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Greg Thomas  
Secretary

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MEMORANDUM

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**TO:** Joe Plunk, P.E.  
Chief District Engineer  
District 3 – Bowling Green

**ATTN:** Benjamin Hunt

**FROM:** John Moore, P.E.  
Director  
Division of Planning 

**DATE:** March 21, 2018

**SUBJECT:** Warren County Traffic Forecast  
US 31W from milepoints 10.561 to 11.688  
Item No. 03-8857.00

In response to your October 20, 2017 request, we are providing the following forecasts on the attached report:

- 2018 and 2043 ADT and DHV values
- 2018 Design Hour No-Build Turn Movements
- 2043 Design Hour Build Turn Movements

If you have any questions, please contact Daniel Hulker of this Division at (502) 782-5064.

JM/DH/BC

Attachments

c/att: Wendy Southworth  
Andrew Stewart  
Deneatra Henderson



# *Executive Summary*

## **Traffic Forecast Report and Bike/Ped Accommodation Assessment for Warren County US 31W Major Widening Item No. 03-8857.00**

Prepared for:



Prepared by:  
**Daniel Hulker**  
Division of Planning  
Kentucky Transportation Cabinet  
March 21, 2018

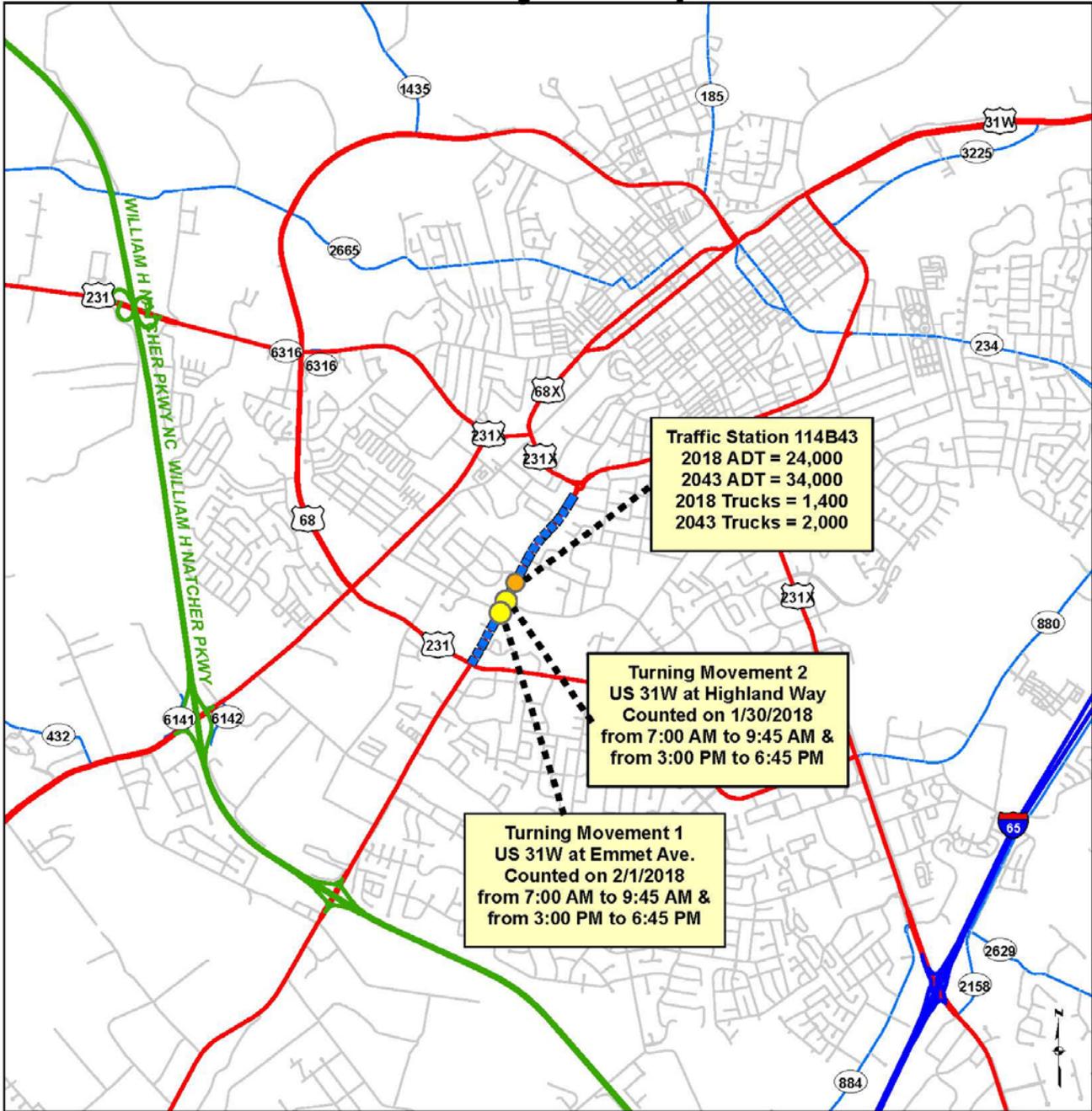
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## **Commonly Used Abbreviations and their Descriptions**

