Greater Morgantown MPO

WV 705 Connector – Falling Run Corridor – Beechurst Avenue

Detailed Traffic Operations Analysis

May 14, 2008

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INTRODUCTION

BACKGROUND

Projects included as the arterial backbone to the Regional Transportation Plan recommended improvements were:

- The WV 705 Connector: Providing a new corridor connection from CR 857/US 119 near Easton School to WV 705 near Stewartstown Road.
- A new corridor through Falling Run: Connecting WV 705 (Chestnut Ridge Road) along Falling Run with the Downtown WVU campus and to Beechurst Avenue near the current Campus Drive/Beechurst Avenue intersection.
- Expansion of Beechurst Avenue/South University Avenue to include two through lanes in each direction and left turn lanes or a center two-way left turn lane.

The proposed system improvement corridors and study limits are displayed in Figure 1.

Through the alternatives analysis conducted as part of the long range transportation planning process, it was demonstrated that implementation of these projects would result in reducing the growth in region-wide congestion and the growth in vehicle miles of travel. The reductions in the rate of growth in travel and the change in regional congestion, which can be quantified through calculating the difference between the No-Build and Build vehicle hours of travel (VHT) are logical because:

- Each of the recommended improvements adds vehicle capacity to the system. The WV 705 Connector and the Falling Run Corridors included in the recommended plan are assumed to be four-lane, limited access facilities. These routes would provide an additional 45,000 vehicles per day of capacity to the current system.
- As displayed in Figure 2, the combination of the WV 705 Connector and the Falling Run Corridor establishes a more direct route between the expanding areas in the northeast and the central business district/WVU Downtown Campus, relative to the existing routes of North Willey Street, Stewartstown Road/Stewart Street and/or I-68/US 119 (South University Avenue). The more direct route, with the capacity to accommodate the forecasted traffic volume, results in a reduction in the growth in vehicle miles of travel (VMT) and VHT.
- The WV 705 Connector provides a higher level alternative (based on assumed operating speeds and capacity) to Mileground Road and WV 705 for commuters and customers moving between I-68 and commercial, office (including the hospitals) and industrial uses such as Mylan Pharmaceuticals, NIOSH, Ruby Hospital, the WVU Evansdale Campus, and the WVU Health Sciences Campus.

CURRENT AND 2030 DAILY VEHICLE MILES OF TRAVEL (VMT) AND VEHICLE HOURS OF TRAVEL (VHT)

Current (2005):
- 1,674,000 VMT
- 37,000 VHT

2030 No-Build:
- 3,224,000 VMT
- 71,500 VHT

2030 Build:
- 3,217,000 VMT
- 70.500 VHT

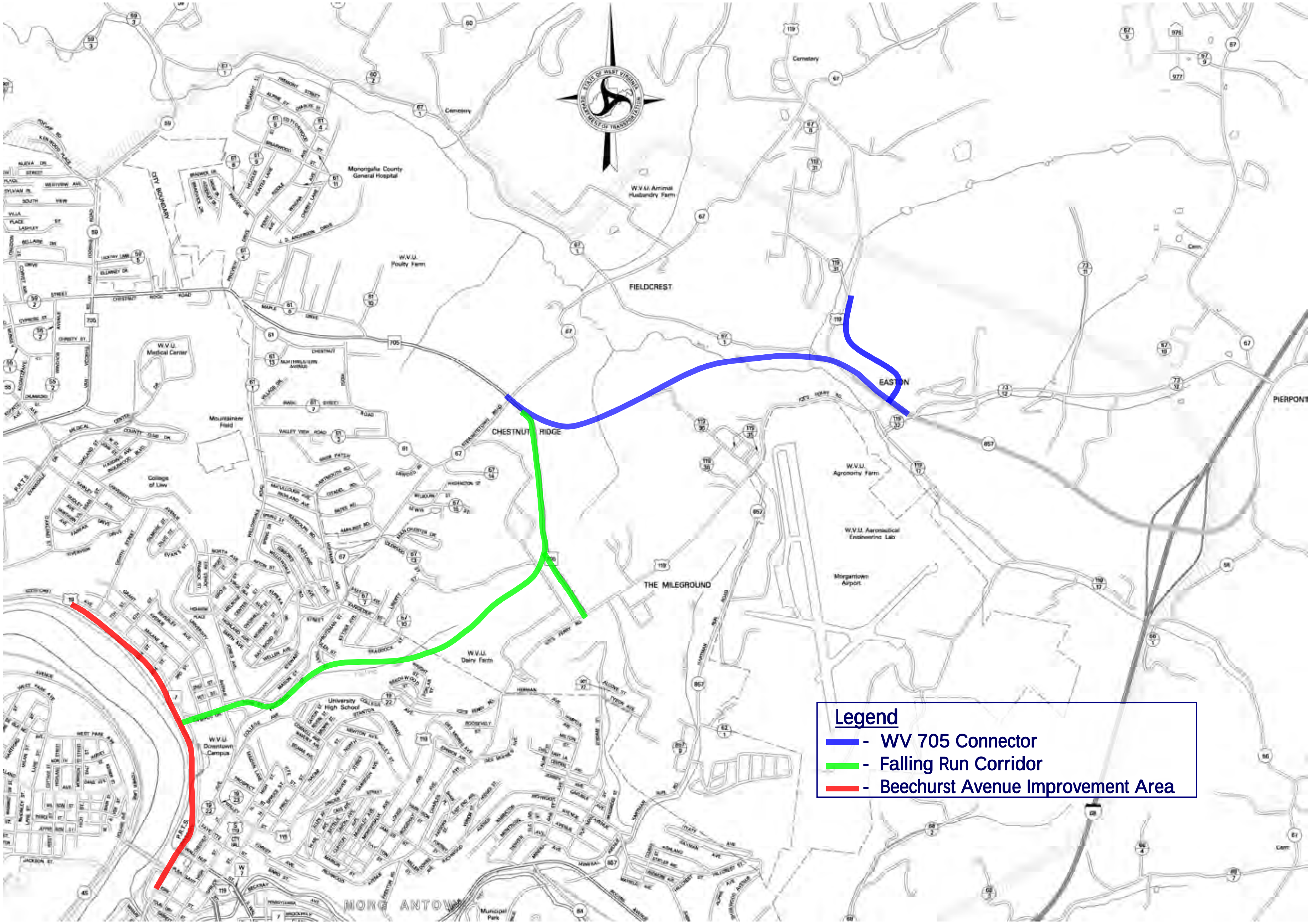

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Figure 1
Detailed Traffic Operations Improvement Corridors

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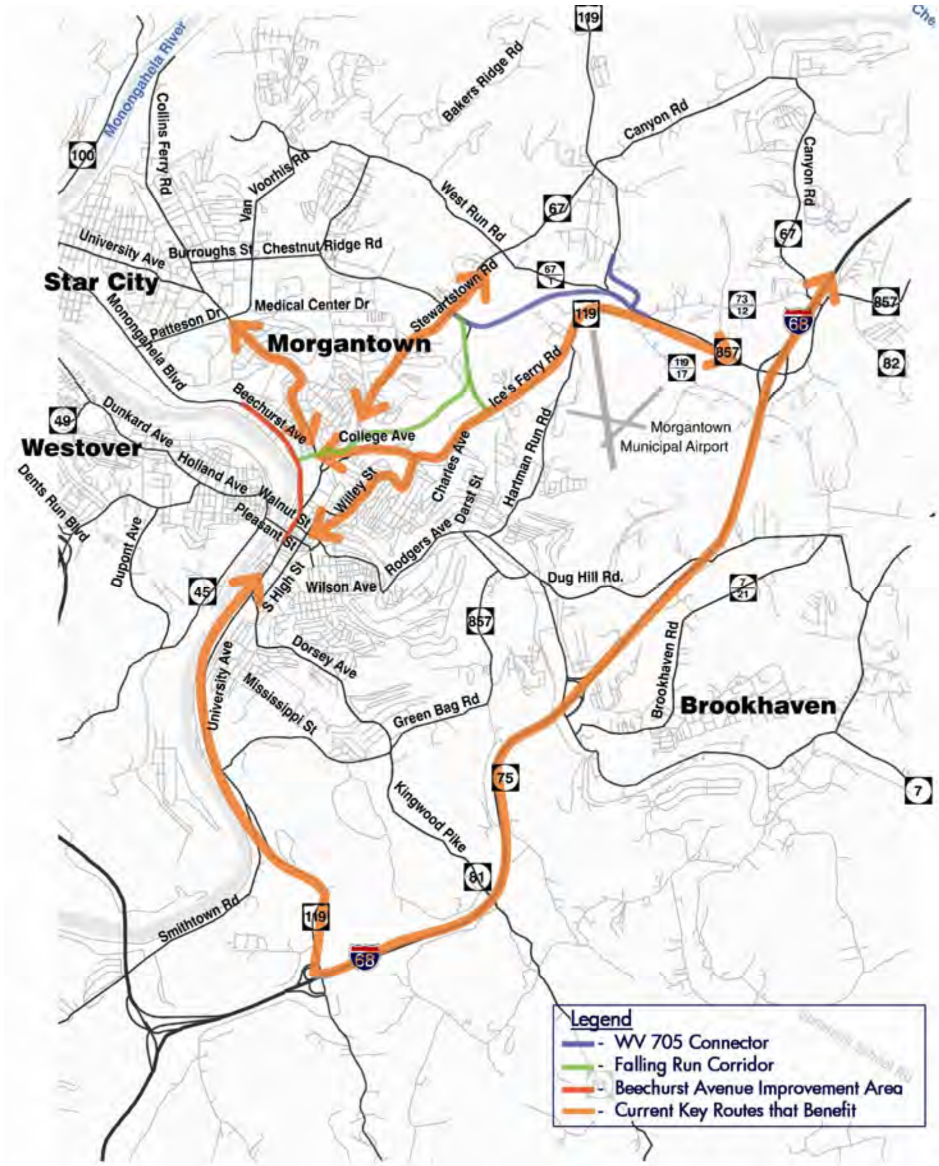
- The combination of traffic volume and congestion in the Beechurst Avenue corridor from 8th Street through the Westover Bridge, one of improvement corridors included in the detailed assessment,

FIGURE 2: IMPROVEMENT CORRIDORS AND CURRENT KEY CONGESTED TRAVEL ROUTES *BENEFITING*



As the name implies, the Regional Transportation Plan evaluates alternatives at a more macro scale in that traffic forecasts are daily segment volumes, the operations analysis is a typical daily volume-to-capacity assessment and costs are based on generalized unit costs applied to the linear feet of corridor improvement. Prior to committing to the level of investment associated with these improvements (WV 705 Connector - $35 million; Falling Run Corridor - $68 million; Beechurst Avenue five-lane - $53 million), an more detailed assessment of the micro-scale transportation benefits and costs is warranted. The purpose of this study is to provide documentation of:

- The AM and PM peak hour intersection/interchange level traffic volumes for the current and 2030 transportation planning horizon with and without the three projects in place.
- Traffic operations in the current and 2030 horizon periods without the improvements in place, which represent the No-build condition. The results of the No-build are to establish the purpose and need for actions, including implementation of the proposed projects.
- Traffic operation with the proposed improvements for the AM and PM peak periods in the 2030 horizon year.
- Intersection level recommendations for lanes and junction traffic control along each of the corridors.

The macro-scale analyses completed as part of the Regional Transportation Plan provided information on the general number of travel lanes, general concepts for the junctions (at-grade intersections or interchanges, signals or stop control), and whether turn lanes would be needed, but as the analysis was macro-scale, many of the details required to determine the critical design features of facilities were not established. Until the detailed analysis is completed, determination of whether the proposed improvements truly provide a benefit consistent with the investment cannot be completed. Thus, the goal of this study is to provide the transportation system details that are critical to the larger transportation investment analysis.

STUDY AREA

It has been, and will continue to be, emphasized that the WV 705 Connector, Falling Run Corridor and the expansion of Beechurst Avenue to five-lanes each have regional travel impacts. Thus, the operations assessment of the projects must extend beyond the immediate limits of the identified corridors. Routes and the key intersections along each route included in the study area are displayed in Figure 3. The key intersections by route are documented below:

- CR 857:
  - I-68 terminal intersections.
  - Glenmark Center.
  - US 119.
- US 119 (Mileground Road):
  - CR 857.
  - Hartman Run Road (CR 857)/Airport Road.
  - WV 705 (Chestnut Ridge Road).
- US 119 (Pierpont Road):
  - CR 857/Mileground Road.
  - West Run Road.
  - Stewartstown Road (CR 67).
- WV 705 (Chestnut Ridge Road):
  - US 119 (Mileground Road).
  - Stewartstown Road (CR 67).
  - WVU Research Park.
  - Maple Drive.
  - Don Nehlen Drive.

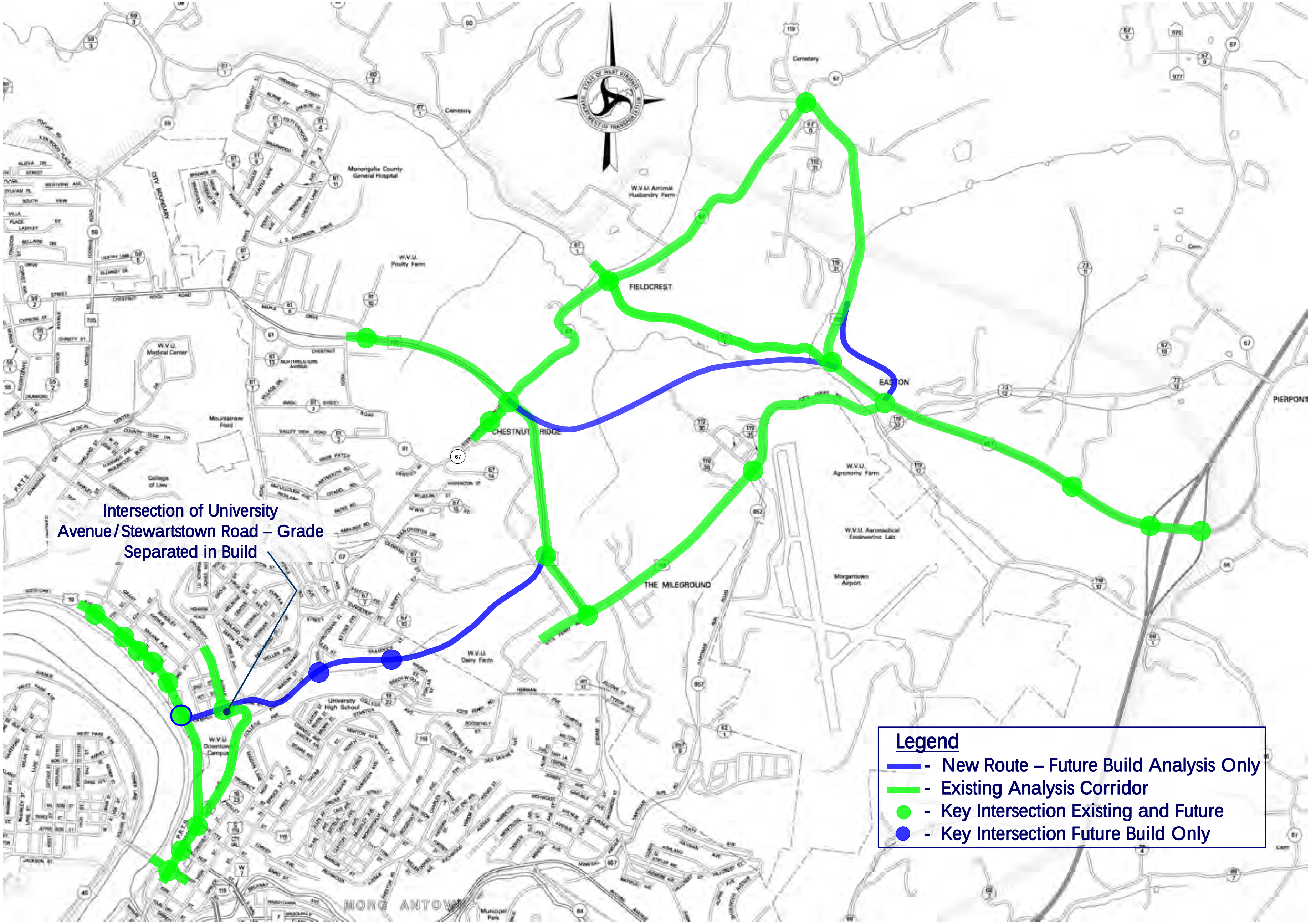


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Figure 3
Study Corridors and Key Intersections

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- Stewartstown Road:
  - US 119.
  - West Run Road.
  - WV 705 (Chestnut Ridge Road).
  - Sun Crest Towne Centre access.
- Beechurst Avenue:
  - 8th Street.
  - 7th Street.
  - 6th Street.
  - 5th Street.
  - 4 ½ Street.
  - 4th Street.
  - 3rd Street.
  - Campus Drive.
  - University Avenue/Fayette Street.
  - Walnut Street.
  - Pleasant Street.
- University Avenue:
  - Stewart Street.
  - Beechurst Avenue.

DETAILED OPERATIONS ANALYSIS METHODOLOGY

OVERVIEW/PRODUCTS

The primary purpose of the detailed operations analysis is to provide local and state decision-makers with a more robust traffic assessment of the WV 705 Connector, Falling Run Corridor and an expansion of Beechurst to five-lanes than was feasible in the regional transportation plan development process. While the alternatives analysis completed within the long range planning process and determination of the locally preferred improvement plan was consistent with supported planning practices, the analyses were not developed to a level that would provide inputs to the conceptual engineering stage of project development. In the long range plan 2030 traffic forecasts reflect the level of traffic likely to occur over the course of a typical day, however, the conceptual design requires forecasts of traffic volumes likely to occur in the peak morning and afternoon hours. The roadway configuration recommendations provided in the regional transportation plan represent general information as to the number of through lanes, whether or not turn lanes would be needed and the type of junction treatment needed (stop controlled at-grade intersection, signal controlled at-grade intersection, or a grade separation). To complete the conceptual design, more detailed intersection information such as through and turn lane queue lengths, signal timing and phasing plans, number of turn lanes, and turn bay storage needs are all required. Development of the recommendations in the regional transportation plan took into account the relative proximity of one intersection to another or the proximity of an interchange to the adjacent intersections, but the specific analyses that address how the traffic operations at one intersection influence those up and down stream intersections was not a part of the long range planning process. Each of these examples supports the need for the detailed operations analysis and outlines many of the products of the analysis, including:

- Existing conditions AM and PM peak hour intersection level traffic volumes for each of the key intersections in the study corridors and selected intermediate intersections.
- Forecasted 2030 AM and PM peak hour intersection turning movements for each of the key intersections reflective of the following roadway networks:
  - Existing roadway network plus all committed improvements. This network is referred to as the E+C network.
  - The E+C network plus the WV 705 Connector route between US 119/CR 857 and WV 705 at Stewartstown Road.
  - The E+C network plus the WV 705 Connector and the Falling Run Corridor connecting WV 705 with Beechurst Avenue at Campus Drive.
  - The E+C network plus the WV 705 Connector, the Falling Run Corridor and Beechurst expanded to a 5-lane section from 8th Street through Pleasant Street.
- AM and PM peak hour intersection level traffic operations reflective of the current and 2030 No-action conditions.
- Future 2030 AM and PM peak hour intersection level traffic operations reflective of the E+C network and the following improvements:
  - WV 705 Connector.
  - Falling Run Corridor.
  - Beechurst Avenue expanded to 5-lanes from 8th Street through the Pleasant Street bridge.
- Recommendations for modification to the initial assumptions of segment and junction configurations along the study corridors for those locations where in unacceptable operations in the future conditions (2030) are observed.

ANALYSIS PROCESS

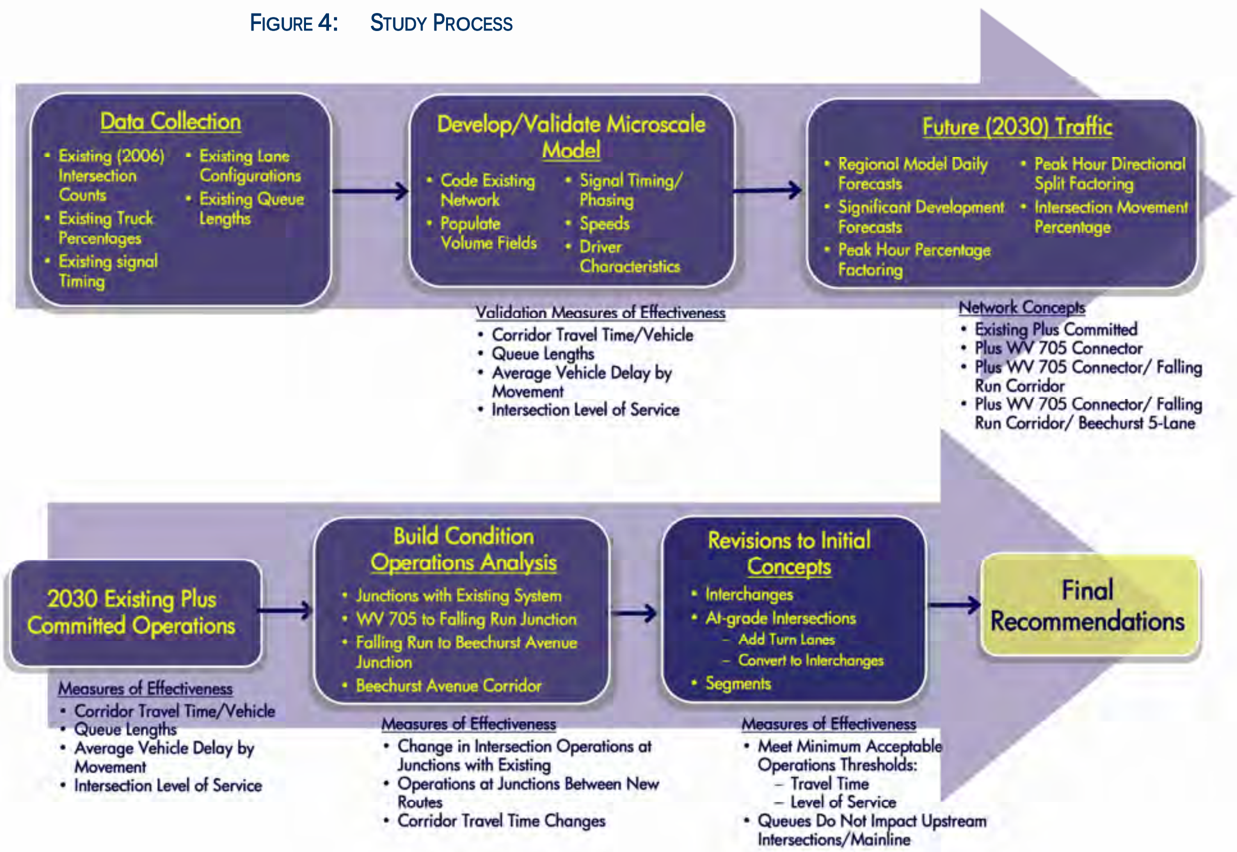
Figure 4 outlines the process employed in conducting the detailed traffic operations analysis in the study corridors and each of the steps is described in the following sections.

DATA COLLECTION

As the purpose of the detailed analysis is to evaluate hourly traffic operations along the key corridors through 2030 with and without the Regional Transportation Plan improvements in place, the data collection completed as part of the study reflects the level of analysis. The data collection efforts included:

- WVDOH staff collected AM and PM peak period hour turning movement counts at 37 intersections along the Beechurst Avenue, Mileground Road, US 119, and CR 857. Again, as the goal was to develop a very detailed level of analysis, turning movements at each of the signalized and selected unsignalized intersections were obtained. Turning movement data were provided in 15-minute intervals for the weekday periods from 7:00 AM through 6:00 PM.
- An individual truck has the potential to impact traffic operations in a dense urban setting, and especially in an urban area like Morgantown that has severe terrain. Thus, the count data collected as part of the detailed study was divided into the following vehicle classifications:
  - Autos and light trucks (pick-ups and sport utilities).
  - Trucks with trailers and larger single unit trucks such as a concrete truck.
  - Buses.

FIGURE 4: STUDY PROCESS



While the vehicle classification information was provided and used in the analysis, specific figures documenting the vehicle classification counts by movement were not produced for the documentation.

- Signal timing and offset information. Current signal timing, phasing and offsets were obtained form the WVDOH and input into to the model as part of the system validation and calibration process. Highlighted in the signal data collection was the presence of protected/permissive left-turn phases, right-turn-on-red restrictions, etc.
- Current lane geometry. Lane geometry was collected by URS staff through field visits. Information collected for each of the intersections included in the simulation network was:
  - Number of through lanes.
  - Number of turn lanes and the storage length.
  - Locations of lane drops and the taper lengths.
  - General/typical lane width.

Existing conditions queue lengths. Present traffic operations in the Beechurst Avenue, University Avenue, Mileground and most portions of the WV 705 corridor are characterized as level-of-service (LOS) F, which represents choked flow. A characteristic of LOS F, or choked flow, is the formation of queues that may or may not be cleared in a single signal cycle, with a greater likelihood of not clearing. If field-observed queuing activities are not taken into account inside the modeling, there is a high likelihood that the model will provide better operations than observed in the field. If the model results are reported to drivers experiencing the system every day they will not likely find much correlation to the conditions they observe and the validity of the model will be questioned.

DEVELOP AND VALIDATE THE MICROSCALE SIMULATION MODEL

Traffic operations in the study corridors were evaluated using the VISSIM microscale simulation model. Compared to more macroscale analysis applications such as the Highway Capacity Model software, a VISSIM application is different in that each vehicle forecasted to enter the system network is monitored every second relative to its location in the system. In the macroscale application, the hourly volume by movement at each intersection in the system is evaluated in one chunk at that one location. The stopped conditions, freeflow conditions and various increments in between experienced by each unique vehicle at upstream and downstream intersections are not tracked and reported in the macroscale applications. Thus, the microscale simulation was developed to provide more realistic analyses results by being able to report the driver/passenger cumulative experience at each intersection and along each segment in the study corridor.

The general steps to the simulation model development process are outlined below:

- Using the traffic and infrastructure information obtained through the data collection efforts, prepare a network representation of the existing street system. The microscale simulation model is a scaled replication of the real-world conditions and in this study the networks contain:
  - Public streets intersecting the key study corridors of Beechurst Avenue-South University Avenue, Mileground Road, WV 705, CR 857 and US 119. Within each of the corridors intersections with public streets, signalized and unsignalized were included. Thus, the networks are very detailed.
  - For the Beechurst Avenue corridor, a number of the higher traffic volume driveways to/from adjacent developments were included. Higher volume driveways where those providing access to WVU parking lots, the driveway to the University Avenue parking garage, and larger multi-family resident parking areas along the corridor. Driveways to/from lower intensity developments along Beechurst Avenue-South University Avenue and Mileground Road were not included in the network as the traffic volumes change dramatically day-by-day and the randomness is difficult to predict.
  - Intersection control type and detail. The current intersection control (uncontrolled, yield signs, stop signs, signals) are programmed into the model. Signal timing information including, phase lengths, yellow times, all red times, timing offsets between successive signalized intersections, etc. is programmed for each intersection.
  - Intersection approach lane configurations. The number of through, right and left turn lanes are included in the networks.
- Validate and calibrate the base year networks. Validation of the network refers to the process of comparing the computer simulation **inputs** with the real world conditions. Validation of each of the components (lane geometry, intersection control, traffic volumes, etc.) was completed as the networks were being built. Calibration refers to an iterative process of testing the **products/output** of the models to real world measures such as intersection queue lengths, travel time through the focus entire corridor or key portions of a corridor, percentage of the counted volume that is served, etc.

DEVELOP FUTURE YEAR AM AND PM PEAK HOUR TRAFFIC

The assumed horizon year for traffic forecasts is 2030, which is consistent with the horizon year of the current Regional Transportation Plan and the travel demand model developed for the plan update. The regional travel demand model is, however, a macroscale daily model and the microscale simulation represents the AM and PM peak periods. Thus, the daily traffic must be factored to reflect the hourly periods that are the focus of the analysis. While the regional travel demand model is a critical source of basic information regarding more macroscale travel pattern changes associated with the growth in traffic driven by continued development in the region and changes associated with placing new facilities into the system (WV 705 Connector and Falling Run Corridor) or substantial capacity improvements in an existing corridor (Beechurst Avenue), the methodology employed to estimate 2030 AM and PM traffic supplemented the regional model information with:

- More detailed data provided from traffic studies for the following developments, Suncrest Towne Centre, WVU Research Park, and the Square at Falling Run.
- Existing AM and PM peak hour percentage and direction split information from the WVODT supplied count data.

Evaluate the 2030 AM and PM Peak No-Build Conditions

The basis for a purpose and need for action is derived through quantification of the poor quality of operations currently observed in the corridors and the operations forecasted for 2030 without the following system improvements in place:

- WV 705 Connector
- Falling Run Corridor
- Beechurst Avenue-South University Avenue expanded to 5-lanes.

The 2030 No-Build network does, however, include the intersection improvements included in the 2008-2013 WVDOT Transportation Improvement Program (TIP). TIP improvements include:

- Adding a southbound University Avenue right turn lane at the Westover Bridge.
- Convert the current southbound right turn lane on Beechurst/South University Avenue to a through lane to provide two through lanes in the southbound direction.

2030 No-Build Conditions operations were summarized using the same set of measures of effectiveness employed in quantifying the current conditions. In general they are:

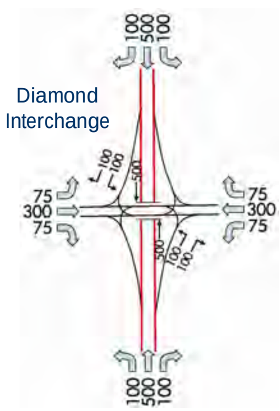
- Travel times through the corridor.
- Average operating speeds through the corridor.
- Level of service at intersections within each of the corridors.
- Lost time due to delay.

