Centre County Long-Range Transportation Plan 2050

Appendix C

Technical Memorandum: Travel Demand and Level of Service Analyses for 2020 No Improvement (No-Build) and 2050 Improvement Scenarios

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Overview

The LRTP 2050 includes travel demand modeling analyses above and beyond the minimum MPO planning requirements in order to better inform the assessment of transportation conditions and needs, and to evaluate potential projects, measures of system performance, and plan prioritization. The modeling was conducted by CCMPO's consultant team using the CCMPO's Cube travel demand model.

Previously, the travel demand model included detailed population and employment forecasts by Transportation Analysis Zone (TAZ) to Year 2040 to represent travel demand. The CCMPO staff and CCMPO LRTP Subcommittee agreed that growth conditions in recent years had not changed sufficiently to warrant a new zone-by-zone forecast and directed the consultant team to extrapolate the population and employment data to Year 2050. The model update also verified or added recently completed highway and transit projects to represent current (2020) conditions as the 2020 No Improvement (No-Build) scenario for later comparison with the 2050 Improvement scenarios.

Next, a year 2050 Existing + Committed (E+C) scenario was created using the 2050 population and employment data and adding highway and transit projects with are already underway and committed through completion (i.e., programmed in the TIP). The team then analyzed travel performance for each scenario and compared the results. This information was reviewed by both the CCMPO staff and the LRTP subcommittee before potential future projects were identified. Finally, the team created Year 2050 conditions, including the additional planned highway and transit projects, modeled the system performance, and compared those results to both the 2020 No Improvement (No-Build) scenario and the 2050 E+C Improvement scenario.

Whitman, Requardt & Associates, LLP
Engineers · Architects · Environmental Planners Est. 1915

MEMORANDUM

Date: September 30, 2020

To: Tom Zilla
From: Tim Preece, AICP and Roberto Miquel, AICP
Subject: Travel Demand Modeling for 2050 LRTP
CC: Anne Messner, Michelle Brummer

Work Order Number: 16
Contract Number: 35104.016
Project: Centre County MPO LRTP Update

Whitman, Requardt & Associates, LLP completed travel demand modeling analyses to inform the planning process of the Centre County 2050 LRTP Update. This work included updating the base year travel model to year 2020 conditions, extrapolating background population and employment forecasts to year 2050, developing a 2050 Existing + Committed model, developing a 2050 Build model (the cost feasible Plan scenario), and computing and summarizing performance measures for each scenario. The results of the 2020 existing conditions and 2050 E+C results were summarized in the April 30, 2020 memorandum on Existing Conditions. This memorandum presents the results of the 2050 Build model and updates the performance measures to include those from the Build conditions.

The modeling for the 2050 Long Range Transportation Plan (LRTP) Build scenario was created to represent the LRTP cost feasible plan. The Build scenario includes those projects contained in the E+C scenario plus those contained in the cost feasible Plan which can be modeled and represented using the Cube travel demand model. These include:

PROJECT TYPE RANK	***OVERALL RANK***	***Project Name***	***Description***
H-1	1	SR 150 (Phoenix Ave Intersection)	At minimum, the project would implement a warranted traffic signal at this intersection and may include a left turn lane on SR 150 if feasible. Phoenix Avenue's cross section would be expanded to include one ingress lane and two egress lanes (one left turn, one right turn) and gates would be installed at the railroad crossing. The project may also include a full realignment of intersections and a bridge replacement.
H-15	43	SR 3014 North Atherton Street Signals (from College Ave to I-99)	Improve efficiency of operations through the corridor by upgrading traffic signals with latest adaptive technology.
H-26	59	SR 26/SR 45 Pine Grove Mills Intersection (convert to signal)	Realignment of the intersection and installation of a full functioning traffic signal if warranted at the intersection of SR26 and SR45 and Nixon Road T334 in the village of Pine Grove Mills located in Ferguson Township, Centre County. Currently there exists a flashing traffic signal at this location.
T-9	15	College - Beaver Avenue Transit Signal Priority (TSP) and Intelligent Transportation Systems (ITS)	Implement transit signal priority and related ITS technologies along the college and Beaver Avenue corridors in State College Borough. The project area will include intersections at Atherton Street, Burrowes Street / Road, Fraser Street, Allen Street, Pugh Street, Garner Street / Shortlidge Road, and the University Drive ramps.

Projects H-1, H-15, and H-26 were modeled using the Cube software's junction modeling methodology. It should be noted that this methodology is not as detailed as those used in traffic operations models such as Synchro and VISSIM and that the representation of and impacts from intersection delay are somewhat limited. More detailed operational modeling such as Synchro or VISSIM might be capable of producing more location-specific measures. Nonetheless, coding these projects within the regional Cube model is appropriate to contribute to measuring changes across the entire region. These projects were modeled by modifying the model's junction characteristics to match the project descriptions for the specified intersections.

