

Mercer County Multi-Modal Transportation Plan Year 2025 Travel Demand Model

Prepared For

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Introduction

The purpose of this report is to document the results of the assignments and analysis used for the Mercer County transportation model. The analysis used the Quick Response System II (QRS II) computer program, version 6.0.6. The QRS II travel demand model is a series of mathematical programs designed to simulate traffic flow. The model is a useful tool in regional studies because it presents the alternative impacts in a consistent, objective manner. The primary objective of the model was twofold. First, to help determine how adequate the existing Mercer County transportation system is functioning, and second, with changes in future land use, determine how well the existing system might expect to perform in the design year 2025. Once this was complete, the model was then used to forecast the regional transportation impacts of various alternatives.

The network was constructed using the General Network Editor (GNE), version 6.0.23. This report discusses the analysis used to compare and measure the effect of various transportation alternatives on the Mercer County transportation system. For the Mercer County Study, the base year used in the analysis was 2000 and the design year was 2025.

Modeling Process

The Mercer County model was used to analyze each of the roadway transportation alternatives. All of the analyses were performed using socio-economic data consisting of employment and dwelling units for 42 traffic analysis zones (TAZ). The existing base year (2000) data was based on the 1990 United States Census, Census Block information for Mercer County; the *West Virginia Bureau of Employment Services data base*; a *Land Use and Utility service area survey*; and a future projection for socio-economic data based on a demographic and economic analysis conducted by Andrew Isserman.

Each new alternative assumed the existing (base) roadway system and committed highway projects would be included in the highway network. The term “committed” refers to those projects that are included in the latest Transportation Improvement Plan.

The Mercer County model was run for eleven (11) alternatives shown on Figure 1. A description of each alternative is provided below. Tables have been prepared to summarize the model run results. All alternatives used the 2025 socio-economic and network data.

The following process was repeated to analyze each alternative:

- The necessary change(s) were made to the network to accommodate the alternative;
- The model was then ran for that alternative to create a model specific to that alternative;

- Separate programs were run to analyze traffic data, level of services (congestion on roadways) etc.; and
- Each new alternative model run was compared to a no-build alternative to determine its effectiveness.

Technical Analysis

This section reviews the technical work performed for the Mercer County analysis. It begins by analyzing the various data and model results for the 2000 base year and 2025 base model runs. The alternatives are then described. The result of applying the travel demand model is also reviewed.

Existing & Future Conditions

Transportation is a function of dozens of factors. The transportation system, demographic trends, economy, public policy, and technology are just a few components that impact travel. In alternatives analyses, it is assumed that most of these factors remain unchanged throughout the future. This is done to isolate the impacts of proposed alternatives.

A key transportation-planning tool in corridor studies is to compare existing transportation conditions to the future while assuming no major new changes to the transportation network. This analysis served several purposes. First, it quantified problems in the future; transportation conditions may worsen or become better over the next 25 years. It revealed areas that would become problematic by 2025, although they may not be experiencing difficulties now. This analysis also identified the framework for the upcoming alternatives analysis. Trip making patterns and demographic trends were assumed to remain unchanged, so any proposed alternative had to account for these trends. It also allowed decision-makers and technicians to review the effects of the model inputs and parameters, which would be indistinguishable if reviewed individually, in a comprehensive context.

For the Mercer County Plan, the existing and future conditions comparison compared the 2000 Base Year with the 2025 Horizon Year. The 2000 Base Year scenario used the 2000 highway network, which included all road facilities existing in that year. The 2025 Horizon Year scenario used the 2025 Long Range Plan highway network. It incorporated all facilities included in the latest WVDOT STIP for the County. No major changes were assumed to occur in the 2025 Horizon Year scenario.

Socio-Economic Data

The base year QRS II model used the existing socio-economic data and produced traffic patterns in the model output, which appeared to be relatively consistent with the existing volumes and directional travels.

The future year 2025 models used the forecasted socio-economic data that were consistent with regional conditions for overall growth of population and employment, and provided a distribution of future households consistent with internal County development conditions.

Description of Alternatives

Eleven alternatives were studied to help determine if roadway improvements could facilitate the future needs of the County. It was determined that to analyze need for these facilities that traffic flow would be examined along with system improvements, such as changes in LOS, VMT, and VHT. The study examined the results from 2025 model runs under various alternative scenarios. See Figure 1.