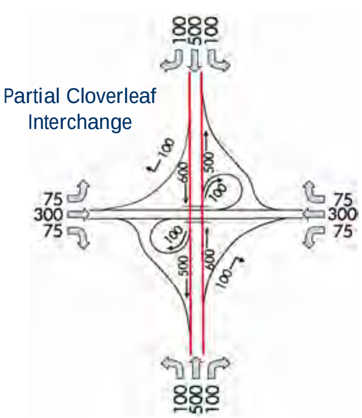
Develop 2030 AM and PM Peak Hour Intersection Turn Volumes for the Build Conditions

Preparation of the peak hour forecasts for the Build Conditions (with the WV 705 Connector, with the Falling Run Corridor and with Beechurst/South University Avenue upgraded to 5-lanes) requires a combination of regional model runs and re-factoring the No-Build 2030 hourly volumes to reflect the observed changes in travel patterns observed in the regional model. The process employed in the analysis will be documented in a later chapter of this report. Volumes were generated at two levels for the junctions and segments:

- Generalized junction turning movements: These forecasts documented the number of through, right turn and left turn movements by approach at each of the mainline/cross route junctions included in the network. For the range of alternatives that included various interchange configurations at the junction of a mainline route and a cross route, the general number of vehicles approaching from a particular direction may be the same, however, the interchange configurations my be such that movements within at the

Macro and Microscale Traffic Volume Comparison





For different interchange configurations, macro-level turns are same, but micro-level are different.

Legend

Macroscale Right/Thru/Left Turns

Microscale Right/Thru/Left Turns

junction are different. For example, the southbound to eastbound movement in one alternative may be completed by exiting the mainline on a ramp and turning left turn at the end of the ramp to get on to the cross route. In another alternative the same southbound to eastbound movement may be accomplished through a right hand exit to a loop ramp connecting to the cross route.

- Detailed approach movements for each of the alternate junction configurations. For each of the alternatives evaluated a unique set of turning movements by approach were prepared. These unique movement specific forecasts incorporated the generalized junction turning volumes and the unique configuration of the intersection and/or interchange.

Evaluate 2030 AM and PM Peak Hour Build Condition Traffic Operations

In this step each of the roadway network improvements that are the focus of the study are incorporated into the VISSIM network and the 2030 traffic volumes are updated to reflect the network changes. The changes in traffic relative to the No-Build are in both the overall level of traffic and changes to specific movements. The VISSIM network covers corridors that are forecasted to experience reductions in traffic (Mileground Road) and increases in traffic (Beechurst Avenue) with the Build improvement in place. As with the current conditions and 2030 No-Build, the following measures of effectiveness are used to define the impacts of the improvements:

- Travel times through the corridor.
- Average operating speeds through the corridor.
- Level of service at intersections within each of the corridors.
- Lost time due to delay.

Summarize the Impacts Relative to the Measures of Effectiveness the Improvements have on System Operations.

The results of the more macroscale analysis of the alternatives demonstrated regional improvements to vehicle miles of travel and vehicle hours of travel. At the microscale the improvements will likely result is better operations along some corridors (Mileground Road and Beechurst Avenue), worse operations at limits of the improvements (Chestnut Ridge Road west of Stewartstown Road) and relatively minor changes in other areas. At the microscale, however, it is anticipated that the overall positive impacts determined through the Regional Transportation Plan analysis will be supported. The potential for reductions in operations in selected corridors and identification of mitigation concepts will be a critical determinant in the process of evaluating whether the identified corridor improvements provide benefits at least consistent with their costs.

DATA COLLECTION

Data collection efforts were shared between the MPO, the WVDOT and URS staff, including turning movement counts, signal timing, lane geometrics for intersections and roadway segments, and observation of peak period operations.

TURNING MOVEMENT COUNTS

Determination of the intersections and driveway access points where it was warranted to collect count information was a collaborative effort between the WVDOT, the MPO and URS. Typically, in corridor studies counts are collected at the signalized intersections, as they reflect the higher volume locations that control corridor operations, and selected minor street intersections. The standard approach for selecting which intersections to include in the counting program was determined to be reasonable in the following corridors:

- CR 857.
- US 119 from CR 857 to Stewartstown Road.
- Mileground Road.
- WV 705.

As the goal of the operations analysis is to evaluate each of the intersections/access points that have a significant influence on corridor operations and determine how the Build Conditions projects influence operations at those points, the number of count stations along Beechurst Avenue was greater than in the other corridors. Additional count stations, and subsequently more analysis points, were included because along Beechurst Avenue and South University Avenue there is the perception that vehicles turning into and out of the intermediate block access points have a relatively significant influence on overall corridor operations. Thus, selected intermediate driveways to parking lots and local streets were included in the data collection efforts. Count data for intermediate private driveway locations and minor cross streets were not collected along Mileground Road because the center two-way left turn lane allows left-turning vehicles to be separated from the through vehicles. Thus, reducing the level of conflict and congestion created by through vehicles queuing behind left turning vehicles that are waiting for an acceptable gap in the opposing traffic stream.

Count data collection locations in each of the key corridors are displayed in Figure 5.

Counts collected for each of the access locations along the study corridors are documented in Table 1. Morning and evening peak hour turning movements for the key intersections (signalized and higher volume stop-controlled intersections) are displayed in Figures 6 and 7 (AM) and Figures 8 and 9 (PM), respectively.

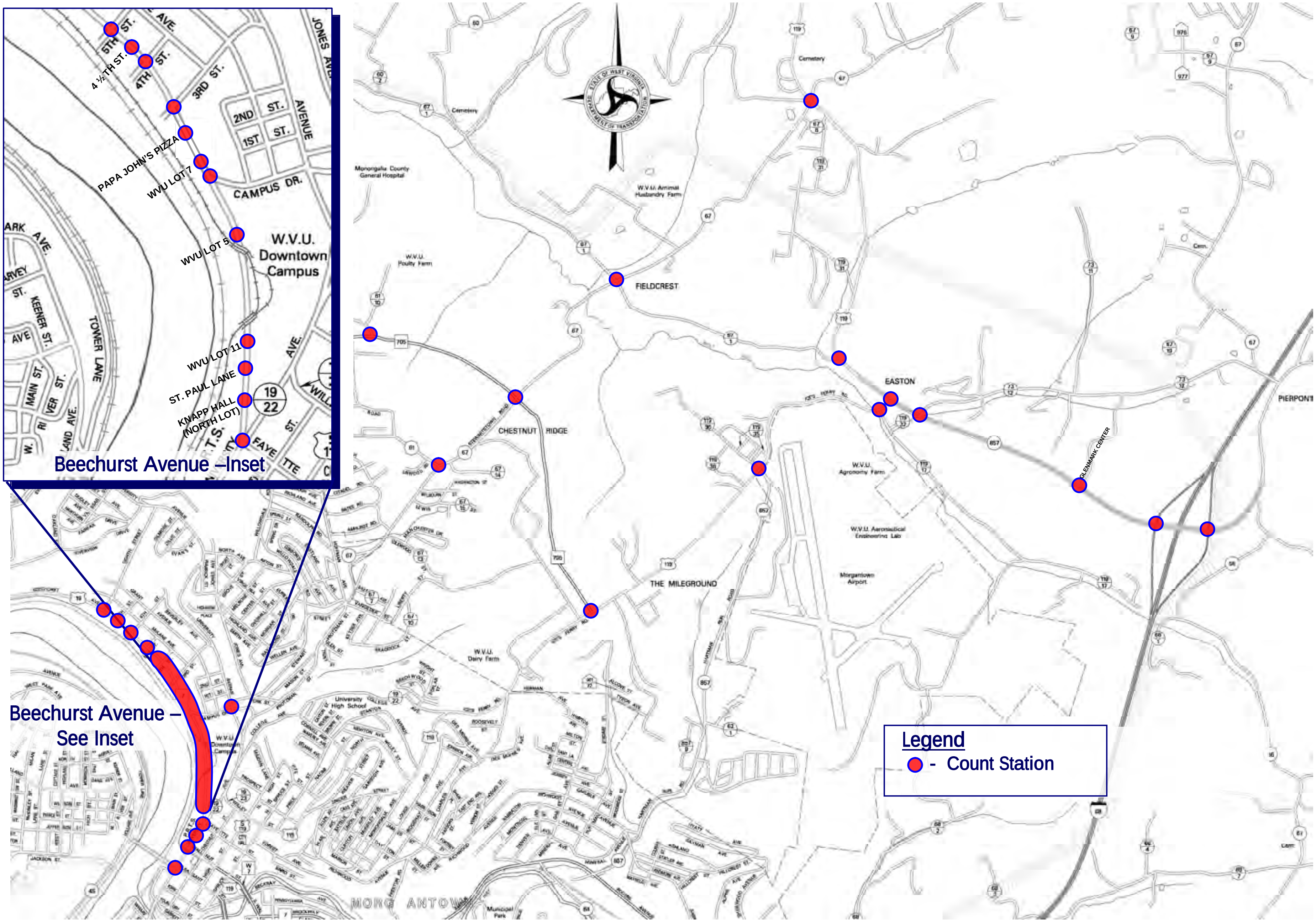


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Figure 5
2006/2007 Intersection Count Stations

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TABLE 1: EXISTING (2006/07) TURNING MOVEMENT COUNTS

Intersection	Approach/ Leg	AM Peak Hour Traffic			PM Peak Hour Traffic		
		Left	Through	Right	Left	Through	Right
WV 705/Stewartstown Road	NW	110	455	15	580	1030	20
	SW	20	30	90	45	190	165
	SE	80	820	35	100	560	80
	NE	75	130	690	35	55	180
US119/WV 705	NW	415	na	205	670	na	565
	SW	275	110	na	320	340	na
	NE	na	160	660	na	215	420
Mileground/Hartman Run Road	NW	10	20	5	45	25	35
	SW	35	360	100	10	735	215
	SE	70	20	220	100	25	225
	NE	175	850	55	115	505	15
CR 857 US 119	NW	na	290	105	na	805	115
	SW	60	na	440	130	na	780
	SE	950	585	na	470	335	na
CR 857/Glenmark Center	NW	90	570	45	305	1065	90
	SW	25	10	45	35	20	110
	SE	90	1295	175	55	510	290
	NE	90	10	70	445	20	190
Westbound I-68/WV 857	NW	na	455	250	na	1220	400
	SE	295	850	na	155	555	na
	NE	20	1	710	25	0	300
Eastbound I-68/WV 857	NW	210	265	na	655	595	na
	SW	295	1	120	305	0	305
	SE	na	850	25	na	405	30
US 119/CR 67	NW	5	275	370	15	260	110
	SW	75	35	55	295	100	270
	SE	280	165	30	115	290	30
	NE	40	175	10	50	40	10
Beechurst Avenue/8th Street	NW	30	580	5	180	970	15
	SW	1	0	2	2	0	5
	SE	5	700	80	1	810	105
	NE	35	1	85	30	1	70
Beechurst Avenue/6th Street	NW	5	600	10	15	980	15
	SW	15	1	25	20	1	20
	SE	30	765	30	10	870	30
	NE	10	1	15	55	1	25
Beechurst Avenue/3rd Street	NW	10	615	10	25	1030	20
	SW	5	1	10	20	1	25
	SE	10	790	20	10	850	20
	NE	10	0	30	35	2	55
Beechurst Avenue/Campus Drive	NW	75	545	na	165	930	na
	SE	na	700	195	na	760	210
	NE	100	na	135	140	na	135
University Avenue/Stewart Street	NW	0	235	45	0	360	50
	SW	65	145	65	45	135	200
	SE	55	455	70	85	435	70
	NE	180	135	25	340	145	35
Beechurst Avenue/University Avenue/Fayette Street	NW	2	2	0	15	10	5
	SW	945	na	175	675	na	155
	NE	5	170	25	35	420	85
	N	70	565	10	220	840	0
University Avenue/Walnut Street	NW	0	na	0	5	na	5
	SW	0	1025	na	5	620	na
	SE	255	1	135	655	2	175
	NE	na	690	10	na	1250	20
University Avenue/Pleasant Street	NW	275	335	260	185	300	285
	SW	160	775	115	325	450	135
	NE	140	535	260	180	885	830

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Figure 6
Existing (2006/07) AM Peak Hour Turning Movements

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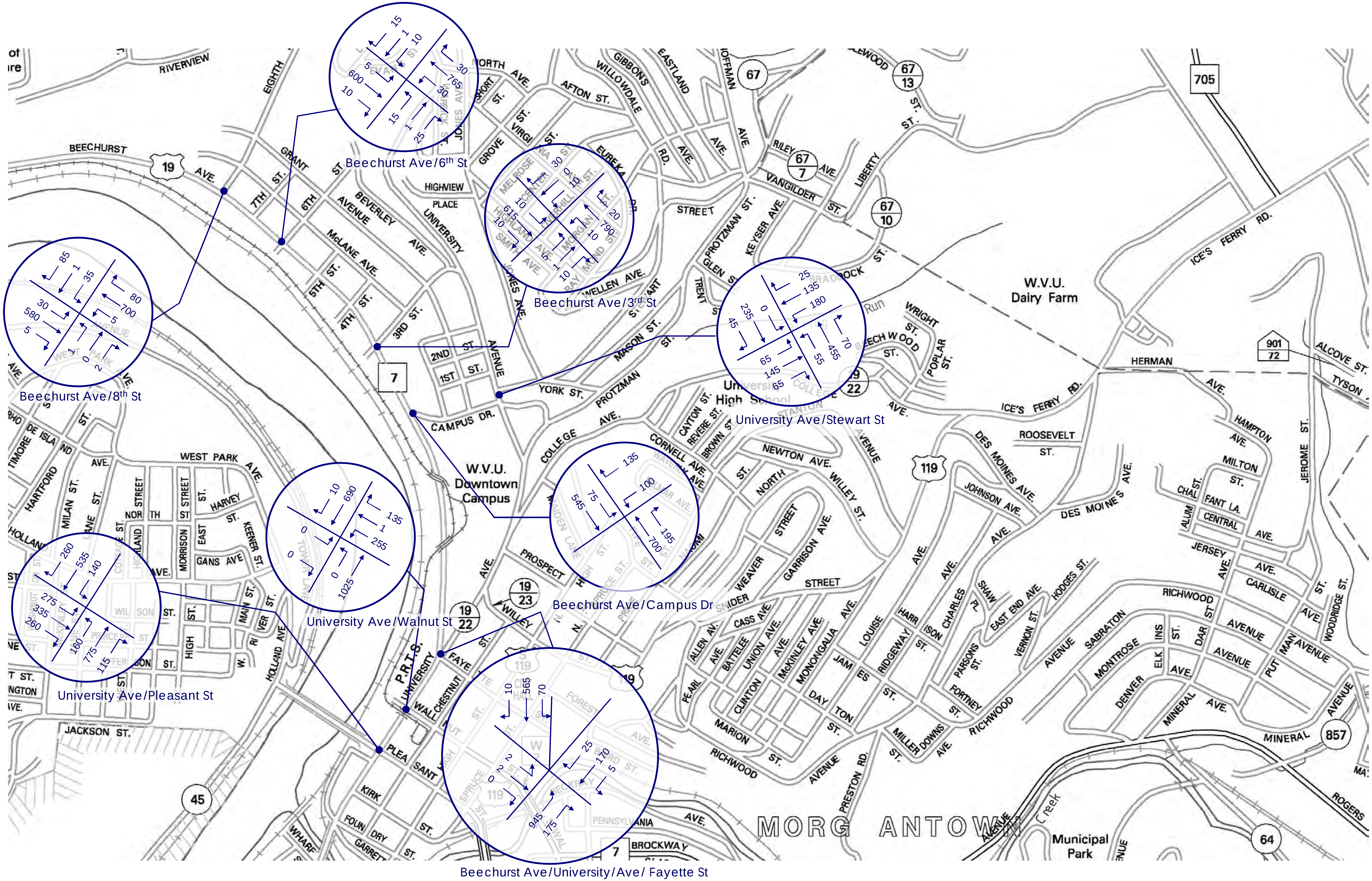

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Figure 7
Existing (2006/07) AM Peak Hour Turning Movements

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Figure 8
Existing (2006/07) PM Peak Hour Turning Movements

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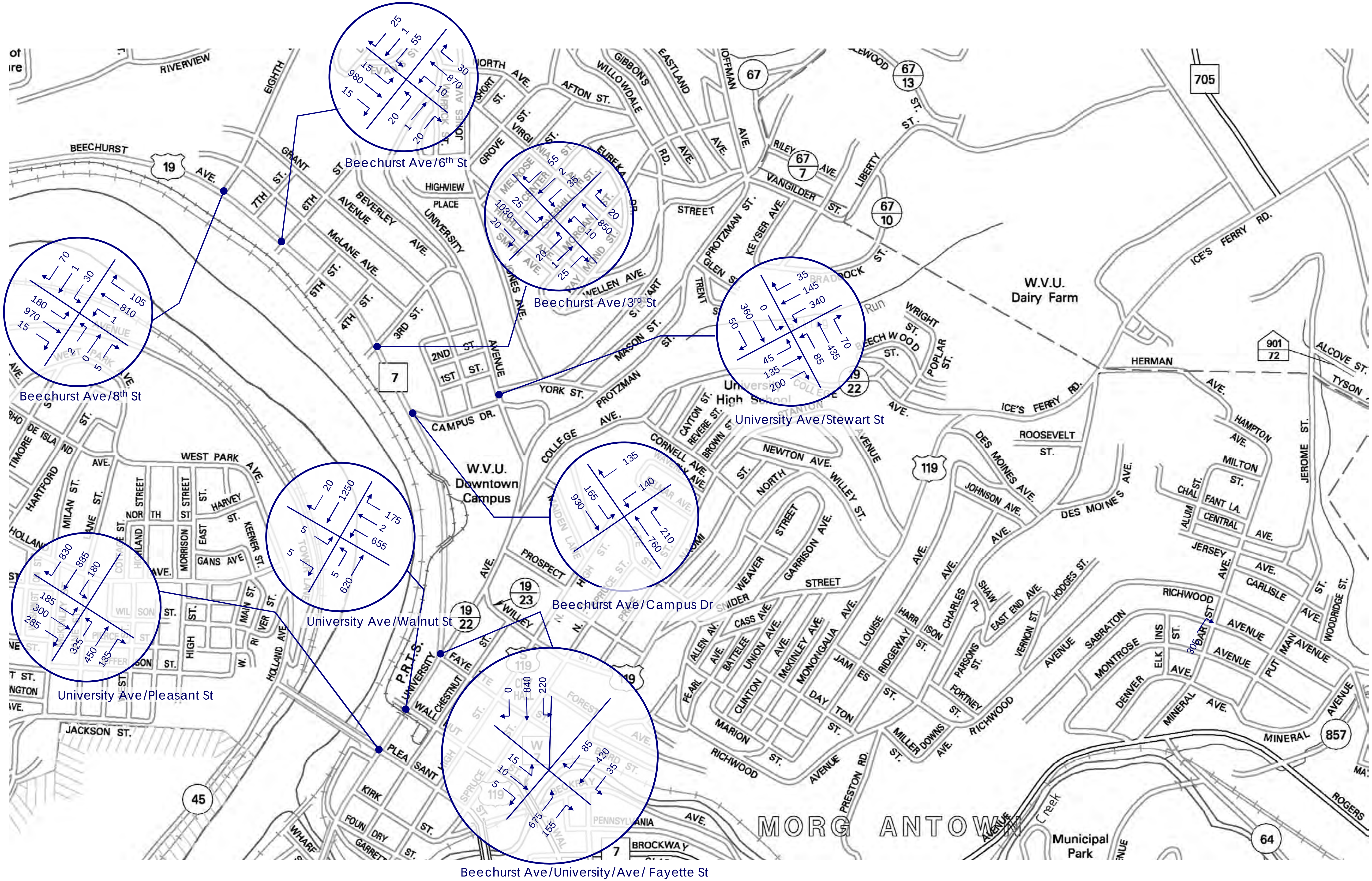


Figure 9
Existing (2006/07) PM Peak Hour Turning Movements

LANE GEOMETRICS AND INTERSECTION CONTROL

The lane configuration for each approach to the intersections included in the study corridors are inputs to the VISSIM microscale simulation model. URS staff was responsible for field checking the information which included:

- Number of lanes: For each intersection approach the number of right, through and left turn lanes were documented.
- Intersection control: The model network contains intersections/driveway access points that range from two-way stop-control on the minor cross route, to four-way stop-controlled, to signalized intersections.
- Signal operating characteristics: The following signal parameters can be incorporated into the model:
  - Actuated versus pre-timed.
  - Cycle length and phasing plan, including minimum and maximum green times for actuated control.
  - Wait times after a detection call for actuated signals.
  - Offsets between intersections along an interconnected corridor.
- Junction type: As the microscale simulation extends along CR 857 to I-68, the network contains both at-grade intersections and grade-separated interchanges.
- Changes in lane configuration/lane drops/lane adds: Most of the corridor segments under study have consistent lane configurations throughout the limits of the study area. Beechurst Avenue is an exception to what is generally observed. In both the northbound and southbound directions there are several locations where the lane figurations change from one upstream intersection to the next downstream intersection. In some situations the change results in a "lane add" for the through movement (southbound direction just south of Hough Street) followed by either a lane drop or changing the through lane to a turn lane (the southbound lane add at Hough Street is terminated as either the southbound right turn or southbound through at Pleasant Street). These lane configuration changes impact the service capacity of the corridor:
  - Typically, improving the approach operations in situations where a lane-add is provided.
  - In situations where the distance from the lane-add to the lane-drop is relatively short (less than three or so blocks) the distribution of traffic between the two through lanes is generally not very balanced because drivers know the lane will drop and do not want to be "caught" a lane that will be terminated. Thus, the utilization of one lane may be lower and the actual service capacity would not be as great as the condition where the close lane-drop is not present.

  In conditions where the volume-to-capacity ratio in a corridor is less than 0.60 the lane drop condition would not generally be an issue. When the volume-to-capacity ratios exceed 0.65, and especially as they approach 1.00, the ability to find a gap to transition out of the to-be-dropped-lane is limited and all but the most aggressive drivers tend to avoid the lane. Thus, little operational benefit is provided by the added lane.

  The lane configurations, including the transition distance for lane drops, were field checked by URS staff.

SIGNAL TIMING DATA

The primary objective of conducting the microscale analysis, as opposed to a more macroscale operations analysis, of the various corridors is to allow for evaluating the influence that the operations at one intersection has on the quality of traffic operations at up and downstream intersections or driveway access points. As the intersection spacing is fairly short and the signal density, at least in the Beechurst Avenue-South University Avenue corridors, is fairly high gathering and inputting as much information on the traffic signals is critical to recreating actual field traffic flow conditions. For each of the signalized intersections the following information was input into the base and future conditions networks:

- Signal phasing.
- Detector location relative to the stop bar and detector length.
- Signal timing including:
  - Minimum and maximum green time by approach.
  - Yellow clearance interval for each phase.
  - All red time between phases.
  - Intersection phase time offsets between up and downstream intersections (for interconnected portions).

Table 2 documents the key signal information that was input for each signalized intersection included in the simulation analysis. Additional detailed information is included in the appendix.

TABLE 2: SIGNAL TIMING DATA

MODEL DEVELOPMENT AND CALIBRATION

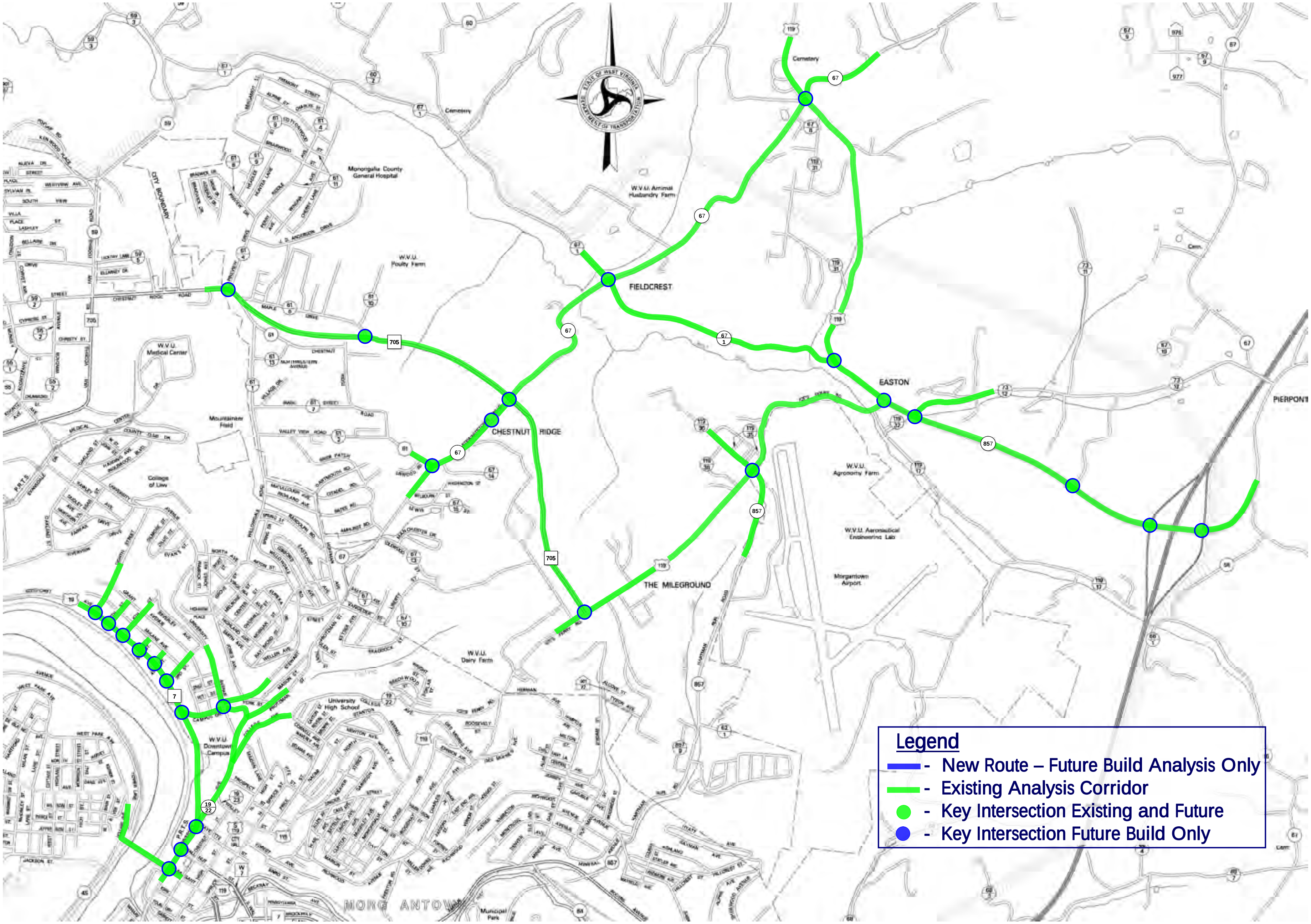
The microscale traffic operations model is a computerized representation of the existing street system or a future period modified street systems. The intent of going the extra distance from a macroscale analysis where each intersection is evaluated in isolation from the up and down stream intersections is to replicate the actual travel conditions as closely as possible. Thus, following the steps of constructing the computerized network of street segments and intersections and then populating the network with turning volumes, signal timing, operating speeds, an iterative process of running the simulation and comparing the results to real world conditions is completed. This process is referred to as calibration. Unlike with the regional travel demand model, which was calibrated relative to a set of criteria established by the FHWA, there is not a published list of calibration criteria or model-to-actual deviation guidelines. Thus, calibration is a combination of science and art. Science comes into the process through making adjustment to input parameters after each iterative comparison of the simulation results to actual street conditions. Art is drawn into the process through the driver parameter adjustments made throughout the calibration process. The VISSIM model allows for modification of parameters that control driver behavior in the simulation, such as:

- Driver's desired/comfortable speed relative to the freeflow speed.
- Land changing behavior (aggressive to cautious).
- Vehicle-following behavior (minimum comfortable distance between vehicles by vehicle type).
- Driver acceleration and deceleration characteristics.

The resulting product of the combined scientific and human behavior parameters is a model that closely resembles actual conditions. Developing this replication then requires field observation of operations in each of the periods being modeled. URS staff conducted observations over both the period of the Regional Transportation Plan, as the corridors being modeled in this analysis were also critical evaluation corridors in the Regional Transportation Plan, and also as part of the more detailed operations study.

DETAILED OPERATIONS NETWORK

Figure 10 displays the street segments and intersection/junctions included in the detailed operations network. As can be observed in the figure, a continuous network from I-68/CR 857 to Beechurst Avenue/South University Avenue was not created for the current conditions. This was because the distance between existing WV 705 and Beechurst Avenue/South University Avenue along the existing connections (Willey Street, Stewart Street, College Avenue, etc) is great enough that the operations along WV 705 do not substantially impact operations on Beechurst Avenue and South University Avenue and vice versa. In addition, the resource investment to model the operational issues along the connector routes would be substantial and including them would not add much benefit, or utility, to the desired goal of the operations analysis (determine the positive/negative impacts of the WV 705 Connector, the Falling Run Corridor and upgrading Beechurst Avenue/South University Avenue).



Greater Morgantown MPO

Figure 10
VISSIM Network Coverage

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For each of the network segments and intersections, the following information is incorporated into the VISSIM network:

- Intersection geometry, including lengths of turn bays, taper lengths, etc.
- Intersection control type.
- Signal operating parameters for signalized intersections.
- To scale distances between intersections or intermediate block access driveways.
- Speed limits and estimates of average freeflow operating speeds.
- Flow restrictions: Within the network coverage several streets are restricted to one-way flow. These restrictions are coded into the VISSIM network.
- On-street parking restrictions: The number of parking maneuvers along each corridor was not collected as part of the study. If parking is allowed along a corridor, the impacts on traffic operations are addressed through adjustments to the saturation flow rate. For the most part, however, parking is restricted from the primary focus routes (Mileground Road, Beechurst Avenue, etc.).

CURRENT CONDITIONS CALIBRATION

OVERVIEW

Travel in each of the selected corridors is very complex and is influenced by a broad array of inputs from weather to incidents to WVU session schedules to construction/reconstruction on other routes. The unique influences that each of the inputs has on how well or poorly the system operates results in making the microscale operations modeling more complex than simply putting together a computerized street network that accurately reflects intersection locations, signal locations, lane geometry, and then populating the network with accurately counted volume by approach and movement. The analysis results of the accurately prepared network populated with accurate count data reflects a macroscale assessment. In the microscale approach driver behavior and when throughout the peak hour vehicles enter the system are also key inputs. The last two inputs are more complex than they may initially sound, but they are the variables that make the corridor operations unique to the selected Morgantown corridors. As there are no compiled data of corridor level driver behavior and detailed distribution of vehicles entering the study corridor, an iterative process of estimation of the two variables is needed. This iterative process is referred to as calibration and the goal is to use the parameters to adjust the model operations until the outputs reasonably reflect Morgantown conditions.

Within the VISSIM package there are two general categories of variables that are systematically adjusted in the calibration process:

- Driver behavior variables.
- Traffic entry patterns into the model area.