Project T-9 was modeled by creating a new facility type for the project corridor. This new facility type was designated as Facility Type 24 and functions identically to the modeled corridor's original facility type of Facility Type 4 in all but one respect. When it comes to the speed delay curves that the model uses for determining transit speeds relative to highway speeds, Facility Type 24 allows for 20% faster transit speeds than Facility Type 4 while still respecting the transit maximum speeds for each area type. This allows the model to capture a representation of transit signal prioritization.

Model Results

Figure 1 shows a representation of changes to Vehicle-Miles-Traveled (VMT) between scenarios while **Figure 2** shows the changes to Vehicle-Hours-Traveled (VHT). **Table 1** shows the numeric data tied to the charts. As can be seen, changes between the 2050 E+C and 2050 LRTP are relatively minor with a slight improvement to congestion represented by a lower VHT in the 2050 LRTP.

Figure 1. Changes to VMT

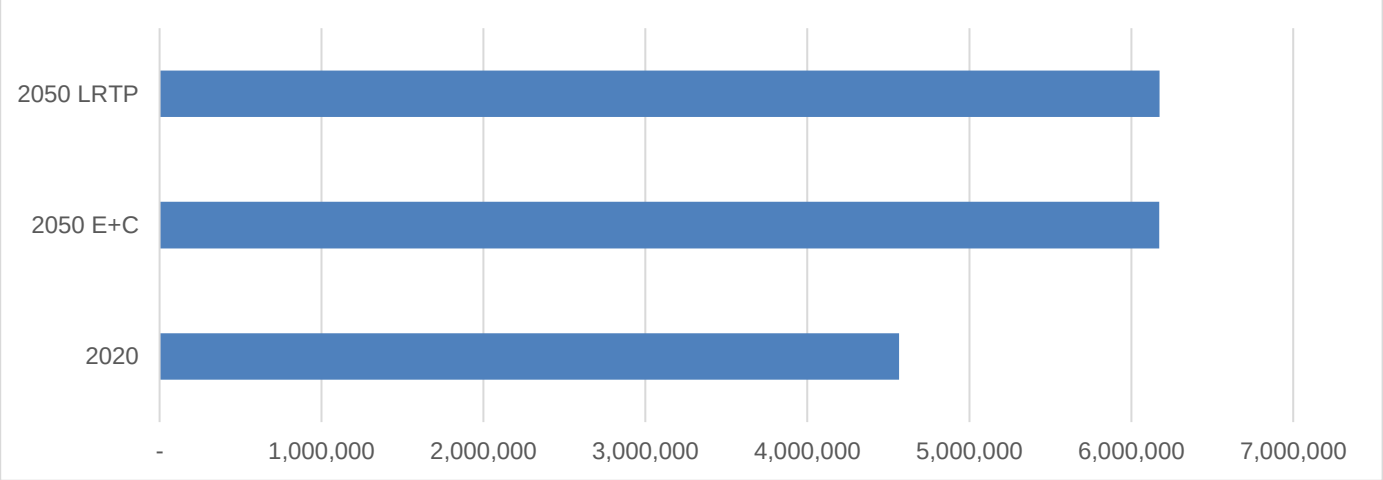

Figure 2. Changes to VHT

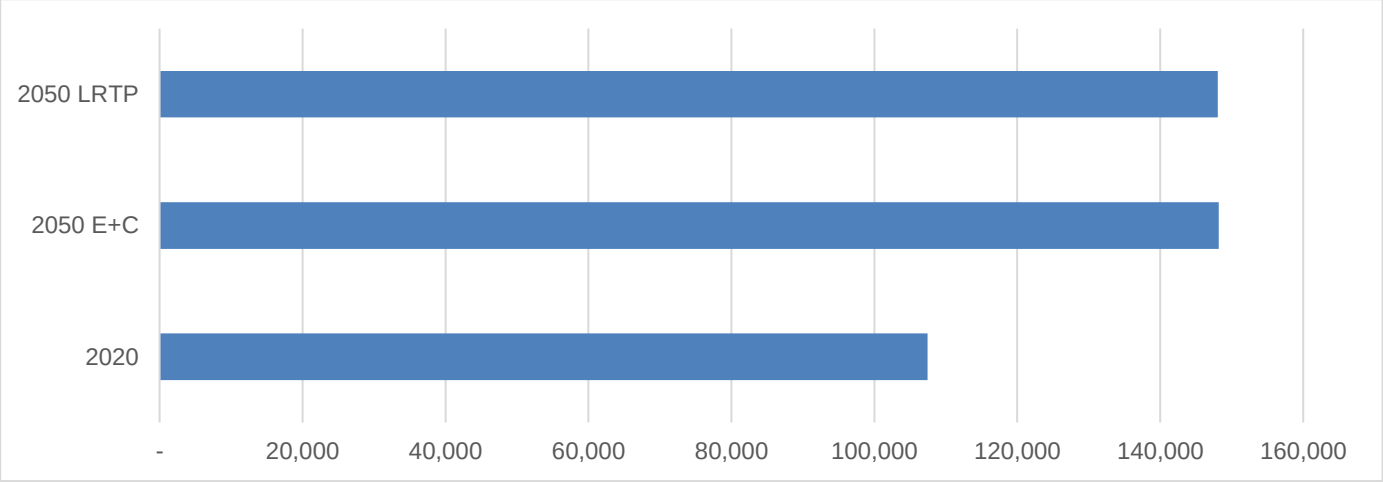

Table 1. Changes to VMT and VHT

	2020	2050 E+C	2050 LRTP
VMT	4,566,325	6,173,353	6,174,179
VHT	107,443	148,161	148,045

Figure 3 shows the 2020 Existing corridor-level Level-of-Service (LOS). **Figure 4** shows the same data for the 2050 E+C. **Figure 5** shows the 2050 LRTP corridor-level LOS. Improvements to LOS in 2050 LRTP relative to 2050 E+C are again relatively minimal.

