BOWLING GREEN TRANSPORTATION PLAN

Submitted to the
Kentucky Transportation Cabinet
Division of MultiModal Programs

HNTB

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EXECUTIVE SUMMARY

In July 1998, the Kentucky Transportation Cabinet (KYTC) Division of Multimodal Programs initiated a study to examine transportation conditions for the urban portion of Warren County, including the City of Bowling Green. HNTB Corporation has assisted the KYTC by updating the existing urban area transportation plan, developed in 1983, for the City of Bowling Green and surrounding portions of Warren County. The study considers transportation improvement strategies targeted for the year 2020 based upon anticipated travel demand and associated roadway deficiencies. This report details the transportation plan update process, the anticipated area-wide transportation-related needs and deficiencies, and the suggested transportation improvements that will be required to adequately address those needs and deficiencies. HNTB also updated the 1995 Travel Demand Forecasting Model (or "traffic model"), which was used in the plan update process. The model update is briefly discussed in this report, and it is discussed in more detail in the HNTB report entitled *Bowling Green/Warren County, Kentucky Travel Demand Forecasting Model* (June 2000).

The model update process included expanding the study area to include all of Warren County and updating socioeconomic forecasts used in the model. These tasks were accomplished with the assistance of the Transportation Committee, which was brought together to participate in this study. The committee consisted of HNTB engineers, local stakeholders and transportation planners with the KYTC Division of Multimodal Programs and District 3 office (located in Bowling Green) and the Barren River Area Development District (BRADD). The Transportation Committee met several times throughout the duration of the project to provide input and direction. The project culminated in a list of recommended projects that are aimed at alleviating capacity and/or safety problems, or are focused on fostering economic development in the region. The recommended projects were prioritized by the Transportation Committee based upon a weighted scale system, and cost estimates were prepared for these projects. A final traffic model was developed that incorporated these recommended projects, and its output suggests a 36% reduction in travel delay in the study target year of 2020, when compared to the "no-build" condition that includes only projects that are currently committed.

1.0 INTRODUCTION

1.1 Background

The Bowling Green Urban Study Area, prior to the recent travel demand model update, included the City of Bowling Green and urbanized portions of Warren County. The subject area was divided into 103 transportation analysis zones (TAZs).[1] During the travel demand model update, HNTB expanded the study area at the direction of KYTC to include all of Warren County for a total of 140 TAZs. This expansion was deemed necessary due to significant growth planned outside of the urban boundary. Another reason for the demand model/TAZ expansion is the underlying belief that Bowling Green may reach Metropolitan Planning Organization (MPO) status (a population of over 50,000 persons) with the results of the 2000 census. If that occurs, the County will be required to comply with the provisions of transportation planning and air-quality requirements. The updated model and the resulting transportation plan will serve as a tool for assisting the newly-formed MPO and the KYTC to address such issues in the future.

The results of this transportation plan update will provide a useful tool for the anticipated MPO and KYTC to address Federally-mandated requirements.

The urban area transportation plan prepared in the 1983 study was considered a continuation and refinement of an earlier study that was completed in 1972. The purpose of the 1983 study was to address current and future automobile travel and recommend any necessary highway improvement options. The study considered existing and projected future deficiencies in roadways, and analyzed methods to address these deficiencies. Street and intersection improvements were identified through these methods.

The last update to the prior traffic model was performed in 1995 and was based on socioeconomic data collected for that year. This study reviews the following components of that model: socioeconomic database, network coverage/coding, internal trip generation rates, external trip simulation, and model calibration. Based upon that review, any necessary revisions to the model have been incorporated. The future year for the prior Bowling Green traffic model was 2015. However, this model update considered the existing socioeconomic forecasts, revised them as necessary and then extrapolated that data to a target year of 2020. These updated data forecasts were then used to develop an updated traffic model for determining future year transportation needs and deficiencies.

1.2 Study Area

The previous transportation plan included only Bowling Green and surrounding areas. Bowling Green is the county seat of Warren County, located in southwest Kentucky on the Barren River approximately 115 miles south of Louisville, Kentucky and 60 miles north of Nashville, Tennessee. **Figure 1** shows the approximate location of the City. Interstate 65 and US 31W traveling north-south and US 68 traveling east-west provide primary access to Bowling Green. Warren County contains four incorporated cities in addition to Bowling Green,

[1] TAZs are zones of similar land use which have associated socioeconomic data that are used to develop travel demand estimates.

Bowling Green lies along I-65, approximately 115 miles south of Louisville, Kentucky and 60 miles north of Nashville, Tennessee. It is currently the fourth largest city in the state.

including Oakland, Plum Springs, Smiths Grove, and Woodburn. Bowling Green covers a land area of 29.0 square miles, corresponding to approximately 5% of Warren County's total land area of 545 square miles, yet contains just over half of the county's population.

Figure 1: Study Area

1.3 Scope of Study

The Bowling Green Transportation Plan has been prepared under the direction of Bowling Green and Warren County officials, community leaders and the KYTC Division of Multimodal Programs and District 3 staff in accordance with federal and state mandates. The plan examines development patterns in the region and their effects on the transportation system. In addition, existing transportation conditions have been analyzed in terms of both safety and operational characteristics. Following the analysis of these characteristics, the plan recommends a list of transportation projects to address existing and long-range transportation needs for Bowling Green and Warren County.

The work items accomplished under this transportation study include the following:

- Coordination with KYTC, City and County staff and public involvement
- Review of previous planning documents and committed transportation projects
- Collection of relevant data
- Analysis of existing system
- Traffic model development and calibration
- Forecasts
- Analysis of future conditions
- Development of recommended plan
- Report preparation

The KYTC Division of Multimodal Programs currently maintains the Bowling Green transportation model, and is responsible for updating the area's transportation plan development.

The first step involved in completing the Bowling Green transportation study included the collection of socioeconomic data to identify the magnitude and distribution of area population, employment, and land use. In addition, previous planning documents were reviewed to determine the existing plus committed highway network. A complete inventory of the existing street system, traffic studies, and an accident analysis were completed to develop baseline traffic flow

and accident data. Areas with high accident rates, excessive delays and perceived safety hazards were identified.

Another component of this project included the development of a Calibrated Base Year Traffic Model and a Future Year Traffic Model. To develop the future year model, land use and socioeconomic forecasts were made based upon the existing 1995 model and its 2015 data forecasts. The updated forecasts were a guide in the evaluation of system improvements targeted for year 2020. As part of the Bowling Green Transportation Plan update, the Bowling Green transportation model was extended to cover all of Warren County. It was decided that an expanded model would allow better coordination between the current urban transportation study and other planning efforts underway in Bowling Green and Warren County, including the proposed Kentucky TriModal Transpark in the northeastern portion of the county currently being considered for development.

The Future Year Traffic Model was used to help determine transportation-related needs for the area by 2020.

Once the future year model was complete, future capacity and operational deficiencies in the highway network were identified. A series of potential system improvements were then analyzed and preliminary cost estimates were developed to address those deficiencies. Projects to address safety concerns were also identified. Finally, recommendations were made for a prioritized plan.

1.4 Coordination and Public Involvement

All previous planning studies and committed projects were reviewed and relevant information was incorporated into the study, allowing for greater efficiency in performing the travel model and transportation plan update.

Review Planning Studies & Committed Projects

To initiate the project, all previous planning studies and all projects committed in the State and local transportation plans were reviewed. All relevant information was incorporated into the current study. The impact of the proposed Kentucky TriModal Transpark on socioeconomic conditions and transportation issues was incorporated into the study. The Transpark is discussed further on page 2-4.

Develop Local Interest & Structure For Local Input

Several public involvement/consensus building models were considered for use in this project, including the common “all-inclusive consensus-based approach”. Each model uses different assumptions regarding the person(s) involved in the decision making and the extent of their involvement. For this project, the “small balanced committee of representative interests” model was utilized. The coordination and public involvement plan process and purpose is described in **Figure 2**. The core group of project participants constituted the Transportation Committee and was made up of HNTB engineers, local stakeholders and transportation planners with both the KYTC District 3 office (located in Bowling Green) and the Barren River Area Development District (BRADD). The committee members, along with their affiliations, are shown in **Table 1**. The formation of this Transportation Committee established a mechanism to identify the goals and objectives for the community’s transportation plan. The core group served to identify transportation issues and priorities that Bowling Green must consider in the coming years.

Plan Process	Purpose
Introduction and Information Exchange	*Identification of project participants/formation of core group:* • KYTC District 3 • City Public Works Dept. • County Public Works Dept. • Planning Commission • BRADD • Western Kentucky University • Intermodal Transit Authority • Chamber of Commerce • Citizen, neighborhood advocacy group
Identification of Issues And Concerns	*Examination of community transportation issues:* • On-going or recently completed projects • State's committed (funded) and future planned (non-funded) projects • Local projects • Discussion of model update and preliminary results (Year 2020) • Land use, economic development and transportation conditions • Congestion, safety and other transportation concerns
Discussion of Issues and Development of Options	*Development of general purpose and need for improvements:* • Analysis/discussion of the issues • Development of a full range of transportation improvement options for the City of Bowling Green
Analysis and Evaluation of Solutions	*Identification of viable alternatives:* • Determination of impacts • Evaluation of alternatives • Cost Analysis
Recommendations	*Development of a recommended transportation plan.*

Figure 2: Coordination and Public Involvement Plan Process and Purpose

Table 1: Transportation Committee Members

NAME	AFFILIATION
Alice Burks / Danny Whittle	City-County Planning Commission
Dan Cherry	Intermodal Transit Authority
Ed Dyer	Warren County Road Department
Karen Foley	City of Bowling Green – Neighborhood Action Program
Bill Hays / Amy Liu	City of Bowling Green – Public Works
Barry House	KYTC Multimodal Programs
Keirsten Jaggers	BRADD
Martin Jones	Bowling Green Area Chamber of Commerce
Jeff Moore	KYTC District 3 - Planning
Dr. Gary Ransdell	Western Kentucky University

The Transportation Committee served to provide key input into the future transportation needs of Bowling Green and Warren County.

Identify Significant Issues And Corridors/Sites

A list of transportation issues and facility concerns that the Transportation Committee identified from public input, organizational interests, and personal knowledge was developed. HNTB engineers visited these identified corridors, along with facilities projecting 2020 level of service problems and intersections with high accident rates. Highway improvements were proposed to address the deficiencies with existing facilities.

Develop Consensus On Recommendations And Plan

A list of recommended improvements based on the Transportation Committee's input, modeling results, and field inspections for the study area were presented during a series of three meetings. Comments received at these meetings were incorporated into the development of a final list of prioritized improvement projects. Consensus was achieved based on an evaluation system that used weighted guiding principals that were agreed upon by the Transportation Committee and KYTC. These principals included capacity and level of service provided by the system, safety considerations and economic development opportunities for the Bowling Green area.

2.0 ANALYSIS OF EXISTING SYSTEM

2.1 Street System Inventory

Roadway functional classification defines a hierarchy in which streets and highways are grouped according to the services they are intended to provide. The classification of streets and highways in such a hierarchy is an important part of land use/transportation analysis model development. A functionally classified system usually includes a standard set of classifications, with subclasses built beneath each primary category. The higher classified roadways generally serve longer average trip lengths. The more common classifications are:

Functional classifications for Warren County roadways were determined using existing KYTC and Bowling Green classifications.

- Interstate / Expressway - An expressway with fully controlled access.
- Principal Arterial - Serves major activity centers and carries the most intra-city traffic and a majority of through traffic.
- Minor Arterial - Interconnects with the principal arterial system and provides somewhat lower levels of travel mobility and local trip service.
- Collector - Collects and distributes traffic to and from the higher function arterial highways and streets.
- Local Streets - Offers the lowest level of mobility but highest level of land accessibility. Local streets comprise the remaining facilities not included on one of the higher systems.

Functional classification data from KYTC and a functional classification map from the City of Bowling Green were used in considering the existing functions of the streets. KYTC classifications took precedence for state-maintained highways and City classifications took priority for all other facilities when classifications varied between the sources. **Page A-1** of the Appendix shows the functional classifications of the facilities in Bowling Green.

2.2 Accident Data

Traffic accident data was obtained from KYTC District 3. This data used critical accident rates that were previously calculated for functionally similar roadways to determine critical rate factors (CRF). A roadway segment with a CRF over 1.0 indicates that the accident rate along that segment is statistically higher than the statewide average for functionally similar facilities. Each location in the Warren County area with a critical rate factor greater than 1.0 is shown on **Page A-2** of the Appendix. It should be noted that the points found on that exhibit represent tenth-of-a-mile (0.10) sections of roadway. Locations with safety-related deficiencies were identified so that improvement plans could be considered.

2.3 Traffic Volume Data

The KYTC provided base year traffic volumes for state-maintained roads, and the City of Bowling Green and Warren County staffs provided traffic data for local roads.

Locations where count data was necessary for planning and modeling were identified through coordination with KYTC Division of Multimodal Programs, Barren River Area Development District, City of Bowling Green, and Warren County officials. The Cabinet provided all necessary volume data for state roads in the model area. HNTB worked directly with City and County staff to acquire count information on non-state roads. Traffic volume data collection was not conducted as part of this study.

2.4 Projects from Previous Study

Any planned projects included in the Six Year Plan are considered to be "committed" and thus preclude the need to be identified as additional projects.

The 1983 Bowling Green Urban Area Transportation Study provided the basis for addressing the future transportation-related needs of the region. The process used to develop the long-range plan included the determination of future travel demand that was anticipated to be placed on the system, the identification of potential problems which the demand would cause, and the development of a plan for improvements which would alleviate those problems. The findings from the plan translated into a list of highway improvement projects, which were divided into two categories: projects with committed funding in the KYTC Six-Year Plan or KYTC Long-Range Plan and projects placed on the Unscheduled Needs List. These planned projects are indicated on an area map on **Page A-3** of the Appendix.