Driver Behavior Variables

A key to making a microscale simulation model unique to a region, a city or a corridor is the ability to account for variations in driver behavior from one area to another. In the modeling world driver behavior is recorded in the following variables:

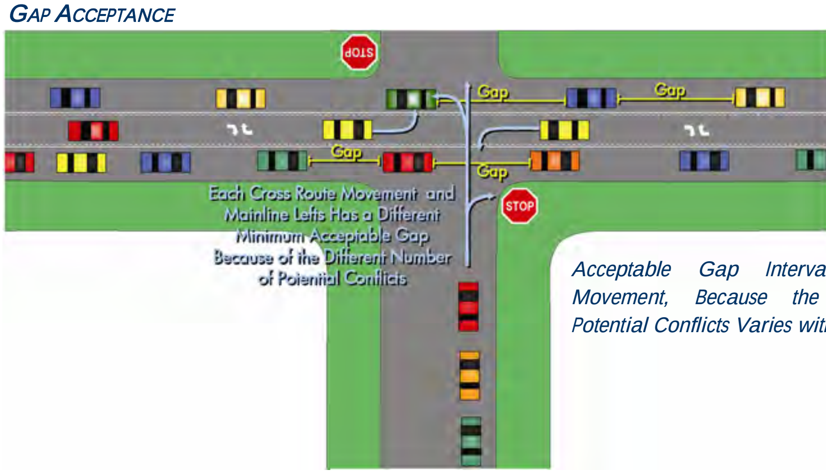
- Gap acceptance: The minimum time between two consecutive vehicles that a driver will accept and still make the turning movement. It is critical to have control of this parameter because the level of traffic able to move through a corridor of a consistent cross section is not exactly the same in all communities or even different parts of the same community. In areas where drivers may be a bit more timid (or some could argue better mannered), the time interval representing an acceptable would be greater than the minimum time interval for a more aggressive driver. In corridors that are congested many hours of the day, drivers are apt to accept smaller gaps.

  The VISSIM model allows input of different minimum gap acceptance parameters for cross route left turns, right turns and through movements, which is reflective of real-world conditions. Recommendations in the Manual on Uniform Traffic Control Devices [MUTCD] (USDOT, 2001) acceptable urban conditions gaps typically range from 4.5 to 6.0 seconds. For the Morgantown application a consistent set of acceptable gaps by movement and cross section were used and they are displayed below:

  - Left Turns: 5.0 seconds turning on to two-lane and 5.5. seconds turning on to four-lane.
  - Right Turns: 4.0 seconds turning on to two-lane and 4.5 seconds turning on to four-lane.
  - Throughs: 5.0 seconds crossing a two-lane and 6.0 seconds crossing a four-lane.

  These values are reflective of a moderately aggressive driver, willing to accept below average time gaps.

GAP ACCEPTANCE



Acceptable Gap Intervals Vary by Movement, Because the Number of Potential Conflicts Varies with Movements

- Lane changing behavior: Similar to the condition where vehicle turning into or out of a corridor look for an acceptable vehicle-to-vehicle gap interval, drivers that desire to change lanes in order to make a downstream left or right turn from a different lane are looking for gaps so they can maneuver to the appropriate lane. For the lane changing maneuver, however, the modeled driver is not looking for a specific gap in the adjacent lane. Their lane change behavior is measured by how far upstream from the movement intersection they decide to make the lane change. The level of congestion, the level of how aggressive/timid the turning driver is and how accommodating are other drivers all come into play in determining the upstream distance. A more timid driver in a congested corridor with other drivers that are less accommodating may decide get in the appropriate lane to make the turn three to four blocks upstream from the tuning point. Whereas a more aggressive driver may make the lane change move one block before the turn.

The lane changing behavior parameter covers all reasons for making a lane change, including:

- Preparing for a downstream turn.
- Preparing for a downstream lane drop.
- Preparing for a downstream lane change (a through lane that terminates as a right turn lane and the driver's intent is not to turn right).

The lane changing behavior input assumption developed through the calibration process was that the typical driver would consider where they desired to be two blocks (800 feet) downstream in selecting a lane.

- Car-following behavior: The established car-following behavior influences both the gap acceptance and land changing behavior activities in the corridor operations. In defining the car-following behavior the headway distance over a range of speeds and vehicle mixes for a specific corridor or set of corridors is characterized. Within the VISSIM model very detailed situational conditions can be defined through the following parameters:
  - Minimum Headway (front/rear): Defines the minimum distance to the vehicle in front that must be available for a lane change in standstill condition.
  - Maximum Deceleration: The fastest rate at which a vehicle can slow down or stop.
  - Accepted Deceleration: The vehicle slow down rate that is considered safe without any dangerous or excessive deceleration.
  - Maximum Look Ahead Distance: The greatest distance that a vehicle driver can see forward in observing the need to react to other vehicles either in front or to the side of it.
  - Average Standstill Distance: Defines the average desired distance between stopped cars and also between cars and stop lines (signal heads, priority rules, etc.).

  There are several other car-following behavior variables that could be used, but the ability to defend an adjustment away from the VISSIM default results in use of the default for all but the most unique conditions. It should be noted that very few adjustments were made to any of the car-following parameters.

CALIBRATION PARAMETERS

Within each of the detailed operations focus corridors the following calibration parameters have been employed:

- Corridor vehicle travel time: This is the principal calibration tool used in the based condition. In the calibration process the modeled travel time was compared to the observed corridor peak period travel times. The primary reasons that the corridor travel time was used in the calibration was that:
  - The number of minutes that is takes to travel from Point A to Point B in a corridor is a value almost any driver/traveler can define and relate to. Many times operations in a corridor are defined as a particular level-of-service measure (A through F), that represent a range of average stopped delay per vehicle. Very few drivers really break their trip to finite enough parts that they can really separate stopped delay from congested flow and/or freeflow travel. But, most can define how long it takes to get from Beechurst Avenue at 8th Street to South University Avenue at Pleasant Street in the AM or PM peak period.
  - Observed travel time relative to freeflow travel time can be converted to a level-of-service. Thus, operations can still be related in a level-of-service unit if desired.

Table 3 documents the freeflow travel time to congested travel time measures associated with various level of service descriptors.

- Intersection queue lengths: Field confirming many of the traffic operations parameters that are used to define operations can be difficult. Observation and/or measurement of the average or maximum intersection queue that forms as volumes approach capacity by movement are relatively simple items to obtain and are critical in defining the reasonableness of the model in replicating current conditions. The goal was not to reproduce each individual queue by cycle at each intersection for each corridor, but rather to replicate the general average queue length by intersection approach.

  In the preceding paragraph it was stated that determining the average or maximum back of queue is a relatively simple item to obtain. This statement is generally true, but in cases where the signal density is relatively high, the block lengths are relatively short and the volume-to-capacity ratio in the corridor approaches 1.0, defining the queues can become very difficult. This is because many times during the peak traffic period intersection queues tend to extend from one intersection to the next upstream intersection, or "spillback, through the upstream intersection. This is the typical case all through the Beechurst Avenue-south University Avenue corridor and at times in the PM peak period for Mileground Road corridor. For these conditions the model was adjusted until similar spillback conditions were created. The key was not to adjust driver and arrival parameters so much that model-world spillback far exceeded real-world spillback.

- Percent of the counted volume served: When the WVDOT conducts an intersection count, the figures reported represent the number of vehicles by approach and movement that cross through the intersection in a given period. Thus, the AM and PM peak period traffic counts provided by the WVDOT represent the service volume of the intersection, which takes into account all of the unique operating characteristics of the intersection that affect the number of vehicles that can physically pass through in a specific period. The model initially does not understand all of the unique quirks associated with each intersection and their impact on the number of vehicles that could reasonably travel through the corridor. As corridors become more congested (as are most all of the corridors covered in this study), making adjustments to various input parameters and variables is critical because the model should be able to allow all of the counted volume at each intersection to pass in the peak hour. While all of the counted volume should pass, unserved vehicles form queues in the AM and PM peaks at the vast majority, if not all of the intersections covered in the study. Thus, the goal of validation is to replicate the queues formed and observed in the field.

TABLE 3: LEVEL OF SERVICE BASED ON CORRIDOR SPEED

Level of Service Descriptor	Operating Speed as Percentage of Freeflow Speed
A	≥90%
B	70% - 89%
C	50% - 69%
D	40% - 59%
E	<30%
F	<25%

Source: *Highway Capacity Manual*, Transportation Research Board, 2000

CALIBRATION ANALYSIS RESULTS

The calibration parameters outlined in the preceding section were used throughout the roadway corridors that comprise the study areas, including Beechurst Avenue-South University Avenue, Mileground Road and CR 857. Limited validation was completed along Stewartstown Road and along WV 705 from Mileground to Stewartstown Road. Calibration at WV 705/ Stewartstown Road was the primary focus along WV 705.

The extent to which each of the identified assessment parameters was used in the calibration process varied by corridor and the feasibility of obtaining reasonable field data. In each of the corridors the percentage of service volume accommodated and corridor travel time were extensively. Use of the queue length parameter was less consistent throughout the intersections in the various corridors. Along the Beechurst Avenue and South University Avenue corridors the average and or maximum queue were not extensively used as it was very difficult to precise information on the queue length. This is because in both the peak periods, and especially the PM peak which was the greater focus, there was extensive spillback throughout the study limits from 8th Street to Pleasant Street. With the spillback conditions, the queue from downstream intersections extends to the next upstream signalized intersection and mixes with the queue from that intersection. At that point it is difficult to determine whether the observed queues should be associated with the up or downstream intersection.

TABLE 4: CORRIDOR TRAVEL TIME BY LEVEL OF SERVICE PARAMETER

Corridor Description	Travel Time By Level of Service (Minutes:Seconds)					
	A	B	C	D	E	F
Beechurst-South University Avenue: 8th Street to Pleasant Street	<2:30	2:31-3:05	3:06-4:20	4:21-5:25	5:26-7:15	>7:15
Mileground Road: WV 705 to CR 857	<3:10	3:11-4:10	4:11-5:50	5:51-7:20	7:21-9:45	>9:45
CR 857: US 119 to I-68	<1:20	1:21-1:45	1:46-2:25	2:26-3:00	3:01-4:00	>4:00

2030 Daily and Peak Hour Traffic Forecasts

Traffic forecasts prepared prior to the initiation of the Detailed Operations Study reflected weekday traffic levels. While these forecasts were appropriate for the Regional Transportation Plan, more detailed volumes representing hourly traffic (design hour traffic) are required for the concept assessment. Preparation of the hourly traffic volumes uses some of the same tools as was used in the Regional Transportation Plan, but substantially more post-processing of the daily volumes are required. The process used for the WV 705 Connector-Falling Run Corridor-Beechurst Avenue Expansion project in developing AM and PM peak period volumes from the regional model average weekday daily forecasts is outlined below and displayed in Figure# **Need to Include – Missing is not Significant to Review):**

- Update the Existing Plus Committed regional model network to include the following project concepts:
  - WV 705 Connector from US 119/CR 857 to WV 705.
  - Falling Run Corridor from WV 705 to Beechurst Avenue
  - Beechurst Avenue-South University Avenue expanded to 5-lanes from 8th Street to Pleasant Street.

  To increase the flexibility of being able to isolate the potential traffic impacts of the selected concepts, a number of regional model runs that included the following combinations of projects were completed:
  - WV 705 Connector only.
  - WV 705 Connector and the Falling Run Corridor.
  - Beechurst Avenue-South University Avenue expansion only.
  - Falling Run Corridor and Beechurst Avenue-South University Avenue corridor expansion.
- Adjust the trip generation to best account for specific development proposals affecting the study corridors. The regional travel demand model increment of development between 2000 and 2030 includes increments of households and employment representative of known developments, however, traffic studies completed for selected larger scale developments will provide much more detail on peak hour traffic and the site-specific directional orientation of generated trips than can be incorporated into the regional model. Thus, in developing the traffic forecast the choices are to update the regional model to account for the developments to the extent that is feasible, or to remove a representative increment of development from the regional model growth plan and then in a manual process add on the site generated traffic obtained from development traffic impact studies.
- Post-process the regional model assignments for each network alternative to adjust for 2000 base year model-to-count deviation. As with all of the 2030 daily traffic forecasts developed for the Regional Transportation Plan, the daily forecasts for each network alternative took into account the error which is inherent in the modeling process. Both absolute and relative error corrections were applied.
- Factor 2030 daily forecasts to AM and PM peak hours. The result of the initial factoring process is the AM and PM peak hour two-way traffic along segments of the study routes.
- Distribute the 2030 peak hour directional volume forecasts for each intersection approach to the available turning movements (right, through, left) at the intersection. The starting point for the turning movement distribution for each of the key intersections

in the study area was the current traffic count distribution for the AM and PM peak periods. The current distribution was modified as warranted to account for:

- New routes provided in a network that would result in new movements, or elimination of a current movement. Examples include the Falling Run Corridor would create a "new" left turn and right turn opportunities on Beechurst Avenue. In addition, the Falling Run Corridor junction with Beechurst Avenue would create left and right turns from Falling Run onto Beechurst Avenue. These movements do not presently exist in the Beechurst Avenue corridor and would need to be derived through assessment of the directional volume on Falling Run and the growth by approach on Beechurst Avenue.
- The level of traffic volume change between the base year and horizon year by approach. The forecasted hourly movements between junction approaches observing more traffic growth would be increase at a greater level than the level of growth on approaches reflecting a lower increment of growth.
- Substantial changes in the type of development adjacent to an intersection or corridor that would likely impact the percent turns by approach. In cases where there are changes in the types of land uses adjacent to a corridor (i.e. conversion of the UVW farm property to office-residential-commercial development), changes to the peaking characteristics of traffic on the street may be warranted. Adjacent land uses influence the percent turns because certain uses such as office/education are vehicle attractors in the AM and vehicle producers in the PM peak. Whereas residential uses are vehicle producers in the AM and vehicle attractors in the PM peak period. Additionally, open space or agricultural uses would not generate much traffic at all. Thus, development of open space parcels or conversion of low intensity industrial developments to residential, or other selected inverse producer-attractor land use changes can create the need to adjust the percentage distribution of turning movements at the key intersections. For the study corridors under review the most likely locations to consider are along WV 705 where the University Towne Center could influence turning movements at Stewart Street and Beechurst Avenue adjacent to the Square at Falling Run development.

- Rebalance the directional flows in and out of each intersection. Generally, following the initial application of the intersection approach turning percentage values to the inbound flows, the outbound flows from the intersection no longer correspond with the segment flows developed in an earlier step. Thus, there is the need to go through one or more additional iterations of turning percentage evaluated to be able to reasonably balance the inbound and outbound flows at each approach to each the key intersection.

Regional Model Traffic Assignment Adjustments

In the Regional Transportation Plan updating process the forecasted increment of residential development (measured through the number of additional households allocated to a TAZ) and commercial/industrial/service/university employment (measured as the number of additional retail, non-retail and/or university employees allocated to a TAZ) was distributed through the following steps:

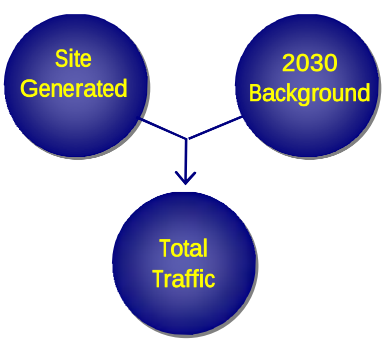
- Estimate the control total for households and employment for the 2030 planning horizon.
- Calculate the increment of households and employment forecasted to be located in the county between the 2000 model base year and the 2030 planning horizon.
- Work with staff from the Morgantown Planning Department, Monongalia County Planning Department, the Morgantown Area Economic Partnership, and Monongalia

County Development Authority to distribute the 2000 to 2030 increment of households and employment. This process took into account known developments such as the University Towne Centre, Suncrest Towne Centre, the WalMart developments, etc. At the time that the 2000 to 2030 socioeconomic data increment distribution was completed for the RTP, estimates of the number of households and/or employment associated with projects such as the Square at Falling Run, the WVU Research Park, University Town Center, and the Suncrest Towne Centre were not available. Thus, estimates of the potential growth were allocated.

- Complete a regional distribution of the household and employment control total increment available after the specific site development allocations were made. This allocation reflected a proportional allocation to each zone based on the current percent of households or employment in a zone. For example, if the 2000 employment allocation to a zone represented 0.5 percent of the entire county employment, 0.5 percent of the 2000 to 2030 remainder increment was allocated to that zone.

As the regional model socioeconomic data allocation was relatively general and that model TAZs cover larger geographic areas containing multiple developments (for the most part) and that trip generation reflects daily levels, it was concluded that for those developments for which a reasonably current traffic impact study was available, adjustments would be made to the regional model data files to allow incorporating the traffic study data. The regional model adjustments reflected "zeroing out" the 2000 to 2030 household and employment growth increment estimated to represent the known future developments. The result of zeroing out the increment of socioeconomic data was a 2030 traffic assignment, and ultimately a 2030 daily traffic forecast, that essentially ignored the proposed developments. This forecast is referred to as the background traffic forecast.

Total Link/Intersection Traffic



Total = Site Generated + Background

Site Generated – From Traffic Impact Studies for:

- Suncrest Towne Centre
- WVU Research Park
- Square at Falling Run

Background – From Regional Model without Traffic for Listed Developments

Each of the developments were accounted for in the cumulative traffic forecasting process by adding the site generated trips reflective of the traffic impact study levels to the regional model-derived background traffic for 2030. Total forecasted 2030 traffic was the combination of the background forecast on a link and the development site generated traffic assigned to a link.

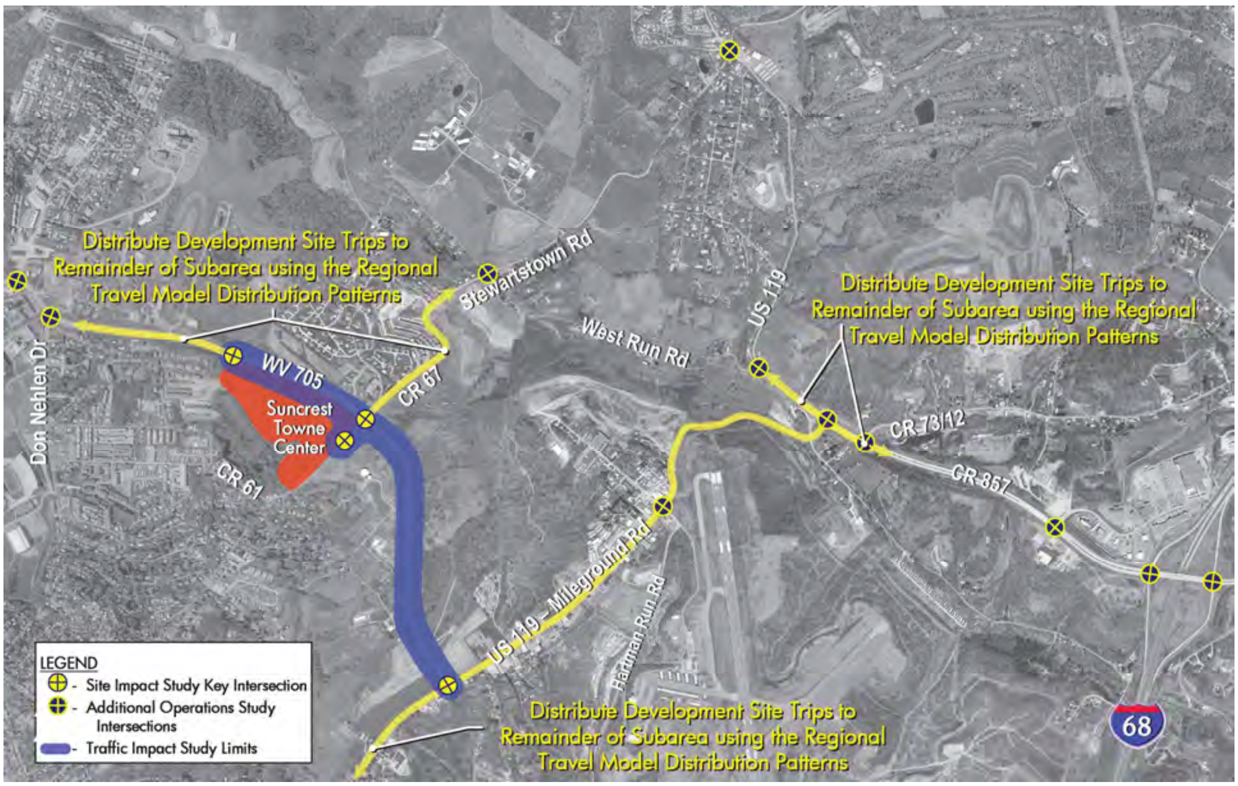
As the development traffic impact studies included only the trip generation for the specific development and not the anticipated future development from adjacent parcels and the coverage of the studies was generally limited to those intersections in close proximity to the development site and not all of the intersections in the present study limits, a methodology for extending the distribution of trips to the traffic operations study coverage limits and a method for obtaining the cumulative intersection total traffic that accounted for each of the larger scale developments was required. The general method employed is outlined below:

- Distribute specific traffic impact study trips throughout the remainder of the operations study limits. From the site impact studies a general orientation of trips away or to a development site was identified. For example, in the Suncrest Towne Centre study approximately 30 percent of the peak hour trips were distributed to/from the east on WV 705 (towards the Mileground). The last intersection included in the traffic study distribution was WV 705/Mileground Road.

From the WV 705/Mileground intersection, the relative distribution from the Suncrest Towne Centre TAZ observed in the regional model took over as the source for allocating rips to the remaining links in the Operations Study project limits. This step was accomplished by reviewing the regional model TAZ-specific assignments to study area segments for 2030 trips. While the absolute level of trip generation in the regional model is not exactly consistent with the trip generation in the site development traffic impact studies, a reasonable relative distribution throughout the detailed operations study area could be derived. The relative distribution of trips from zones consistent with the site impact assessments were extracted from the regional model and were used from the limits of each of the site impact analyses to continue the trip distribution throughout the operations study limits.

- Sum the various traffic impact study site generated trips to obtain a cumulative forecasted level of traffic.
- Add the 2030 background traffic to the cumulative site development traffic to obtain the **total forecasted traffic** for each segment and each approach to each of the key intersections.

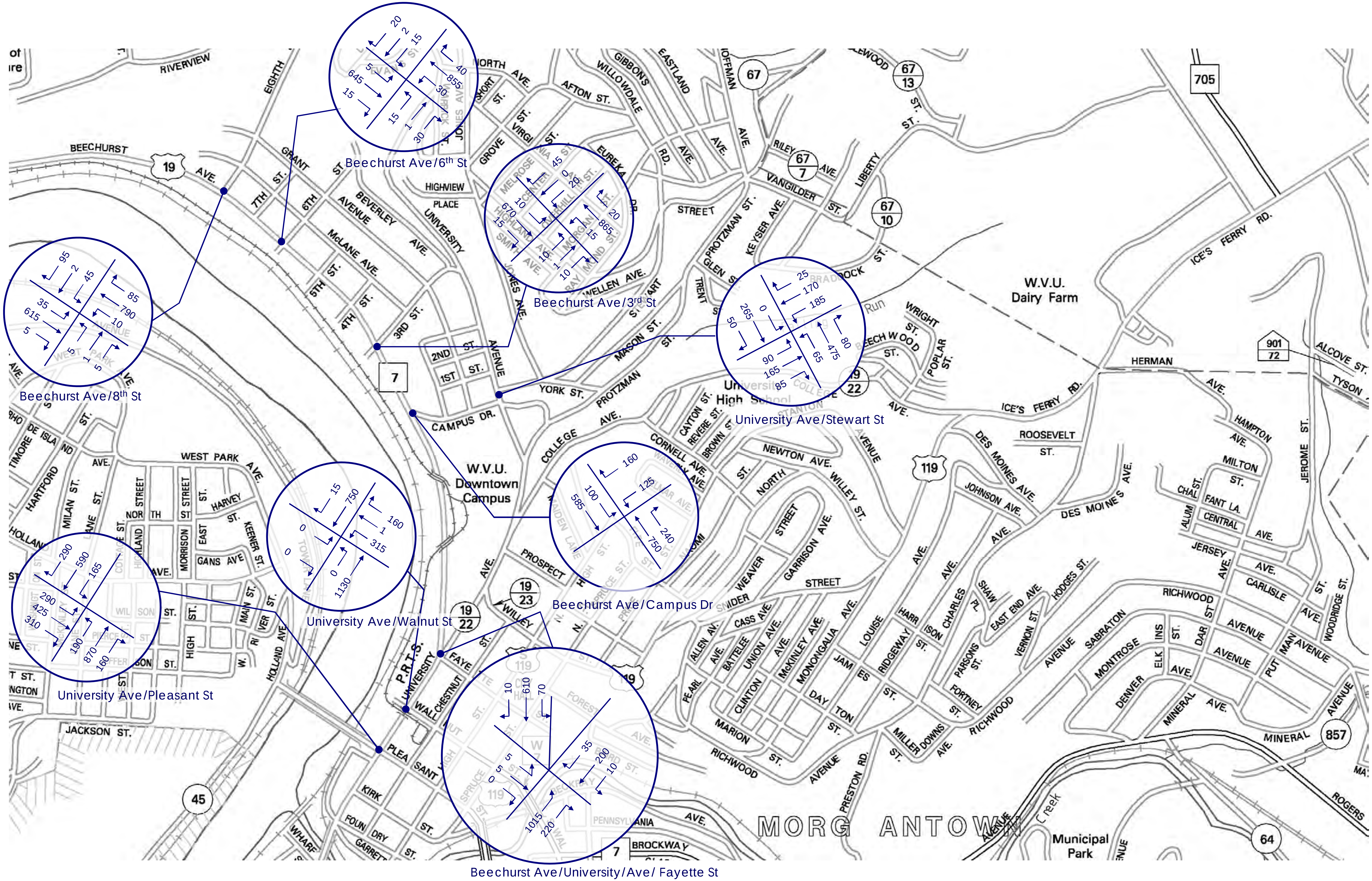
Illustration of Distribution Parameters – Suncrest Towne Center



2030 Peak Hour Traffic Forecasts

The regional model outputs daily traffic assignments which are then adjusted to account for error that is inherent in the model. The result is a daily traffic forecast, which needs to be factored to represent the AM and PM peak hours evaluated in the Operations Study. The factoring process was outlined in the introduction to the 2030 traffic forecasts. Figure 11 through 14 display the results of the forecasting process that combines elements of the regional travel demand model and traffic impact studies prepared for specific larger scale developments.

Figure 11
2030 AM No-Build Peak Hour Turning Movements



Greater Morgantown MPO

Figure 12
2030 AM No-Action Peak Hour Turning Movements

URS

Greater Morgantown MPO

Figure 13
2030 PM No-Action Peak Hour Turning Movements

URS

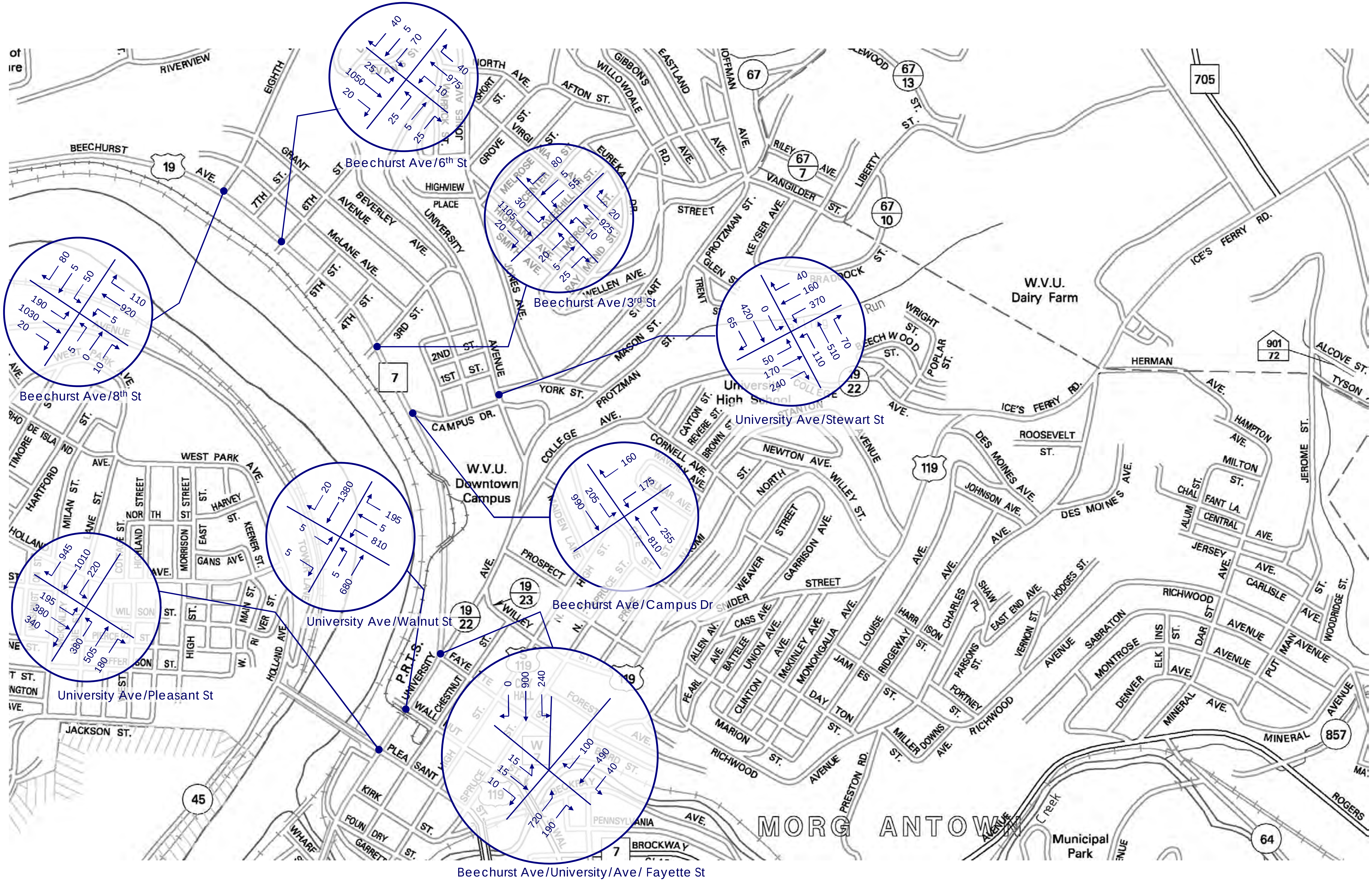


Figure 14
2030 PM No-Action Peak Hour Turning Movements

PEAK HOUR TRAFFIC OPERATIONS

OVERVIEW

The primary measure of effectiveness used in the microscale analysis is level-of-service, which can be reported through several different measures, but they all come back to a unit which is associated with travel time through an intersection or a corridor. Typically for a signalized arterial, level-of-service is based on the average intersection delay experienced by each vehicle in the traffic stream. For an expressway, as the WV 705 Connector is defined, level-of-service reflects the number of conflicts at interchange merge/diverge points, estimated operating speed on the mainline relative to the freeflow speed, and the number of conflicts in weave areas adjacent to interchanges. Use of the average intersection delay measure is entirely acceptable when individual intersections are reviewed in isolation. The intent of the micro scale analysis is to evaluate each vehicle's trip through a specifically defined portion of a specific corridor. In simplest terms, level-of-service represents the amount of time it takes to travel through a specific portion of a corridor. If the travel time is close to the freeflow time the quality of operations would be good, which is reflective of level-of-service A. If the travel time through a corridor (or segment of a corridor) is substantially greater than the freeflow time over the same segments and through the same intersections, the quality of travel would be poor, which is reflective of a level-of-service D through F. The estimated operating speeds by level-of-service category are displayed in Table 5

TABLE 5: LEVEL OF SERVICE BASED ON CORRIDOR SPEED

Level of Service Descriptor	Operating Speed as Percentage of Freeflow Speed
A	≥90%
B	70% - 89%
C	50% - 69%
D	40% - 59%
E	<30%
F	<25%

Source: *Highway Capacity Manual, Transportation Research Board, 2000*

While traffic engineering and roadway design professionals freely interpret level-of-service defined by average per vehicle stop delay, many decision makers are not as experienced in using these measures. To bring the measures of effectiveness into units that decision makers and the public have more experience, current and future peak hour operations in the study corridors is travel time are expressed relative to the freeflow travel times. As was described earlier in this report, level-of-service can be expressed in estimated/actual corrdiro travel time relative to the estimated/actual freeflow time.

