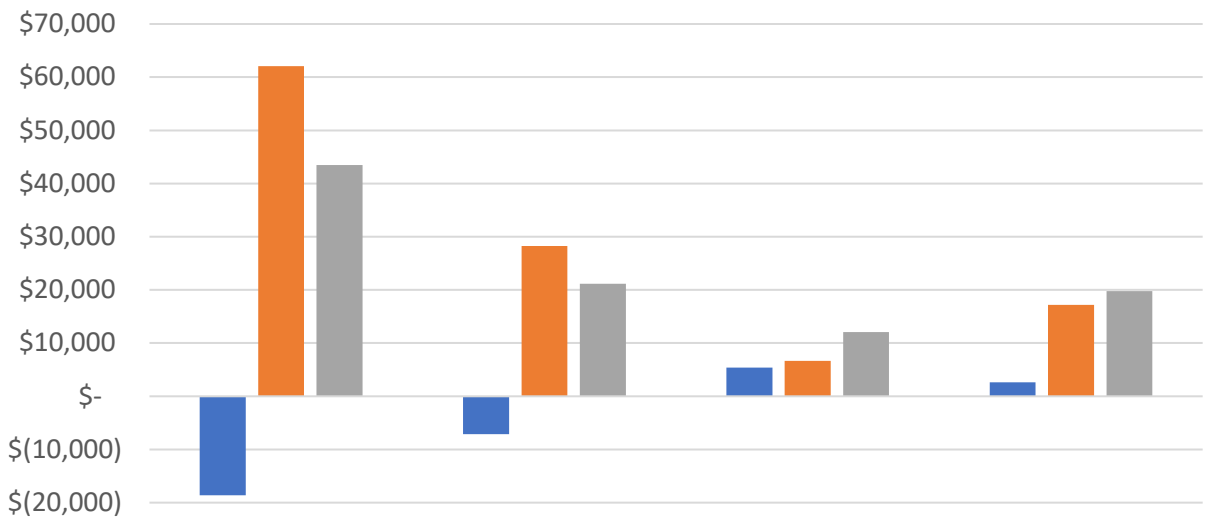
	NS	EW @ Copia	EW @ Piedras
Build	0.42	0.25	0.17
CD	0.44	0.36	0.28
CD2	0.42	0.35	0.27

Figure A1-8-1: Cost and Monetized Time Relative to No Build Alternative – Light Vehicles



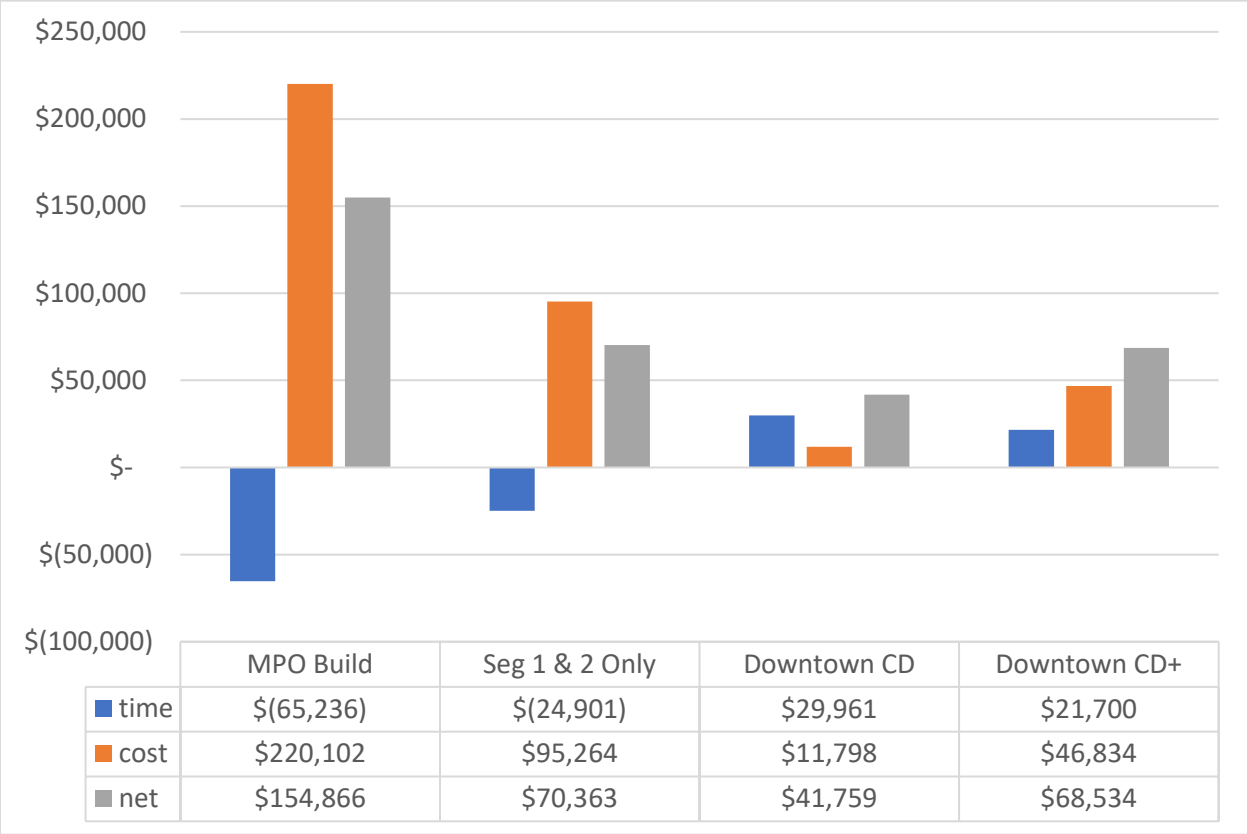
	MPO Build	Seg 1 & 2 Only	Downtown CD	Downtown CD+
time	$(46,617)	$(17,772)	$24,548	$19,057
cost	$158,001	$66,988	$5,110	$29,673
net	$111,384	$49,216	$29,658	$48,730

Figure A1-8-2: Cost and Monetized Time Relative to No Build Alternative – Trucks



	MPO Build	Seg 1 & 2 Only	Downtown CD	Downtown CD+
time	$(18,619)	$(7,129)	$5,413	$2,643
cost	$62,101	$28,276	$6,688	$17,161
net	$43,482	$21,147	$12,101	$19,805

Figure A1-8-3: Cost and Monetized Time Relative to No Build Alternative – All Vehicles



	MPO Build	Seg 1 & 2 Only	Downtown CD	Downtown CD+
time	$(65,236)	$(24,901)	$29,961	$21,700
cost	$220,102	$95,264	$11,798	$46,834
net	$154,866	$70,363	$41,759	$68,534

The regional metrics for alternatives compared to the No Build alternative are very similar for both land use alternatives. With the MPO land use, all the alternatives perform worse than the No Build on net when accounting for both the monetary value of travel time savings and travel cost, and the Full Build alternative performs the worst of all.

Appendix 2: Model Files

Land use files:

- Balanced land use alternatives: ELP_Master_TAZ.dbd
- MPO land use alternatives: ELP_Master_TAZ_LU.dbd (NEW)

Networks

- MPO Build: ep50NET_28Oct2022.dbd
- No Build: 2050_NB.dbd (NEW)
- Segments 1 & 2 Only: 2050_1&2.dbd (NEW)
- Collector-Distributor: 2050_DT_CD.dbd (NEW)
- Collector-Distributor+: 2050_DT_CD2.dbd (NEW)