The following projects were previously in the FY 1999-FY 2004 KYTC Six-Year Plan or are currently in the FY 2000-FY 2006 plan:

- **KY 234 (Cemetery Rd.):** widen to 5-lanes from Collett Lane to I-65 including an interchange
- **US 31W (Nashville Rd.):**

  1) major widening from Campbell Lane to Natcher Parkway;

  2) add left turn lanes at KY 242 approaches;

  3) major widening from Natcher Parkway to Dillard Road (Industrial Park)
- **US 231 (Scottsville Rd.):**

  1) widen from 0.1 mile SE of Cumberland Trace to 0.3 mile NW of Dye Ford Road;

  2) major widening/relocation from Old Scottsville Road to Warren / Allen County Line
- **Natcher Parkway:** extend Natcher Parkway from I-65 to US 231 at Dye Ford Road
- **KY 1435 (Barren River Rd.):** reconstruction from Dedman Road to 2 miles northwest
- **KY 880 (Lovers Lane):** major widening from US 231 to KY 234
- **KY 880 (Veterans Memorial Boulevard/Bowling Green Bypass):** extend from KY 185 to 7th and College Street intersection
- **KY 2158 (Cumberland Trace):** major widening from US 231 to US 234
- **US 31W Bypass:**
  1) reconstruct intersection of US 31W Bypass and Lehman Avenue;
  2) reconstruct from Lain Avenue to Cemetery Road to provide left turn lanes
- **KY 622:** roadway improvements from US 231 to Plano - Richpond Road

- **KY 234/KY 185:** reconstruction of the 6th and 7th Street one-way couplets
- **I-65:** widen from Sims Road to Warren / Edmonson County line
- **US 68 (Russellville Road):** add left turn lanes at intersection with Old Morgantown Road and Dogwood Avenue
- **KY 101:** reconstruct from Smiths Grove north to US 31W; may be redefined to bypass Smiths Grove and tie into existing KY 101 near the interchange with I-65
- **KY 185:** reconstruct from KY 263 to Warren / Butler County line

The following projects are currently on the Unscheduled Needs List:

- **US 231 (Morgantown Rd.):** widen/improve from Old Morgantown Road to Natcher Parkway
- **New Route:** outer loop south from US 231 to I-65
- **New Route:** outer loop north from I-65 to Natcher Parkway
- **US 231 (Scottsville Rd.):** widen from I-65 to US 31W
- **KY 234:** widen from Drakes Creek to Allen County Line
- **I-65:** construction of new interchange at KY 240
- **US 31W:** widening from US 231 to KY 880
- **KY 880:** widening from US 68 to KY 1435
- **US 68:** reconstruction at CSX Railroad underpass
- **KY 884 (Three Springs Rd.):** widen from US 231 to Natcher Parkway

Additional Warren County and Bowling Green projects will impact the transportation network and thus were considered in this plan update.

2.5 Other Projects

Other relevant projects recently implemented by the Bowling Green community on the local level are as follows:

- **University Boulevard**

  Western Kentucky University had proposed converting this facility to one-way operation for safety and other transportation related reasons. However, the plan had received an overwhelming amount of negative criticism due to its impact on the surrounding neighborhoods and businesses. The staff of KYTC District 3 prepared a compromise strategy, which offered an operational solution for pedestrian safety. This strategy appeared to have the local support and was implemented. It channelized pedestrian traffic to two specific and much safer points, and incorporated numerous improvements at the intersection of University Boulevard and Big Red Way/Russellville Road. The entire project was completed in April 2000.

- **Green Belt System Master Plan**

  This on-going project was commissioned by the City of Bowling Green two years ago. It is a City and County initiative that promotes the concept of greenways, trails and pedestrian facilities, which provide recreational opportunities and means for alternative transportation. The Green Belt System Master Plan will total over 450 miles of trails in Bowling Green and Warren County. These trails are divided into approximately 58 miles of pedestrian walkways, 45 miles of vehicular/pedestrian/bicycle routes, 117 miles of multi-use independent trails, 166 miles of bicycle routes, and 78 miles of scenic drives.

The Green Belt System Master Plan calls for over 450 miles of multi-use trails and numerous greenways in Warren County.

- **Riverfront Development Master Plan**

  Due to the revitalized interest in the downtown area and Fountain Square, significant attention has been placed on the Barren River area of downtown in envisioning the future of Bowling Green. The City of Bowling Green contracted with a consultant in May 1999 to study the development potential in the riverfront area. Their study attempts to reach a consensus between community members in deciding the future of the Bowling Green Downtown Riverfront District. The Riverfront Development Master Plan includes plans for an outdoor recreational area, festival grounds, and a heritage trail in the area. The development of this area is expected to provide a central link to the Riverfront area and create recreational, educational, and private development opportunities for residents and visitors. Several initial sections of the Green Belt System Master Plan are being incorporated into this project.

- **US 68 – US 31W Connector**

  Work on the US 68-US 31W (Southwest Parkway) connector, commissioned by the City, will have a significant impact on future transportation in and around Bowling Green. The need for this roadway has arisen from the City's awareness of the potential influx of numerous large-scale residential developments in the area and the subsequent need for an improved collection system to provide access to US 31W and US 68. The US 68-US 31W connector is currently in the planning stage of development.

- **Kentucky TriModal Transpark**

  The Kentucky TriModal Transpark will combine a network of transportation modes (rail, highway, and air) to transport freight and people. The TriModal Transpark, a regional economic development center located in south central Kentucky, is anticipated to begin construction in 2001 and be operational by 2005. It will occupy 3,800 acres, including aviation, industrial, commercial, and residential uses. The Kentucky TriModal Transpark is being planned, designed, and constructed by the Inter-Modal Transportation Authority, Inc. (ITA), which was created for this sole purpose. ITA has planned the construction of the Transpark in traffic analysis zones 119 and 121. These zones are shown in **Figure 3**. There are no specific site plans prepared for the facility at this time. ITA, however, as part of the planning process, has

The proposed Kentucky TriModal Transpark will include a combination of aviation, industrial, commercial and residential land uses in its 3,800 acres.

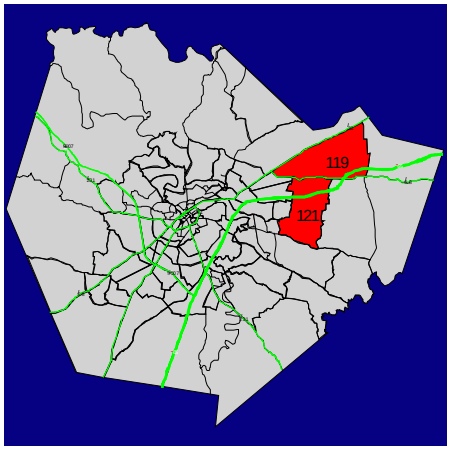


Figure 3: Traffic Analysis Zones 119 and 121

The TriModal Transpark will be located in TAZ zones 119 and 121 east of Bowling Green.

suggested that the proposed air facility will occupy most of zone 119, while related industrial uses and residential areas will occupy zone 121. Light industrial and commercial uses will reside on both sides of the proposed Transpark Connector located between Interstate 65 and US 68. It is projected that traffic analysis zones 119 and 121 will experience significant growth in response to the proposed Kentucky TriModal Transpark. **Table 2** shows the distribution of land uses by corresponding TAZ.

Table 2: Kentucky TriModal Transpark Distribution of Use by TAZ

	TAZ 119	TAZ 121
Aviation and related industrial	1,500 acres	
Industrial/Commercial Park	1,000 acres	1,300 acres

2.6 Identification of Transportation Facilities Having Safety Concerns

Accident data received from KYTC District 3 was compiled to identify high accident locations. Graphs and tables indicating high accident rates and Average Daily Traffic (ADT) were prepared. Through meetings with Transportation Committee members, broad-based community input was also obtained to determine locations with perceived and/or real safety concerns.

HNTB engineers made several visits to these sites to observe existing facility conditions, traffic signalization, and safety issues. While not part of the project scope, this process allowed the Transportation Committee to identify problematic locations and consider recommendations for improvement options. Such recommendations were suggested for intersections with high volumes, lack of good access management practices, inadequate turn lanes, and safety concerns. Particular attention was given to US 31W Bypass, which has the highest concentration of critical rate factors over 1.0 in the network.

The US 31W Bypass, with its limited degree of access management, has a higher number of locations with high accident rates than any other route in Warren County.

The US 31W Bypass is a principal arterial with two lanes in each direction and a speed limit of 35 mph. The 1995 ADT for the bypass ranged from 17,800 to 25,700 vehicles per day. There are some instances of good access management, but overall the intensity of development limits the implementation of effective access control. Nearly all adjacent land is developed in fragmented parcels, resulting in an excessive number of driveways that contribute to conflicts in traffic when motorists enter/exit these drives. A high number of accidents in this corridor can be associated with these types of conflicts. As such, US 31W Bypass has two high accident rate locations (CRF greater than 5.0). These locations are near the intersections of the US 31W Bypass with Lehman Avenue and KY 234 (Fairview Avenue).

3.0 TRAVEL DEMAND FORECASTING MODEL

3.1 Socioeconomic Data

A number of factors affect the travel frequency and destination choice of drivers, including such factors as land use development patterns, perceived travel costs, mode availability and trip purpose. Socioeconomic data have proven to be invaluable tools for estimating the travel behavior of the driving public. The 1995 travel demand model served as the foundation for this model update. Existing socioeconomic data and land use information were updated to reflect present and future growth patterns Warren County.

Estimates of present and future trips are based on socioeconomic data and land use information.

Ideally, surveys are made at many points in the modeling process to establish the relationship between input variables and model-estimated variables. Because data collection is costly and time consuming, surveys are conducted rather infrequently, and travel data collected during previous transportation study updates is carried forward to the new base year. Normally, this does not create a model reliability problem since most underlying model relationships have been found to be relatively stable over time. Therefore, the socioeconomic data found in the 1995 travel demand model was carried forward through the update process, negating the need for a lengthy, expensive data collection effort.

However, model estimates still need to be verified against independent data for the calibration of existing year conditions. For most metropolitan areas, the decennial Census provides the demographic/economic benchmark by which the socioeconomic estimates and forecasts are based. Census data (by census tract) provided the socioeconomic base for the Warren County 1995 population estimates. Other transportation-related socioeconomic data required for the Warren County trip generation model include the following items:

- Population
- Dwelling units
- Industrial employment
- Commercial employment
- Public employment
- Total employment

As is the case for most metropolitan areas, census data provides the base for Warren County population estimates.

As part of the Bowling Green Transportation Plan update process, the City-County Planning Commission staff reviewed the existing model's base year socioeconomic data for each TAZ, including population, dwelling unit, and employment totals. Following that review, the City-County Planning Commission staff revised the TAZ-level 1995 socioeconomic data estimates and forecasts for each of the 103 TAZs (prior to expansion) in the model based on updated population estimates and projections received from the Kentucky State Data Center at the University of Louisville.

Originally, the traffic analysis zones that were studied included only the Bowling Green urbanized area, or Zones 1-103. As part of the Bowling Green Transportation Study update, the existing transportation model was extended to cover all of Warren County. It was felt that an extended model would better

To include the portions of Warren County outside the Bowling Green urbanized area, an additional 27 TAZs were added to the existing 103.

enable coordination between the current urban transportation study and other study efforts underway in Bowling Green and Warren County, including the proposed Kentucky TriModal Transpark Facility Study. Another consideration in the decision to expand the model was that Bowling Green might achieve "metropolitan area" status after the 2000 Census. If that happens, the area will likely be required to address transportation plan/air quality conformity issues. A countywide traffic model would help the KYTC and the new MPO to address and deal with such potential transportation and air quality issues.

Ultimately, it was decided the benefits of having a countywide model that would address the intermodal facility issues and future air quality issues outweighed the additional time necessary to complete the current transportation study and update the model. For the expanded model, a revised zone structure was created and an extended roadway network was developed to serve the additional zones. In addition, new socioeconomic data was added in the expanded area, external stations were redefined and the external-to-external trip table was recalculated.

The new study area includes 27 new TAZs, designated as zones 104-130, as determined in a joint effort by KYTC staff, Bowling Green City-County Planning Commission staff, and other Transportation Committee members. In addition to the new zones, minor changes were made to some of the traffic zones from the existing model as a result of the Kentucky Transportation Cabinet's preparation for the 2000 Census.

For the TAZs added during the Warren County model expansion, the Warren County census tract population estimates provided by the City-County Planning Commission were used as a base. The tracts in the outlying area included some TAZs already included the base model. Prior to distributing the tract population to the new zones, those totals were removed from the outer area census tract totals to avoid any double counting.

The remainder of the outer area tract population was allocated to the new TAZs based on each TAZ's development characteristics. This allocation was reviewed by City-County Planning Commission staff. After a consensus was reached regarding the population allocations, a "persons-per-dwelling-unit" factor was applied to each TAZ to estimate the number of dwelling units located in each zone.

For the base year employment estimates for the new zones, City-County Planning Commission staff conducted windshield surveys, as well as reviewed local employment base data sources (such as the State's manufacturing data book), to identify the location of all major workplaces in the outlying county area.

After the employment locations in each TAZ were identified, employment estimates for each site were made. These estimates were made based on the type of workplace found and were completed in a manner which maintained an overall county labor participation ratio (total employment divided by total population) equivalent to the existing overall county ratio. Based on information collected

from the developers of the Transpark, projections were also made for employment in zones 119 and 121.

All 130 TAZs and the increase in population and employment estimates from 1995 to 2020 in each are shown on **Page A-4** of the Appendix. **Table 3** presents the descriptive statistics relative to the differences in the 1995 and 2020 socioeconomic estimates. **Tables 4 and 5** show the population and employment estimates for each TAZ for 1995 and 2020, respectively.

Table 3: Socioeconomic Data Descriptive Statistics

Statistic	Population		Employment	
Total	**1995**	**2020**	**1995**	**2020**
	82,579	112,102	39,889	73,677
Percent Difference*	35.8%		84.7%	
Average Difference*	227		260	
Maximum Difference*	5,495 (zone 25)		9,099 (zone 121)	
Minimum Difference*	-90 (zone 15)		0 (24 zones)	
Standard Deviation of Difference*	545		1,110	

*Note: “Difference” equals 2020 minus (-) 1995 values.

As is evident in the exhibit, the greatest increases in population and employment are found in the TAZs east and south of Bowling Green. Areas with the greatest negative population growth include zone 15 (-90 persons) and zone 4 (-57 persons), both of which are found in the city center. The highest levels of population growth are found in zone 70 (1,473 persons) and zone 25 (5,495 persons), both of which are south of the downtown area. In addition, the greatest increases in employment are expected outside the existing urban boundary to the east in zone 119 (7,366 jobs) and zone 121 (9,099 jobs). These increases reflect the growth that is anticipated as a result of the TriModal Transpark, which will include land in both zones. The consideration of where growth is occurring suggests that urban sprawl is affecting areas outside the city center, and that a relatively small amount of redevelopment in the central business district (CBD) is anticipated.

The new population totals for the existing model area are very similar to the totals that were already being used. However, there is some zone-by-zone variation when the revised database was compared to the original database. The maximum variation found was approximately 33 percent with an average difference of 15 percent.