Figure 3. 2020 Existing Corridor LOS

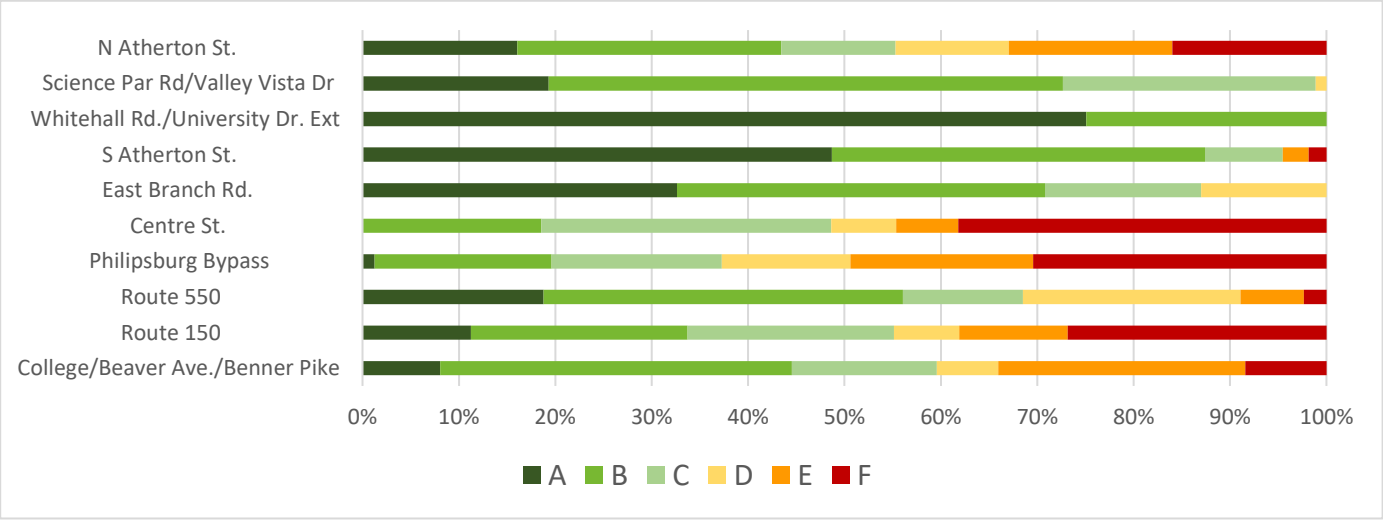

Figure 4. 2050 E+C Corridor LOS

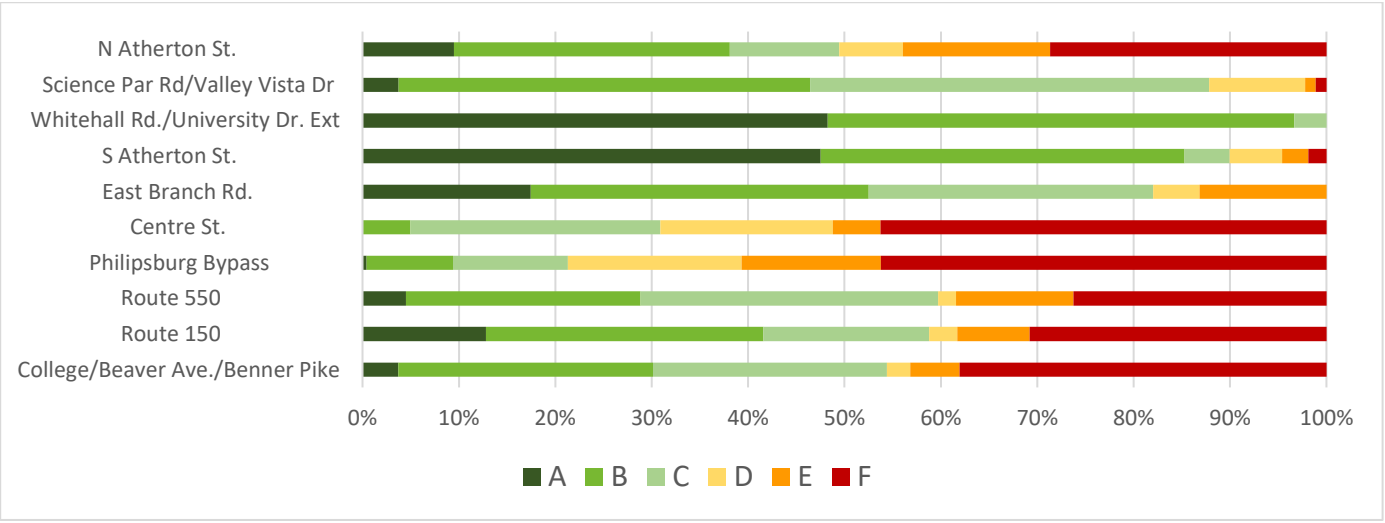

Figure 5. 2050 LRTP Corridor LOS

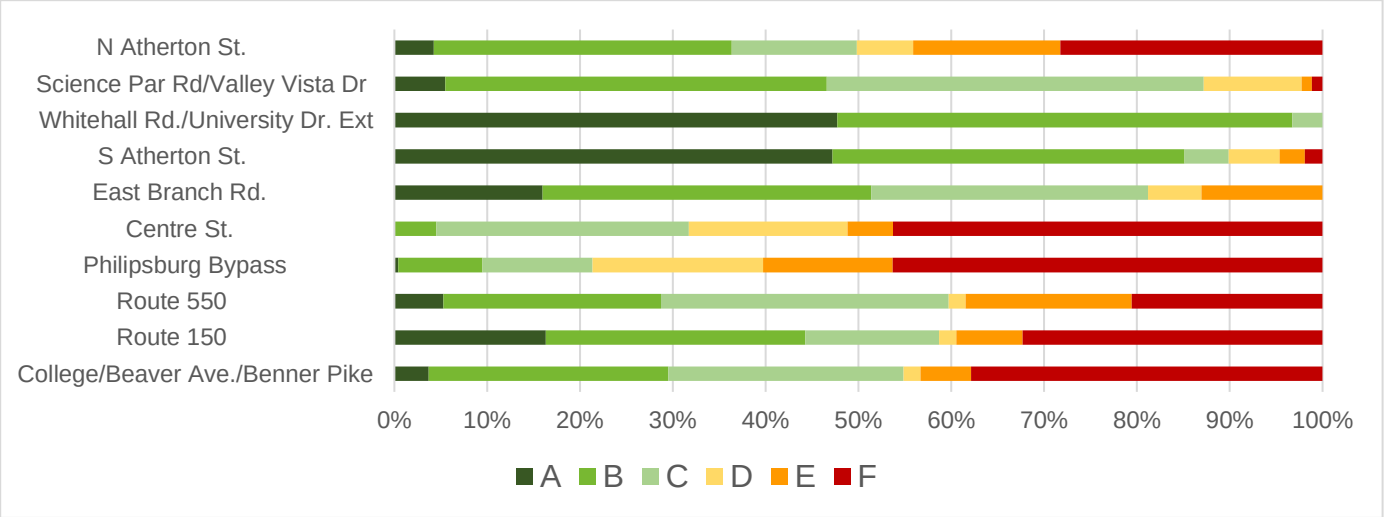

Figure 6 shows the number of jobs within 20 minutes travel time to low income population. **Figure 7** shows the number of jobs within 20 minutes travel time to minority populations. In both cases, the number of accessible jobs increase from the 2050 E+C to the 2050 LRTP, but the increases are minor.