1. **No-build Base Alternative:** This alternative assumed that no new construction was completed with the exception of committed projects currently listed in the Transportation Improvement Plan.
2. **US 52 Relocation:** Relocation of sections US 52 from its somewhat circuitous route through Bluefield to a more direct route between US 19 and US 460.
3. **Virginian Industrial Connector:** Extension from WV 16 to WV 104 on the east side of Princeton.
4. **Pisgah Connector:** Recommended to provide some relief to WV 20 from residential traffic using CR 24 to access Princeton. The connector is proposed to extend from CR 24 at CR 24/3 south to CR 219/3 connecting to US 460 east of Princeton.
5. **King Coal Highway from Montcalm to the Mercer County Line:** Currently not programmed in the State Transportation Improvement Program but was tested as part of the proposed plan.
6. **Cross-County Connector:** Connector from the CR 7/ CR 16 intersection near I-77 to the proposed King Coal Highway.
7. **Athens to WV 24 Connector:** Connects Athens to WV 24 just east and parallel to WV 20.
8. **Athens to Gardner Connector:** Uses a portion of existing WV 7 and new location to connect Athens with I-77 to the west.
9. **New River Parkway:** Connects WV 20 from Summers County to I-77 at the WV 7 interchange.
10. **WV 20 Upgrade:** Improve existing WV 20 from Athens to I-77.
11. **I-77/WV20 Interchange:** The addition of an interchange at this location.

Insert Figure 1
Alternative Projects
(Figure already Made by Mark K. Dated 3/15/02)

Determination of System for Analysis

The above alternatives originated with the Study team and discussions with local officials, the public, and WVDOT. Before being able to evaluate preferred overall system improvements, a determination was made as to the viability of the proposed project. To do this, a travel demand model network was developed that included each of the above projects individually on the network. Each project was loaded on the network, examined using the model, and evaluated to determine its performance. During this analysis several questions were asked:

- Does this project compete with another proposed project?
- Does this project serve a purpose by providing access to an area where there is a desire to travel?

Additionally, there were questions that needed to be answered outside of the modeling process:

- Is this project disruptive to the community, a neighborhood or a business area?
- Are there topographical constraints?

By asking these questions, it was found that several of the proposed projects could be eliminated. They included:

- 1. The US 52 Relocation.** As shown in Figure 1, this project proposed improving the current circuitous routing of US 52 through Bluefield. Reviewing the existing system with year 2000 traffic and the year 2025 system with committed projects model runs, it was found that there was not a deficiency in the Bluefield Central Business District that warranted this improvement. Additionally, due to the proposed location, it was very disruptive to downtown Bluefield, therefore, it was eliminated from further consideration.
- 2. Athens to Gardner Connector.** This project originated from the 1997 WV 20 Needs Study conducted by WVDOT. The project's intent was to improve access from Athens to Princeton. When added to the model, it was found that this alternative did not relieve congestion along WV 20 between Athens and Princeton. The volumes between I-77 and Princeton along WV 20 remained at approximately 11,000 vpd, increasing to 16,000 vpd at the edge of Princeton. It attracted only trips that currently used WV 7 to access WV 20 and Athens between the intersection of WV 7 and WV 20. It also would be very costly to build this facility on new location. Therefore, the alternative was modified to improve existing WV 7 by widening it to 24 feet and improving safety.
- 3. Athens to WV 24 Connector.** This project was also proposed to relieve congestion along WV 20. It did not perform well when analyzed by the model to serve traffic demands from Athens to Princeton. WV 20 was still the preferred route when the travel demand model assignment was completed. Additionally, this project was found to be extremely costly due to the topography along the proposed alignment. This project was eliminated from future consideration.

- 4. New River Parkway.** This project proposed between I-77 and Summers County paralleled WV 20, north of Athens. This project, when analyzed with the mode, showed that it would attract 4,400 trips from WV 20 north of Athens in the year 2025. WV 20 along this section was not expected to be over capacity by the year 2025 and would carry approximately 6,800 vehicles per day without the project. Therefore, based on the model analysis and high cost to construct, the project it was not recommended. However, as a scenic highway and for economic development purposes, the project may still be viable in the future.

Having eliminated the above projects, the remaining projects were added to the network as a system and analyzed against the existing plus committed system of projects to determine their benefit. These results are discussed below. The results compared Total Trips, VMT, VHT, average travel speeds by facility type, and LOS for the proposed system vs. the base plus committed system.

Results

Vehicle Trips

This section reviews region-wide vehicle trips. In the year 2000, about 410,400 auto trips occurred daily in Mercer County. This figure was estimated to increase by 8.5 percent to 445,400 by the year 2025. Almost 30 percent of the vehicle trips have at least one trip end outside of the County. These external trips were estimated to grow by 28 percent between 2000 and 2025. These trips were typically insensitive to local transportation alternatives since their origin and/or destination was outside the region.