Table 4: 1995 Socioeconomic Data

Zone	Pop.	Employ.
1	57	507
2	297	278
3	73	1,289
4	778	180
5	74	189
6	180	233
7	416	1,529
8	426	2,050
9	260	1,351
10	94	407
11	778	409
12	778	543
13	475	24
14	917	136
15	1,766	183
16	562	146
17	624	1,502
18	299	165
19	878	127
20	12	299
21	517	389
22	1,533	134
23	347	87
24	701	500
25	3,353	697
26	715	347
27	802	377
28	1,335	2,775
29	202	65
30	497	7
31	1,430	408
32	386	140
33	291	80
34	479	2,148
35	1,260	230
36	124	539
37	3,158	1,351
38	1,172	274
39	1,068	37
40	230	159
41	1,032	24
42	672	22
43	606	244
44	142	2
45	286	0
46	94	33
47	189	39
48	139	823
49	1,066	36
50	80	1,354
51	3	288
52	478	224
53	343	12
54	104	0
55	57	4
56	92	0
57	143	37
58	516	3
59	433	38
60	76	1,087
61	901	1,041
62	1,072	285
63	141	63
64	482	573
65	229	75
66	534	10
67	204	588
68	775	710
69	24	2
70	1,684	82
71	2,384	341
72	1,843	2,297
73	2,288	74
74	1,005	1,740
75	38	304
76	33	1,087
77	147	374
78	107	44
79	272	466
80	452	1,343
81	377	3
82	819	88
83	177	0
84	23	9
85	894	99
86	545	27
87	813	20
88	1,119	270
89	116	32
90	238	28
91	193	0
92	292	2
93	167	583
94	201	1
95	158	8
96	26	2
97	493	12
98	627	6
99	107	1
100	420	50
101	916	47
102	109	24
103	154	0
104	1,840	0
105	920	0
106	460	35
107	690	10
108	690	10
109	751	0
110	1,002	0
111	751	0
112	751	10
113	501	0
114	501	0
115	751	50
116	1,608	20
117	804	0
118	1,608	0
119	900	130
120	1,350	92
121	675	0
122	675	85
123	450	0
124	473	5
125	473	0
126	496	5
127	496	0
128	1,239	0
129	1,239	10
130	991	55
Total	**82,579**	**39,889**

Table 5: 2020 Socioeconomic Data

Zone	Pop.	Employ.
1	53	561
2	295	299
3	68	1,373
4	721	199
5	73	212
6	179	249
7	414	1,628
8	424	2,824
9	251	1,438
10	91	433
11	750	436
12	900	578
13	440	27
14	1,019	172
15	1,676	197
16	533	155
17	621	1,600
18	298	176
19	873	135
20	14	445
21	610	443
22	2,393	142
23	395	93
24	797	554
25	8,848	5,463
26	813	369
27	1,034	418
28	1,822	3,232
29	400	117
30	550	12
31	1,440	434
32	389	149
33	280	85
34	702	2,719
35	1,360	284
36	208	796
37	4,507	1,567
38	1,335	292
39	1,012	39
40	217	185
41	977	37
42	636	23
43	724	276
44	182	2
45	366	0
46	112	41
47	234	49
48	164	1,059
49	1,510	70
50	94	1,891
51	21	669
52	802	276
53	350	329
54	350	0
55	528	110
56	352	0
57	400	45
58	950	4
59	890	240
60	229	1,158
61	1,092	1,284
62	1,265	351
63	299	96
64	821	802
65	379	158
66	884	84
67	338	902
68	1,283	892
69	40	53
70	3,157	101
71	3,481	465
72	2,386	2,893
73	3,088	226
74	1,118	2,014
75	42	400
76	37	1,340
77	163	599
78	177	46
79	400	746
80	1,077	3,420
81	801	6
82	1,628	105
83	353	0
84	192	448
85	1,891	209
86	1,122	682
87	1,795	30
88	1,494	337
89	92	47
90	192	35
91	152	0
92	306	5
93	158	658
94	168	1
95	134	8
96	24	2
97	662	15
98	660	6
99	196	2
100	435	74
101	1,223	205
102	132	34
103	216	0
104	2,508	0
105	1,254	0
106	627	44
107	941	13
108	941	13
109	761	0
110	1,015	0
111	761	0
112	761	13
113	507	0
114	507	0
115	761	63
116	2,160	25
117	1,080	0
118	2,160	0
119	937	7,496
120	1,405	117
121	702	9,099
122	702	109
123	468	0
124	556	6
125	556	0
126	645	6
127	645	0
128	1,611	0
129	1,611	13
130	1,289	70
Total	**112,102**	**73,677**

3.2 Traffic Model Development and Calibration

A transportation model provides planners with a robust tool that can be used to quantify/evaluate developmental impacts and strategies focused on alleviating system deficiencies.

Essentially, a travel demand model consists of a set of computerized procedures used to systematically predict travel behavior in response to changing land development patterns, transportation systems and demographics. MINUTP, a travel demand forecasting software package, provides the framework for performing most of the computer processing involved with the Bowling Green transportation model. MINUTP has numerous options that enable planners to develop and adapt a model to their community-specific conditions.

Increasing demands have been placed upon land use/transportation models over the past several years. Part of the increased demand is the result of air quality and congestion management legislation that mandates transportation model analyses. With this increased focus, it must be kept in mind that transportation models are tools, which, based on their underlying assumptions, provide limited insight into the future. The main advantage of having a transportation system model in place is that it provides a systematic analysis process by which alternatives can be evaluated in an unbiased, comparative manner.

The Bowling Green area travel forecasting model was updated and used in conjunction with revised Warren County socioeconomic data provided by the City-County Planning Commission to replicate base year (1995) travel patterns. The base model's output traffic volumes were extensively compared to existing traffic volume count data to ascertain the capability of the model to replicate 1995 travel conditions. The conclusions drawn from this analysis and the implications for future travel forecasting activities are as follows:

- The Bowling Green Transportation Study's travel demand model, when used in conjunction with the 1995 socioeconomic variables, is capable of successfully simulating current area-wide travel patterns. There is small, localized variation found in the model; however, these variations are not significant.

The updated travel demand model successfully replicates existing travel patterns.

- An initial comparison of trips generated and distributed over a number of cutlines shows the region's travel flows are replicated across the cutlines. The total number of vehicle trips assigned to the network at each cutline were compared to existing volume counts to determine if the trips assignment was reasonable. It was found that the model had a tendency to overestimate the number of internal trips. Therefore, these trips were adjusted accordingly.
- The model roadway network now includes a functional classification attribute in the base-year data set. This attribute was used extensively during the model validation process.
- The model now extends across the entire Warren County area, and is available for conducting countywide impact analysis. This includes the impacts of the new Kentucky TriModal Transpark currently being considered for northeast Warren County near the community of Oakland.

- Statistical validation analysis, along with considerable link-by-link visual inspection, provided sufficient information that the model is replicating existing conditions and can confidently be used for forecasting future traffic volumes generated by changes in area population, employment and land development.

3.3 Traffic Model Results

The analysis of future year conditions using the traffic model considered present transportation systems and forecasted socioeconomic conditions, including population and employment growth, as well as the impacts of the proposed TriModal Transpark discussed earlier. These model results produced system deficiencies in terms of volume-to-capacity (v/c) ratios. A qualitative measure of these conditions is described through Levels of Service (LOS). The LOS varies from A to F, with A representing the most ideal traffic scenario and F representing a breakdown in traffic conditions. Level of Service D represents typical urban conditions with moderate levels of congestion. According to the *Highway Capacity Manual*, a v/c ratio of 1.0 is equivalent to a LOS D. The values used for the modeling process are shown in **Table 6**.

A v/c ratio that exceeds 1.0 indicates that the traffic volume exceeds the roadway's capacity.

Table 6: V/C Ratio Values Used for Levels of Service

Level of Service	Volume/Capacity Ratio
LOS A-C	less than 0.95
LOS D	0.95 – 1.05
LOS E	1.05 – 1.40
LOS F	1.40 and greater

The model developed to identify future (2020) capacity concerns considered the following elements:

- Capacity of the transportation system
- Projected volumes based on socioeconomic data
- Local projects having significant impact on the future transportation system
- Input from local agencies and the Transportation Committee

The projected 2020 traffic volumes for all major state-maintained and locally maintained roads in Bowling Green (as well as the base year 1995 volumes)

A level of service (LOS) of D or lower is considered to reflect a system deficiency and need for improvement.

developed by the model are shown on **Page A-5** of the Appendix. With respect to capacity of the system and the projected volumes, a LOS of D or lower is considered to be indicative of a system deficiency. Thus, a do-nothing alternative was recommended until the v/c ratio reached a value of 0.95.[1] The results of this model run and the resulting 2020 system deficiencies are shown in **Table 7** and also highlighted on **Page A-6** of the Appendix.

[1] As volumes approach or exceed the capacity of the roadway (indicating that the v/c ratio exceeds 1.0), operational conditions degrade dramatically.

Table 7: Deficient Roadways According to 2020 Levels of Service

Roadway	Limits	2020 LOS
13th Avenue	Chestnut St. to State St.	D
US 68 (Adams Street)	13th Ave. to 12th Ave.	D
Cabell Drive	US 31W Bypass to Park St.	D
Cave Mill Road	Smallhouse Rd. to US 231 (Scottsville Rd.)	E
Chestnut Street	Cabell Dr. to 13th Avenue	E
Covington Street	US 231 (Scottsville Rd.) to Lehman Ave.	E
I-65	Simpson County Line to KY 101	D-F
KY 185	Double Springs Rd. to KY 880 (Veterans Memorial Ln.)	D
KY 234 (Cemetery Rd)	US 31W Bypass to I-65	D-F
KY 446	US 31W/US 68 (Louisville Road) to I-65	E/F
US 231/KY 880 (Campbell Ln.)	US 31W (Nashville Rd.) to Smallhouse Rd.	D
US 231/KY 880 (Veterans Memorial Blvd.)	US 68 (Russellville Rd.) to Old Barren River Rd.	D/E
KY 884	Spring Hollow Ave. to US 231 (Scottsville Rd.)	E
Lehman Avenue	US 31W Bypass to Covington St.	E
Main Avenue	US 31W/US 68 (Kentucky Street) to State St.	E
US 231/US 231 Business (Morgantown Road)	Hammett-Hill Rd. to Old Morgantown Rd.	D-F
US 231 (Morgantown Road)	At US 68 (Russellville Rd.)	D
Mt. Olivet Road	At Plum Springs Road	D
KY 3225 (Old Louisville Road)	US 31W Bypass to Old Louisville Rd.	D
Old Morgantown Road	Morgantown Rd. to University Dr.	D/E
KY 2629 (Old Scottsville Road)	KY 2185 (Cumberland Trace) to Blue Springs Dr.	E
Smallhouse Road	Cave Mill Rd. to US 231 (Scottsville Rd.)	D-F
State Street	13th Ave. to 8th Ave.	E
US 231 (Scottsville Road)	Ashley Circle to Cumberland Trace	D-F
US 31W (Nashville Road)	Memphis Junction to University Dr.	D/E
US 31W Bypass	Lehman Ave. to KY 234 (Fairview Ave.)	D
US 31W/US 68 (Kentucky Street)	14th Ave. to Main Ave.	D
US 31W/US 68 (Louisville Road)	US 31W Bypass to Porter Pike	D/E
US 68 (Glasgow Rd.)	Transpark Connector to Carl Jordan Rd.	E
US 68 (Russellville Road)	Blue Level Rd. to University Dr.	D-F
Westen Street	KY 880 (Campbell Ln.) to US 231 (Scottsville Rd.)	D-F

4.0 LONG RANGE PLAN DEVELOPMENT

4.1 Target Year Deficiency Analysis

Roadways with capacity deficiencies were identified through analysis of predicted roadway congestion using the 2020 base condition model network. Model results were provided in graphic form to KYTC, City of Bowling Green and Warren County staffs. HNTB presented the model results to the Transportation Committee, including estimated traffic volumes and levels of service, for purposes of developing project improvement alternative scenarios.

Areas with excessive delays, congestion, and other transportation deficiencies were identified based on Levels of Service, critical accident rates, and input from Transportation Committee meetings. The nature and likely causes of these problems were determined through field reconnaissance, and improvement alternatives were developed to address the identified problems. Descriptions of each facility with identified problems and an explanation of recommended improvements are shown on pages 4-1 through 4-20.

FACILITY	13TH AVENUE
LIMITS	Chestnut Street to State Street
BACKGROUND	13th Avenue is one lane in each direction. It is located in an urban setting, running through part of Western Kentucky University's campus. The facility is congested. The surrounding area is used primarily for student housing. Curb and gutter sections and sidewalks line both sides of 13th Avenue. The projected 2020 LOS is D.
RECOMMENDATIONS	Since this corridor is in a built-up section of Bowling Green, there exists little opportunity for meaningful roadway improvement. However, since there is no anticipated growth in this area and any newly designed roadway would likely be designed with a goal LOS of D, the recommendation is to do nothing at this time.

FACILITY — ADAMS STREET

LIMITS — 13th Avenue to 12th Avenue

BACKGROUND

Adams Street is a one-way principal arterial that travels west towards town. Adams Street (westbound) and Kentucky Street (eastbound) serve as a one-way couple for US 68 from Seventh Avenue to just west of Fifteenth Avenue. A channelized island is located where the road separates into a one-way pair at Seventh Avenue. The island provides an ideal opportunity for the gateway to downtown as well as Western Kentucky University. Sidewalks or pedestrian facilities lie on both sides. The surrounding land uses include commercial and industrial. It has some access management issues, with undefined driveways too close to the intersections. A traffic signal exists at 12th Avenue. Adams Street is still designated as US 31W/US 68 (Louisville Road) through downtown, and eventually leads to Old Morgantown Road. Adams Street terminates at Western Kentucky University and becomes US 68/KY 80 (University Boulevard) at Old Morgantown Road. The projected 2020 LOS is D.

RECOMMENDATIONS — Study and improve signal coordination if necessary.

FACILITY — CABELL DRIVE

LIMITS — US 31W Bypass to Park Street

BACKGROUND — Cabell Drive is a two-lane facility in the downtown district. It has curb and gutter sections with sidewalks. It has primarily college-related uses. A traffic signal is located at the US 31W Bypass. The projected 2020 LOS is D.

RECOMMENDATIONS — Since this corridor is in a built-up section of Bowling Green, there exists little opportunity for meaningful roadway improvement. However, since there is no anticipated growth in this area and any newly designed roadway would likely be designed with a goal LOS of D, the recommendation is to do nothing at this time.

FACILITY

CAVE MILL ROAD

LIMITS

Smallhouse Road to US 231 (Scottsville Road)

BACKGROUND

Cave Mill Road begins in the west at its intersection with US 31W (Nashville Road) and across from Dishman Lane, which is a recently-constructed three-lane facility with shoulders and wider pavement sections, including left turn bays at major cross streets. It terminates on the east at US 231 (Scottsville Road) and across from Shive Lane, a three-lane facility. Cave Mill Road has two narrow lanes with no shoulders, and widens to four lanes at the approach to Scottsville Road. The roadway travels through residential areas, with a mall located off of the facility. The 2020 projected Level of Service on Cave Mill Road is E at the intersection with South Smallhouse Road and approximately one mile west of Scottsville Road.

RECOMMENDATIONS

Widen to a three-lane section for the entire route. Increase the number of lanes near Scottsville Road, and smooth the curve just west of Scottsville Road. Studies should be made to determine if signalization is warranted at the intersection with Smallhouse Road.

FACILITY

COVINGTON STREET

LIMITS

At US 231 (Scottsville Road)

BACKGROUND

The intersection of Covington Street and US 231 (Scottsville Road) has an odd skew. The projected 2020 LOS for Covington Street is E.