Figure 6. Low Income Job Accessibility

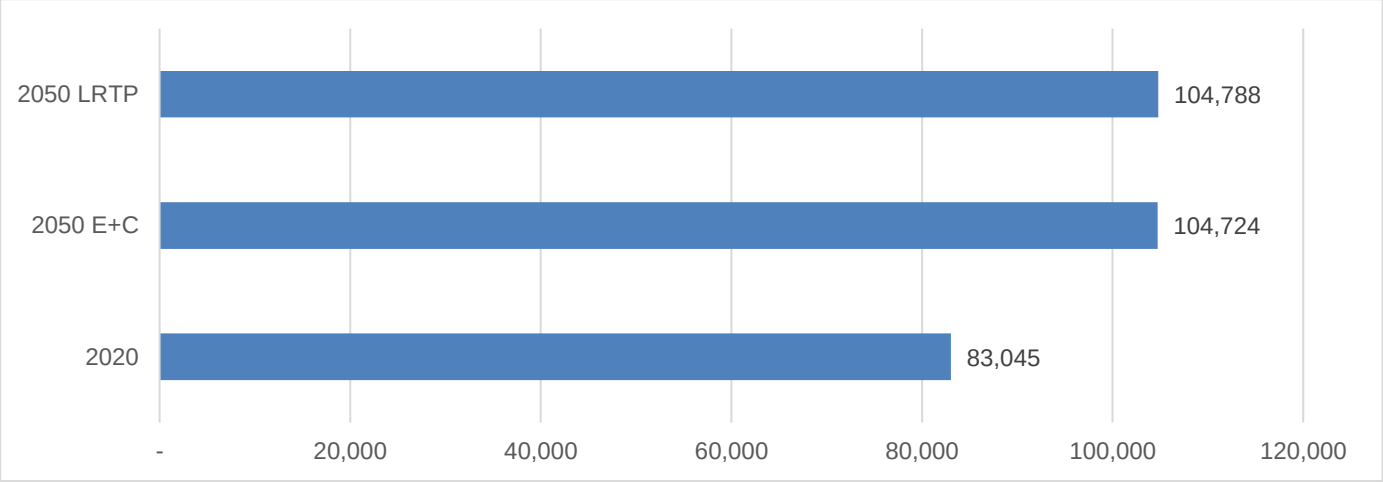

Figure 7. Minority Population Job Accessibility

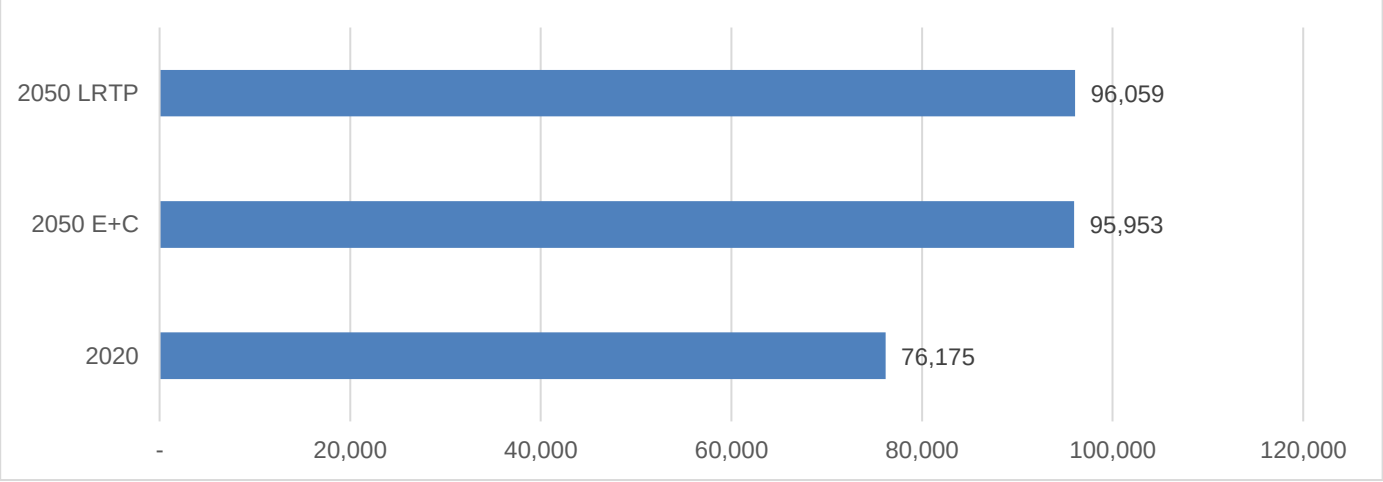

Figure 8 shows the amount of population within certain bands of travel time to key activity centers for 2020. **Figure 9** shows the same information for the 2050 E+C and **Figure 10** shows the same information for 2050 LRTP. Again, changes between 2050 E+C and 2050 LRTP are minor.