CURRENT (2006) TRAFFIC OPERATIONS

For each of the corridors in the study area freeflow and congested conditions speeds were measured and/or derived in the microscale simulation model calibration. Displayed in Figures 15 through 18, are the results of an assessment of the current conditions AM and PM peak hour operations. As observed in the figures, the following characterize the key corridor operations and/or intersection:

- **Beechurst Avenue:** In the AM peak period southbound operations along the segment from 8th Street through Campus Drive reflects level-of-service D operations. Queues of moderate length form at each of the signalized intersections, but only minor levels of spillback occur. South of Campus Drive, the influences of vehicles turning to enter the downtown area from both northbound and southbound Beechurst Avenue (South University Avenue) result in:
  - Poor operations at the Campus Drive intersection.
  - Poor operations at the Fayette Street intersection.
  - Poor operations along the southbound segment of Pleasant Street.

  Operations along Pleasant Street from South University Avenue to Spruce Street reflect LOS E/F conditions, as this is one of the primary entry corridors for commuters into the downtown.

  Level-of-service D and E/F operations are observed in the northbound direction from Walnut Street through Campus Drive. Traffic operation on Pleasant Street approaching Beechurst Drive (Westover Bridge) reflect level-of-service D operations in the model, but it is likely there are periods of greater congestion throughout the peak hour than is documented for the entire hour.

  North of Campus Drive, traffic volume is generally lighter in the northbound direction during the AM peak, relative to the southbound direction. With the lower volumes and lower percentage of left turning volume (most uses between Beechurst Avenue and the Monongahela River are residential or retail commercial which are not significant destinations in the early AM hours), a higher level-of-service is maintained throughout the peak hour.

  North of Hough Street the Beechurst Avenue corridor is consistently striped as a three lane (one through lane in each direction and a center two-way left turn lane) which improves overall operations in the corridor by separating the stopped left-turning traffic from the through traffic. While turning volumes at the individual public and private access points are substantially lower than at points to the south, vehicles stopped waiting for a gap still negatively influence corridor operations.

  Conditions in the PM peak hour are substantially more congested than they are in the AM peak. Traffic flow on Beechurst Avenue in the southbound direction exceeds the throughput capacity by 100 to 200 vehicles per hour. Thus, substantial queues build throughout the hour from the Pleasant Street intersection, the University Avenue/Fayette Street intersection and the Campus Drive intersection. Long queues at these intersections build, in at least one direction, past the next upstream intersection, which causes substantial delays and breakdowns in operations throughout the study area. In addition, traffic turning left from the corridor, while not substantial, results queues also building from mid-block locations that can spill back to the left turn lanes of the upstream intersection. The only portion of the corridor in the study area to operate at better than level-of-service E/F is the northbound segment from north of Campus

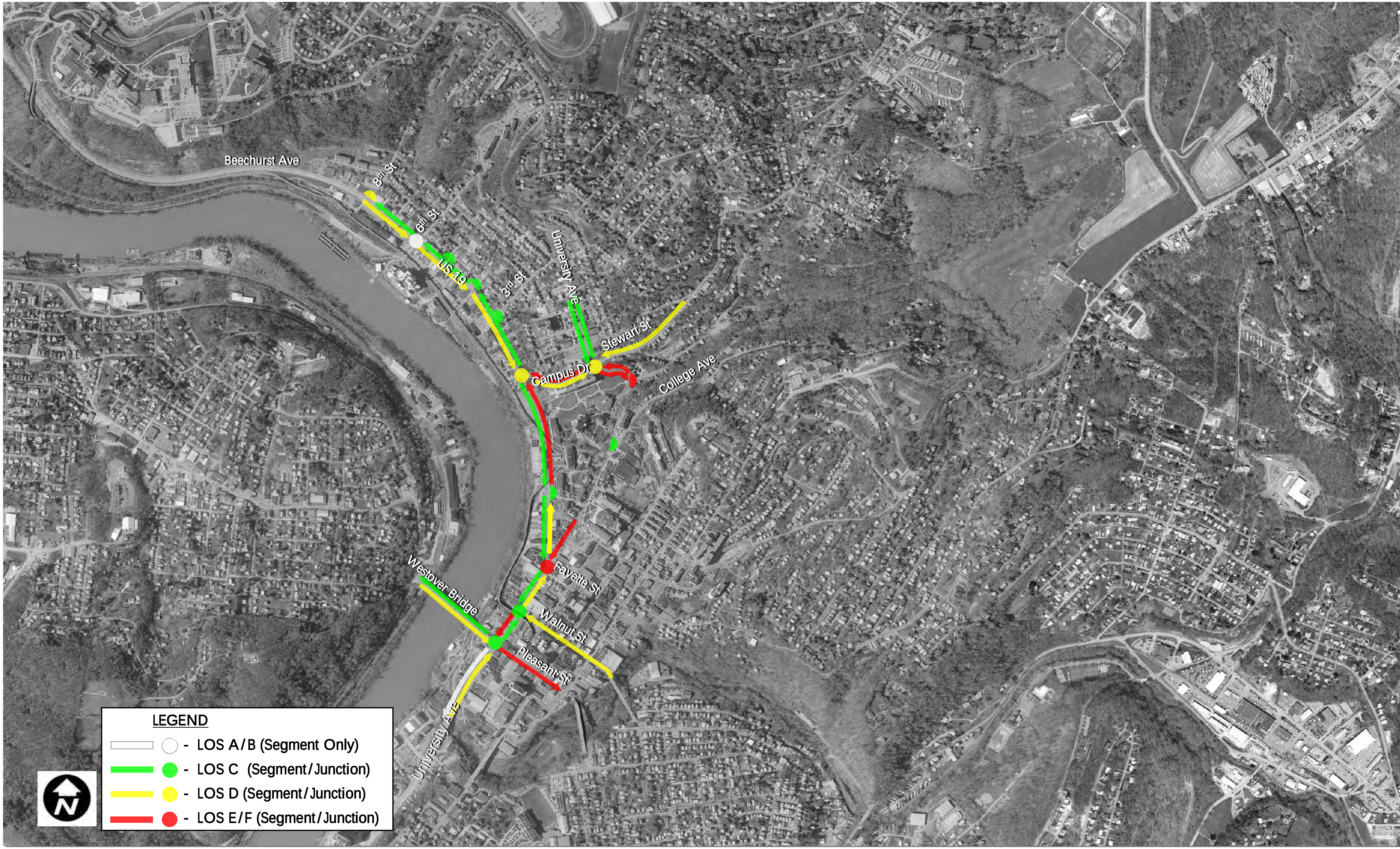


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Figure 15
Beechurst Ave/University Ave Traffic Operations Summary, Existing Conditions (AM Peak)

URS

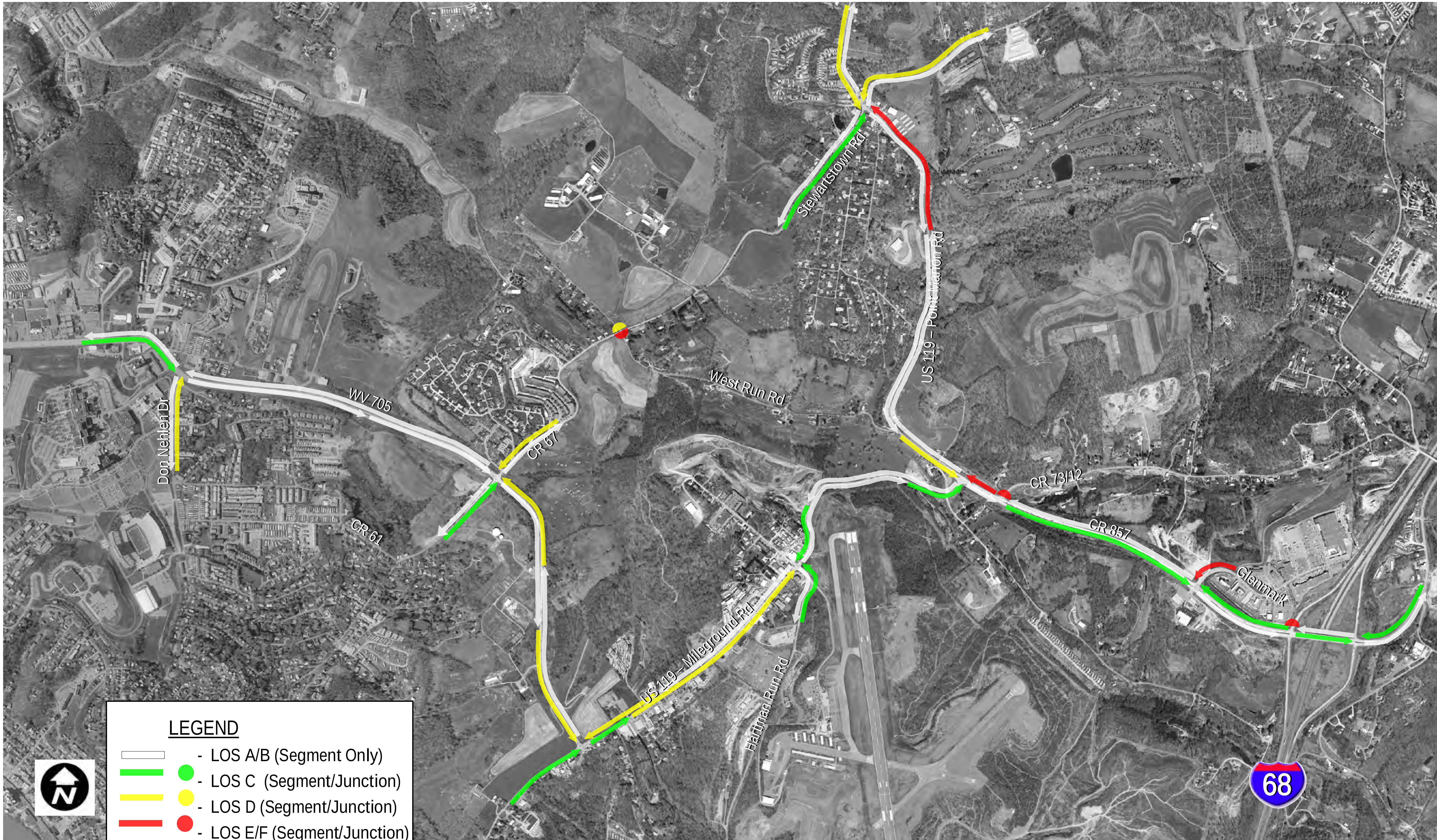

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Figure 16
WV 705 / Co 857 / US 119 Traffic Operations Summary, Existing Conditions (AM Peak)

URS

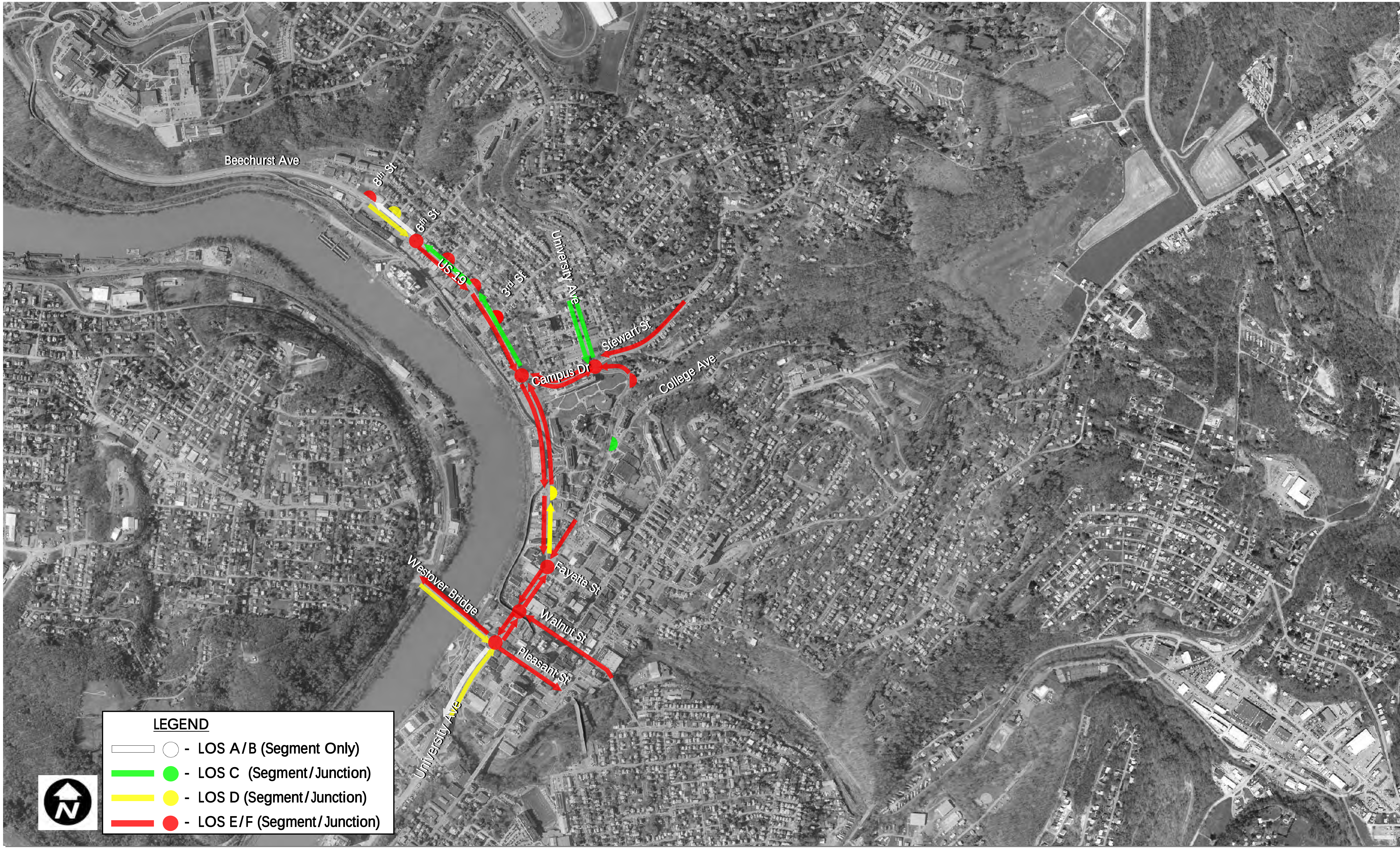

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Figure 17

Beechurst Ave/University Ave Traffic Operations Summary, Existing Conditions (PM Peak)

URS

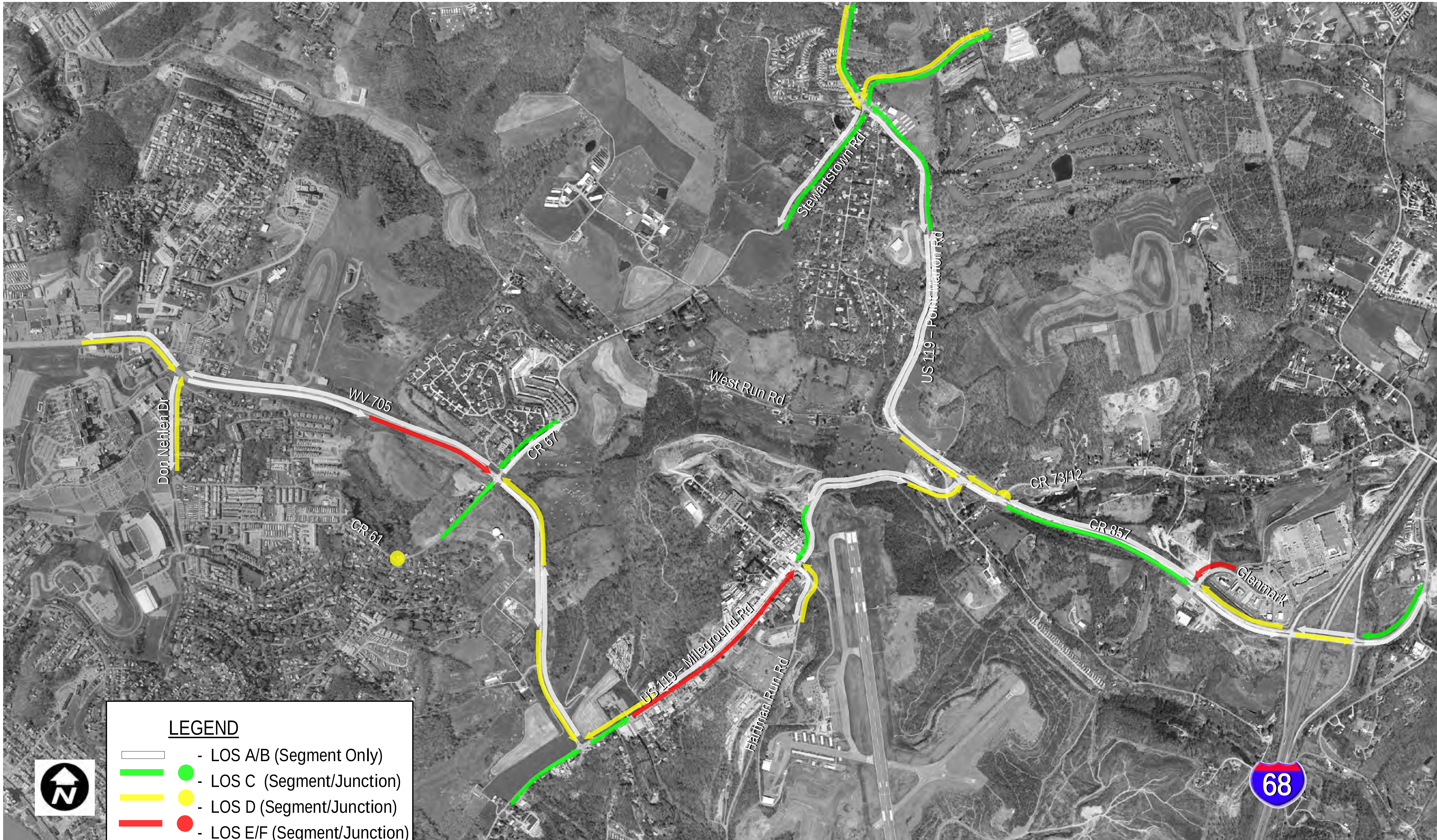

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Figure 18

WV 705 / Co 857 / US 119 Traffic Operations Summary, Existing Conditions (PM Peak)

URS

Drive. Segment operations in the northbound direction reflect level-of-service D conditions with level-of-service E/F observed at Beechurst Avenue/6th Street signal. While the Beechurst Avenue mainline operates at better than failure conditions, all of the cross routes from north of Campus Drive through 8th Street with stop control on the minor cross street operate at less than desirable levels, due to:

- Limited gaps: Vehicles desiring to turn left out of the cross routes are required to coordinate northbound and southbound acceptable gaps (which are almost non-existent throughout much of the PM peak). As gaps are difficult to find, vehicles stack up on the cross routes and increased delay is observed.
- Poor operations and resulting long queues at Campus Drive and 6th Street that build past the stop controlled cross routes and block access to or across Beechurst Avenue. The inability to get into or across Beechurst Avenue results in poor operations for cross route vehicles.

Should a signal be added between Campus Drive and 6th Street (no are planned, but assuming a future redevelopment project that required a signal may be proposed at some time), the observed level-of-service D operations would likely fall to E/F operations even with current traffic volumes.

Poor operations along Beechurst Avenue negatively impacts routes connecting into and out of the downtown area (Walnut Street coming out of the downtown, Fayette Street going to the downtown, Pleasant Street going into downtown) as vehicles are forced to wait to find the very infrequent gaps to get into the Beechurst corridor or cross over the Beechurst Avenue corridor to turn left. A primary concern (in addition to the cost associated with delay) is that as drivers are required to wait an increasing amount of time for a gap in the traffic stream, they become impatient and tend to select shorter than preferred gaps that may be too small and result in a crash.

- **WV 705 Don Nehlen Drive to US 119 (Mileground):** Model-derived AM peak hour traffic operations along portions of this study area corridor are likely being shown in Figure 16 (AM peak hour operations) as better than what actually occurs. The model limits extend to WV 705/Don Nehlen Drive, which is being shown to operate at level-of-service C in the AM period. On the street, operations at WV 705/Don Nehlen Drive, in the AM period especially, are influenced by operations at the signalized intersection of WV 705/Pineview Avenue, which is located approximately 650 feet away, and to a certain extent WV 705/Van Voorhis Road. The proximity of Don Nehlen to Pineview and the level of volume desiring to traverse both intersections, results in spillback from the WV 705/Pineview Drive intersection to the WV 705/Don Nehlen Drive intersection, which would reduce the quality of service at Don Nehlen. The spillback factor is not included in the model for this intersection as it is throughout other areas of the model, because the WV 705/Don Nehlen intersection is the model limits. As the intersection is located outside the most critical segments, the underreporting of the level-of-service is not a significant issue.

  AM peak period operations at the WV 705/Stewartstown Road intersection and the WV 705/US 119 (Mileground) intersection reflect level-of-service D operations, with many shorter periods in the AM peak hour that are level-of-service F. Traffic volumes in the morning peak period essentially grow from 6:30 AM and maintain a level near the peak through about 9:00 AM, which reflects a much longer AM "peak" period than most other parts of town. Thus, while routes in other parts of town experience a "spike" peak, the listed corridor experience more of a "plateau" peak period. The plateau peak results from the more spreadout peak of the range of generators with traffic in these corridors. Hospital uses, office uses, university uses and retail uses in the corridor all have different AM peak times (all likely with in a 90 minute period), that result in reducing the peak hour percentage of daily traffic in the corridor, but then also extending the peak period. This analysis does not account for the extended peak, just the lower peak hour percentage of daily traffic.

AM peak hour operations for both WV 705/US 119 (Mileground) and WV 705/CR 67 (Stewartstown Road) reflect level-of-service C operations. Operations at both intersections benefit from the presence of right-turn bays on some of the heaviest movement approaches. Providing the turn bays allows a greater number of vehicles to turn right-on-red relative to conditions without the turn bays. Each vehicle that turns right-on-red is essentially removed from the operations analysis. Thus, the quality of operations is improved relative to a condition where the turn lane is not present. At both intersections right turn volumes are a relatively high percentage of the approach volume. Thus, the positive influences of the right-turn-on-red provision are fairly significant.

Existing traffic operations for the PM peak period also reflect the model limitations listed for the AM period and results in a reported level-of-service that is better than what is actually observed at selected intersections. Even with the limitations listed, the level –of-service at key intersections are at to well below the desired threshold of level-of-service C. Operations at WV 705/Don Nehlen Drive, US 119 (Mileground)/Hartman Run Road, Stewartstown Road/West Run Road all reflect level-of-service F, as do the operations. Level-of-service D operations are observed each of the remaining signalized intersections in the study area. Each are displayed in Figure 18.

In breaking the operations at each intersection down to the individual approaches, failing operations are observed along the following routes:

- WV 705 eastbound at Don Nehlen Drive.
- WV 705 eastbound at CR 67 (Stewartstown Road).
- US 119 (Mileground Road) northbound approach to Hartman Run Road.
- Glenmark Center southbound approach at CR 857.

2030 No-Action Traffic Operations

The initial round of traffic operations analysis completed using 2030 traffic, which was documented in a preceding chapter, reflected assigning future traffic to the existing roadway network for the study area. Following the 2030 traffic evaluation of the initial network, transportation system improvements documented the 2008-11 Transportation Improvement Program (TIP) were incorporated into the operations analysis. For the purposes of the traffic operations analysis, these networks have been labeled:

- No-action: This network is assumed to be consistent with the 2007 network.
- No-Action + TIP: This network represents the 2008 roadway system plus those potentially influencing projects included in the 2008-2011 TIP. The TIP improvements that would result in a noticeable change in traffic operations in at least one of the primary corridors are the proposed improvements to South University Avenue at Pleasant Street. The proposed change at the intersection would provide an additional southbound through lane on South University Avenue from Walnut Street to Pleasant Street. Included in the alternative is maintaining the southbound right turn lane onto the Westover Bridge. The product would be a north approach that includes a left turn lane, two southbound through lanes and a right turn lane. The vast majority of the remaining TIP projects fall more into the category of rehabilitation and reconstruction of bridges,

extension of the Mon-Fayette Expressway and roadway overlays. These projects will not have an immediate impact on traffic operations in the study corridors.

While the four primary existing study area corridors of CR 857, US 119 (Mileground Road), WV 705 and Beechurst Avenue-South University Avenue are all covered in a single VISSIM microscale simulation model, the percentage change and distribution of traffic in each corridor were influenced to very different levels by land development change in the region. In addition, the streets/roadways incorporated into the simulation network represent very little of the overall network. Thus, the level of updating that was incorporated to reflect the 2006/07 to 2030 traffic changes in the various corridors (such as signal control/timing, vehicle arrival parameters, and other simulation parameters) was different for each of the corridors. For example, in the current PM peak period most of the intersections along Beechurst Avenue are operating at level-of-service E/F. In addition, through a parallel analysis of the impacts of signal timing changes to increase the potential corridor throughput without adding lanes that corridor operations cannot be improved much, if any, by changing the signal parameters, including:

- Cycle length.
- Phasing.
- Time allocated to each phase.
- Time interval offsets between intersections in a corridor.
- Level of up and downstream coordination of signal timing.

Thus, it would not be reasonable to make global changes in corridor parameters to reflect the changes in traffic. For the Beechurst Avenue corridor, there is not a good argument to change signalization/control parameters until a capacity change (such as adding a southbound through lane at Pleasant Street) is made. The CR 857 corridor, on the other hand, has a relatively significant level of reserve capacity in both the AM and PM peak periods (at least relative to other many other corridors in town) and traffic volumes in the corridor are anticipated to increase substantially as more and more residential development comes on line in the Cheat Lake area. As very little future development is expected to occur directly adjacent to the CR 857 corridor, several signal parameter changes may be reasonable to reflect more growth in intersection/corridor through traffic compared to intersection turning traffic. These changes were incorporated into the VISSIM simulation runs for the 2030 No-Action and the 2030 No-Action+TIP conditions.