Internal trips began and ended inside the region and comprised 70 percent of all vehicle trips. They were estimated to grow by 0.20 percent between 2000 and 2025, reflecting a stable and slow growing region. These trips were sensitive to local transportation alternatives.

A comparison of the External Station ADT volume counts between the base year 2000 and the Horizon Year 2025 is shown in Table 1.

**TABLE 1
COMPARISON OF EXTERNAL STATION VOLUMES**

<u>Ext. Sta.</u>	<u>2020 Volume</u>	<u>2025 Volume</u>
A	30,497	39,107
B	500	640
C	2,799	3,592
D	10,298	13,206
E	24,500	31,419
F	19,096	24,485
G	7,997	10,258
H	5,599	7,181
I	9,057	11,536
J	3,698	4,743
K	550	706
L	6,297	8,075
M	851	1,090

Highway Assignment Statistics

The amount of auto travel is measured using: Vehicle-Miles Traveled (VMT) and Vehicle-Hours Traveled (VHT). VMT measures the amount of distance traveled. One vehicle-mile is equivalent to one car traversing one mile. Six cars traversing one-mile equals 6 vehicle-miles traveled, or VMT. VHT measures the amount of time used to travel. One vehicle-hire is equivalent to one care traveling for one hour, no matter how far that car progresses. Six cars traveling for minutes each equals one vehicle-hour of travel, or VHT.

By the year 2025, when comparing the proposed alternatives transportation system to the base plus committed network, Mercer County would see 0.05 percent decrease in VMT, a 0.89 percent decrease in VHT if the proposed projects were implemented. The lowering of VMT and VHT could be due to the slow to moderate population growth in the county over the 25-year analysis period, while access to various parts of the county is improved by the new projects, reducing both the total distance driven and time in the car. Table 2 illustrates VMT, VHT and average travel speed by functional class.

TABLE 2
COMPARISON OF SYSTEMWIDE VMT AND VHT

Existing Plus Committed Measures of Effectiveness				Proposed Alternatives Measures of Effectiveness			
Class	VDT	VHT	Speed	Class	VMT	VHT	Speed
Freeway	1017051	14563.7	69.83	Freeway	1024535	14750	69.46
Expressway	556097.4	11928.8	46.62	Expressway	557834.3	11990.7	46.52
Major	153593.1	5014.2	30.63	Major	152729	4997.8	30.56
Minor	403450.8	13218.3	30.52	Minor	392742.3	12494.5	31.43
Collector	299377.9	10267.9	29.16	Collector	300431.3	10160.6	29.57
Local	137913.7	6483.6	21.27	Local	136960.2	6492	21.1
Other	20884.7	841.7	24.81	Other	21627.9	873.1	24.77
Totals	2588369	62318.2	36.12	Totals	2586860	61758.7	36.20143

Level of Service (LOS)

Roadway Level of Service (LOS) is a measurement of traffic congestion. A street with a high LOS is less congested than one with a low LOS. LOS is measured in six discrete categories labeled “A” through “F”. LOS “A” is the highest level; LOS “F” is the lowest. LOS was computed for all roadways in the travel demand model using Volume-to-Capacity ratios. The regional LOS results from the Mercer County Travel Demand Model are shown in Table 3.

TABLE 3
PERCENT OF ROADWAY BY LOS

Alternative	LOS "A"	LOS "B"	LOS "C"	LOS "D"	LOS "E"	LOS "F"
2025 Base + Committed	61.1%	19.1%	12.7%	4.2%	0.74%	2.1%
2025 Proposed Alternatives	63.2%	17.7%	14.3%	3.5%	0.41%	0.7%

When reviewing the above table, it can be seen that the proposed alternative system does perform better overall than the base plus committed system with a larger percent of the system in the LOS “A” category and less in the LOS “D”, “E” and “F” categories.

Conclusions

Population and employment in Mercer County is expected to have modest growth over the next 25 years from the year 2000 level. Overall travel in the County is expected to increase slightly by the horizon year 2025. Much of this can be attributed to growth in external travel.

The model analysis identified several areas that were either approaching or exceeding LOS “E”. Much of these were due to inadequate pavement width causing inadequate capacity. Projects recommended to solve these problems were not listed in the initial alternatives. Additional projects were added as a result of the previous model analysis to improve overall system LOS. Implementation of these “additional” projects will cause a decrease in congestion in the County over the 25-year planning period.