RECOMMENDATIONS

Intersection improvement at Scottsville Road are recommended. A right turning lane from Covington Street is recommended to facilitate traffic flow and motorist safety.

FACILITY

CHESTNUT STREET

LIMITS

Cabell Drive to 13th Avenue

BACKGROUND

Chestnut Street is a collector street located in an urban setting with one lane in each direction. Surrounding uses are primarily residential for college students, including fraternity and sorority housing. Chestnut Street lies in the "College Hill Historic District." Sidewalks are located on both sides of the roadway. Intersections are properly marked for additional right-turn lanes. There is little room available for widening or improvements. Some segments of sidewalk and other encroachments within the right of way are such that they create changes in horizontal alignment of the road, reducing or calming traffic conditions. The projected 2020 LOS is E.

RECOMMENDATIONS

Since this corridor is in a built-up section of Bowling Green, there exists little opportunity for meaningful roadway improvement. The recommendation is to do nothing at this time.

FACILITY

KY 185 (KY 185/ Gordon Avenue)

LIMITS

Double Springs Road to KY 880 (Veterans Memorial Boulevard)

BACKGROUND

KY 185 is a relatively new facility with adequate shoulders. It is classified as a minor arterial from its beginning at US 68 to just north of Bowling Green at Garvin Lane. At that point, it becomes a collector. During field observation of KY 185, the roadway was busy with traveling motorists. It has a projected LOS of D in 2020.

RECOMMENDATIONS

The section of KY 185 near Veterans Memorial Boulevard should be treated as a separate study for an intersection improvement. Details concerning lanes and turning counts should be collected and analyzed.

FACILITY

KY 234 (Cemetery Road)

LIMITS

US 31W Bypass to I-65

BACKGROUND

KY 234 (Cemetery Road) is a minor arterial with heavy traffic. Adjacent land uses are primarily residential with scattered commercial parcels. Cemetery Road is a two-lane roadway from I-65 to just east of Ironwood Drive, at which point it becomes a four-lane facility.

RECOMMENDATIONS

An intersection study should be conducted for the intersection with the US 31W Bypass. In particular, the potential need for double left-turn lanes and signal timing enhancements should be considered. The remainder of this section of Cemetery Road is in the KYTC Six Year Plan for reconstruction and widening. In addition, a new interchange with I-65 is currently under construction.

FACILITY

KY 446 (CORVETTE DRIVE)

LIMITS

US 31W Interchange to I-65 Interchange

BACKGROUND

KY 446 (Corvette Drive) is a relatively new four-lane principal arterial with adequate paved shoulders. It provides access from the industrial facilities off of US 31W to I-65. Corvette Drive is unique in that it begins at its interchange with US 31W and ends at its interchange with I-65, just over a mile to the east. The roadway has a projected 2020 LOS F from I-65 to its intersection with Hennessy Parkway and LOS F from Hennessy Parkway to US 31W.

RECOMMENDATIONS

The interchanges of Corvette Drive with US 31W and I-65 should be studied for necessary operational improvements. These improvements may include the addition of lanes and/or signal timing enhancements. In particular, future capacity needs should be considered in conjunction with any improvements to the I-65 interchange.

FACILITY

US 231/KY 880 (VETERANS MEMORIAL BLVD.)

LIMITS

US 68/KY 80 (Russellville Road) to Old Barren River Road

BACKGROUND

US 231/KY 880 (Veterans Memorial Boulevard) is a minor arterial with excellent access control, governed by topography. The roadway increases from two to four lanes beginning at Barren River Road and traveling east. The drop in the number of lanes may be the source of congestion-related problems. Veterans Memorial projected 2020 LOS of E south of Glen Lily Road and LOS D north of Glen Lily Road.

RECOMMENDATIONS

Reconstruct the section between Barren River Road and US 68 as a four-lane facility. Access control restrictions should be considered on the reconstructed section with turning lanes at major intersections.

FACILITY

KY 884 (THREE SPRINGS ROAD)

LIMITS

Spring Hollow Avenue to US 231 (Scottsville Road)

BACKGROUND

KY 884 (Three Springs Road) is a two-lane collector, with narrow lanes, that travels through commercial development. Grades currently limit available sight distance and need improvement throughout. The area surrounding Three Springs Road is occupied by commercial and mixed uses (storage and warehousing). The facility carries heavy volume and travels through some residential areas. Approaching Scottsville Road, the facility becomes congested with a projected 2020 LOS of E. There has been recent work adding right turn storage at the intersection.

RECOMMENDATIONS

Enforce/improve access management near the intersection with Scottsville Road. Widen roadway to three lanes in response to the projected 2020 increase in traffic volume.

FACILITY — LEHMAN AVENUE

LIMITS — US 31W Bypass to Covington Street

BACKGROUND

Lehman Avenue is a two-lane collector roadway with poor access management that connects KY 234 (Fairview Avenue) to Broadview Street. The signalized intersection of Lehman Avenue with the US 31W Bypass currently has a two-phase timing plan with permitted left turns, because there are no left-turn lanes on either roadway. Year 2020 LOS on Lehman Avenue is E indicating capacity problems.

RECOMMENDATIONS

The KYTC Six-Year Plan identifies a project to add left-turn lanes to US 31W from Lain Avenue to Cemetery Road, as well as to the approaches of Lehman Avenue. The addition of left-turn lanes will aid traffic movement as well as improve traffic safety at the intersection. There are currently no other recommendations for Lehman Avenue.

FACILITY — MAIN AVENUE

LIMITS — US 68 (Kentucky Street) to State Street

BACKGROUND

Main Avenue is primarily a four-lane facility with parking on both sides and traffic in both directions. The street narrows to three lanes with parking on the east side at Center Street, where it begins to approach the town center. Main Avenue travels through a built-up environment within the downtown area. The roadway follows a unique traffic operation because of the park downtown. Main Avenue is one-way northbound south of College Street. The projected 2020 LOS is E.

RECOMMENDATIONS

Since this corridor is in a built-up section of Bowling Green, there exists little opportunity for meaningful roadway improvement. Therefore, the recommendation is to do nothing at this time.

FACILITY

US 231 (MORGANTOWN ROAD)

LIMITS

KY 2632 (Hammett-Hill Road) to Old Morgantown Road

BACKGROUND

US 231 (Morgantown Road) is a two-lane minor arterial that travels through sections of residential development. The arterial has two narrow lanes, without shoulders, beginning approximately 1,000 feet west of the interchange with Natcher Parkway. As the arterial approaches the interchange, it widens to include additional turning lanes. The ramps for the cloverleaf interchange do not meet current standards. There is a shared through/right-turn lane at the intersection of US 231/KY 880 (Veterans Memorial Boulevard). Morgantown Road has a projected LOS E from KY 2632 (Hammett-Hill Road) to Natcher Parkway, which decreases to F from Natcher Parkway to Veterans Memorial Boulevard, and then increases to D from Veterans Memorial Boulevard to Old Morgantown Road.

RECOMMENDATIONS

A dedicated right-turn lane eastbound should be constructed at Veterans Memorial Boulevard. The ramps for the interchange with Natcher Parkway could use some modifications, such as the improvement of the on-ramp for northbound traffic and better accommodation for left-turning vehicles. Morgantown Road, west of Natcher Parkway, could benefit from minor safety improvements, such as widened shoulders and added turn lanes as needed. The section of roadway from Natcher Parkway to Veterans Memorial Boulevard should be widened to four lanes.

FACILITY

KY 526 (MT. OLIVET ROAD)

LIMITS

At Plum Springs Road

BACKGROUND

KY 526 (Mt. Olivet Road) is a two-lane facility with a sight distance problem at its intersection with Mt.Olivet-Girken Road. The approach from Mt.Olivet-Girken Road is designed to allow only right turns onto Mt. Olivet Road. Congestion problems may occur from motorists making the offset move from Mt. Olivet-Girken Road to Plum Springs Road. New residential development is located in the vicinity of the intersection. The geometry of Mt. Olivet Road includes a crest in the road and an ill-defined island. The roadway has a projected LOS of D in 2020.

RECOMMENDATIONS

The offset intersection of Mt. Olivet-Girken Road and Plum Springs Road at Mt. Olivet Road needs to be aligned. This intersection improvement could entail moving Mt. Olivet-Girken Road to the east or Plum Springs Road to the west, or a combination of both. Plum Springs and Mt. Olivet Road should be connected to create a more conventional intersection.

FACILITY

OLD MORGANTOWN ROAD

LIMITS

US 231 (Morgantown Road) to US 68/KY 80 (University Boulevard)

BACKGROUND

Old Morgantown Road is a two-lane, two-way collector. It travels through primarily residential area, with some inadequate access management practices. In some sections there are sidewalks, but they are not continuous and are inadequate in terms of design and location. A stop sign exists at the intersection with US 231 (Morgantown Road). A railroad crossing is located near the signalized intersection with US 68/KY 80 (University Boulevard). Old Morgantown Road turns into Dogwood Avenue south of University Boulevard as it enters into Western Kentucky University. This section of the street is in a campus setting and is wider with curbs and sidewalks on both sides. The 2020 projected level of service for Old Morgantown Road is D and decreases to E approximately 0.5 miles west of University Boulevard.

RECOMMENDATIONS

Improve the intersection at Morgantown Road, including addition of a left turning lane on Old Morgantown Road. Conduct traffic signal warrant analysis at the intersection of Old Morgantown Road and Morgantown Road. Upgrade the street with one additional lane to provide a two-way continuous left-turn lane with dedicated turning lanes at major intersections. Construct curb and gutter section with sidewalks on both sides. Pedestrian facilities are recommended because Old Morgantown Road is located in an urban setting in the university area.

FACILITY

KY 2629 (OLD SCOTTSVILLE ROAD)

LIMITS

KY 2158 (Cumberland Trace) to Blue Springs Drive

BACKGROUND

KY 2629 (Old Scottsville Road) is a winding, two-lane facility with narrow lanes and no shoulders. It has very poor horizontal and vertical alignments, which is a factor in the bad sight-distance problem at the cross streets, driveways and entrances to subdivisions. A new subdivision lies in the general vicinity of Old Scottsville Road, which contributes to the relatively high volume of traffic for this type of road. The projected 2020 level of service is E. A flashing red signal is located at the intersection with KY 2158 (Cumberland Trace).

RECOMMENDATIONS

Rebuild as a two-lane section with turning lanes at major entrances to subdivisions and at cross streets. Consider signalizing the intersection with Cumberland Trace.

FACILITY

SMALLHOUSE ROAD

LIMITS

Cave Mill Road to US 231 (Scottsville Road)

BACKGROUND

Smallhouse Road is a narrow, heavily traveled facility that passes through primarily residential areas. There is an odd offset at Cave Mill Road. There are no left turning bays at signalized intersections, except at US 231/KY 880 (Campbell Lane). The projected 2020 LOS for Smallhouse Road is D/E. The LOS decreases to a value F south of Campbell Lane for approximately 1.25 miles.

RECOMMENDATIONS

Align the facility north and south of Cave Mill Road. Widen Smallhouse Road to three or four lanes, depending on volume. A “Signal Ahead” sign should be added just north of Highland Way. The sight distance could also be improved.

FACILITY	STATE STREET
LIMITS	13th Avenue to 8th Avenue
BACKGROUND	State Street is a two-lane minor arterial between 8th and 12th Avenues, and a collector between 12th and 13th Avenues. The roadway has curb and gutter sections and parking on both sides. East of 13th Avenue, this becomes a one-way facility serving eastbound traffic. Adjacent land uses are historical and residential with significant religious and historical structures. State Street lies in the "College Hill Historic District." Between 10th and Main Avenues, State Street borders the town center circle and park. State Street and College Street border the town center as a one-way pair system. Traffic signals exist at 13th Avenue, 12th Avenue, 11th Avenue, Park Row, Main Avenue, and 8th Avenue. The projected 2020 LOS is E.
RECOMMENDATIONS	Study signal system and improve coordination if necessary.

FACILITY	US 231 (SCOTTSVILLE ROAD)
LIMITS	Ashley Circle to KY 2158 (Cumberland Trace)
BACKGROUND	Scottsville Road is a principal arterial south of Campbell Lane to the Warren / Allen County Line. North of Campbell Lane it is a minor arterial. It will undergo major widening/relocation from Dye Ford Road to the Allen County Line as one of the KYTC Six-Year Plan projects with committed funding. Recognized as an Unscheduled Highway Needs project, it is expected to be widened from I-65 to the US 31W Bypass. The projected 2020 LOS is E but decreases to F south of KY 884 (Three Springs Road) as it approaches I- 65. The LOS improves to D as it approaches Ashley Circle. The Critical Accident Rate Factor (CRF) on Scottsville Road near KY 884 (Three Springs Road) is greater than 5.0.
RECOMMENDATIONS	Due to the tremendous amount of growth that has occurred along Scottsville Road in the past few years, a separate study should be conducted to determine what measures should be taken to provide for capacity needs in the future. Although widening of the facility is identified in the Unscheduled Needs List, much more needs to be done to enhance mobility through this area. As properties develop, opportunities to relocate frontage roads, or even to construct access to the rear of the properties, should present themselves. Parallel collector routes to serve the commercial areas might also be considered. In addition, a study of the interchange with I-65 should be conducted. This area is not only congested, it also has a very high accident rate.

FACILITY

US 31W (NASHVILLE ROAD)

LIMITS

Dillard Road to Campbell Lane

BACKGROUND

The area surrounding US 31W (Nashville Road) consists of warehousing and light industrial uses as the road approaches Natcher Parkway. At the Natcher Parkway interchange, Nashville Road becomes a four-lane minor arterial with turning lanes at two of the ramps. Heavy truck traffic was observed south of Natcher Parkway. South of Elrod Road, the facility becomes a collector. The roadway will undergo major widening from US 231/KY 880 (Campbell Lane) to Natcher Parkway and from Natcher Parkway to Dillard Road (Industrial Park) as separate KYTC Six-Year Plan projects with committed funding. The 2020 projected LOS is E from Natcher Parkway to Lynnwood Drive. The remainder of Nashville Road has a projected LOS of D or lower.

RECOMMENDATIONS

The planned widening should help alleviate congestion in the area just south of Campbell Lane, where the projected LOS is D. Some access management strategies should also be considered for implementation in this area. The terminals of the Natcher Parkway interchange should be studied to determine if they warrant traffic signalization. It is unknown if the projects included in the Six Year Plan will address this situation, but the railroad overpass/bridge near Central Avenue should be improved. An additional truck lane should be added for eastbound trucks, which must travel up a hill as they approach the railroad overpass.

FACILITY

US 31W (NASHVILLE ROAD)

LIMITS

Campbell Lane to University Boulevard

BACKGROUND

This portion of US 31W (Nashville Road) is a two-lane minor arterial. Beginning in the north near University Boulevard, Nashville Road passes through primarily residential areas, but the surrounding area becomes more commercial proceeding south. It was noted during site visits that poor access management contributes to unsafe and congested traffic conditions. The 2020 projected LOS is E from Campbell Lane to University Boulevard.