Figures 19 through 22 display the results of the 2030 No-Action network AM and PM peak period traffic analyses. Keys to recognize as the information is being reviewed are:

- The networks reflect the current lane geometry and access points.
- In the Beechurst Avenue-South University Avenue corridor traffic volumes along the stop sign controlled minor cross routes and turning into and out of private driveways was not increased substantially over the planning period. The limited level of traffic growth is representative of a mature area that is not expected to redevelop at a substantially greater density.
- In the Beechurst Avenue-South University Avenue corridor signal timing and operating parameters were not modified substantially from current conditions.
- Signal timing parameters in the CR 857 corridor from US 119 to I-68, and to a lesser extent along the Mileground corridor, signal timing parameters were modified to reflect a greater increase in through traffic growth relative to left turn and right turning traffic. The intersection of US 119/CR 857 is an exception, where the AM period eastbound

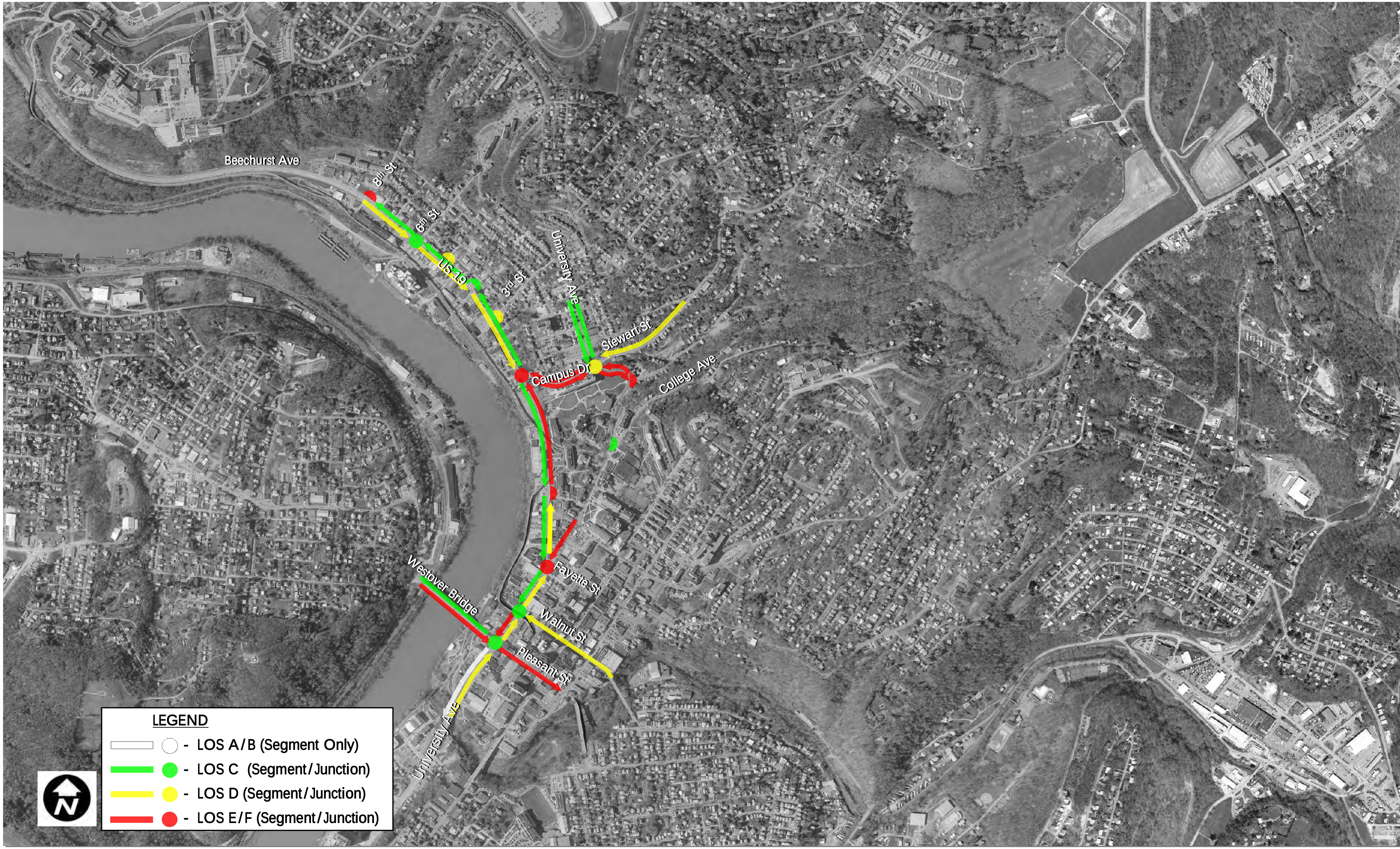

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Figure 19

Beechurst Ave/University Ave Traffic Operations Summary, 2030

No-Build Traffic Operations (AM Peak)

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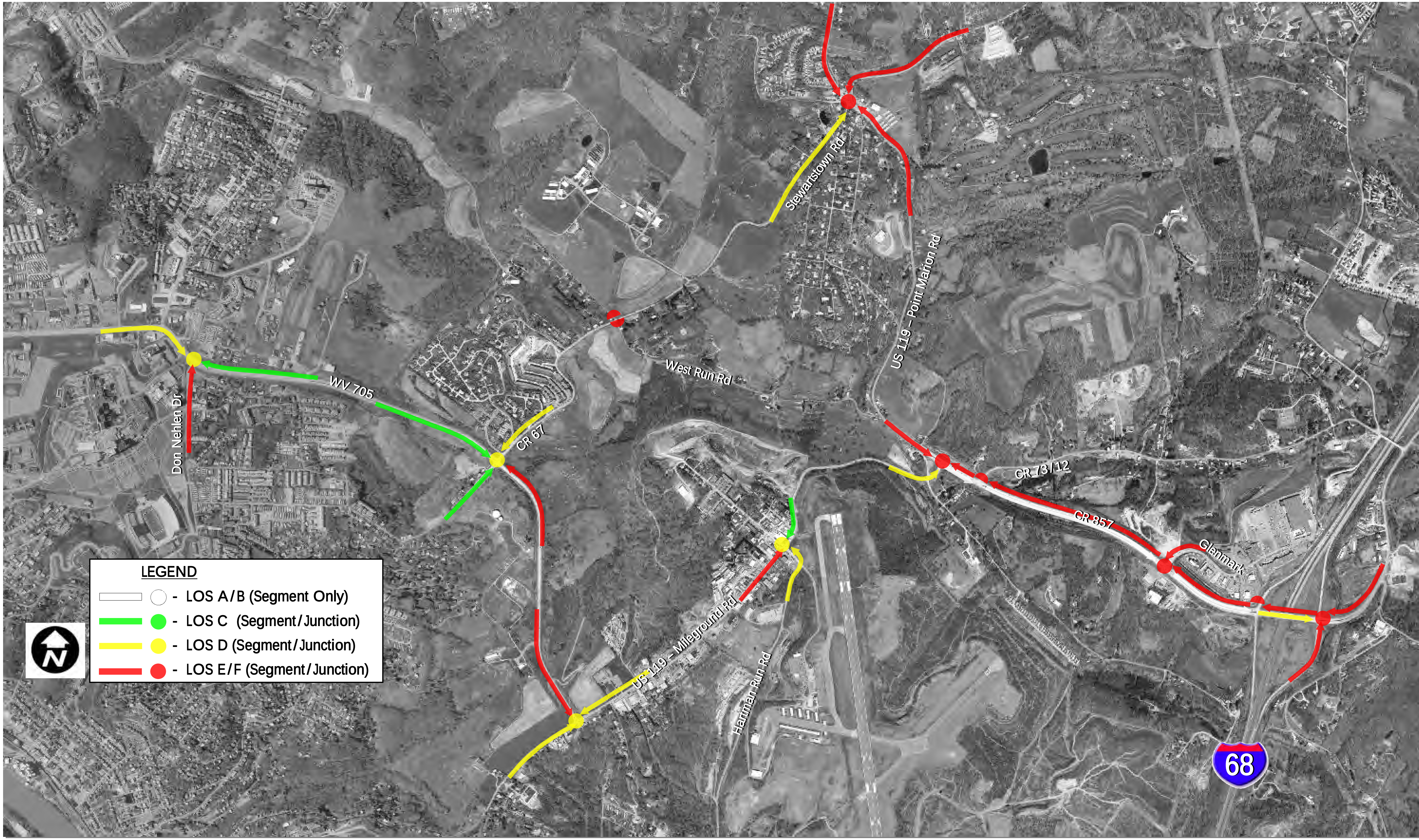

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Figure 20
WV 705 / CR 857 / US 119 Traffic Operations Summary, 2030
No-Build Traffic Operations (AM Peak)

URS

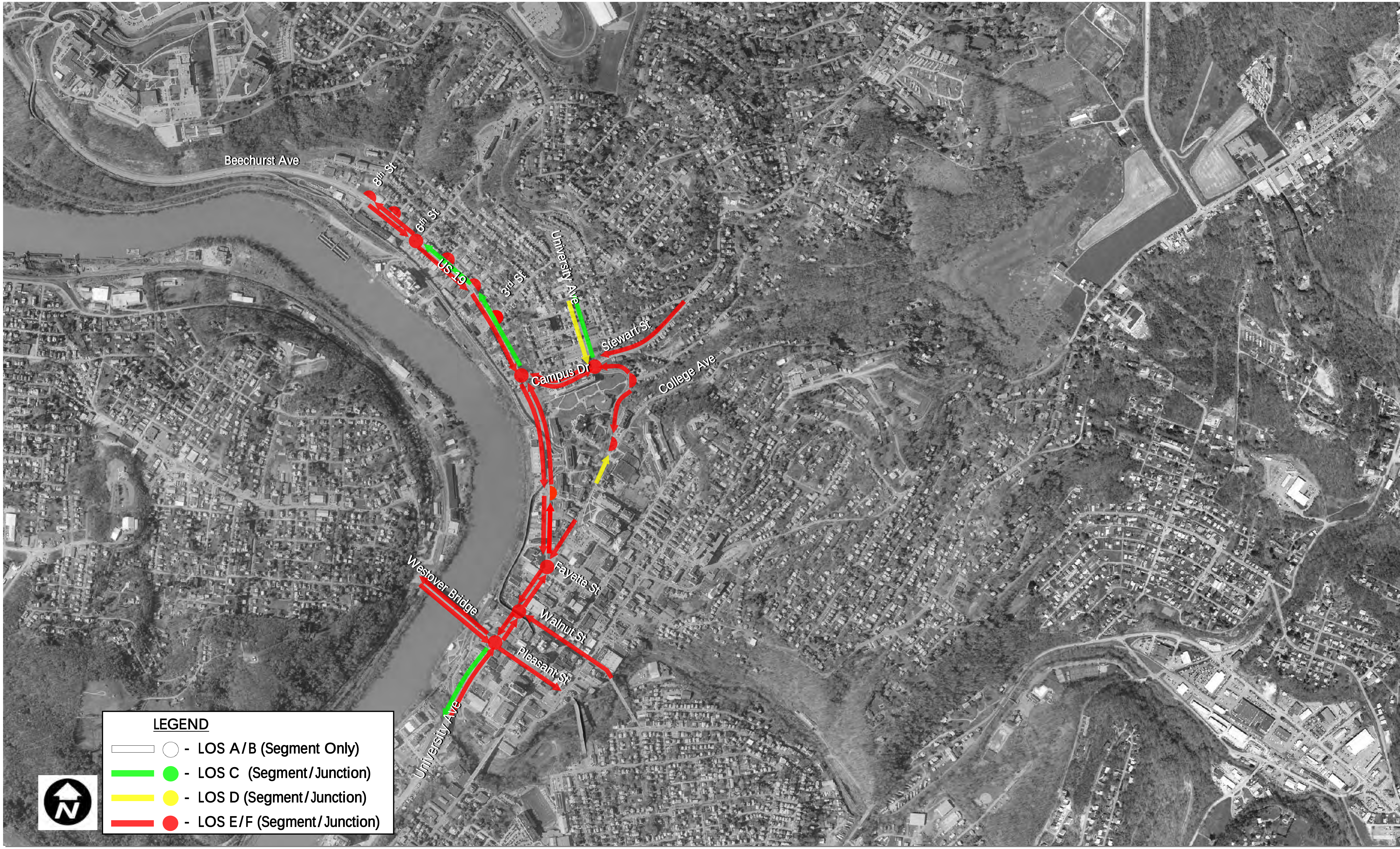

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Figure 21

Beechurst Ave/University Ave Traffic Operations Summary, 2030

No-Build Traffic Operations (PM Peak)

URS

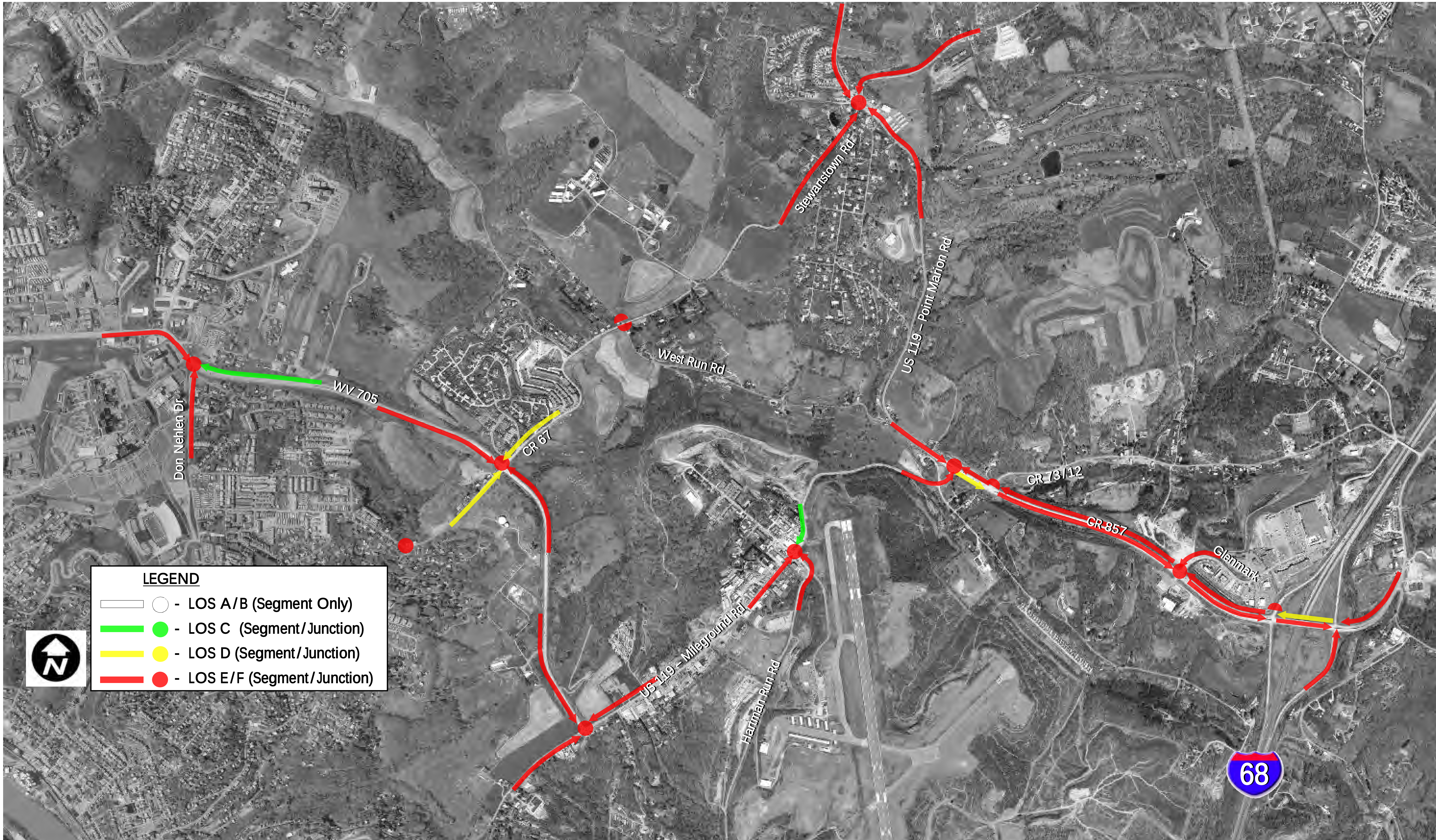

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Figure 22

WV 705 / CR 857 / US 119 Traffic Operations Summary, 2030

No-Build Traffic Operations (PM Peak)

URS

left turn volume and in the PM peak period the northbound right turn traffic onto CR 857 were forecasted to increase substantially.

- Few significant changes were made to signal operating parameters along the WV 705 corridor.

As is likely expected with the anticipated level of development, peak period traffic operations at almost all of the key intersections along the corridor that have in the current conditions still had some level of reserve capacity drops to level-of-service E/F. In the forecasted conditions long queues, spillback from one signalized intersection to the next signalized intersection upstream, slow moving platoons, blocked mid-block access points due to almost no observable gaps in traffic, and vehicles stacked in the center turn lane will be the typical conditions. Where today (2007) congested conditions last for about an hour or so in the AM period and just under two hours in the PM period, congested conditions in the AM will likely occur for two hours and approximately three hours in the PM period. Listed below are a number of key findings from the analysis:

- Total delay along the focus routes will increase from 1 to 2 hours per day to 3 to 4 hours per day, an increase of 50%.

- Traffic flow along the Beechurst Avenue-South University Avenue corridor will be strained in both the AM and PM periods. Based on the information developed through the simulation, traffic would move through the corridor in spurts; with vehicles progressing at less than ½ block before stopping as they catch up with the back of the queue from the next intersection or from vehicles waiting behind a mid-block left turning vehicle. Even with the added southbound through lane at Pleasant Street, PM peak hour travel times from 8th Street to the Pleasant Street Bridge will take approximately seven minutes, relatively consistent to today. As was reported in an earlier section, freeflow travel time in the corridor is approximately 2½ minutes and anything over 5½ minutes would be considered level-of-service E/F operations.

  Compared to existing conditions the Beechurst Avenue-South University Avenue corridor is projected to experience minor improved operations under the 2030 No Build conditions, with southbound travel times improving by approximately one minute. This improvement results from the proposed Beechurst Avenue-University Avenue intersection reconstruction for the southbound intersection approach. Each of the intersections, however, is forecasted to operate at level-of-service E/F conditions throughout the AM and PM peak period. It should be noted that less than 100 percent of the demand volume may be reaching those intersections or segments that are displayed as operating at better than level-of-service E/F conditions. Less than 100 percent of the demand volume reaches the intersections/segments because the upstream intersections cannot accommodate all of the traffic. Thus, act as a meter to downstream intersections by restricting flow.

  Traffic flow breakdowns and congestion forecasted to occur along Beechurst Avenue-South University Avenue in the 2030 No-Action conditions radiate through the downtown area and along each of the local street cross routes from Pleasant Street through 8th Street. Traffic operations on the cross routes connecting with Beechurst Avenue and South University Avenue are forecasts to reflect level-of-service E/F conditions.

  Of particular concern is the operations and queue that is forecasted to form along Campus Drive at Beechurst Avenue. With the level-of-service E/F operations, the requirement to provide more than 50 percent of the cycle green time to Beechurst Avenue, and the short block length on Campus Drive the Campus Drive queue that would form would extend back up the hill to the Stewart Street intersection, located approximately 700 feet upstream. The intermediate intersections of McLane Street and Grant Street would essentially be blocked for the vast majority of the peak hour/period.

- The CR 857 corridor from I-68 to US 119 would operate at level-of-service E/F in both the AM and the PM peak periods. As the Pierpont interchange is the first Interstate access between the expanding Cheat Lake area and Morgantown, the vast majority of the commuter traffic growth between the two areas would be assigned to the CR 857 corridor. Based on the level of residential development anticipated in the Cheat Lake are and growth assumed to occur along I-68 to/from the east of Cheat Lake that has a destination/origin in northern Morgantown traffic volumes in the CR 857 corridor are forecasted to increase by approximately 1,100 in each of the AM and PM peak periods.

  In the AM peak period, the eastbound section of CR 857 from US 119 to the eastbound I-68 off-ramp would still have reserve capacity, as the generators in the area are retail uses along the corridor (Glenmark Center and highway commercial) and residential (located to the east on I-68) which would either not generate at a high level in the AM (retail) or not have a high level of "inbound" traffic in the AM period.

  The PM period operations also reflect level-of-service E.F operations, but the degree to which traffic operations fail is much more pronounced than in the AM period. A key factor is the residential commuter traffic existing the city and heading to the Cheat Lake area and points east on I-68. Presently, the eastbound left turn on CR 857 to enter I-68 in the PM peak hour is approximately 650 vehicles. With the anticipated level of expansion in Cheat Lake and growth at the I-68 external station, the left turn volume is forecasted to increase to over 11,100 vehicles in the PM peak hour. As the intersection is configures (single left turn lane onto a one-lane ramp), there is not nearly the capacity required to turn that many vehicles in an hour. Thus, queues begin to form in the early stages of the PM peak and continue to grow until the queue from the interchange ramp extends back through the CR 857/Glenmark Center intersection and to the US 119/CR 857 intersection.

- While the 2030 operations figures show a break in the level-of-service E/F conditions between US 119/CR 857 and US 119/CR 67 (Stewartstown Road) it is likely that operations along this entire segment would reflect failing conditions.

- Traffic operations along Mileground Road in the AM peak period are forecasted to be a little worse than they are today, but this is in part due to the capacity limitations at the US 119/CR 857 intersection. The forecasted AM peak hour westbound CR 857 left turns onto Mileground Road exceed the capacity that the intersection can accommodate. Thus, only 77 percent of the AM peak hour traffic that wants to make the left, are able to make the left. Thus, the increase in traffic on Mileground Road is restricted by the limited capacity of the eastbound left turn from CR 857 to Mileground Road (which in reality is a left followed by a quick right).

  As with the AM peak hour operations at Mileground Road/Hartman run Road, the level of inbound to the city traffic demand that actually makes it to the Mileground Road/WV 705 intersection is approximately 83 percent of the forecasted demand. Thus, the operations on the Mileground Road approach are under reported. The WV 705 approach to Mileground Road is forecasted to operate at level-of-service E/F in the AM peak period. The poor operations is attributed to the high left turn volume (almost 550 vehicles per hour – an increase of approximately 150 vehicle from current) from WV 705 which are trying to turn from a single lane. Generally, an hourly volume of 300 vehicles is a threshold for adding a second left turn lane.

- The WV 705 corridor is forecasted to operate at level-of-service D, which is about one letter grade lower than today. It should be noted, however, not all of the corridor demand is served in the AM hour because the poor operations at CR 857/US 119 does not allow all of the commuter demand to continue through the system. As WV 705 connects the commuter destinations of WVU, NIOSH, area hospitals and other employment centers that draw from the I-68 commutershed, the fact that the intersection of CR 857/US 119 cannot serve all of the demand influences downstream intersections and roadway segments along Mileground Road, North Wiley Street, and WV705. Expanding the CR 857 capacity between US 119 and I-68 to accommodate the demand from I-68 would likely result in decreased operations in the WV 705 corridor, because more traffic would make it into the corridor. Assessing the demand volume along WV 705 in isolation provides a finding of level-of-service E/F operations at:

- WV 705/US 119 (Mileground Road).
- WV 705/CR 67 (Stewartstown Road).
- WV 705/Don Nehlen Drive.

The WV 705 corridor in the PM peak hour is forecasted to operate at level-of-service E/F conditions. The intersections of WV 705 with Don Nehlen Drive, CR 67 (Stewartstown Road) and US 119 (Mileground Road) all reflect breakdown conditions. As these intersections are located at the edge of the simulation model, they essentially establish the metering point in the PM peak period similar to the intersection of CR 857/US 119 in the AM peak hour.

BUILD CONDITION ALTERNATIVES

The Regional Transportation Plan documented the following general roadway system improvements that form the backbone of the concepts covered in this detailed operations study:

- Expand the Beechurst-South University Avenue corridor to a five lanes from 8th Street through Pleasant Street (RTP Roadway Project #2). Implementation of this project would provide a four through lanes in the corridor from the junction of US 19/CR 19/24 (connection to I-79 in Osage) to Green Bag Road.
- Construction of an arterial creating a continuous corridor along Falling Run with connections to Beechurst Avenue and WV 705 (RPT Roadway Project #11).
- WV 705 Connector providing a high speed, multi-lane connection from the junction of CR 857/US 119 and WV 705 between CR 67 (Stewartstown Road) and US 119 (Mileground Road) (RTP roadway Project #37).

Fundable Improvements – 2030 Regional Transportation Plan

The Regional Transportation Plan analysis is best described as a "sketch" planning level review of the alternatives. Through the sketch planning analysis the goal is to identify whether a concept reasonably addresses the current or future congestion/connectivity/safety issue and whether the concept as defined has a fatal flaw. A fatal flaw is an impact that would result in concluding that implementation of the concept is not feasible due to design issues, environmental impact issues, and/or unacceptable traffic operations or similar. All of these tests are performed using information such as:

- USGS 20 foot contour mapping.
- Daily traffic volumes and capacities.

- Crash rate change data collected from other metropolitan areas that have implemented the identified change.

Through the detailed operations analysis completed as part of this study and more detailed conceptual design of the concepts that has been completed by the WVDOT, the conclusions of the sketch planning analysis are more rigorously assessed. The results of which could be used to refine the feasibility conclusions and cost estimates documented in the Regional Transportation Plan.

BEECHURST AVENUE-SOUTH UNIVERSITY 4-LANE PLUS TURN LANES CONCEPT

The Beechurst Avenue-South University Avenue expansion project was described in the Regional Transportation Plan as a four-lane plus left and/or right turn lanes at intersections/ access locations in the corridor that would warrant them. The warrant for a turn lane is based on the combination of turning traffic (whether it is right or left) and the opposing traffic volume that would conflict with the turning traffic. For example, left turn lane warrants generally focus on the amount of left turning traffic and opposing through and left turning traffic that come together at a "conflict point"

The range of ideas for configuring the left turn lanes through the corridor included:

- Construct a center raised median and allow breaks in the median at public street intersections and/or major traffic generators that would not result in a conflict with a public street access. Within this alternative mid-block driveways and/or minor public streets would not be provided a median break, which would restrict Beechurst Avenue-South University access to right-in-right-out.

- Provide a continuous two-way center left turn lane for the length of the corridor from 8th Street to Pleasant Street. For the most part, the current level of access could be maintained, however, some consolidation would be desirable to improve safety and traffic operations.

- Through the length of the corridor provide a combination of a raised median with limited breaks and segments with a center two-way left turn lane. In areas of the corridor where the block lengths are shorter and/or left turning volume is higher, which leads to the need for longer storage bays, a center left turn lane may prove to be the better alternative. In locations where mid-block turns are resulting in safety concerns, a raised center median may be the preferred concept.

Through the detailed operations analyses of the corridor, which will include adding the Falling Run Corridor connection, recommendations as to the configuration of each block or segment will be formulated.

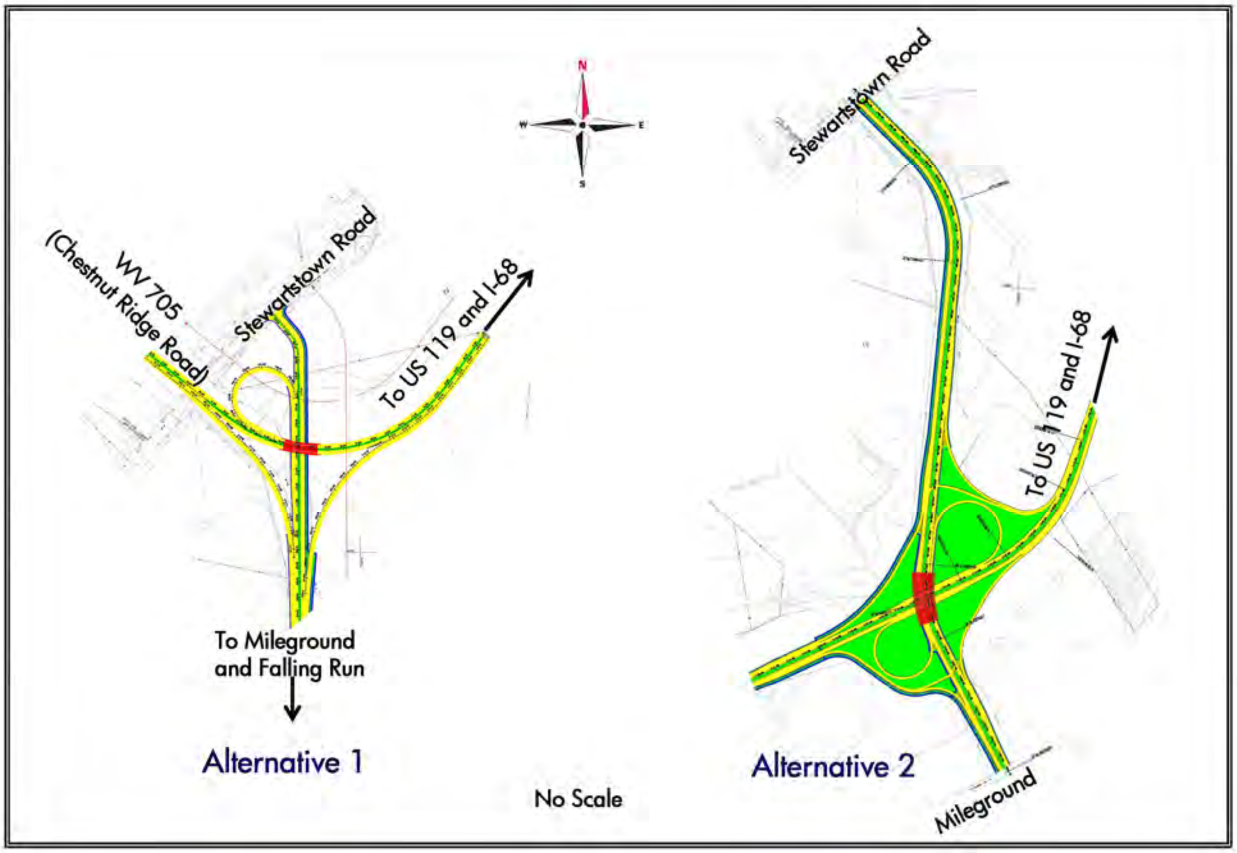
WV 705 CONNECTOR CONCEPT

Two WV 705 Connector Build alternatives have been evaluated. The key difference between the alternatives is the location and the configuration of the junction with existing WV 705 (Chestnut Ridge Road). Alternative 1 reflects an interchange incorporated into the junction of

WV 705/CR 67 (Stewartstown Road). Alternative 2 includes a the WV 705 Connector and existing WV 705 interchange located between the proposed CR 67 (Stewartstown Road) and Mileground Road. Each of the junction concepts is displayed in Figure 23.

Each of the concepts assumed the connector roadway between the US 119/CR 857 junction and the WV 705 junction would be a higher speed, four-lane median divided roadway.

FIGURE 23: WV 705 CONNECTOR INTERCHANGE CONCEPTS AT EXISTING WV 705



Source: Gannett Fleming

The configuration of the WV 705 Connector junction at US 119/CR 857 was not developed to the same extent as the junction at existing WV 705. In the initial stages of the analysis a signalized, at-grade intersection was assumed. As is described later in this report, the forecasted level of traffic demand for the 2030 Build conditions far exceeded the service capacity of a the signalized intersection configured as follows:

- CR 857 approach from I-68: Two through lanes to WV 705 Connector, a left turn lane to US 119 (Mileground Road) and a right turn lane to US 119 (Point Marion Road).
- US 119 (Point Marion Road) approach: One through lane to US 119 (Mileground Road), a right turn lane to WV 705 Connector and a left turn lane to CR 857.
- US 119 approach from Mileground Road: A single through lane to US 119 (Point Marion Road), a single left turn lanes to WV 705 Connector and a right turn lane to CR 857.

- WV 705 Connector: Two through lanes to CR 857, a single left turn lane to US 119 (Point Marion Road), and a right turn lane to Mileground Road.

With the roadway improvements in place an additional 600 to 800 vehicles per hour are forecasted to be attracted to CR 857 from other routes connecting I-68 to the Cheat Lake area, I-68 to/from the east of the Cheat Lake area and to/from the Mon-Fayette Expressway. The attracted/diverted vehicles are presently and in the future (2030) No-build would continue beyond the Pierpont interchange to other junctions into/from Morgantown and Westover.

The impact of attracting more vehicles into the CR 857 corridor on their way to the WV 705 Connector and the Falling Run Corridor results in 2030 AM and PM Build Conditions where traffic far exceeded the capacity of the signalized, at-grade intersection. As the WV DOT has not developed detailed alternatives for this junction, additional design analysis of the US 119/CR 857 junction area is warranted. Thus, various configurations of interchanges were discussed purely as an alternative that would accommodate the traffic.