Figure 8. 2020 Access to Activity Centers

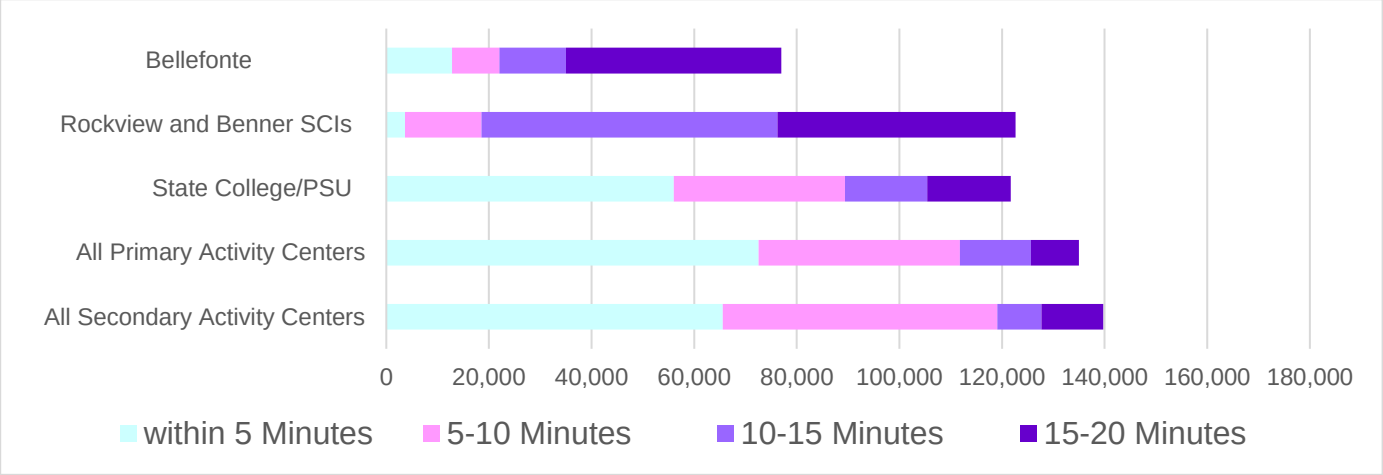

Figure 9. 2050 E+C Access to Activity Centers

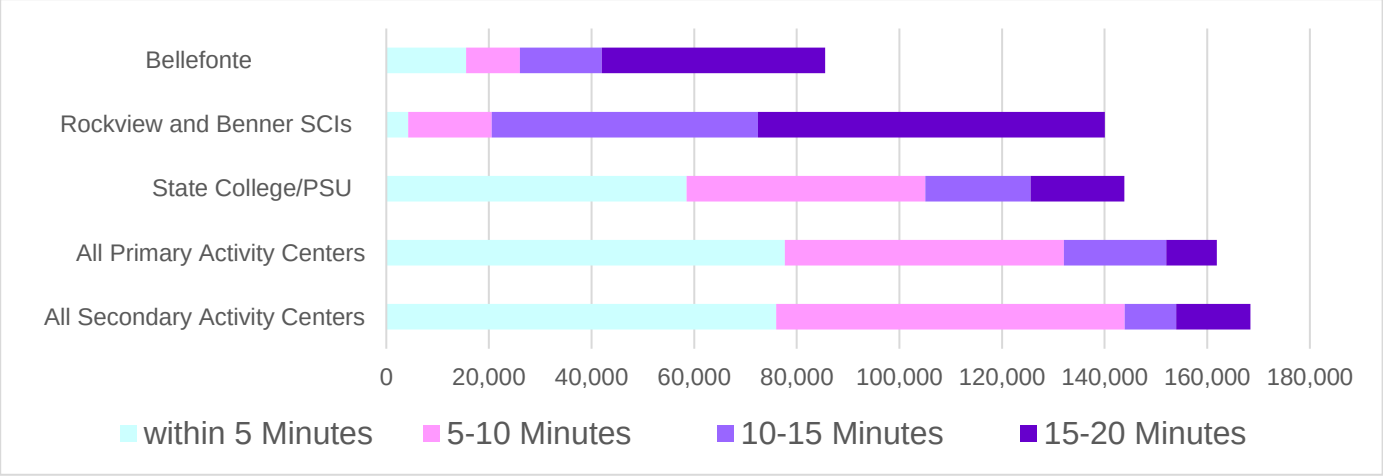

Figure 10. 2050 LRTP Access to Activity Centers

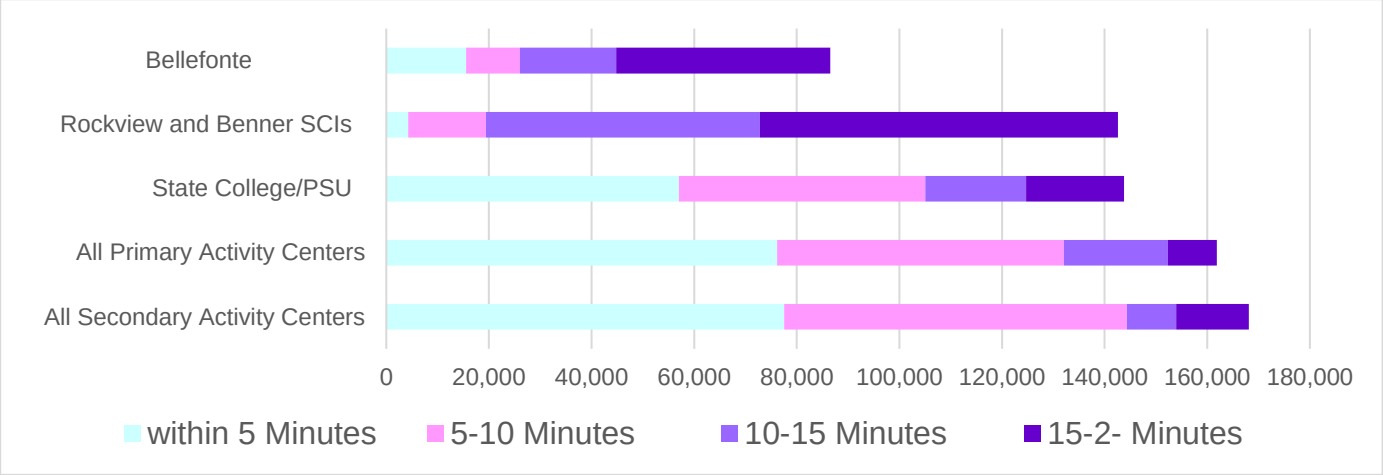

Table 2 shows the linked transit trips for the 2020, 2050 E+C, and 2050 LRTP scenarios. As can be seen, there is a slight increase in transit ridership from the 2050 E+C to the 2050 LRTP, but again, this is minor.

Table 2. Unlinked Transit Trips

	2050 LRTP	2050 E+C	2020
Transit Trips	19,303	19,239	18,847

Conclusions

Overall, there is a small but measurable improvement in the LRTP slate of projects over the 2050 E+C condition. The following points should be noted concerning the magnitude of these improvements as it relates to the projects modeled for this LRTP:

- Beyond the E+C Scenario projects, most of the additional projects in the Build Scenario are related to maintenance of existing facilities or safety improvements. Therefore, we would expect only slight changes in travel performance between the E+C and Build scenarios, as described herein.

- Of the projects that could be modeled above the E+C scenario, all four represented operational improvements at intersections including adding new signals, adding turn lanes, converting existing signals to adaptive signals, and transit signal prioritization.

- Travel demand models are designed primarily to measure the regional impacts of large-scale capacity improvement projects including road widenings, new road construction, and new fixed route transit routes or high capacity transit.

- While Cube can model operational improvements at intersections, it lacks some of the sophistication that makes it an adequate tool for measuring performance at the intersections in a meaningful way.

- Traffic operations models and traffic simulation models such as Synchro, SimTraffic, and VISSIM are tools that are much better at capturing the true benefits of operational improvements to the transportation system.

As such, it is important to bear in mind that the modeling results for the 2050 LRTP may not capture the individual benefits of certain location specific LRTP projects. Should a similar slate of projects be considered in the future, it is recommended that the travel demand model be used to develop demand volumes for the future year E+C condition. These demand volumes should then be used as inputs into operational models to better measure the benefit of these projects. Should a mix of traditional capacity projects be considered along side operational improvements, it is recommended that a preliminary effort be taken to identify which projects should be modeled using operational models versus the TDM. Finally, it is recommended that future Plan updates include at a minimum this similar modeling approach and continue to compare travel performance both over time and between scenarios.