RECOMMENDATIONS

The current KYTC Six-Year Plan includes no projects for this portion of Nashville Road. Recommended improvements include widening the roadway to a three lane section and adding turn lanes at major intersections. In addition, it is recommended that a good access management plan be prepared for this corridor.

FACILITY

US 31W BYPASS

LIMITS

Lehman Avenue to KY 234 (Fairview Avenue/Cemetery Road)

BACKGROUND

The US 31W Bypass is a minor arterial, with one of the highest accident rates in the study area. The US 31W Bypass is a four-lane facility with two lanes in each direction. The speed limit along the bypass is 35 mph. There are some elements of good access management, but overall the intensity of development limits the access control. As a result, an excessive number of driveways contribute to conflicts in traffic when motorists enter/exit these drives. A high number of accidents in this corridor are associated with these types of conflicts in traffic. The Critical Accident Rate Factor (CRF) near Lehman Avenue and KY 234 (Fairview Avenue) is greater than 5.0. The intersection of US 31W Bypass and Lehman Avenue will be reconstructed as one of KYTC Six-Year Plan projects with committed funding. The projected 2020 LOS is D between Lehman Avenue and Fairview Avenue/Cemetery Road.

RECOMMENDATIONS

Improve access control by closing unnecessary curb openings/entrances. Maintain access control along the US 31W Bypass. Detailed traffic studies should be conducted to determine the need for left turn lanes at major intersections that do not currently have dedicated lanes.

FACILITY

US 31W/US 68 (KENTUCKY STREET)

LIMITS

14th Avenue to Main Avenue

BACKGROUND

US 31W/ US 68 (Kentucky Street) is one way west of KY 185. It is a principal arterial with two lanes going east, and has curb and gutter and sidewalk facilities. 14th Avenue splits into Kentucky Street, where a community shopping center (Hilltop Shops) and a university parking lot lie. Truck usage was observed in this area. East of 13th Avenue, the street widens and parking is allowed on the north side. This section remains two lanes with traffic going east. Signalized intersections include 12th Avenue, 11th Avenue, and Main Avenue. A Justice Center was recently built near the intersection with 11th Avenue. The projected 2020 LOS is D.

RECOMMENDATIONS

Since this corridor is in a built-up section of Bowling Green, there exists little opportunity for meaningful roadway improvement. However, since any newly designed roadway would likely be designed with a goal LOS of D, the recommendation is to do nothing at this time.

FACILITY	US 31W/US 68 (LOUISVILLE ROAD)
LIMITS	US 31W Bypass to KY 1402 (Porter Pike Road)
BACKGROUND	US 31W/US 68 (Louisville Road) is a principal arterial with two lanes in each direction and turning lanes at most access points. There are severe access management issues – driveways are too close to intersections and/or undefined and uncontrolled (i.e. businesses/commercial establishments with no control for the entire frontage of the business). This condition typically contributes to disorderly and chaotic traffic conditions. However, this condition improves somewhat further west due to the limited access provided by the presence of a railroad on the north side of the facility. Louisville Road's interchange with KY 446 (which provides access to I-65) requires a difficult turning maneuver for trucks turning left from westbound Louisville Road. The Kentucky Scenic Byway designation ends just west of the junction with KY 3225. Louisville Road has a projected LOS of E in 2020. However, the LOS increases to D or higher as the road approaches town.
RECOMMENDATIONS	As vacant land along US 31W/US 68 develops, the roadway will approach its capacity. This is indicated in the year 2020 traffic model results. With the exception of the area around the KY 446 interchange, a four-lane cross section appears to be adequate. However, an access management plan should be considered to address median openings, left-turn storage bays and driveway locations. A detailed interchange scoping study is recommended at KY 446 to examine geometrics, lane balance requirements and access to and from I-65.

FACILITY

US 68 (GLASGOW ROAD)

LIMITS

US 31W (Louisville Road) to I-65 Interchange

BACKGROUND

US 68 (Glasgow Road) is a two-lane roadway, designated as a Kentucky Scenic Byway. The roadway is in generally good shape, with approximately ten-foot wide lanes and three-foot shoulders on each side. The half-diamond interchange at I-65 provides access only to and from the south (the Bowling Green area). US 68 will provide access to the proposed Trimodal Transpark facility. The projected 2020 LOS is E.

RECOMMENDATIONS

A study should be conducted to determine if a full interchange is required with I-65. The ten-foot lanes should be widened to full twelve-foot lanes with adequate shoulders. As vacant land develops in conjunction with the Transpark, turn lanes at major intersections should be considered to address capacity and safety needs. The impact of the new Transpark should be monitored once it begins operation.

FACILITY

US 68/KY 80 (RUSSELLVILLE ROAD)

LIMITS

Blue Level Road (KY 432) to University Boulevard

BACKGROUND

US 68/KY 80 (Russellville Road) is a principal arterial. It has a five-lane section west of US 231/KY 880 (Veterans Memorial Boulevard), with turning lanes and turning bays and shoulders on each side. A diamond interchange is located at Natcher Parkway with ramps that are currently adequate. A new traffic signal has been installed on the east side of the interchange. The roadway travels through a developed area of mixed commercial and light industrial use, with some pockets of land still available. Access control is not an issue in this area. Pedestrian facilities and street lighting are located on both sides of Russellville Road, just west of Veterans Memorial Boulevard. The roadway has a curb and gutter section with an abundance of driveways and unlimited access to facilities. As Russellville Road approaches University Boulevard, the roadway narrows to two lanes as it slopes down and travels under a railroad overpass. This area is well-known for the narrow underpass with inadequate horizontal clearances and for the flooding that occurs there. Russellville Road has a projected LOS D/E from Veterans Memorial Boulevard to Morgantown Road. The LOS decreases to F at the approach to University Boulevard.

RECOMMENDATIONS

Russellville Road needs additional lanes throughout the study limits. The roadway also needs better access control, with possible consolidation and/or relocation of entrances. A new signal may need to be installed on the west side of the Natcher Parkway interchange. The railroad underpass should be reconstructed to provide additional lanes and better shoulders.

FACILITY	WESTEN STREET
LIMITS	US 231/KY 880 (Campbell Lane) to Business US 231 (Scottsville Road)
BACKGROUND	Westen Street is a facility designed and built for three lanes and initially striped as two from Campbell Lane to Highland Way. East of Highland Way, the roadway is wide enough for only two lanes and travels through a residential area to Scottsville Road. This facility is newer than Smallhouse Road, which runs almost parallel to Westen Street, and is used by many motorists as a shortcut between Campbell Lane and Scottsville Road. The intersection of US 231/KY 880 (Campbell Lane) is not signalized. The LOS is F near Campbell Lane and D near Business US 231 (Scottsville Road).
RECOMMENDATIONS	Verify that the current signage and striping are adequate. From a traffic-flow improvement standpoint, the recommendation is to widen Westen Street to three lanes to provide a continuous left-turn lane. This could be accomplished by simply restriping from Campbell Lane to Highland Way and then by widening to Scottsville Road. However, given the residential nature of the eastern portion of this corridor and the fact that the roadway is currently used as a cut-through between Campbell Lane and Scottsville Road (such usage likely to increase if the roadway was widened), such a configuration may not be feasible. At a minimum, Traffic Systems Management (TSM) and/or traffic calming techniques should be instituted at the local level to provide adequate traffic flow while maintaining a balance between safety, capacity, and the character of the residential areas. Since the intersection of Westen Street and Campbell Lane is so close to the intersection of Campbell Lane and Smallhouse Road (less than 0.1 miles), a study should be conducted to determine the feasibility of making the Westen Street intersection right-in/right-out only.

4.2 Improvement Identification & Alternatives Analysis

Based on the 2020 base condition model outputs, input from Transportation Committee members and evaluations of field reviews, a series of highway improvements were developed to address deficiencies on existing facilities. In addition, transportation improvement projects and new routes were identified to serve the proposed TriModal Transpark in the northeastern portion of Warren County. A survey was sent to each member of the Transportation Committee to determine the priority of each recommended project. The members were asked to evaluate each project's need based on its perceived ability to enhance traffic capacity, increase safety and promote economic development. These criteria were weighted on a point scale from 1.0 to 3.0 and the results were submitted to HNTB for compilation. The results were presented at the final Transportation Committee meeting, and it was evident that the members' perceptions of each project's relative need were similar. As a result, consensus was achieved for the prioritization of the recommended projects. The locations of these priority projects are mapped on **Page A-7** of the Appendix. The projects are also listed (in order of priority) and discussed in **Table 8**.

Project prioritization was based on a weighted rating system that examined traffic capacity, safety and economic development potential.

Table 8: Final List of Roadway Improvements

Priority Rank	Facility Description	Project Limits
1	Transpark Connector, a New Facility	US 31W to I-65
2	Eastern Outer Beltline, a New Facility	US 231 to I-65
3	US 68 (Russellville Road) Widening & Relocation of RR Underpass	KY 880 to University Blvd.
4	US 31W (Nashville Road) Widening	KY 880 to University Blvd.
5	KY 884 (Three Springs Road) Widening	Natcher Pkwy. to Scottsville Rd.
6	Smallhouse Road Widening	Cave Mill Rd. to US 231
7	US 231/KY 880 Widening (Veterans Memorial Boulevard)	Russellville Rd. to Barren River Rd.
8	Old Morgantown Road Reconstruction	Morgantown Rd. to University Blvd.
9	Southwest Parkway, a New Facility	US 68 to US 31W
10	US 68	Scotty's Way to Louisville Rd.
11	Cave Mill Road	Dishman Ln. to Shive Ln./Lovers Ln.
12	US 231 (Morgantown Road) Widening	KY 2632 (Hammett-Hill Rd.) to Old Morgantown Rd.
13	Southwest Parkway, a New Facility	US 31W to I-65
14	KY 2629 (Old Scottsville Road)	KY 2158 (Cumberland Trace) to Blue Springs Dr.
15	Northern Outer Beltline	US 31W to Natcher Parkway near Hadley

A separate traffic model was developed incorporating all of these improvements. The results of the model are shown on **Page A-8** of the Appendix. In order to quantify a tangible benefit of the recommended projects for Warren County, the final traffic model was used to determine system-wide travel improvements. The benefit of implementing the projects included in the recommended plan was derived by comparing the outputs of the 2020 base "existing plus committed" and the "recommended plan" traffic assignment models.

The traffic model recalculates travel speeds as vehicles are assigned to the network links, predicting increases or decreases in travel times.

The model provides a method of looking at network travel efficiency in terms of system-wide vehicle miles of travel. In the model, as traffic volumes increase on network segments, the model recalculates travel speeds before allowing additional trips to traverse the respective system roadways. This decrease in speed results in increased travel times. Following a series of speed adjustments, the model attempts to find shorter alternative routes than the original minimum time path. This process repeats until the transportation system becomes balanced, or reaches a state of "equilibrium".

The total time required for all trips to travel through the system in the year 2020 without adjusting the network speeds based on congestion was determined (at or near the posted speed limits). These are referred to as the free-flow vehicle hours of travel. Then, capacity constraints were imposed, and the total time required to traverse the same system was determined. This represented the congested network vehicle hours of travel. The difference between the two calculations is vehicle hours of travel due to delay.

By implementing the recommended projects, Warren County motorists can expect 36% less delay in the year 2020 than without the projects.

Table 9 presents the comparison of vehicle hours of travel between the recommended plan and the no-build condition. As shown, substantially less time will be spent in automobiles in the Bowling Green area after the recommended improvements are made. The recommended projects make a notable difference in the 2020 congested travel condition. The result is that, while delay may still be expected in the 2020 system after the improvements are made, it is 36% less delay than would be experienced if the recommended improvements were not made over the 20 year planning period.

Table 9: 2020 Model Comparison

Vehicle Hours of Travel			
Network Condition	**Free Flow**	**Congested**	**Delay**
2020 No-build	135,000	156,100	21,100
2020 Recommended Plan	134,000	147,600	13,600

4.3 Funding and Evaluation of Probable Costs

The availability of funding can be a deciding factor in determining when the recommended improvement projects will be implemented. In addition, the phasing of these projects is based on an "as funding becomes available" basis. Cost estimates were gathered for the projects identified as priority projects. Several improvements were identical to projects listed on the Unscheduled Needs List of Warren County, prepared by the Barren River Area Development District (BRADD) in conjunction with KYTC. Estimated probable costs for these projects were based on the unscheduled costs developed by BRADD and KYTC. Probable cost estimates were developed for all other priority projects based on existing facility conditions, adjacent development, and proposed improvements. **Table 10** shows these estimated costs and relates further details about the recommended projects.

Table 10: Cost Estimates for Roadway Improvements

Facility	Existing Description	Proposed Improvements	Probable Cost
Transpark Connector: *US 31W to I-65* *2.3 mi*	• N/A	• New Facility • Two full lanes each direction with full shoulders and wide median • Construct interchange at I-65	$30 million[1]
Eastern Outer Beltline: *US 231 to I-65* *9.5 mi*	• N/A	• New Facility • Two full lanes each direction with full shoulders and wide median	$85 million[1]
US 68/KY 80 (Russellville Road): *KY 880 to University Blvd.* *1.6 mi*	• Principal arterial • Four-lane section from KY 880 to Springhill Avenue with one lane in, two lanes out, and center lane for left turns • Three-lane section from Springhill Avenue to US 231 with one lane in each direction and center lane for left turns, including curb and gutter section • One lane in each direction from US 231 to University Blvd. • Some access management issues • Flooding at CSX railroad underpass	• Widen facility to five lanes-two lanes in each direction with a continuous left-turn lane-and create lane balance • Implement access control • Reconstruct CSX railroad underpass and construct new bridge	$12 million
US 31W (Nashville Road): *KY 880 to University Blvd.* *1.2 mi*	• One lane each direction • Principal arterial with turning lanes at major intersections • Some access management issues	• Widen from two lanes to three lane section with improved striping	$3.6 million[2]

[1] Cost estimates developed for new facilities were made without the benefit of final alignments. Conceptual alignments were used for the purpose of estimating costs.
[2] Cost estimates based on BRADD's Unscheduled Needs List for Warren County.

Table 10 (cont'd.): Cost Estimates for Roadway Improvements

Facility	Existing Description	Proposed Improvements	Probable Cost
KY 884 (Three Springs Road): *Natcher Pkwy. to Scottsville Rd.* 2.2 mi	• One narrow lane each direction • Collector	• Widen from two lanes to three lanes with urban section	$9 million[2]
Smallhouse Road: *Cave Mill Rd. to US 231* *2.8 mi*	• One lane each direction • Collector • Narrow, heavily traveled facility • Odd offset exists at Cave Mill Road	• Widen from two lanes to three lane section • Align facility north and south of Cave Mill Road • Add a "Signal Ahead" sign just north of Highland Way • Improve sight distance	$10 million
US 231/KY 880 (Veterans Memorial Blvd.): *Russellville Rd. to Barren River Rd.* *3.3 mi*	• One lane each direction • Minor arterial with excellent access control governed by topography	• Two lanes each direction • Continue existing four-lane section east of Barren River Road	$10 million[3]

[2] Cost estimates based on BRADD's Unscheduled Needs List for Warren County.
[3] HNTB recommends an increase in cost estimate from BRADD's Unscheduled Needs List for Warren County.