The junction presently operates at an acceptable level-of-service in both the AM and PM peak periods, and the level of traffic growth needed in the Build Condition to result in unacceptable operations is quite substantial. Thus, the WV 705 Connector and Falling Run Corridor improvements could occur without immediately needing to construct an interchange at US 119/CR 857. As is discussed in a later section, forecasted traffic volumes would not likely exceed the capacity of the signalized, at-grade intersection until approximately 2020 (assuming a straight-line growth in traffic volumes between 2006/07 and 2030 occurs). As the need for a large scale improvement at CR 857/US 119 is not immediately required, alternate configurations have not been reviewed from an engineering perspective, and the need to modify the configuration of the junction of WV 705 Connector/CR 857/US 119 at some point does not establish a fatal flaw in the alternatives review, a simple diamond interchange was assumed. This alternative would provide the capacity needed to reasonably accommodate traffic through the junction.

Over capacity operations for the Build Condition in the CR 857 corridor are not limited to the junction of WV 705 Connector/US 119/CR 857. Each of the intersection s not the intersections along CR 857 from US 119 through I-68 would reflect level-of-service E/F operating conditions in both the AM and PM peak periods based on the demand volumes. In the AM peak hour, the level of traffic demand through the I-68 off-ramp from the Cheat Lake area and from I-68 the west far exceeds the level of traffic that can be served in an hour through the intersections with CR 857. As serving all of the demand at these intersections is critical to being able to obtain a good picture of the needs in the remainder of the WV 705 Connector and Falling Run Corridors, improvements that would serve all of the demand volume were incorporated into the analysis. As with the CR 857/US 119 junction improvement assumptions, the need to improve the I-68 terminal intersection and the CR 857 segment connecting to US 119 is not immediate with implementation of the WV 705 Connector improvement, the improvements included in this analysis are conceptual only and should be evaluated more as stand alone projects. The following assumptions for CR 857 were included in the detailed operations analysis:

- Expansion of CR 857 to a six-lane divided arterial. Where there are turn lanes today, they would be maintained in the mitigation expansion concept.
- Provide an eastbound I-68 loop ramp from CR 857 to supplement the current ramp. PM peak hour traffic volume on this ramp from CR 857 is currently approximately 655 vehicles per hour. By 2030 the forecasted No-build turning volume from CR 857 is forecasted to increase to 1,125 vehicles in the PM peak hour. When the WV 705 Connector-Falling Run Corridor and Beechurst Avenue improvements are included in

the network, forecasted left turn volumes from CR 857 to I-68 are anticipated to increase to 1,500 in the PM peak hour.

FALLING RUN CORRIDOR CONCEPT

Downstream from the existing WV 705 junction (toward Beechurst Avenue), the Falling Run Corridor in each of the WV 705 Connector Build alternative follows an identical alignment. In addition, the suggested access locations, intersection control and number of lanes are the same for either of the junction alternatives. While the forecasted traffic along the Falling Run Corridor is somewhat dependent on the junction configuration at existing WV 705 and along CR 857, for the purposes of the detailed operations analysis, a single set of forecasts were used. Thus, only one set of operations results would be needed.

The network concept assumed for the initial analysis reflected the following cross section:

- WV 705 to Stewart Street Extension: Four-lane median divided parkway.
- Stewart Street Extension to Beechurst Avenue: Three-lane arterial, composed of one through lane in either direction and a center left turn lane.
- Beechurst Avenue intersection: One left turn lane to southbound Beechurst Avenue, one right turn lane to northbound Beechurst Avenue and one lane on Falling Run heading up the hill from Beechurst Avenue.

The concept as prepared by Gannett Fleming is displayed in Figure 24.

FIGURE 24: FALLING RUN CORRIDOR – BUILD ALTERNATIVE

Source: Gannett Fleming

BUILD CONDITION 2030 TRAFFIC FORECASTS

Implementation of the WV 705 Connector, the Falling Run Corridor, and the Beechurst Avenue-South University Avenue improvement concepts will result in substantial changes in the travel routes between areas to the northeast within and outside Morgantown and areas in the heart of the community. The changes will result from lower travel time routes that are established between current and future development areas and larger generators of the university, downtown employment centers, the medial centers along WV 705 and Van Voorhis, and employment centers along WV 705. In addition, as the corridors create a fairly direct connection from I-68 to/from the east to the center city (a substantial origin/destination), traffic that in the No-Build condition uses I-68 and even I-79 to access Morgantown and Westover through other exits, would be diverted to the Pierpont interchange and through the CR 857-WV705-Falling Run corridor. The result is a greater level of traffic on CR 857 in the 2030 Build Condition than in the 2030 No-Build.

While the generalized turning movements at key junctions are similar for Alternative 1 and Alternative 2, at the detailed intersection/interchange level, the AM and PM peak hour turning movements along WV 705 would be different for the two concepts. As the detailed operations analysis focuses on specific intersection movements and intersection movements within an interchange, concept specific forecasts for the AM and PM peak periods have been prepared.

Figure 25 displays the 2030 Build Condition AM peak turning movements for the WV 705 and CR 857 portions of the study area for Alternative 1. Figure 26 displays the PM peak turning movements for the same area.

Figures 27 and 28 display the Alternative 2 forecasted 2030 turning movements for the WV 705 and CR 857 portions of the study area, respectively.

As both Alternatives 1 and 2 assume a similar alignment, level of access and cross section in the Falling Run Corridor, it has been assumed that it is logical that the hourly turning movements are similar for two alternatives. Figures 29 and 30 show the AM and PM peak hour turning movements through the Falling Run Corridor and along the Beechurst-South University Avenue corridor.

TRAFFIC OPERATIONS RESULTS / MITIGATION CONCEPTS

BUILD NETWORK AND FORECASTED 2030 VOLUMES RUNS

The microscopic traffic operations analyses of the study corridors included the current traffic on the existing roadways, future (2030) peak hour traffic on the existing roadways and future (2030) peak hour traffic on the various Build condition roadway networks. The analyses completed were not simply a one shot evaluation of the concepts provided, with either a thumbs up or thumbs down finding. The goal of the detailed operations analysis is to provide recommendations on junction modifications that are needed to improve the operations of the corridors, and the iterative process of evaluating modifications is referred to as the Mitigation Analysis.

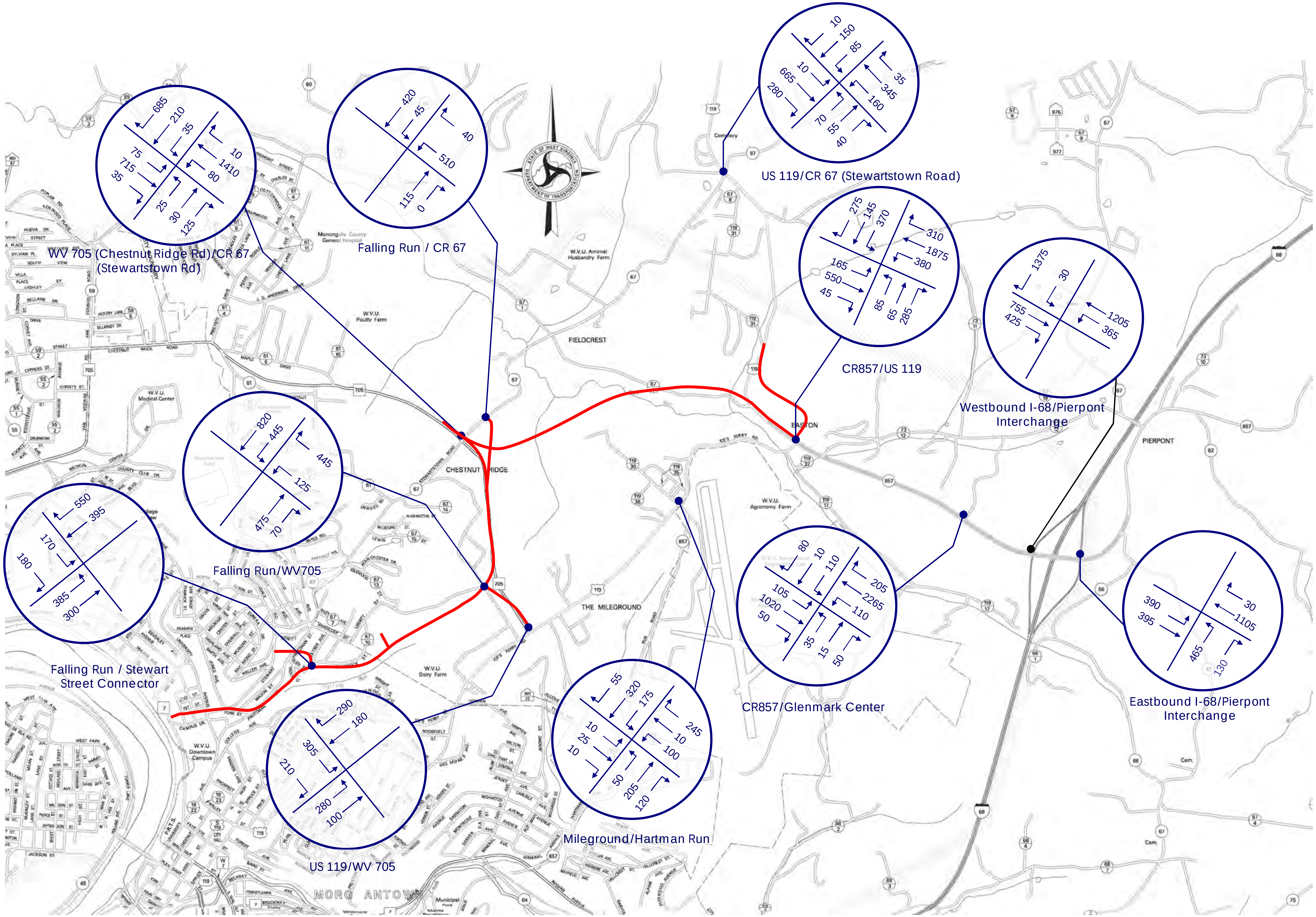


Figure 25
Alternative 1 - 2030 AM Peak Hour Turning Movements

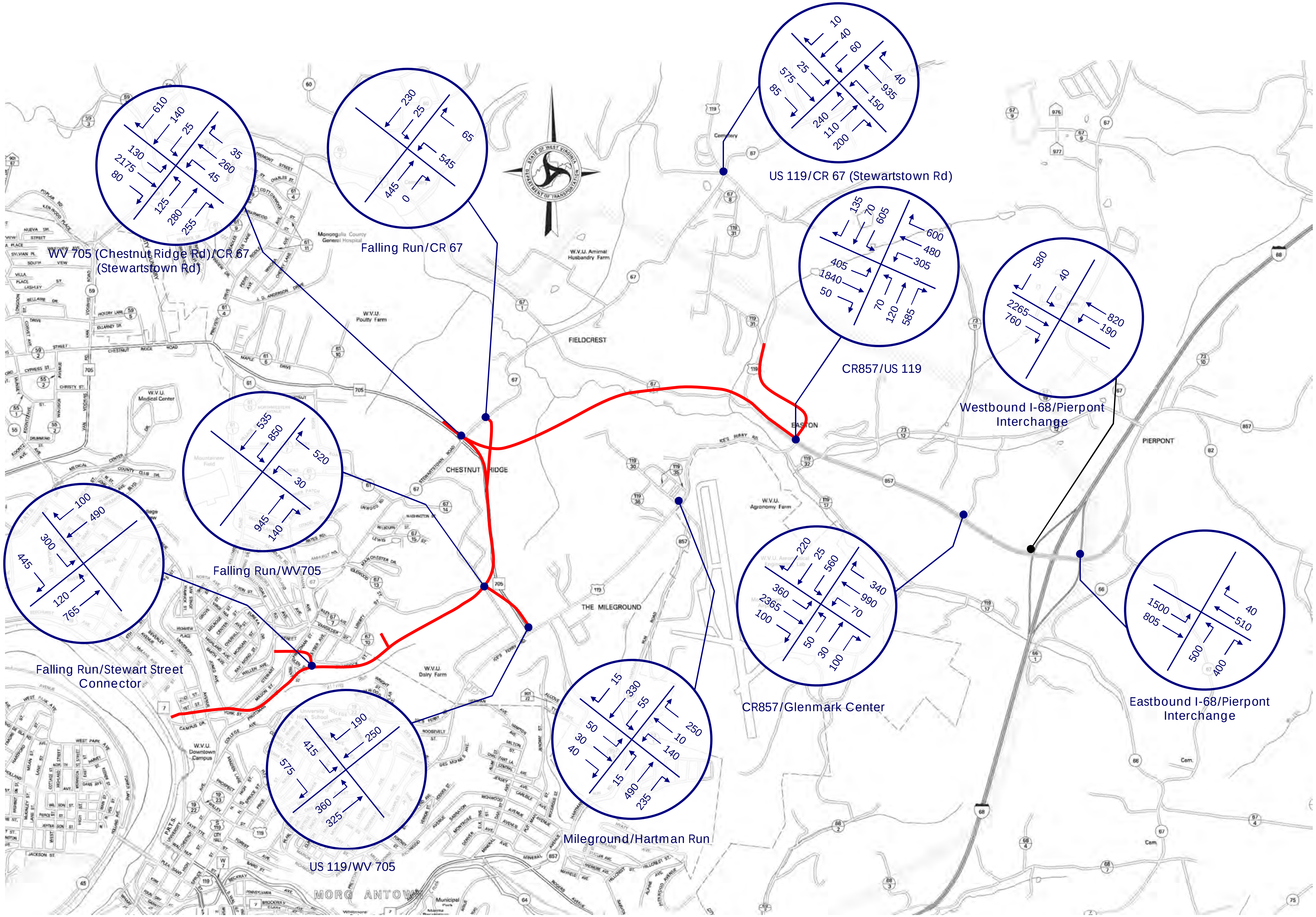


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Figure 26
Alternative 1 - 2030 PM Peak Hour Turning Movements

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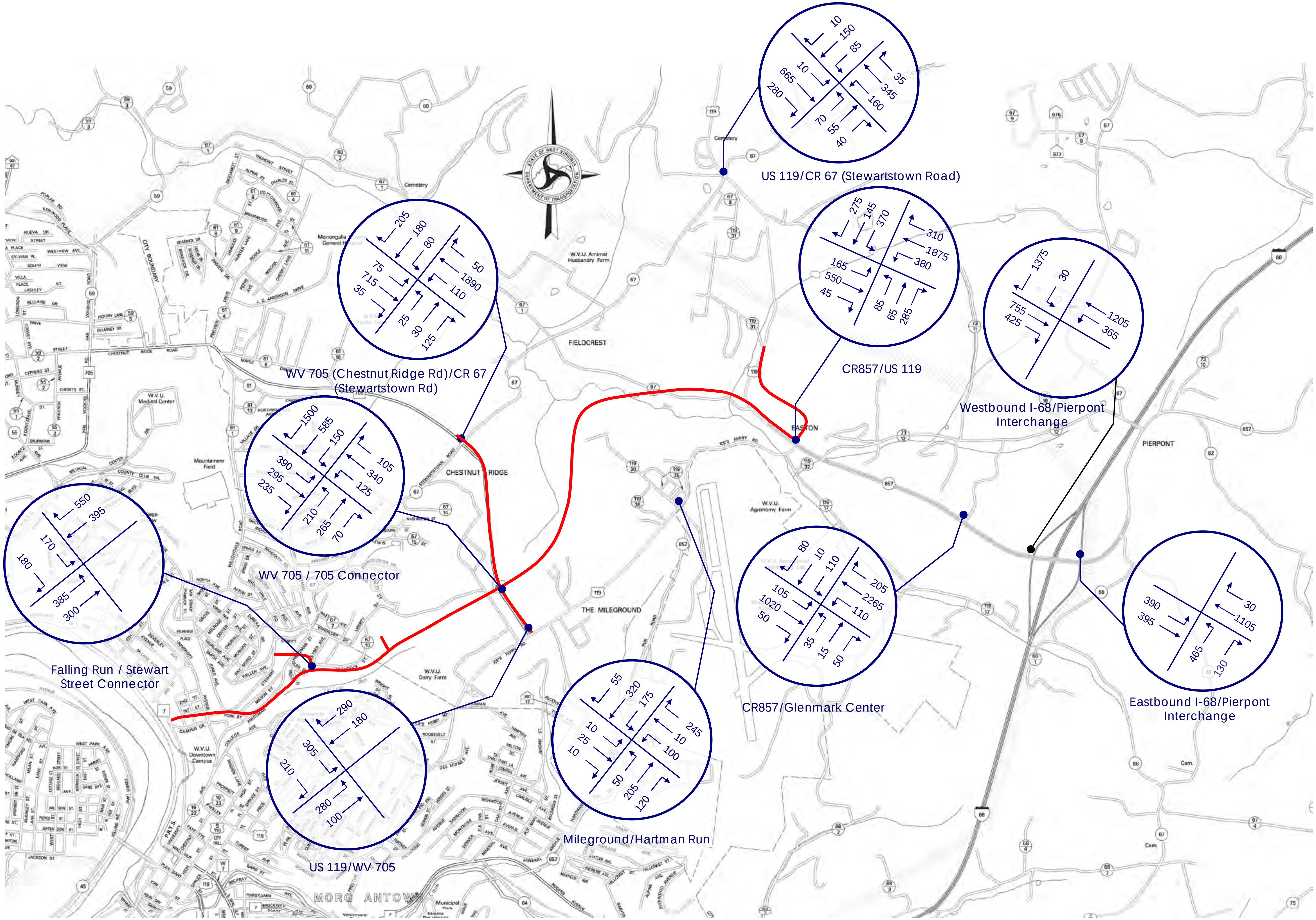

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Figure 27
Alternative 2 - 2030 AM Peak Hour Turning Movements

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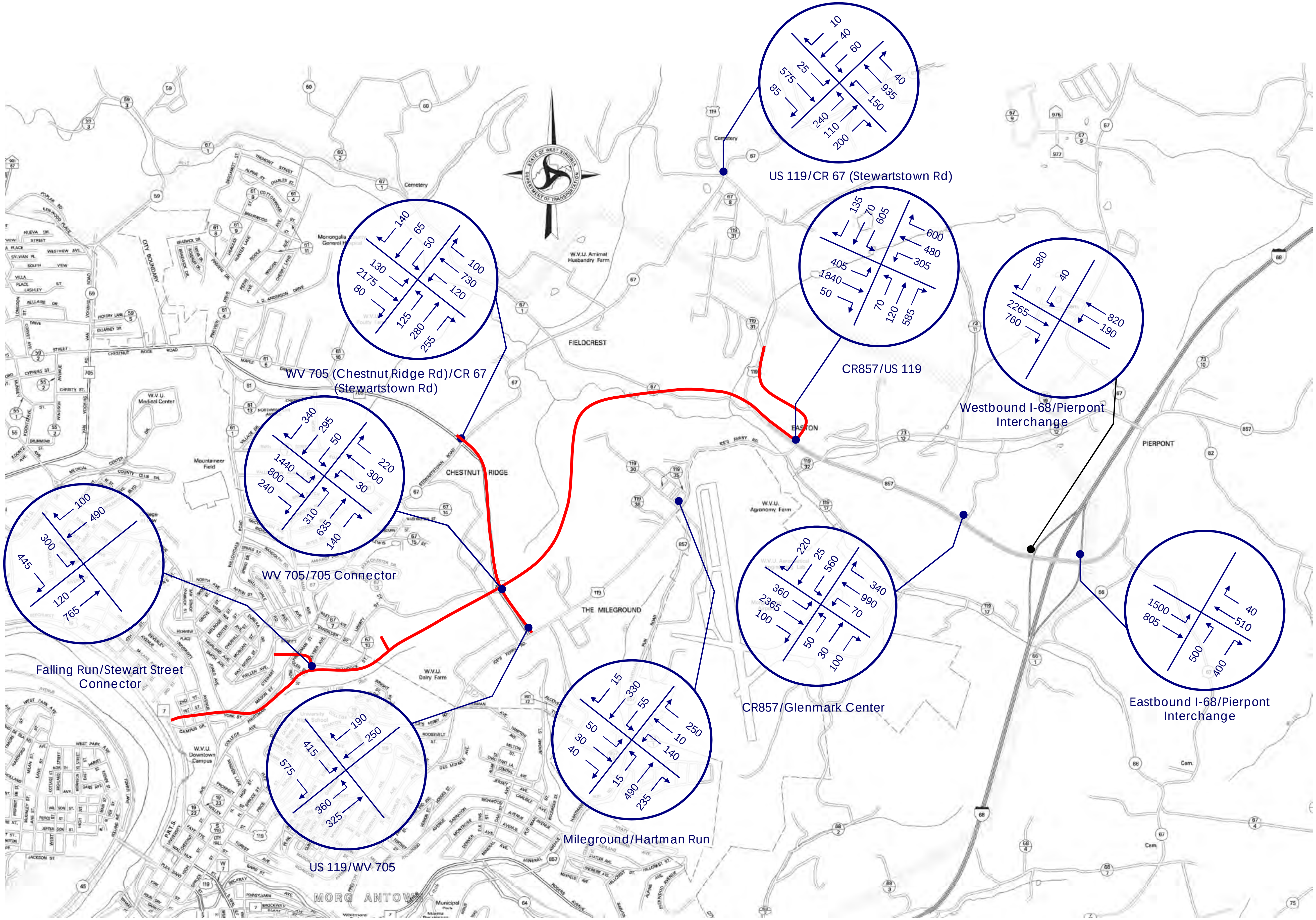

Figure 28
Alternative 2 - 2030 PM Peak Hour Turning Movements

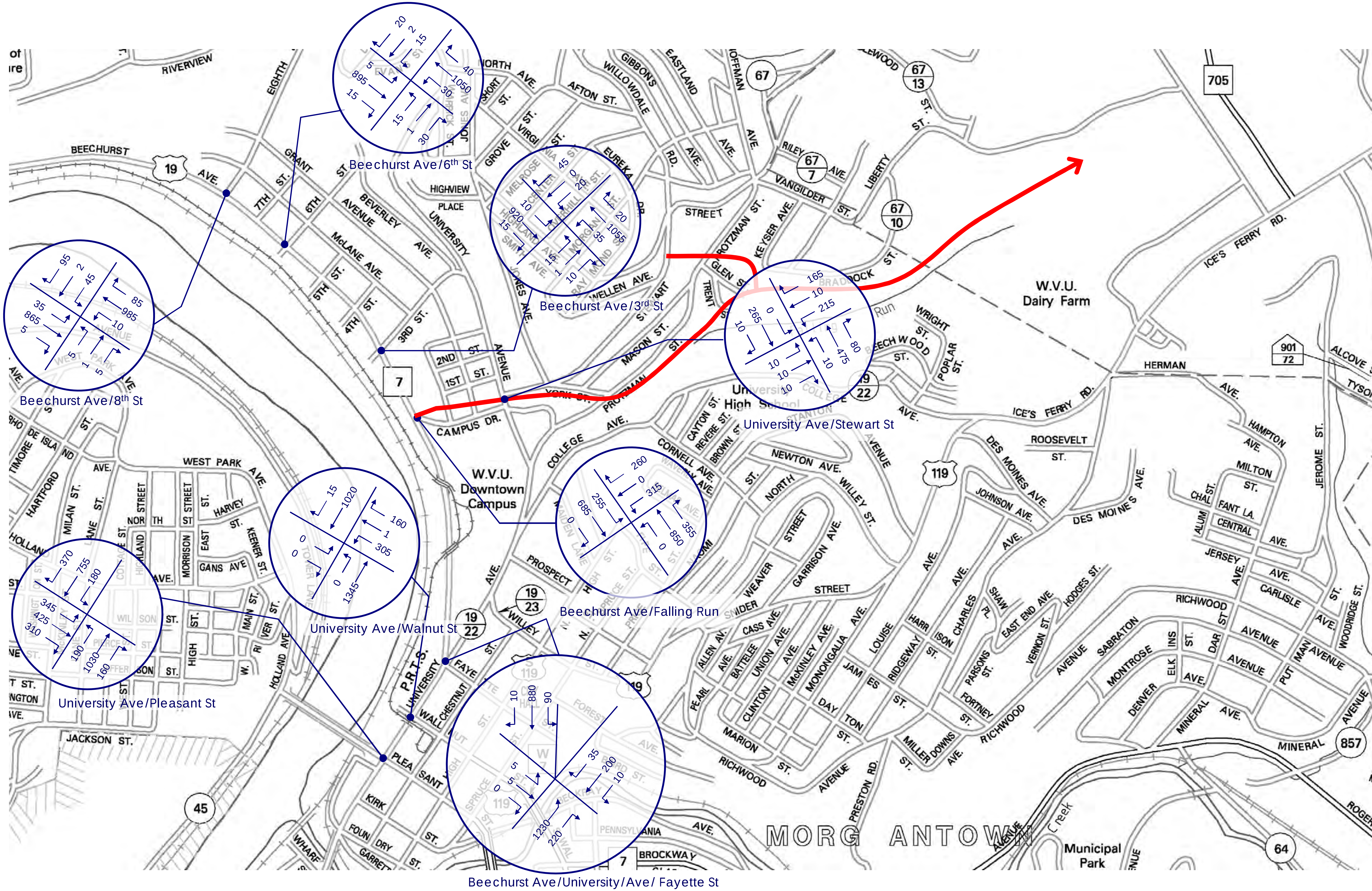

Figure 29
Alternative 1/2 - 2030 AM Peak Hour Turning Movements – Falling Run/Beechurst/ University

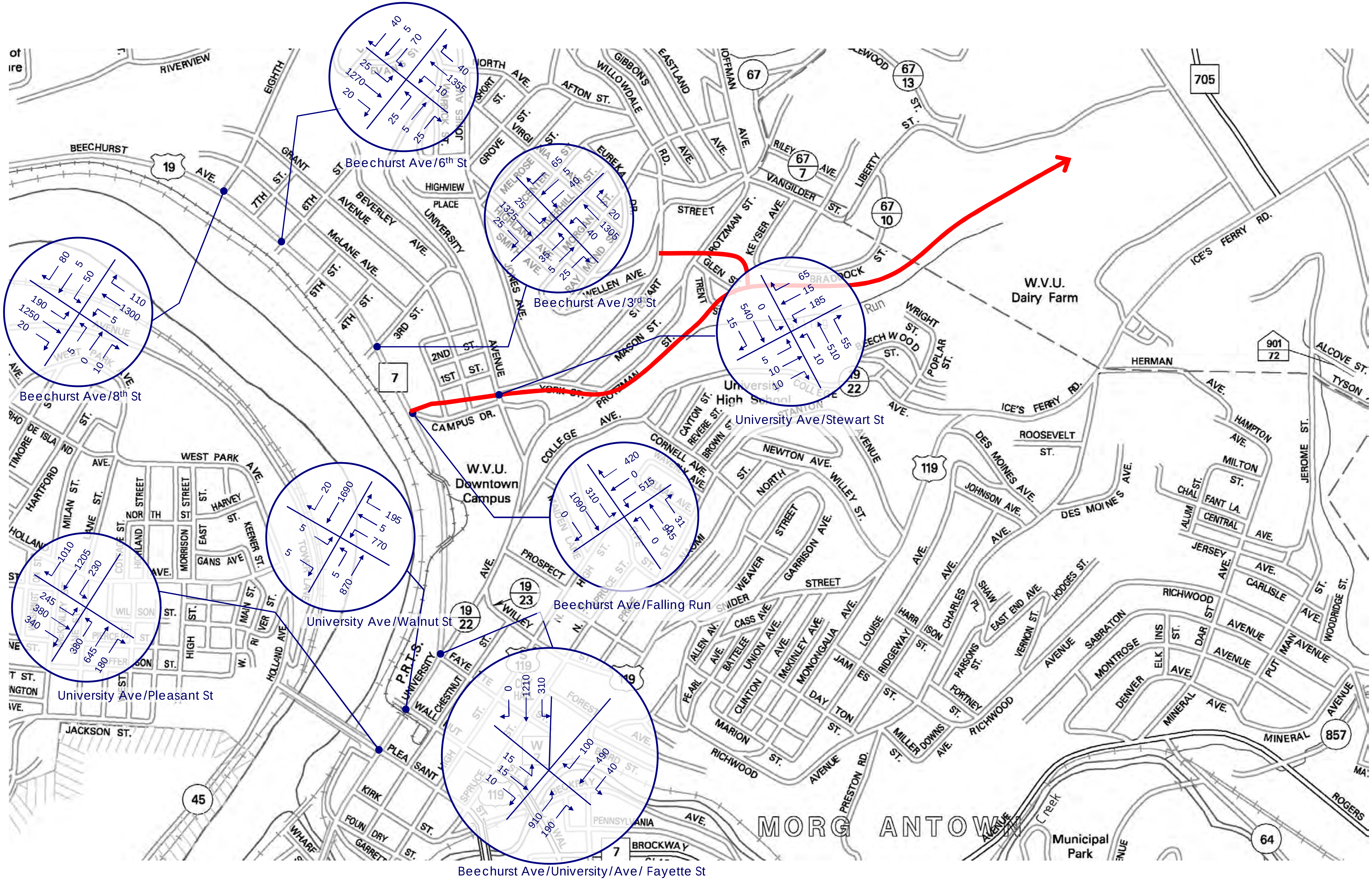

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Figure 30
Alternative 1/2 - 2030 PM Peak Hour Turning Movements

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Figures 31 through 34 display the first iteration of the operations analyses of the key segments and junctions of the corridors included in the study area. The traffic concept and study are displayed in each figure are listed below:

- Figure 31: 2030 AM peak hour for the WV 705 Connector Alternative 2, CR 857, US 119, and the north end junction of the Falling Run Corridor.
- Figure 32: 2030 PM peak hour for the WV 705 Connector Alternative 2, CR 857, US 119, and the north end junction of the Falling Run Corridor.
- Figure 35: 2030 AM peak hour for the Beechurst Avenue-South University Avenue corridor.
- Figure 36: 2030 PM peak hour for the Beechurst Avenue-South University Avenue corridor.

INITIAL FINDINGS/MITIGATION DISCUSSION

As would be expected in areas that presently experience marginal to poor traffic operations in the peak periods and areas that represent locations in a community where substantial traffic growth is expected, investment into a single corridor will not alleviate observed or 2030 No Build conditions congestion. Addressing the observed congestion requires, as was emphasized in the Regional Transportation Plan, a system approach that involves multiple corridors in the solution. Some of the key findings from the traffic analyses are documented below:

- Implementation of only the WV 705 Connector concept providing a complementary route to Mileground Road would result in operational improvements for the segment and intersections along US 119 (Mileground Road) from WV 705 at Wiley Street to CR 857, including the following intersections:
  - WV 705/Hartman Run Road (access to airport).
  - WV 705/US 119/North Wiley Street.