External trips in the year 2000 comprised 23 percent of the total trips in Mercer County. By the year 2025, this percentage is expected to increase to 26 percent of the total trips in the County. Since these trips are typically insensitive to local transportation alternatives and will most likely continue to use I-77 and US 460, the primary focus of the Plan should be to address internal County travel needs. One facility proposed in the Plan that could divert through trips in the County is the King Coal Highway. However, the initial proposed section, studied as part of this Plan, is expected to serve mostly local traffic and external-internal trips as opposed to through trips until its entire completion across southern West Virginia. In the future, another review of the travel within Mercer County may be warranted.

Appendix

Appendix

The following appendix provides information related to using the QRS II travel demand model network and data files for the 2025 Mercer County Multi-Modal Transportation Plan.

Folder Names:

Folder Name	Description
2025 Mercer	Contains all the folders for 2025 Mercer County Model Runs
<i>25RecAlts_EastConnector</i>	Files for unfunded East-West Connector Project
<i>25Recom Net</i>	Files for recommended network
<i>Exist&Committed Net</i>	Files for existing plus committed network
<i>Individual Alt Runs</i>	Contains Folders from Alt1 to Alt 13 of Individual Alternative Analysis
<i>Parameters</i>	Parameters File for 2025 Networks use with all 2025 model runs

Select Files:

The following files are found in each of the above Folders and are the results of a model run. They aid in evaluating the effectiveness of changes in the network and to compare various network.

Important Text Files Contained in Each Model Run Folder	
File Name	Description
DistLabl.txt	Identifies district lable names used in the model
District.txt	shows trips between districts within the model
LengthDs.txt	Trip Length Distributions
LinkLabl.txt	Lable used by model to identify links
LinkVols.txt	List Volumes for each link
MOE.txt	Measure of Effectiveness, reports VMT, VHT, Avg. Speed
PsAndAs.txt	Productions and Attractions by trip purpose
Tratios.txt	VMT by class and time ratio
VehTrips.txt	Vehicle Trips by Zone

Network Files:

List of key network files for Mercer County

Network File Name	Folder Name	Description
EstConn.dta	25RecAlts_EastConnector	Network Containing Proposed Unfunded East-West Connector
25VC_Short.dta	25Recom Net	Network with Proposed Alternatives showing V/C Ratios
25Vol_Short.dta	25Recom Net	Network with Proposed Alternatives showing Volumes
commit2.dta	Exist&Committed	Existing Plus Committed Network with Volumes
comvc2.dta	Exist&Committed	Existing Plus Committed Network with V/C Ratios
Alts01-Alts13	Individual Alt Runs	Network used to evaluate individual alternative runs.

Individual Alternative Run File Names:

Input name	Name	STIP Status	Description
King01.dta	King Coal	Alternative	King Coal from County Line to I-77
King02.dta	King Coal Connector	Committed	King Coal from WV 123 to I-77
EWConn.dta	East-West Connector	Alternative	From the King Coal to CO 7
Spanish.dta	Spanishburg Connector	Alternative	From US 19 in Spanishburg to CO 7
Industrial.dta	Industrial Connector	Alternative	From Brick St to CO 7
Athens.dta	Athens Connector	Alternative	From US 20 in Athens to CO 16
Pisgah.dta	Pisgah's Improvements	Alternative	From CO 24 to US 460
us20inter.dta	US 20 & I-77 Interchange	Alternative	Add the interchange
newriver.dta	New River Extension	Committed	US 20 Upgrade & new road to CO 7
shawny.dta	Shawny Parkway	Committed	Upgrade CO 1
us19blue.dta	US 19 into Bluefield	Committed	Upgrade US 19
52cherry.dta	US 52 Relocation	Alternative	Relocate US52 in Bluefield to Cherry St
	US 460 & I-77 Interchange	Committed	Not effecting the model
	Old Pisgah Road	Committed	Not effecting the model
	Lashmeet Road	Committed	Not effecting the model
	Locus Drive Relocation	Committed	
	Princeton School Access Rd	Committed	

Directions for plotting a large-scale network for the cities of Princeton and Bluefield from QRS.

For both cities: Under plotter setup the Size should be set to 34 x 44 with a 36 inch roll of paper

page setup for Princeton

Scale: 15

Margins: top: 0.5
bottom: 34
left: 0.5
right: 34

Image shift: down: -76
right: -70

Bluefield

Scale: 15

Margins: top: 0.5
bottom: 34
left: 0.5
right: 34

Image Shift: down: -113
right: -31