Table 10 (cont'd.): Cost Estimates for Roadway Improvements

Facility	Existing Description	Proposed Improvements	Probable Cost
Old Morgantown Road: *Morgantown Rd. to University Blvd.* *1.0 mi*	• One lane each direction with some section of sidewalks • Collector • Railroad crossing located near intersection with US 68/KY 80 (University Blvd.) • Sidewalks are not continuous and inadequate in terms of design and location • Some access management issues	• Reconstruct with one lane in each direction with curb and gutter section with sidewalks and turning lanes at major intersections • Add left turn lane at intersection with Morgantown Road and conduct traffic signal warrant analysis • Continue urban section with sidewalks north of University Blvd.	$4 million
Southwest Parkway: *US 68 to US 31W* *2.2 mi*	N/A	• New Facility • Two lanes each direction	$25 million[1]
US 68 (Glasgow Road): *Scotty's Way to Louisville Rd.* *0.6 mi*	• One lane each direction, 10' wide with 3' shoulders • Collector in generally good condition	• Widen to one full lane each direction with full shoulders • Install traffic signal at intersection with US 31W/US 68 (Louisville Road)	$1.5 million
Cave Mill Road: *Dishman Ln. to Shive Ln./Lovers Ln.* *3.1 mi*	• One narrow lane each direction with no shoulders east of US 231 (Scottsville Road). Shive Lane is three lanes wide. • Collector	• Widen to three-lane section for entire route • Smooth curve just west of US 231 (Scottsville Road) • Install traffic signal at Smallhouse Road	$12 million

[1] Cost estimates developed for new facilities were made without the benefit of final alignments. Conceptual alignments were used for the purpose of estimating costs.

Table 10 (cont'd.): Cost Estimates for Roadway Improvements

Facility	Existing Description	Proposed Improvements	Probable Cost
US 231 (Morgantown Road): *KY 2632 (Hammett-Hill Rd). to US 231/KY 880 (Veterans Memorial Blvd.)* *3.6 mi*	• Two lanes with shared right-turning lane at US 231/KY 880 • Collector/Minor arterial • Ramp geometrics at Natcher interchange do not meet present standards	• Widen from two lanes to four lanes (two lanes each direction) • Construct dedicated right turn lane eastbound at US 231/KY 880 (Veterans Memorial Blvd.) • Improve ramp geometrics and address left turn movement from Natcher Parkway to US 231	$13 million
Southwest Parkway: *US 31W to I-65* 4.3 mi	N/A	• New Facility • Two lanes each direction • Interchange with I-65	$40 million[1]
KY 2629 (Old Scottsville Road): *KY 2158 (Cumberland Trace) to Blue Springs Dr.* *0.5 mi*	• One lane each direction, narrow lanes with no shoulders • Flashing red signal at KY 2158 (Cumberland Trace) • Winding facility • Poor horizontal and vertical alignments	• Rebuild as two-lane section (one lane each direction) with turning lanes at major entrances to subdivisions or cross streets • Signalize intersection with KY 2158 (Cumberland Trace)	$2 million
Northern Outer Beltline: *US 31W to Natcher Parkway near Hadley* *16.8 mi*	N/A	• New Facility • Two lanes in each direction, with limited access similar to Natcher Parkway • Interchange with (at a minimum) US 31W and Natcher Parkway	$123 million[1]

[1] Cost estimates developed for new facilities were made without the benefit of final alignments. Conceptual alignments were used for the purpose of estimating costs.

Appendix

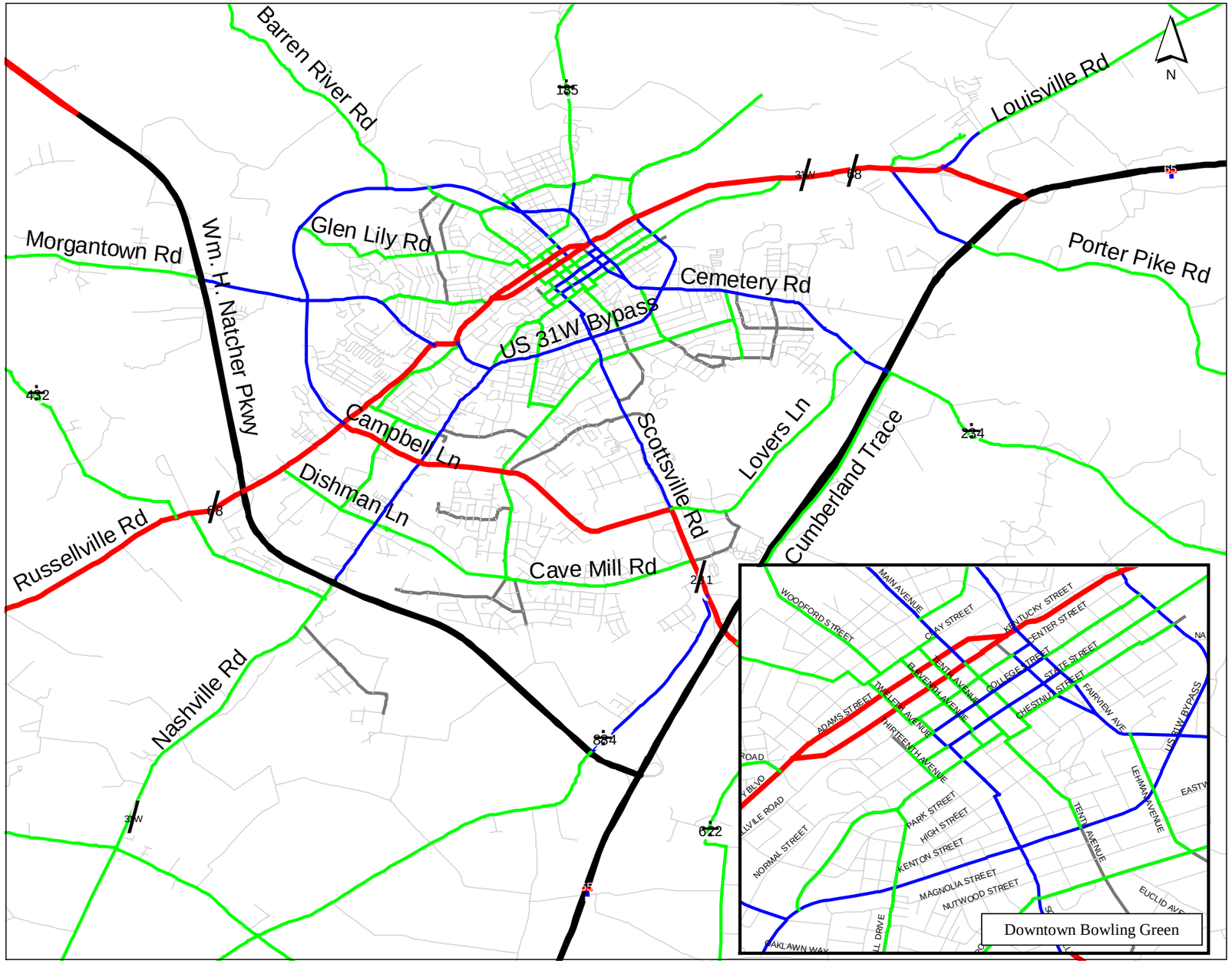
EXHIBIT 1
FUNCTIONAL CLASSIFICATION

BOWLING GREEN TRANSPORTATION PLAN

HNTB

LEGEND

- Interstates & Expressways
- Principal Arterials
- Minor Arterials
- Collectors
- Locally Classified
- Local Roads



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Functional Classification - Exhibit 1

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Date: 2/18/00

EXHIBIT 2
HIGH ACCIDENT LOCATIONS

BOWLING GREEN TRANSPORTATION PLAN HNTB

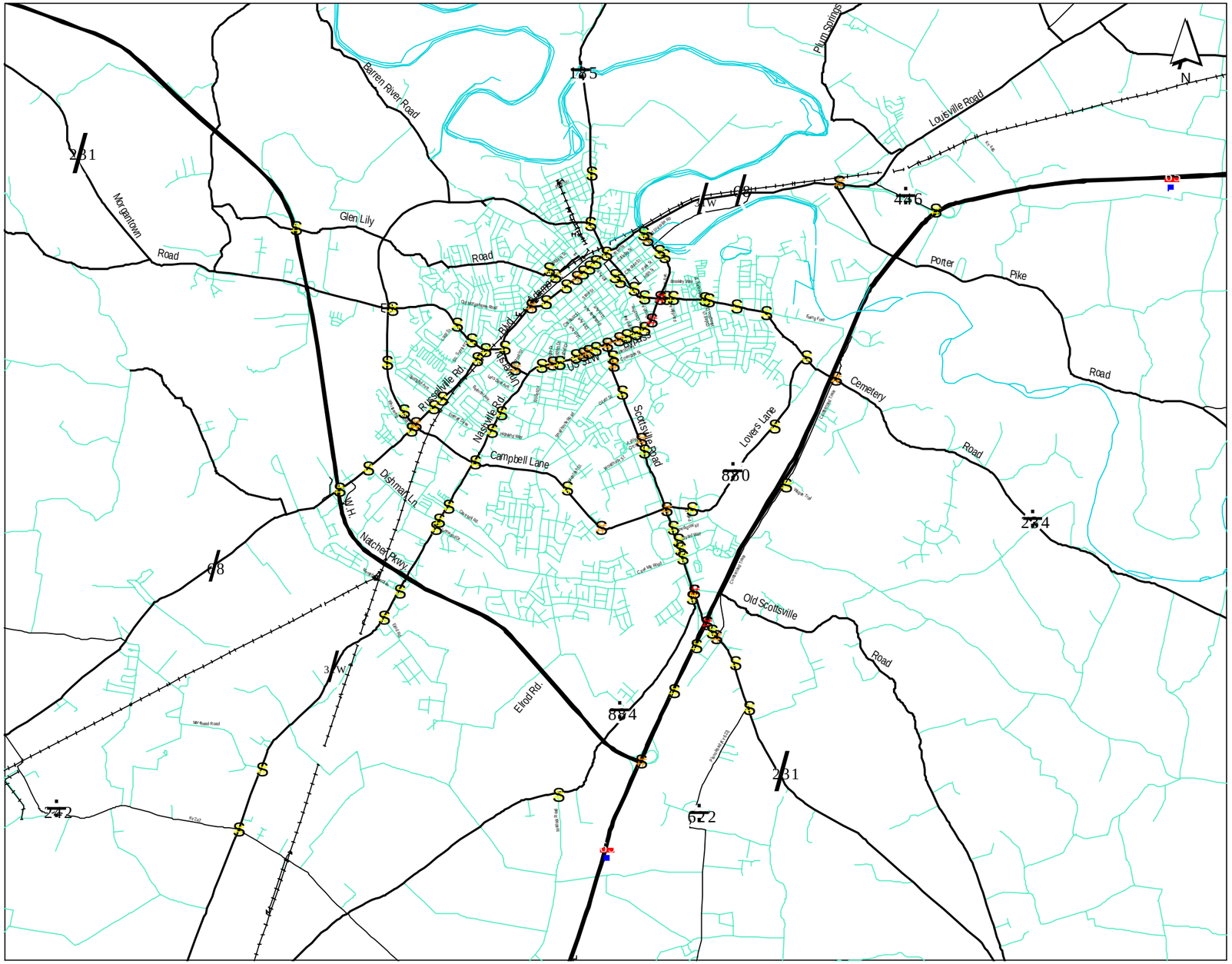
LEGEND

Critical Accident Rate Factors

1.0 - 3.0

3.1 - 5.0

> 5.1



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High Accident Locations - Exhibit 2

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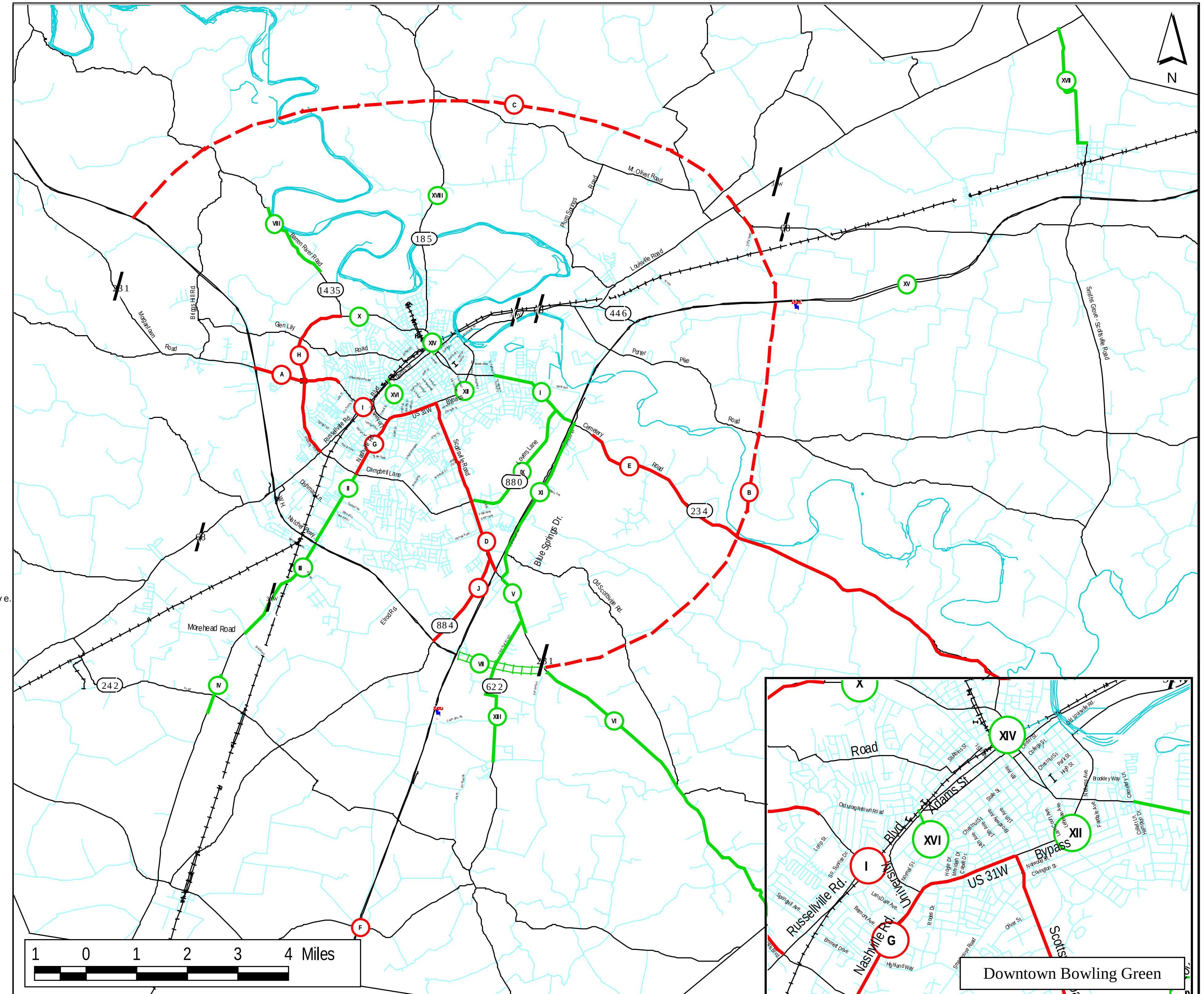
Date: 1/07/99