  Traffic operations in the AM and PM peak periods would suffer substantial degradation at each of the intersections along WV 705 west of the Mileground Road intersection to past Don Nehlen Drive. As WV 705 would be the terminus of the route and the four-lane divided corridor of the WV 705 Connector would provide a large travel time advantage route for at least a short distance (US 119/CR 857 to WV 705/CR 67 (Stewartstown Road), the more traffic would desire to use the corridor. At the WV 705 corridor terminus, however, the positive provided by the WV 705 Connector would become a negative for the WV 705 corridor. More traffic with origins/destination of downtown, the Evansdale Campus and western medical and industrial employment centers would be "dumped" into the already congested corridor without providing any substantial improvement (beyond retiming signals). WV 705 does not have the capacity to accommodate the increased traffic and operations throughout the corridor in extended AM and PM peak periods would become even a worse F.
- The extent of the positive impacts of just the Falling Run Corridor concept are focused on the areas south of WV 705. As with the WV 705 Connector, providing only the Falling Run Corridor improvements results in negative traffic operations impacts to the WV 705 corridor from Mileground Road to past Don Nehlen Drive. Negative impacts to operations occur because the reduced travel time through the Falling Run Corridor draws a large number of vehicles to commit to using the corridor, but once they get to

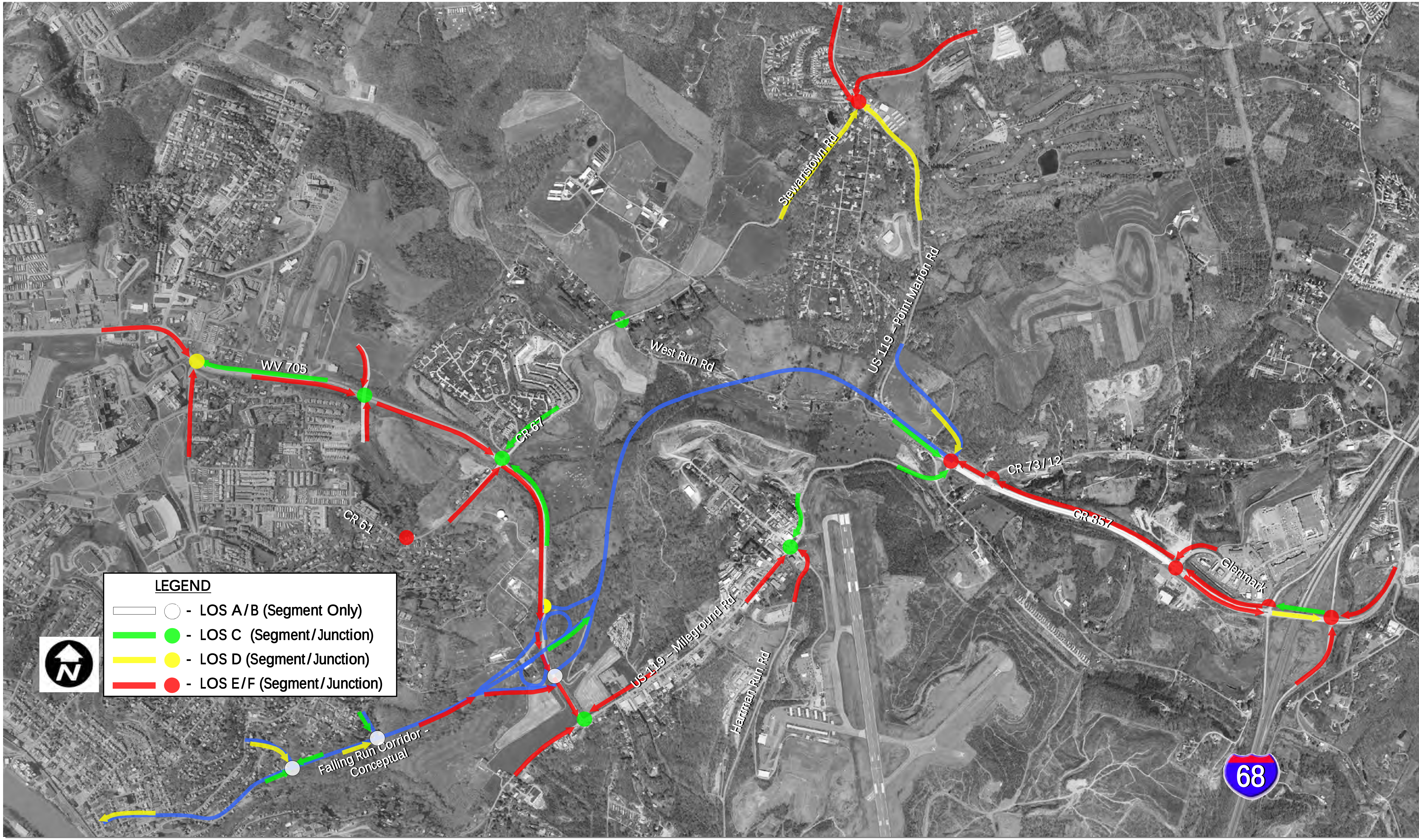

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Figure 31

WV 705/ Co 857 / US 119 Traffic Operations Summary, 2030 Build Alternative 2 (AM Peak)

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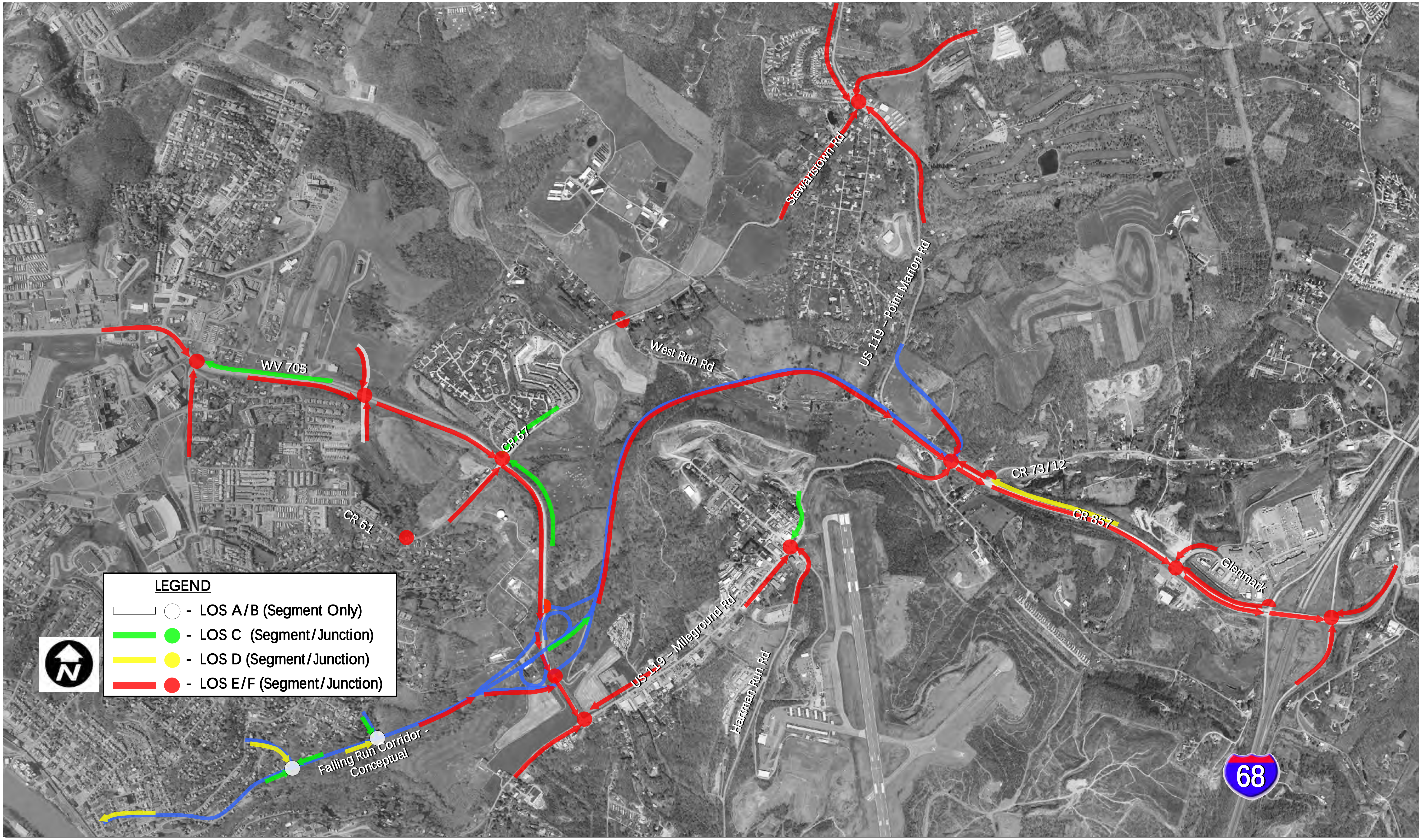

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Figure 32

WV 705/ Co 857 / US 119 Traffic Operations Summary, 2030 Build Alternative 2 (PM Peak)

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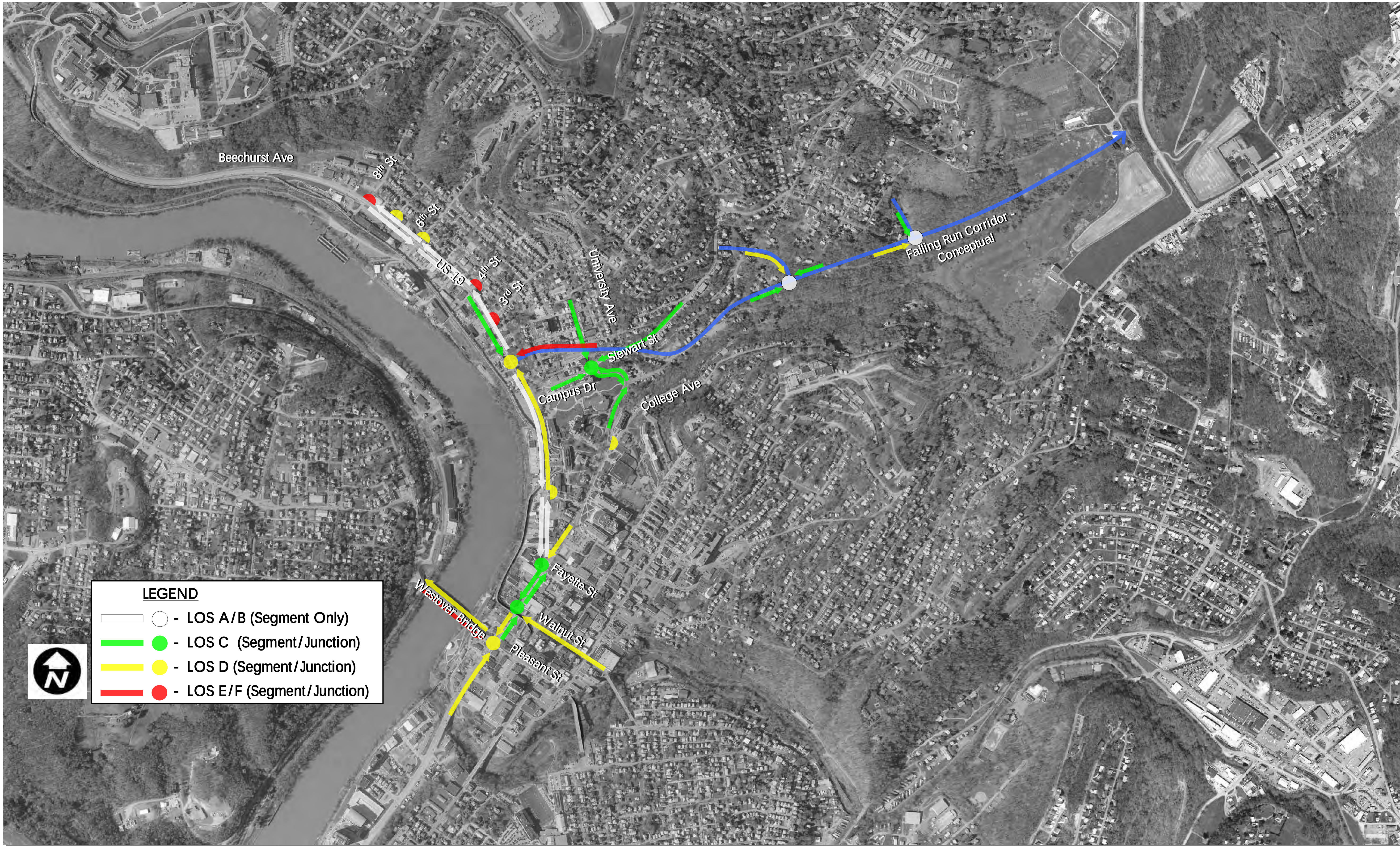

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Figure 33

Beechurst Ave/University Ave Traffic Operations Summary, 2030 Build Alternatives 1 and 2 (AM Peak)

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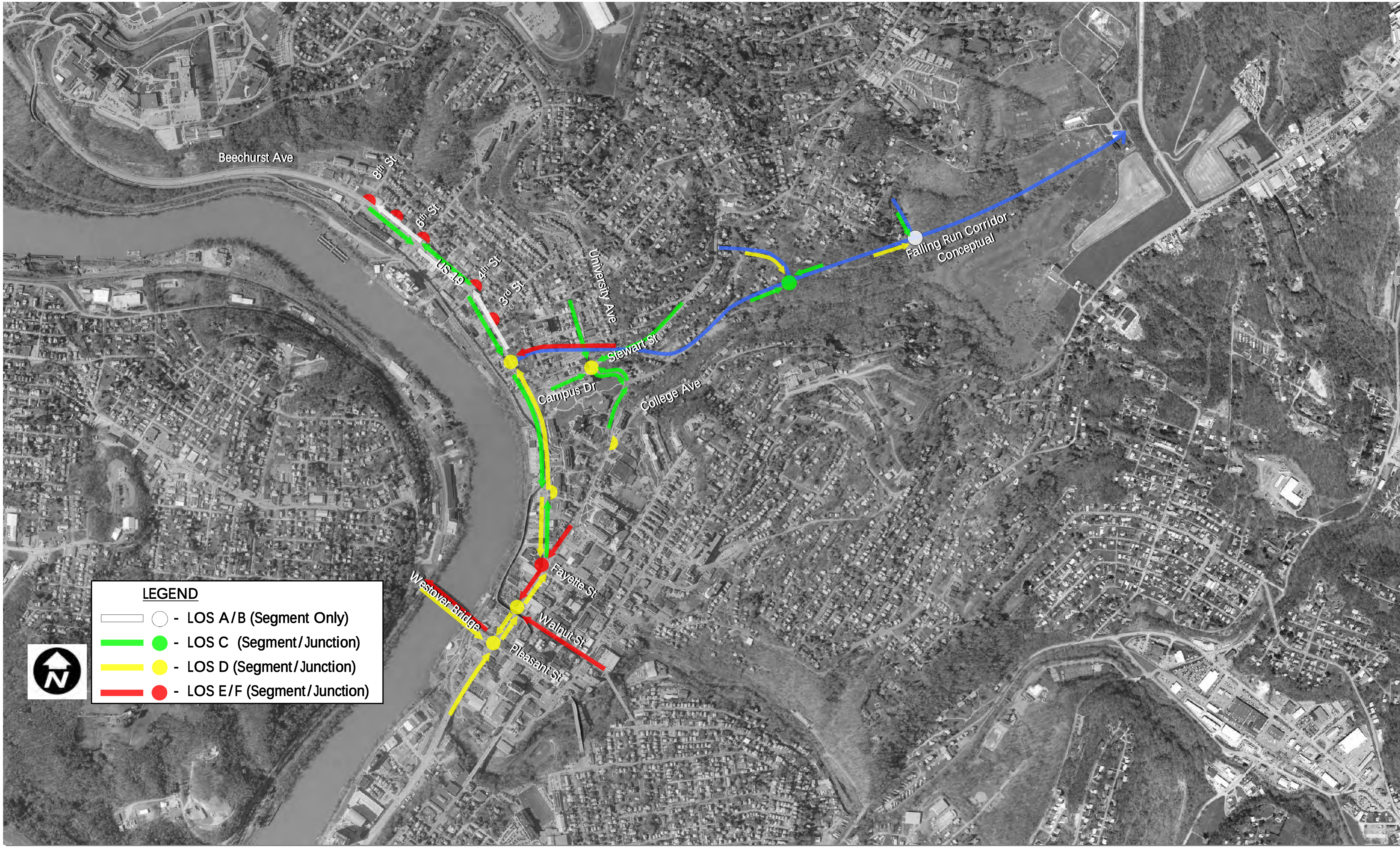

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Figure 34

Beechurst Ave/University Ave Traffic Operations Summary, 2030 Build Alternatives 1 and 2 (PM Peak)

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the WV 705 corridor, they encounter substantial delay. Those drivers in the corridor in the No Build condition are subjected to lower operating speeds, substantially increased travel times and intersection delay. While the negative impacts of providing just this connection are not as bad as providing just the WV 705 Connector (because the connection to I-68 is more distant), implementation of the concept as the only improvement, does not support the long term needs/goals for the area.

- Implementation of the Falling Run/705 Connector concept without any other roadway improvements result in severe capacity issues at the junctions of and along segments of the following corridors:
  - CR 857.
  - US 119.
  - Beechurst Avenue-South University Avenue.

  The primary capacity constraints are located at the CR 857/I-68 interchange and the CR 857/US 119 intersection, where forecasted volumes exceed the capacity by 20 to 35 percent.

- Under the 2030 Build condition scenarios the Beechurst Avenue-University Avenue corridor is assumed to be widened to five-lanes. Through the traffic analysis completed it is recommended that the proposed southbound right turn lane from South University Avenue to the Westover Bridge be extended north to near the Fayette Street intersection. The results of extending the turn lane several more blocks to the north are reasonable levels-of-service through the southern portion of the study corridor. A summary of the intersection operations and corridor travel times is provided below:
  - For the majority of the corridor intersection the projected threshold of acceptable traffic flow is level-of-service is LOS D or better. The exception is the Fayette Street/South University Avenue/Beechurst Avenue intersection is projected to operate at level-of-service E. The University Avenue approach to that intersection is projected to have significant delays.
  - The proposed east approach of Falling Run with Beechurst Avenue is projected to operate at level-of-service E/F with the initial Build Condition assumption of a single left turn lane from Falling Run to southbound Beechurst Avenue. The estimated 2030 PM peak hour queue on Falling Run would extend through the tunnel that is proposed as part of the alternative and around the curve to the north. Queuing vehicles in a tunnel is generally not good practice due to air quality issues and the combination of the tunnel and the curve to the north would restrict the sight distance for drivers coming down the hill. While an adequate sight distance to meet standards could be provided, having the queue extend into or through the tunnel is a negative to the alternative.

    As Beechurst Avenue would have two southbound through lanes to accommodate left turns from Falling Run and in the PM peak hour the lefts from Falling Run to southbound Beechurst are forecasted to exceed 550 vehicles per hour, a mitigation concept of providing dual left turn lanes and a single right turn lane is recommended. Critical in analysis of the feasibility of adding the second left turn lane is not impacting the tunnel included in the concept. If the tunnel would need to widened from the initial two-lane tunnel concept to accommodate two left turn lanes at Beechurst Avenue, it was assumed to result in a fatal to the alternative. Through the queue length assessment, it was concluded that the second left turn lane could be provided without requiring a modification to the two-lane tunnel portion of the Falling Run.

    Including the addition left turn lane would require widening the initial concept by approximately 12 feet for a distance of approximately 400 feet uphill from the

Beechurst Avenue intersection (tunnel portal is located approximately 420 feet up the hill). Providing the second left turn lane onto southbound Beechurst Avenue would achieve a reasonable overall intersection level-of-service.

- A few intersection movements that today experience delays will continue to see lower level-of-service in the future even with the corridor expansion. Examples include northbound left turns at Pleasant Street/South University Avenue, westbound left-turns at Walnut Street/South University Avenue, and left turns out of many of the stop controlled intersections. Once in the corridor, however, vehicles will progress through the study limits much more efficiently, and at a substantially reduced travel time.
- The corridor travel along Beechurst Avenue between 8th Street and Pleasant Street in the southbound direction is projected to improve by approximately four minutes compared to existing conditions.

- Throughout the AM peak period the WV 705/705 Connector interchange in Alternative 1 would operate poorly as vehicles from the WV 705 Connector off-ramp queue at the Stewartstown Road intersection. A dual left turn would be provided at this location, however, the vast majority of the vehicles that are turning left also want to turn right at WV 705/Stewartstown Road which is locate about 350 feet to the south. This is not an adequate distance to reasonably allow people to merge into the single lane to turn right. In addition, operations along the WV 705 portion of the corridor in the Build conditions are level-of-service E/F from west of Stewartstown Road through Mileground Road. This is due to all of the mixing of traffic between vehicles entering/leaving the WV 705 corridor and vehicles entering/leaving the Falling Run Corridor at two different junctions. Due to the poor operations in the AM peak, this alternative is likely fatally flawed and should be dismissed from further consideration. The traffic operations associated with this alternative are not shown in the figures.

- The WV 705/705 Connector interchange (Alternative 2) is projected to operate at a reasonable level of service and no significant deficiencies were identified through the traffic analyses. The initial concept provided a higher speed off-ramp accommodating northbound right turning traffic that wanted to go to Mileground Road. The queue extending from the WV 705/Mileground intersection back to the WV 705 Connector/WV 705 junction would likely conflict with the higher speed ramp traffic I

  The recommended mitigation is to bring the northbound off-ramp to a signalized intersection located directly adjacent to the southeast quadrant loop ramp. This ramp terminal intersection would be located outside the queue created at WV 705/Mileground Road. The traffic operations analysis of the signalized intersection resulted in the conclusion that WV 705, Falling Run Corridor and WV 705 Connector traffic could all be accommodated (AM and PM) at an acceptable level-of-service.

- The primary concern with the WV 705/705 Connector interchange (Alternative 2) is eastbound WV 705 between the Stewartstown Road intersection and the interchange. The initial concept provides for two lanes in the eastbound direction. The outside (curb) lane would need to accommodate traffic destined for both the southbound on-ramp and the northbound loop on-ramp. The level of traffic would approach the capacity of the curb lane resulting a lower peak hour travel time and lower level-of-service. A third eastbound lane between the Stewartstown Road intersection and this interchange would improve this situation.

- Providing improvements at the CR 857/I-68 interchange (eastbound to northbound loop ramp) and widening the CR 857 corridor to six lanes provide significantly improved levels of service (i.e., majority of intersections LOS D or better). A summary of the intersection operations and corridor travel times is provided below:

- The improved intersection of CR 857/US 119 is projected to operate near Level-of-service F, with average delay of approximately 90 seconds/vehicle. There are several high volume movements/approaches and it will be difficult to improve upon this situation without upgrading to an interchange.
- The projected corridor travel times along US 119 (northbound direction) corridor between WV 705 and CR 857 is projected to improve by approximately 60 percent compared to the 2030 No Build scenario and will be approximately 20 percent better than observed in the existing condition.
- The projected corridor travel times along CR 857 (eastbound direction) corridor between US 119 and I-68 is projected to improve by approximately 60 percent compared to the 2030 No Build scenario.

The traffic operations analyses were revised to take into account the list of mitigation concepts addressed along each of the corridors and at specific junctions. The results of the revised assessment for the AM and PM peak hours for WV 705/Falling Run/WV 705 Connector Alternative 2 are displayed in Figures 35 through 38.

REDUCED GROWTH TRAFFIC VOLUME ASSESSMENT

Based on the current bleak funding outlook, it is in no way certain that the identified WV 705 Connector, Falling Run Corridor and Beechurst Avenue-South University Avenue improvements can be funded. Thus, the financial feasibility of adding additional lanes to CR 857 and providing I-68/CR 857 interchange improvements to support the forecasted is probably very questionable. With these funding constraints in mid, a secondary set of traffic forecasts that factored the 2030 PM peak hour demand volumes to a level that would not require expansion of CR 857 to a six-lane divided roadway were developed and evaluated. The improvements to the I-68/CR 857 (Pierpont) interchange ramp was maintained in the analysis because they are relatively close to being justified today, would not likely require reconstruction of the entire interchange, and would access a funding source that was not heavily tapped in the Regional Transportation Plan alternatives analysis. Thus, they may be affordable even in with the limited funds available for expansion.

The reduced growth volume concept reflects a scenario where the increment of traffic associated with implementation of the WV 705 Connector, the Falling Run Corridor, and the Beechurst Avenue-South University Avenue concepts was reduced to a level that would allow at least minimal peak period flow through the CR 857 corridor with four-lanes and turn lanes and maintenance of the signalized at-grade intersection at CR 857/US 119/WV 705 Connector junction.

The forecasted horizon year Build conditions (WV 705/WV 705 Connector junction Alternative 2) representing the PM peak hour for this traffic alterative are displayed in Figure 39. Listed below are several of the key findings of this intermediate condition analysis:

- Approximately 80 percent of the forecasted 2030 AM and PM peak hour traffic can be accommodated in the CR 857 corridor prior to needing to include a third though lane on CR 857 from I-68 to the WV 05 terminus and a grade-separated junction at CR 857/US 119/WV 705 Connector.
- Traffic operations at the I-68 terminal intersections with CR 857 would operate at a reasonably acceptable level-of-service (D at 80 percent of 2030 traffic).
- PM peak hour operations along CR 857 at the Glenmark Center and at US 119 would reflect level-of-service F. While they are identified as level-of-service F, traffic would still

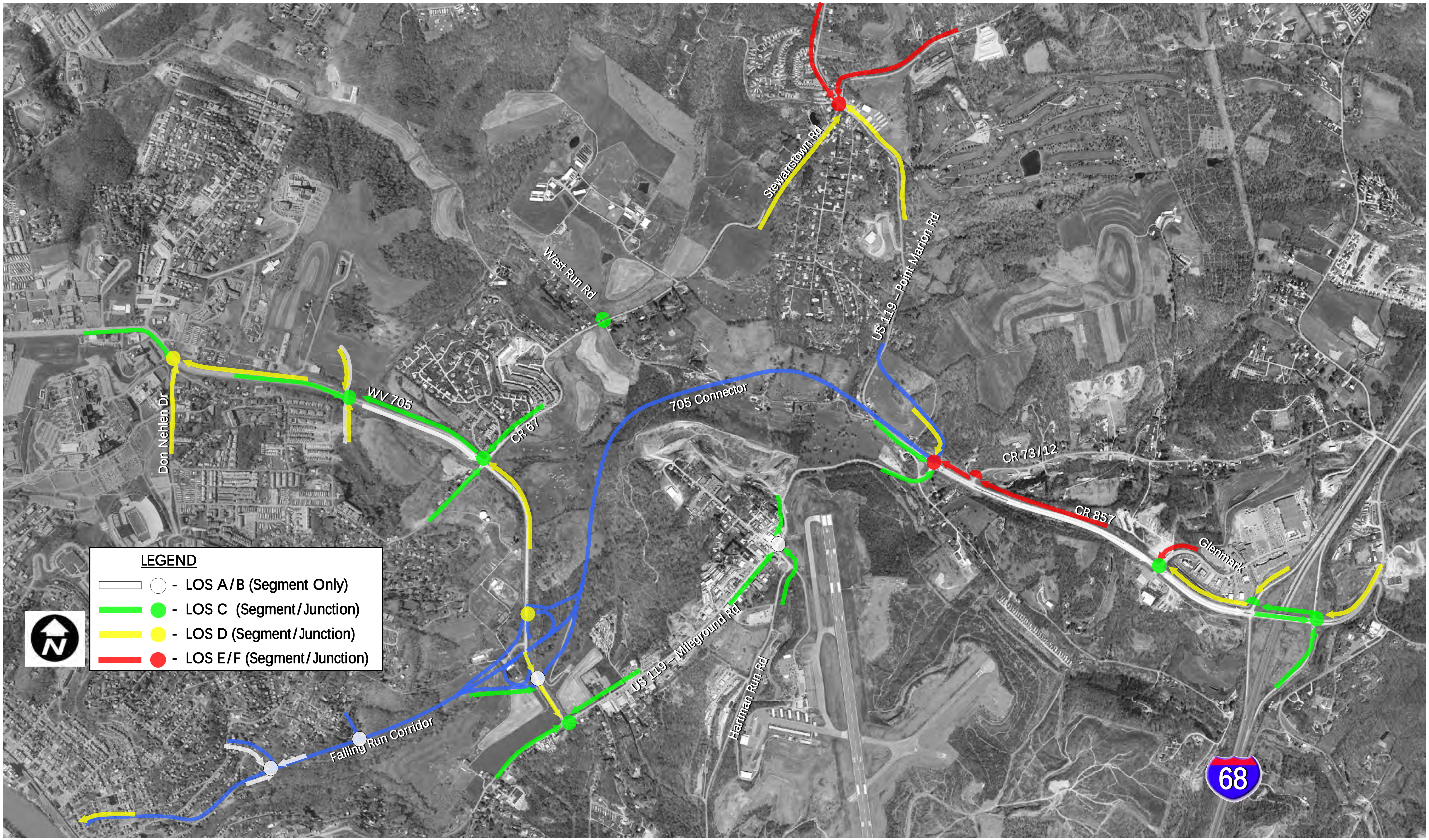

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Figure 35

WV 705/ Co 857 / US 119 Traffic Operations Summary, 2030 Build Alternative 2 – 6-Lane CR 857 (AM Peak)