Systemwide Performance Measures

LRTP Key Questions	LRTP Goals								Performance Measures		CCMPO LRTP Performance Measures: Centre County:				FAST Act Performance Measures: Centre MPO:		PennDOT Statewide:		Source Notes:
	1	2	3	4	5	6	7	8	Measure	Measurement	2015	2019	2050 E+C	2050 Build Scenario	Baseline (2013-2017)	Target (2015-2019)	Baseline (2013-2017)	Target (2015-2019)	
1. Is the Centre County transportation system getting safer?	X								Total crashes	Countywide, average annual (5-year rolling average)	1,264	1,258							
									Total fatalities*	Countywide, average annual (5-year rolling average)	13.6	15			15	16.4	1,185.6	1,146.3	
									Fatality rate*	Countywide, per 100 million VMT, average annual (5-year rolling average)	1.00	1.10			1.102	1.173	1.179	1.121	
									Total serious injuries*	Countywide, average annual (5-year rolling average)	36.6	44.4			38.6	41.1	3,588.4	3,971.20	
									Serious injury rate*	Countywide, per 100 million VMT, average annual (5-year rolling average)	2.72	3.20			2.835	2.94	3.569	3.883	
									Total non-motorized fatalities and serious injuries*	Countywide, average annual (5-year rolling average)	n/a	8.2			8.0	9.5	629.8	698.40	
									# incidents (most recent 5 year period)	most recently available 5-year period	8	7							2010-2014; 2012-2016 from NTD TS5.1
									# projects with Goal 1 average rating >=2	from project priority ratings	36		36	48					
2. Is the Centre County transportation system in a state of good repair?		X							Percent of interstate pavement in Good condition*	Countywide, over most recently available 4-year period	85.0%	78.9%					67.2%	60.0%	
									Percent of interstate pavement in Poor condition*	Countywide, over most recently available 4-year period	0.0%	0.8%					0.4%	2%	
									Percent of non-interstate NHS pavement in Good condition*	Countywide, over most recently available 4-year period	76.0%	64.7%					36.8%	33.0%	
									Percent of non-interstate NHS pavement in Poor condition*	Countywide, over most recently available 4-year period	6.5%	3.1%					2.3%	5.0%	
									Percent of NHS bridges in Good condition*	Countywide, over most recently available 4-year period	n/a	68.6%					25.6%	26.0%	
									Percent of NHS bridges in Poor condition*	Countywide, over most recently available 4-year period	6.3%	0.5%					5.5%	6%	
									Bus fleet average age	most recent NTD data	9.1	10.0							NTD 2014 and 2018
									Transit condition	from PennDOT Capital Planning Tool, rated 1-5	Greg	Greg							
									# projects with Goal 2 average rating >=2	from project priority ratings	26		26	32					
3. Does the Centre County transportation system have adequate capacity?			X		X				Percent of person-miles traveled on interstate that are Reliable*	see 2018 RITIS data	n/a	100%					89.8	89.8%	
									Percent of person-miles traveled on non-interstate that are Reliable*	see 2018 RITIS data	n/a	92.6%					87.4	87.4%	
									Travel time**	Change in travel time from 2019 (see O-D pairs below)	n/a	n/a	3.3%	3.2%					
									Transit average load factor	annual passenger miles / annual vehicle revenue miles	11.0	9.5							NTD 2018
									Transit fleet size	VOMS from NTD or CATA	58	62	62	62					NTD 2018
									Transit percent spares	from NTD or CATA	0.0%	12.7%	12.7%	12.7%					NTD 2018
4. Does the Centre County transportation system have an adequate mix of modes?				X	X				Transit mode share	Average weekday unlinked transit trips / total person trips		*4.1%*	3.6%	3.7%					
									Miles of multi-use trails and bicycle lanes	Total countywide centerline miles of facilities	Trish	Trish	Trish	Trish					
									Number of dedicated park-and-ride spaces	Countywide	0	0	0	200					
5. Does Centre County's transportation system support existing and future community and economic development needs?						X	X	X	Number of key stakeholders interviewed	Number stakeholders interviewed w/in past 24 months	0	40							
									Truck reliability index*	see 2018 RITIS data (closer to 1.0 is better, higher is worse)	n/a	1.14					1.34	1.34	
									# projects with Goal 8 average rating >=2	from project priority ratings			5	10					
									Amount of grant funding received by CCMPO	Discretionary grant funds awarded above normal allocation within past 24 months		Tom							

** Performance measure required by 23 CFR part 490 (final rule on national performance measures)*

**** Representative Travel Time Pairs**

O-D Districts	Planning Region
State College	Centre
Bellefonte	Nittany Valley
Philipsburg	Moshannon Valley
Snow Shoe	Mountaintop
Port Matilda	Upper Bald Eagle Valley
Blanchard	Lower Bald Eagle Valley
Millheim	Penns Valley

Transit Asset Management performance measures
Percent of revenue vehicles exceeding useful life bechmark (ULB)
Percent of non-revenue service vehicles exceeding ULB
Percent of facilities rated less then 3.0 on the Transit Economic Requirements Model (TERM)
(transit safety measure tbd…)
these have been adopted and calculated; get updated annually; should be documented in LRTP