KYTC Six-Year Plan Projects with Committed Funding

- (I) KY 234 (Cemetery Rd.): widen to 5-lanes from Collett Lane to I-65 including an interchange
- (II) US 31W (Nashville Rd.): major widening from Campbell Lane to Natcher Parkway
- (III) US 31W (Nashville Rd.): major widening from Natcher Parkway to Dillard Road (Industrial Park)
- (IV) US 31W (Nashville Rd.): add left turn lanes at KY 242 aproaches
- (V) US 231 (Scottsville Rd.): widening from 0.1 mile SE of Cumberland Trace to 0.3 mile NW of Dye Ford Road
- (VI) US 231 (Scottsville Rd.): major widening/ relocation from Dye Ford Road to Allen County Line
- (VII) Extend Natcher Parkway from I-65 to US 231 at Dye Ford Road
- (VIII) KY 1435 (Barren River Rd.): reconstruction from Dedman Road to 2 miles N.W.
- (IX) KY 880 (Lovers Ln.): major widening from US 231 to US 234
- (X) KY 880 (Veterans Memorial Blvd.): extend from KY 185 to 7th and College Streets
- (XI) KY 2158 (Cumberland Trace): major widening from US 231 to US 234
- (XII) US 31W Bypass: reconstruct from Lain Ave. to Cemetery Rd. inlcuding left turn lanes at the intersection with Lehman Avenue
- (XIII) KY 622: roadway improvements from US 231 to Plano - Richpond Road
- (XIV) KY 234/KY 185: reconstruction of 6th and 7th couplet
- (XV) I-65: Widen from Sims Road to Warren County line
- (XVI) US 68 (Russellville Road): add left turn lanes at intersection with Old Morgantown Road and Dogwood Ave.
- (XVII) KY 101: reconstruct from Smiths Grove north to US 31W
- (XVIII) KY 185: reconstruct from KY 263 to Warren / Butler County line

Unscheduled Projects

- (A) US 231 (Morgantown Rd.): widening/improvements from Old Morgantown Road to Natcher Parkway
- (B) New Route: outer loop south from US 231 to I-65
- (C) New Route: outer loop north from I-65 to Natcher Parkway
- (D) US 231 (Scottsville Rd.): widening from I-65 to US 31W
- (E) KY 234: widening from Drakes Creek to Allen County Line
- (F) I-65 interchange at KY 240
- (G) US 31W: widening from US 231 to KY 880
- (H) KY 880: widening from US 68 to KY 1435
- (I) US 68: reconstruction at CSX Railroad underpass
- (J) KY 884 (Three Springs Rd.): widening from US 231 to Natcher Parkway



Planned Projects - Exhibit 3

BOWLING GREEN TRANSPORTATION PLAN HNTB

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Date: 1/07/00

EXHIBIT 3
PLANNED PROJECTS

EXHIBIT 4
TRAFFIC ANALYSIS ZONE (TAZ) MAP

BOWLING GREEN TRANSPORTATION PLAN

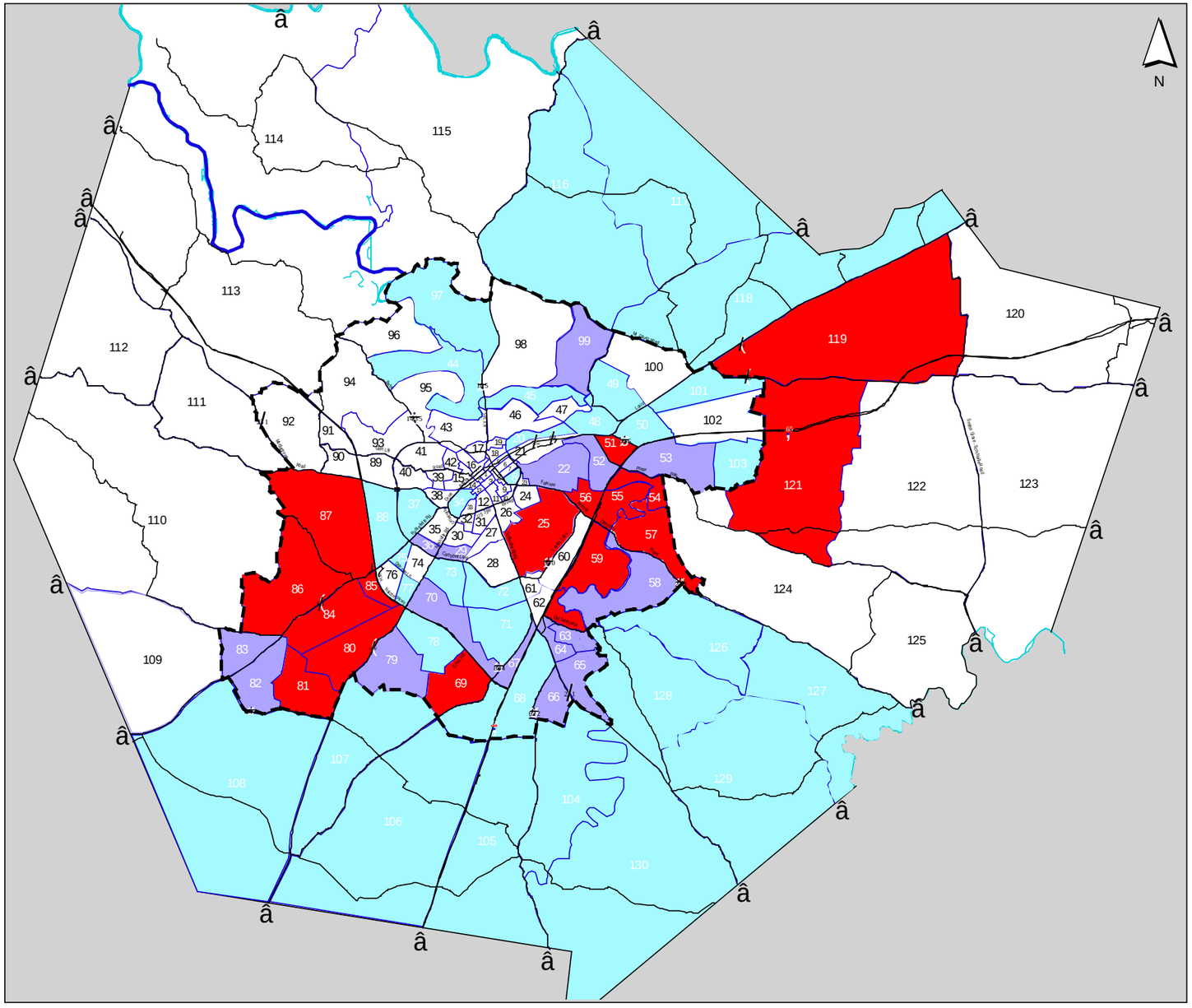
HNTB

LEGEND

- Traffic Analysis Zone (TAZ) Boundary

THE COMPARISON OF 1995 VS. 2020 POP. & EMP. DATA:

- up to 25% increase
- 25% to 50% increase
- 51% to 100% increase
- more than 100% increase
- External Count Stations
- Urban boundary



1 0 1 2 3 4 5 6 7 Miles

Traffic Analysis Zone (TAZ) Map - Exhibit 4

2020 Population and Employment Data

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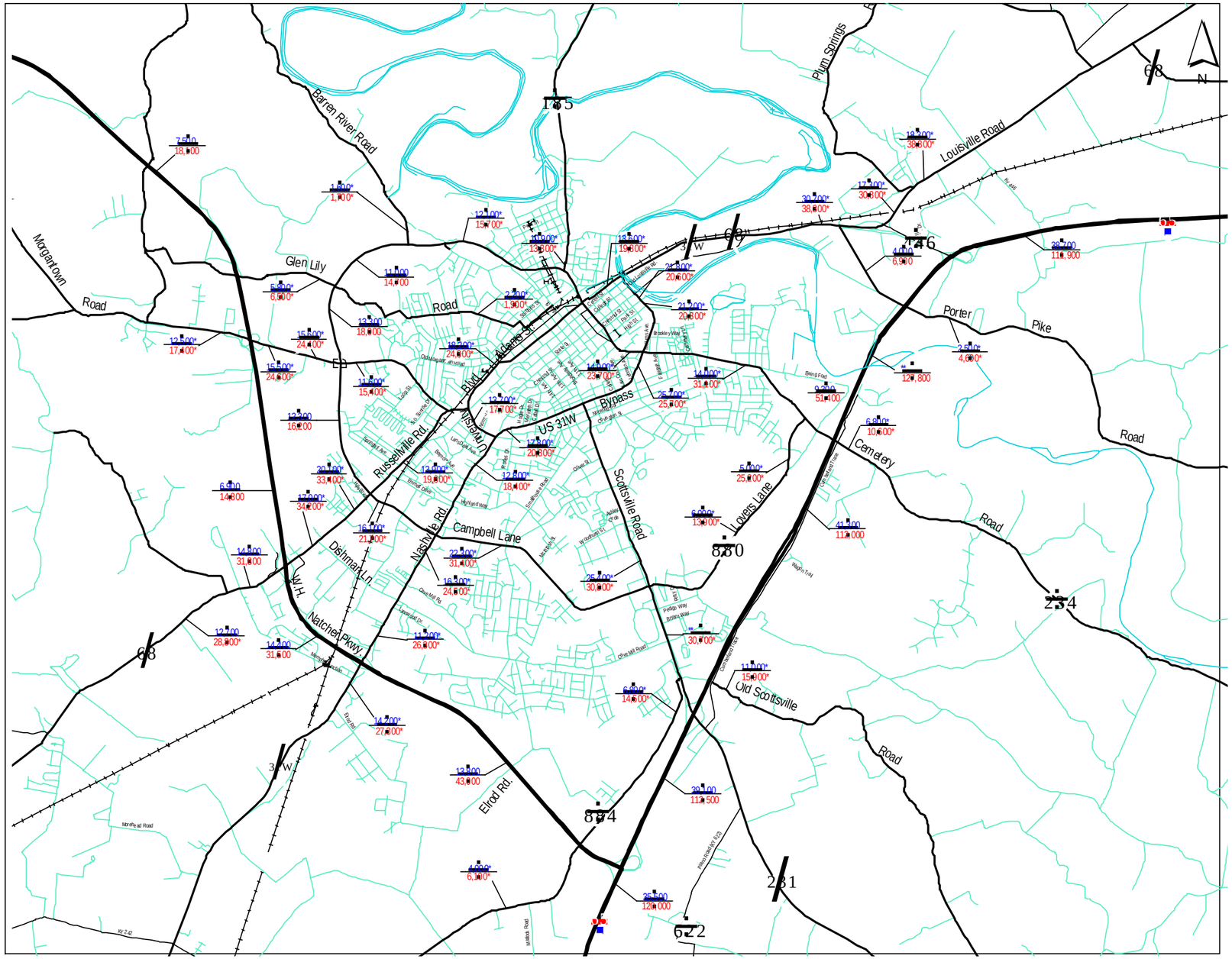
Date: 20 7/00

LEGEND

Average Daily Traffic Volumes

1995 Vehicles Per Day
2020 Vehicles Per Day

* For roadways having segments with varying traffic volumes, the highest segment volume is shown.



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Traffic Volume Data - Exhibit 5

EXHIBIT 5
TRAFFIC VOLUME DATA

BOWLING GREEN TRANSPORTATION PLAN

HNTB

R/29472/MAP SWARREN02
Date: 2/17/00

BOWLING GREEN TRANSPORTATION PLAN

HNTB

EXHIBIT 6
YEAR 2020 LEVEL of SERVICE (LOS)

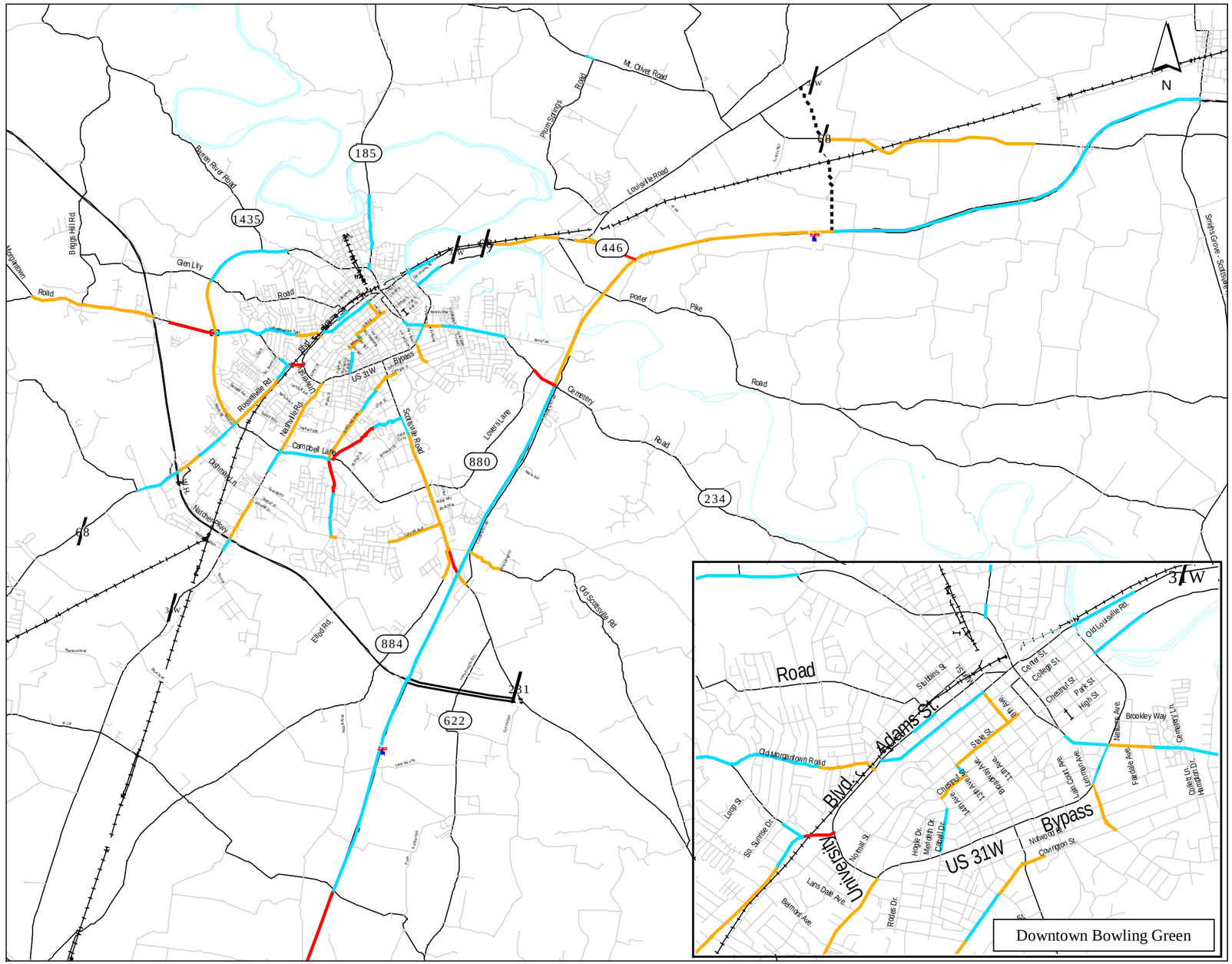
LEGEND

- LOS F, V/C >=1.4
- LOS E, V/C >=1.05+
- LOS D, V/C >=.95+
- US & KY Routes
- Local Roads