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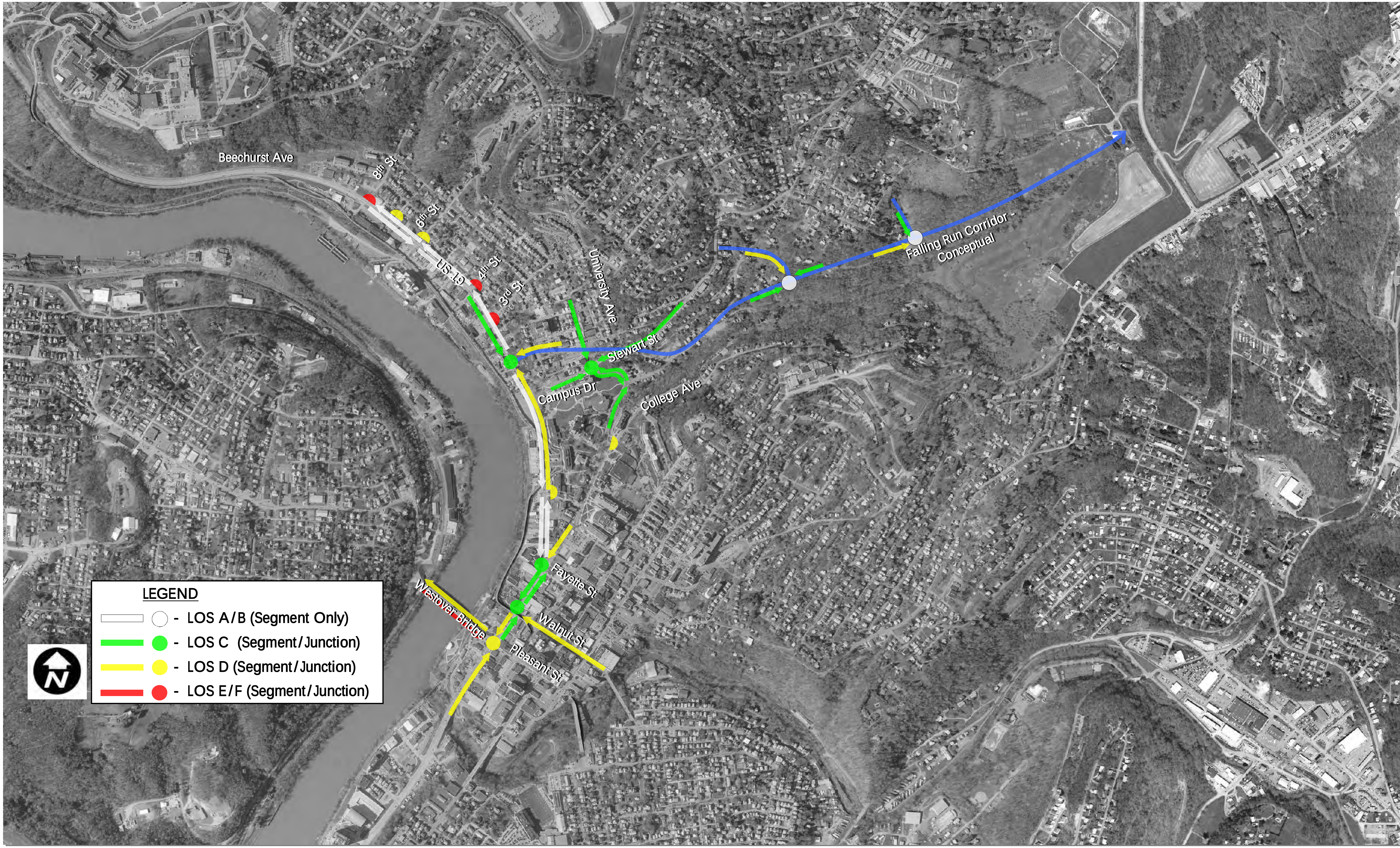

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Figure 36

Beechurst Ave/University Ave Traffic Operations Summary, 2030 Build Alternatives 1 and 2 (AM Peak)

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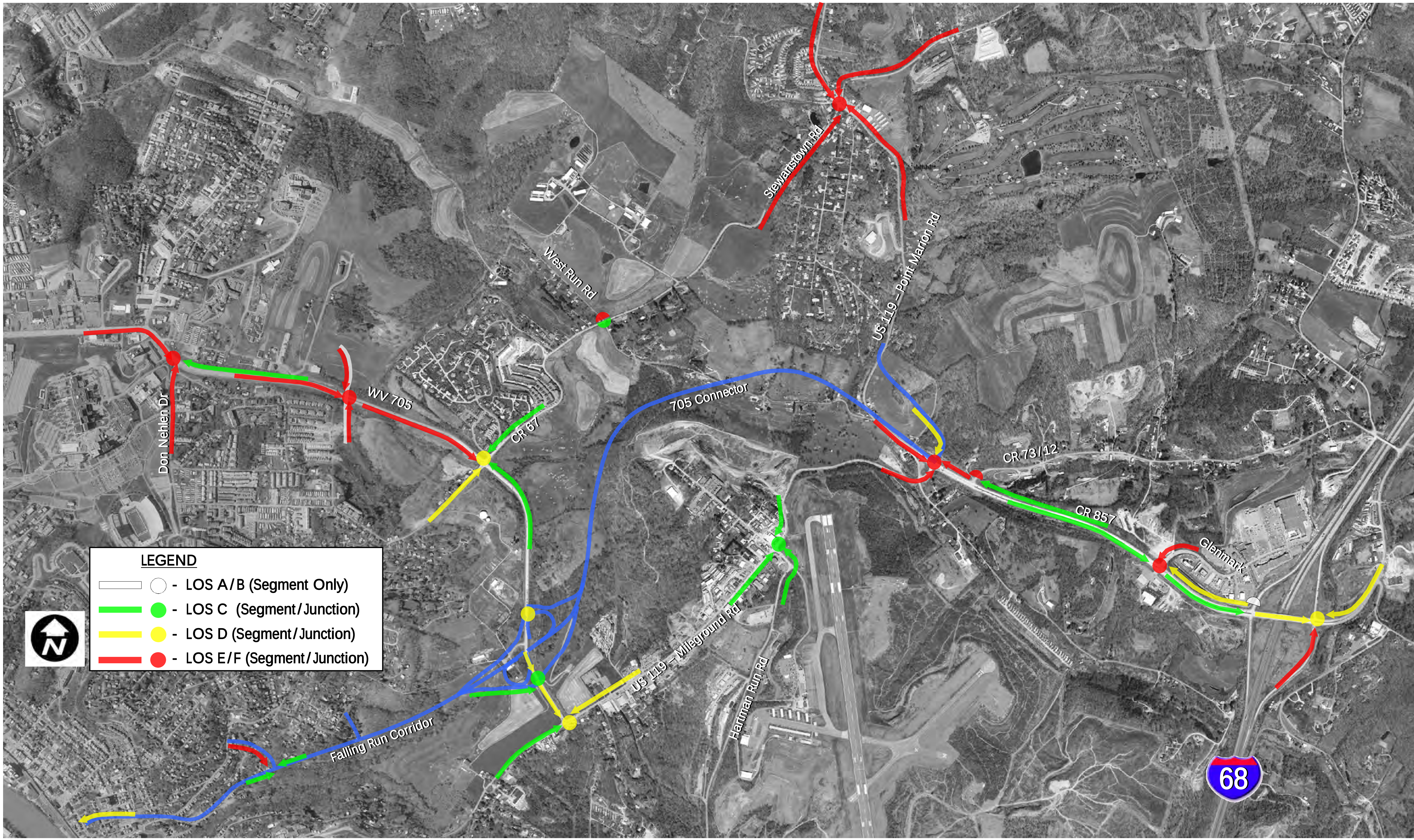

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Figure 37

WV 705/ Co 857 / US 119 Traffic Operations Summary, 2030 Build Alternative 2 – 6-Lane CR 857 (PM Peak)

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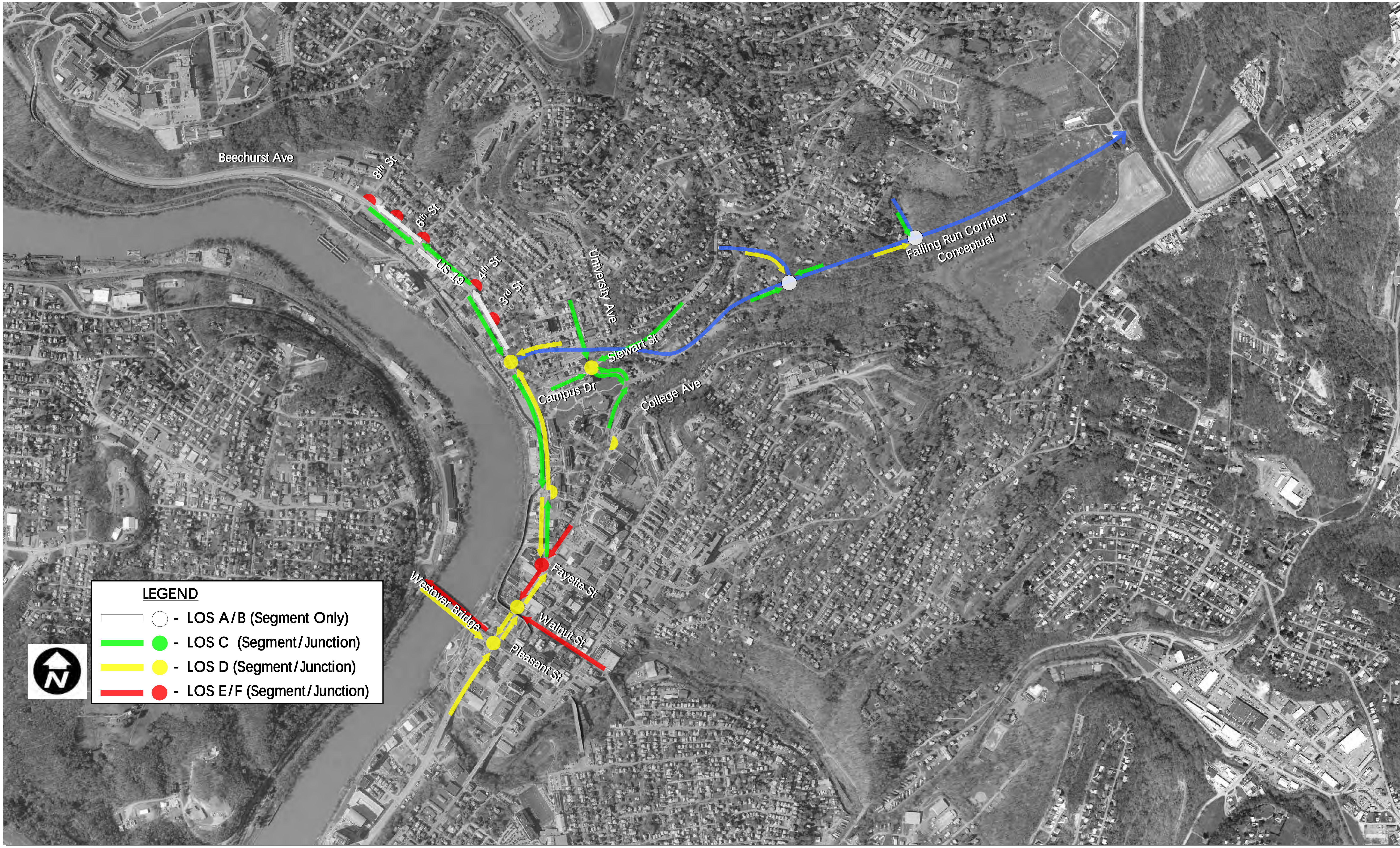

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Figure 38

Beechurst Ave/University Ave Traffic Operations Summary, 2030 Build Alternatives 1 and 2 (PM Peak)

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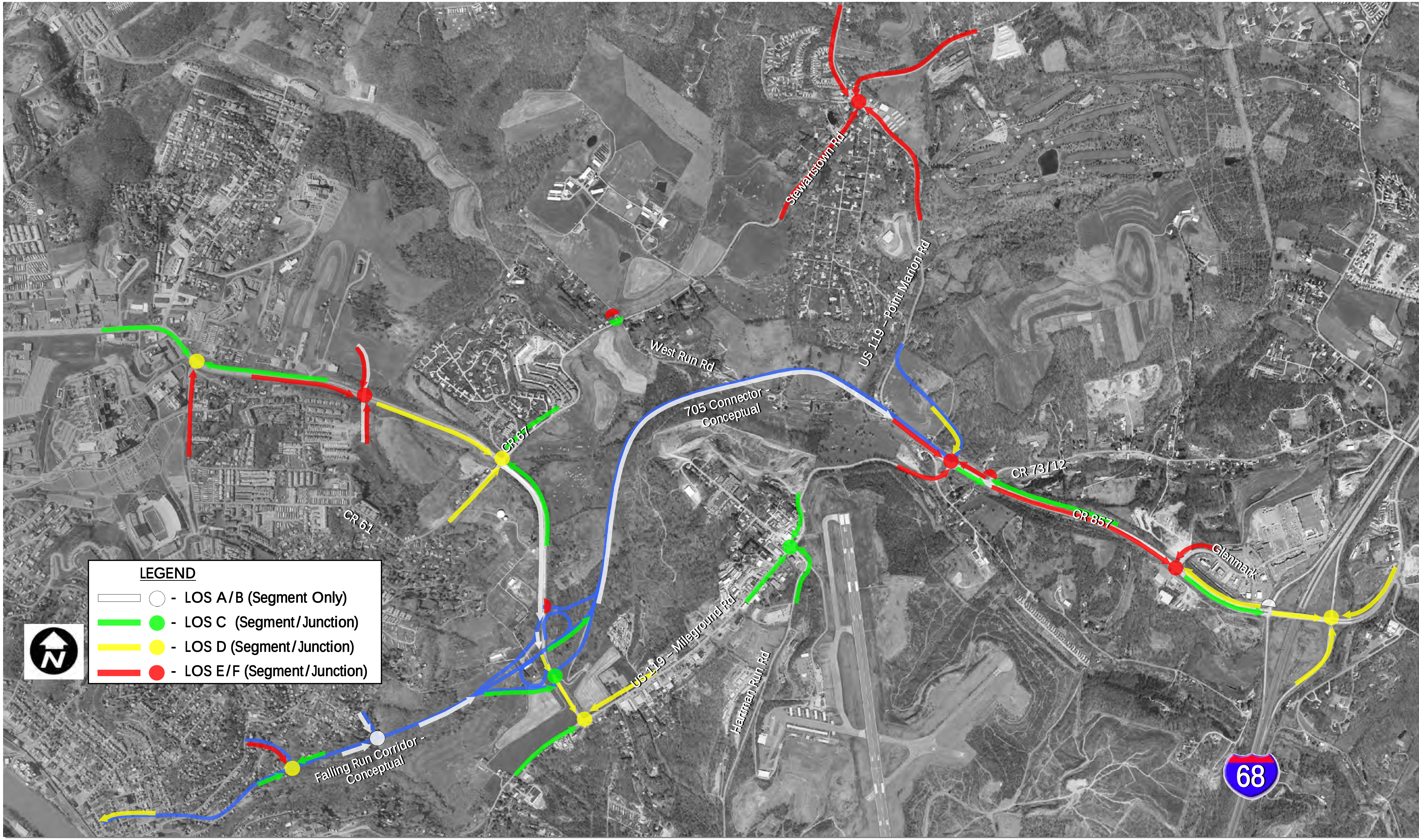

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Figure 39

WV 705/ Co 857 / US 119 Traffic Operations Summary, 2030 Build Alternative 2 Reduced Volume (PM Peak)

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flow through the intersections and each of the intersections could accommodate in one hour all of the traffic demand of the peak hour.

- Operations at the US 119/CR 67 (Stewartstown Road) intersection would still reflect level-of-service F operations.
- Peak hour traffic operations along US 119 (Mileground Road) would be representative of level-of-service C at Hartman Run Road and D at WV 705. These levels forecasted for 2030 would be better than levels observed today in the PM peak.
- Traffic flow in the PM peak along WV 705 would be improved relative to the full future traffic conditions, with a substantial improvement observed at WV 705/CR 67 (Stewartstown Road).
- Traffic operations through the Falling Run Corridor and along Beechurst Avenue reflect level-of-service D or better throughout the PM peak period, which is the worst-case scenario for the corridors.

Beechurst Avenue-South University Avenue Traffic Management – Restrict Southbound Left Turns at Fayette Street

Background

All of the concepts documented to this point for improving traffic operations reflect construction alternatives. In order for the analysis to be considered robust, we need to also consider traffic management alternatives. Traffic management that encompasses access control, restricting movements, considering directional has been incorporated into the analysis for the Beechurst Avenue-south University Avenue corridor. Minor adjustments that reflect traffic management related elements have been included in the WV 705 Connector and Falling Run Corridor reviews, but as they are both new route (rather than an expansion), current traffic management practices are built into the design concept.

In reviewing the turning movements at private access points and public intersections, the only location where it may be "logical" to restrict a left turn movement as well as the additional through lanes would be Fayette Street. All other turn movements a fairly light or could not reasonably be relocated to another intersection. Restricting southbound left turns at Fayette Street in the current and No-build conditions would allow reassignment of the left turn lane as a second southbound through lane. The intent would be to provide additional southbound through capacity in a congested portion of the corridor. A primary issue in this alternative is reassigning the displaced southbound to eastbound left-turn vehicles (i.e., 220 in the PM peak hour). In the analysis it has been assumed the vehicles would be reassigned to either the Beechurst Avenue/Campus Drive or the South University Avenue/Pleasant Street intersections.

In the southbound direction of travel during the PM peak hour the segment of South University Avenue between Pleasant Street and Fayette Street is very congested. This congestion also extends north from the Fayette Street intersection along Beechurst Avenue and North University Avenue. In order to understand the traffic operations along South University Avenue it is appropriate to take a look at how the three signalized intersections in that segment are coordinated, as outlined in Table 6. This table provides information on which intersection movements are served (i.e., who has the green light) during each signal grouping and how the southbound queues typically form / disperse during those signal groupings.

TABLE 6: SOUTH UNIVERSITY AVENUE QUEUE ASSESSMENT

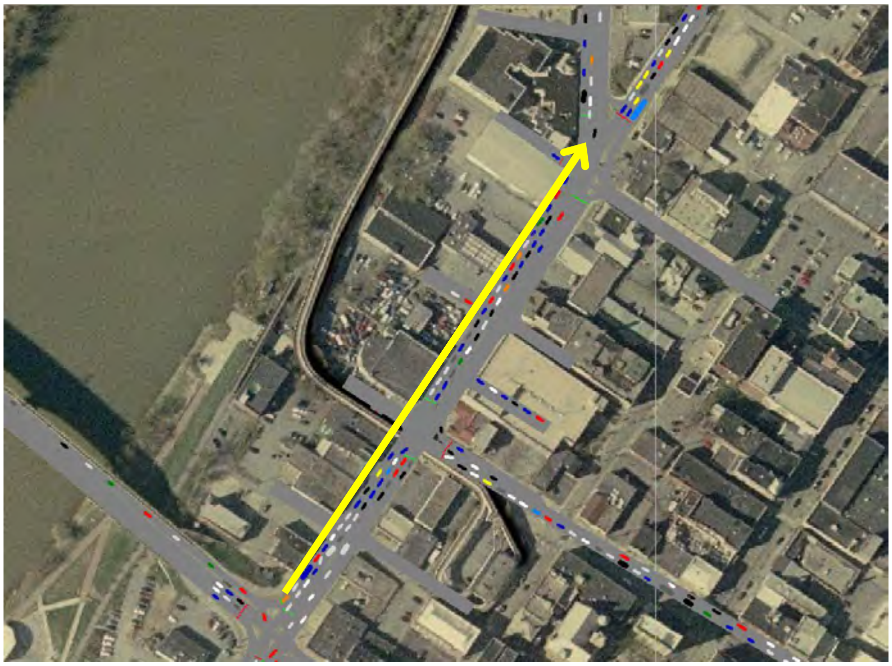
Signal Timing Groupings		South University Ave Intersections		
		Pleasant St	Walnut St	Fayette St
# 1	Movement	Eastbound	Westbound	Southbound Beechurst Ave
Queuing =			*Above vehicles form a southbound queue between Walnut and Pleasant St*	*Above vehicles form a southbound queue between Fayette and Walnut St*
# 2	Movement	Northbound / Southbound LT	Westbound	Northbound / Southbound Beechurst & S. University
Queuing =			*Above vehicles form a southbound queue that fills the entire block between Walnut and Pleasant St*	*Above vehicles form a southbound queue that fills the entire block between Fayette and Walnut St*
# 3	Movement	Northbound / Southbound	Northbound / Southbound	Northbound / Southbound Beechurst & S. University
Queuing =			*Southbound queue between Walnut and Pleasant St is dispersing*	*The long southbound queue between Fayette and Walnut is still present and very few vehicles enter that segment*
# 4	Movement	Northbound / Southbound	Northbound / Southbound	Southbound North University
Queuing =			*Southbound queued vehicles between Walnut and Pleasant St have all traversed the Pleasant St intersection and southbound queued vehicles between Fayette and Walnut St are now traveling through the segment between Pleasant and Walnut St*	*Above vehicles typically cannot enter the intersection at the beginning of the green light because the back of the southbound queue between Fayette and Walnut is present*

Notes:
Movements: LT = Left-turn arrow; TH = Through (also includes right-turn and left-turn movements)

Additional information on the southbound queuing typically found along South University Avenue is provided below:

- Typically, at the beginning of signal timing Group #3 the southbound queue extends from Pleasant Street through the Fayette Street intersection, as shown in the graphic on the next page. The average/maximum southbound queue lengths for the three South University Avenue intersections are provided below:
  - Pleasant to Walnut = 250 feet/325 feet plus: The segment length is 325 feet.
  - Walnut to Fayette = 360 feet/440 feet plus: The segment length is 440 feet.
  - Fayette to Campus Dr = 800 feet/1800 feet: The segment length is 1920 feet.

An average queue length that approaches the length of the block segments indicates that queued vehicles are present for each traffic signal cycle throughout the PM peak hour.



Typical PM Peak Southbound Queue at Beginning of Signal Timing Group #3 (NB/SB through phase just beginning at the Pleasant and Walnut Street intersections)

- Storage space for southbound queuing vehicles along South University Avenue between Pleasant and Fayette Street is very limited due to the short block spacing.
- The single southbound through lane from Beechurst Avenue at the Fayette Street intersection provides sufficient capacity to fill all of the southbound queue storage in the segment between Walnut and Fayette Street. During the PM peak it is common for the southbound queue storage between Walnut and Fayette Street to fill up prior to the end of the green light and the southbound Beechurst Avenue through traffic has to wait on the north side of the Fayette Street intersection. Thus, opening another through lane will not allow more vehicles to get through the intersection of Fayette Street. It will simply fill the storage north of Walnut Street faster.

The next question to ask is “Why is the southbound queuing along South University Avenue so heavy?” The primary reason is the intersection of Pleasant Street is at/near its operational capacity. The Pleasant Street intersection accommodates considerably more traffic than the other two South University Avenue intersections, as shown below:

- Pleasant Street = 3,570 entering vehicles
- Walnut Street = 2,730 entering vehicles
- Fayette Street = 2,460 entering vehicles

The southbound approach to the Pleasant Street intersection only has a single lane for the southbound through movement. This limits the available capacity for that movement, but just as important it limits the amount of southbound queue storage space for vehicles between Pleasant and Walnut Street. The operational capacity constraints at the Pleasant Street intersection cause additional congestion for the upstream intersections.

CONCLUSION

Will a second southbound through lane for Beechurst Avenue traffic at the Fayette Street intersection improve corridor operations? The answer is no, it will not improve corridor operations and there is a high probability it will further degrade South University Avenue operations. The single southbound through lane for this movement currently provides enough capacity to fill all of the available queue storage space between the Walnut and Fayette Street. Providing a second southbound through lane simply allows for that queue storage space to fill at a faster rate, but it does not increase intersection ability to serve “more” traffic.

Removal of the southbound left-turn movement at the Fayette Street intersection would move those vehicles to other intersections (i.e., Campus Drive and Pleasant Street). The additional southbound left-turn vehicles at the Pleasant Street intersection would traverse the already congested South University Avenue segment between Fayette and Pleasant Street, further degrading corridor operations.

It is recommended that the conversion of the southbound Beechurst Avenue left-turn lane at the Fayette Street intersection into a second southbound through lane not be done.

RECOMMENDATIONS BY CORRIDOR

The purpose of this section is to provide a concise summary of the corridor improvement recommendations for each of the key corridors of:

- Beechurst Avenue-South University Avenue from 8th Street through Pleasant Street.
- CR 857 from I-68 through US 119.
- WV 705 Connector from US 119 to WV 705.
- Falling Run Corridor from WV 705 to Beechurst Avenue.
- WV 705 from Don Nehlen Drive to US 119 (Mileground Road).

BEECHURST AVENUE-SOUTH UNIVERSITY AVENUE: 8TH STREET TO PLEASANT STREET

Throughout the Regional Transportation Plan providing improvements to the Beechurst Avenue-South University Avenue corridor was emphasized as one of the most regionally significant improvements in the region. From a regional perspective the corridor is important because:

- Daily and peak hour volumes throughout the corridor are consistently among the highest in the region.
- The corridor is essentially the only continuous arterial traversing Morgantown (other than the Interstate system).
- The corridor serves a number of critical functions from providing access to both campuses of WVU, access to regional commercial areas, access to the central business district, access to Westover, access to residential areas, carrying regional through traffic and providing direct access to adjacent development parcels.
- The corridor is highly congested today, and the level of congestion present does and will continue to negatively influence development growth potential.

Throughout the study area the general recommended improvement concept is consistent in that two-through lanes are recommended for each direction and left turn lanes are recommended for locations that warrant. The primary variable elements of the recommendations are:

- Whether the left turn lane is provided as a two-way left turn lane or a raised median with limited left turn lanes are provide.
- Selected locations with dual left turn lanes.
- Recommendation for including right turn lanes.

8TH STREET TO NORTH OF 3RD STREET

Throughout this portion of the study area the blocks are relatively short and each block has about the same volume of turning traffic going in and coming out. In addition, there are several retail commercial businesses along the corridor. While it could be argued form a safety perspective that a median would be beneficial, the negative impacts to business access and the desire to retain the public street access providing a median through this area is not recommended. Northbound and southbound left turn lanes would essentially back into one another, leaving very small segments for a median.

The recommended cross section is:

- Two through lanes in each direction.
- A center two-way left turn lane.
- Signals at 6th Street and 3rd Street would be retained and no others added.

3RD STREET TO SOUTH OF FALLING RUN (CONCEPTUAL ALTERNATIVE)

Associated with widening the corridor would be acquisition of the properties on the west side of the corridor. It has been assumed that following acquisition and determination of the amount of each parcel that would be needed for right—of-way, the remaining area would be re-parceled and sold for redevelopment. Prior to resale of the parcels the locations where access would be provided and the level of access (right-in=-right-out) would be determined. Thus, placement of a median is feasible and desirable from a traffic operations perspective.

The recommended cross section for this segment is:

- Two through lanes in each direction.
- A center raised median with turn bays at 3rd Street and Falling Run. The turn bay at 3rd Street can be limited to approximately 100 feet in length, which will allow for an extended southbound left turn lane for Falling Run.
- Signals at 3rd Street and Falling Run only.

SOUTH OF FALLING RUN TO PLEASANT STREET

This portion of the corridor is characterized by selected cross routes with very high turning volume to them (Pleasant Street) and/or very high turning volumes from them (Walnut Street). The product of this combination at even a few of the intersections is long left turn queue storage demand. With heavy left turn, in the case of the southbound right turns onto the Westover Bridge – heavy right turns, the ability to provide a median is very limited. The vast majority of the center portion of the street will need to dedicated to northbound and southbound left turn storage.

The recommended cross section is:

- Two through lanes in each direction.
- A center two-way left turn lane.
- Signals at Falling Run, Fayette Street/University Avenue, Walnut Street and Pleasant Street.

FALLING RUN CORRIDOR

The vast majority of the corridor as developed in the initial concept has been demonstrated to provide an acceptable level of traffic service as the combination of a four-lane divided parkway and a two-plus turn lane concept through the Square at Falling Run area and through the university.

BEECHURST AVENUE TO TUNNEL

The Falling Run Corridor would create the primary northern downtown and WVU downtown campus access to Beechurst Avenue, the only continuous north-south principal arterial in town. Thus, Falling Run as it approaches Beechurst Avenue would draw from a broad travelshed and would carry considerable volume. With the anticipated level of access control and improvements to the Beechurst Avenue corridor, the following Falling Run cross section through this area would provide acceptable operations:

- East approach: Two left turn lanes extending from the west tunnel portal to Beechurst Avenue and a right turn lane. Heading away from Beechurst Avenue, a single lane would accommodate the level of traffic demand, as long as turning lanes are provided to the next intersection.
- North approach (Beechurst Avenue): Two through lanes and a single left turn lane.
- South approach (Beechurst Avenue): Two through lanes and a single right turn lane to Falling Run.

TUNNEL TO SOUTH OF THE STEWART STREET EXTENSION

The two lane eastbound (created with the lane add coming form the proposed parking structure, and a single westbound would provide acceptable operations through the corridor, as long as access control is maintained in this segment. In the analysis, it was assumed that no direct property access would be provided in the segment from north of the tunnel to the first round about (Stewart Street extension). Direct property or public street access is not recommended due to the relatively high volumes for a two-lane roadway. As few as 10 left turns in the peak hour at any location along Falling Run would result in level-of-service D or worse operations.

STEWART STREET EXTENSION TO WV 705

The four-lane divided parkway and roundabout intersection concept will provide very acceptable operations through the 2030 forecast period. As with other segments, a high level of access control is also recommended.

The partial cloverleaf concept (Alternative 2) provides acceptable operations. A recommended modification to the initial concept is to eliminate the free right turn from eastbound Falling Run to WV 705 and Mileground Road. The recommendation is to bring this movement to the proposed signal and allow right turns on red. Bringing the movement the signal would increase the separation to Mileground Road and improve the weaving that was problematic in the initial Alternative 2 concept.

WV 705 CONNECTOR CORRIDOR

The connector as proposed as a four-lane expressway would provide enough capacity to accommodate traffic through and beyond 2030. When combined with a continuous through connection to the Falling Run Corridor concept, a much superior corridor from CR 857 to downtown is created, relative to today. The connector would result in substantial reductions in AM, PM and off-peak through traffic on Mileground Road, which would allow it to operate much better in 2030 that it does today.

In the longer term (20 plus years) the at-grade junction with CR 857/US 119 would need to be upgraded to an interchange in order to accommodate the forecasted traffic. The at-grade concept as identified would provide reasonably adequate operations in the near term, but should not be considered a long term solution. There is a minor level of concern about the proximity of the US 119 and Mileground Road curves to the CR 857 corridor. The curves reduce the sight distance which in turn negatively impacts operations as vehicles slow for the curve. Upgrading the at-grade concept to an interchange would likely resolve the issues.

CR 857 FROM I-68 TO US 119

In the short term, few improvements to the corridor would be needed to accommodate traffic growth with or without the WV 705 Connector. The existing corridor has enough reserve capacity to accommodate approximately 70 to 80 percent of the forecasted increment of traffic. Thus, assuming a straight line growth in traffic, the current corridor would provide enough capacity for the next 15 to 20 years of growth.

In the long term, the following improvements are recommended:

- Provide an interchange/grade separated access between CR 857/WV 705 Connector/US 119.
- Expand the CR 857 corridor to six lanes with turn lanes.
- Reconstruct the I-68/CR 857 interchange to include a CR 857 to eastbound I-68 loop ramp to supplement the current ramp. Presently, left turning traffic in the PM peak hour approach 700 vehicles and this movement is forecasted to increase to 1100 in the No-build and over 1500 in the Build. It is unlikely that an alternative that does not include a supplemental ramp would provide adequate operations.