NOTE

This exhibit takes into consideration that the following projects with committed funding have been implemented:

KY 234 (Cemetery Rd.)
*Widen to 5-lanes from Collett Lane to I-65 including an interchange
* S 31W (Nashville Rd.)
*Major widening from Campbell Lane to Natcher Parkway
US 231 (Scottsville Rd.)
*Widening from 0.1 mile SE of Cumberland Trace to 0.3 mile NW of Dye Ford Road
Natcher Parkway
*Extend from I-65 to US 231at Dye Ford Road
KY 1435 (Barren River Rd.)
*Reconstruction from Dedman Road to 2 miles NW
KY 880 (Lovers Ln.)
*Major widening from US 231 to US 234
KY 2158 (Cumberland Trace)
*Major widening from US 231 to US 234
US 31W (Nashville Rd.)
*Major widening from Natcher Parkway to Dillard Road (Industrial Park)
US 31/Lehman Avenue
*Reconstruct Intersection
US 31W (Nashville Rd.)
*Add left turn lanes at KY 242 aproaches
KY 622
*Roadway improvements from US 231 to Plano - Richpond Road
KY 234/KY 185
*Reconstruction of 6th and 7th couplet
US 231 (Scottsville Rd.)
*Major widening/ relocation from Dye Ford Road to Allen County Line
I-65
*Widen from Sims Road to Warren County line



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Year 2020 Level of Service (LOS) - Exhibit 6

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Date: 3/15/00

Facility Improvements

1. Transpark Connector (US 31W to I-65)
-Four lane facility connecting US 31W to US 68 to I-65, including an interchange

2. Eastern Outer Beltline (US 231 to I-65)
- New Facility

3. Russellville Road (KY 880 to University Blvd.)
-Major widening, including the reconstruction of CSX RR underpass

4. Nashville Road (KY 880 to University Blvd.)
-Construct four lane urban/curb and gutter section
-Reconstruct RR Underpass

5. KY 884 (Natcher Pkwy. to Scottsville Rd.)
-Reconstruct and widen to three lanes

6. Smallhouse Road (Cave Mill Rd. to Scottsville Rd.)
-Reconstruct and widen to three-lane section

7. KY 880 (Russellville Rd. to Barren River Rd.)
-Widen to four-lane section

8. Old Morgantown Road (Morgantown Rd. to University Blvd.)
-Upgrade with one lane each direction and turning lanes at major intersections
- Install traffic signal at Morgantown Rd.
-Improve intersection with University Blvd. and improve pedestrian facilities

9. Southwest Pkwy. (US 68 to US 31W)
- New Facility, Phase I

10. US 68 (Scotty's Way to Louisville Rd.)
-Widen to full lanes and shoulders, including traffic signal installation at Louisville Rd.

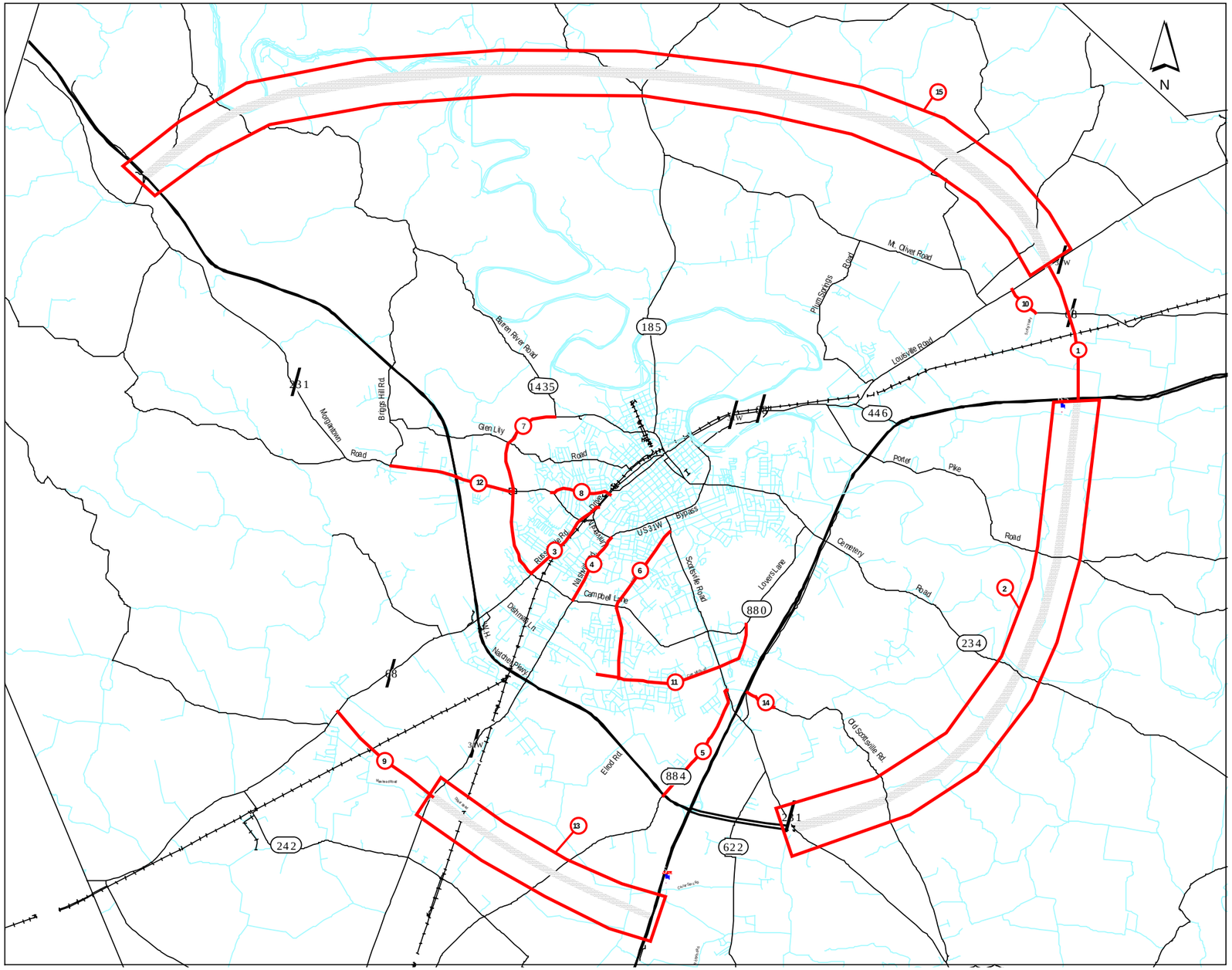
11. Cave Mill Road (Dishman Ln. to Shive Ln. /Lovers Ln.)
-Widen to a three-lane section

12. Morgantown Road (Hammett Hill Rd. to KY 880)
-Widen to four lanes, including improvement of Natcher Pkwy. interchange

13. Southwest Pkwy. (US 31W to I-65)
-New Facility, Phase II

14. Old Scottsville Road (KY 2158 to Blue Springs Dr.)
-Rebuild as two-lane section with turning lanes at major intersections

15. Northern Outer Beltline (US 31W to Natcher Pkwy. near Hadley)



1 0 1 2 3 Miles

Priority Highway Improvements - Exhibit 7

BOWLING GREEN TRANSPORTATION PLAN HNTB

EXHIBIT 7
PRIORITY HIGHWAY IMPROVEMETNS

R/29472/MAPS/WARREN01
Date: 5/01/00

BOWLING GREEN TRANSPORTATION PLAN

HNTB

EXHIBIT 8
YEAR 2020 FINAL LOS OPTION

LEGEND

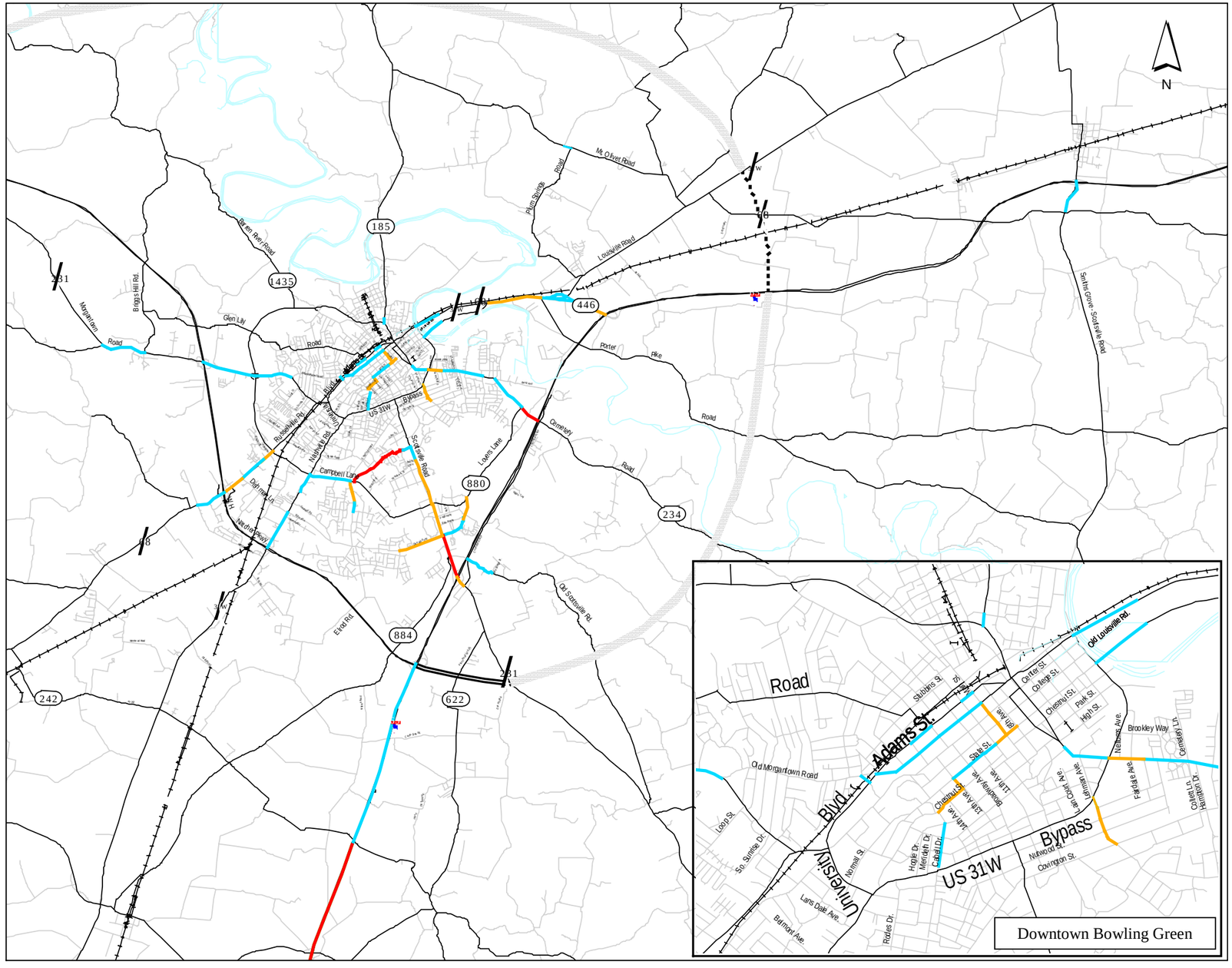
- LOS F, V/C >=1.4
- LOS E, V/C >=1.05+
- LOS D, V/C >=.95+
- US & KY Routes
- Local Roads

NOTE

This exhibit takes into consideration that Six Year Plan committed projects and the following projects decided by the Bowling Green Transportation Committee members have been implemented:

1) Transpark Connector (US 31W to I-65)
   -Four lane facility connecting US 31W to US 68 to I-65, including an interchange
2) Eastern Outer Beltline (US 231 to I-65)
   -New Facility
3) Russellville Road (KY 880 to University Blvd.)
   -Major widening, including the reconstruction of CSX RR underpass
4) Nashville Road (KY 880 to University Blvd.)
   -Construct four lane urban/curb and gutter section
   -Relocate RR Underpass
5) KY 884 (Natcher Pkwy. to Scottsville Rd.)
   -Reconstruct and widen to three lanes
6) Smallhouse Road (Cave Mill Rd. to Scottsville Rd.)
   -Reconstruct and widen to three-lane section
7) US 231/KY 880 (Russellville Rd. to Barren River Rd.)
   -Widen to four-lane section
8) Old Morgantown Road (Morgantown Rd. to University Blvd.)
   -Upgrade with one lane each direction and turning lanes at major intersections
   -Install traffic signal at Morgantown Rd.
   -Improve intersection with University Blvd. and improve pedestrian facilities
9) Southwest Pkwy. (US 68 to US 31W)
   -New Facility, Phase I
10) US 68 (Scotty's Way to Louisville Rd.)
   -Widen to full lanes and shoulders, including traffic signal installation at Louisville Rd.
11) Cave Mill Road (Dishman Ln. to Shive Ln./Lovers Ln.)
   -Widen to a three-lane section
12) Morgantown Road (Hammett Hill Rd. to KY 880)
   -Widen to four lanes, including improvement of Natcher Pkwy. interchange
13) Southwest Pkwy. (US 31W to I-65)
   -New Facility, Phase II
14) Old Scottsville Road (KY 2158 to Blue Springs Dr.)
   -Rebuild as two-lane section with turning lanes at major intersections
15) Northern Outer Beltline (US 31W to Natcher Pkwy. near Hadley)
   -New Facility

0.5 0 0.5 1 1.5 2 2.5 3 3.5 Miles



Year 2020 Final LOS Option - Exhibit 8

R/29472/MAP SWARREN01
Date: 5/10/00

HNTB