ADT	Average Daily Traffic	Without any adjustment
AADTT	Average Annual Daily Truck Traffic	
BCI	Bicycle Comfort Index	
DHV	Design Hour Volume	30 <sup>th</sup> highest hour of a <u>year</u>
DHTV	Design Hour Truck Volume	Truck volume during peak hour of total traffic
ESAL	Equivalent Single Axle Load	A measure of traffic's impact on roadway
%T	Truck Percentage	The percentage of trucks to total volume
FC	Functional Class	Refers to a road's importance
GR	Growth Rate	A value normally compounded annually
PHF	Peak Hour Factor	Considers a 15 minute spike in an hourly count
K-Factor	K-30 <sup>th</sup> hour Factor	DHV divided by ADT (DHV/ADT)
D-Factor	Directional Factor	Percentage of dominant flow to total
MP	Mile Point	Miles increase easterly and northerly
ATR	Automatic Traffic Recorder	A permanent & continuous recording station
KYSTM	Kentucky Statewide Model	A computerized representation of KY roads

# Vicinity Map



Major Widening & Reconstruction  
 of US 31W from MP 10.561 to  
 11.688  
 Item # 03-8857.00



### Legend

- Project Location
- Traffic Stations
- Turning Movements

0 0.5 1 Miles

**Traffic Forecast Executive Summary**  
**Warren County: US 31W Major Widening**  
**from MP 10.561 to 11.688**  
**Item No. 03-8857.00**

**FORECAST SUMMARY**

This forecast is for the major widening of US 31W from milepoints 10.561 to 11.688. The project is located south of downtown Bowling Green with a roundabout at its northern end and US 231 at its southern end.

**FORECAST TYPE**

The following types of forecasts were developed:

- 2018 and 2043 ADT and DHV values
- 2018 Design Hour No-Build Turn Movements
- 2043 Design Hour Build Turn Movements

**CURRENT-YEAR VOLUMES**

Current year volumes were based upon the 2017 class count taken at station 114B43 on US 31W at milepoint 11.094. The count indicated an overall daily volume of 24,000.

**DESIGN-YEAR/GROWTH FACTORS**

The growth rate of traffic was calculated by running the Warren County Travel Demand Model base year (2015) and future year (2040) scenarios. The historic annual growth rate for traffic station 114B43 is 1.0%. The base year scenario has the route open to traffic as a two-lane road while the future year scenario has the road open to traffic as a four-lane road. This improvement will relieve congestion and make the route more attractive to traffic with the road improvements. The model indicated an annual traffic growth rate of 1.5%. Census projections also indicate an annual population growth rate of 1.5%. Therefore, traffic was increased on US 31W at a rate of 1.5%.

**DESIGN HOUR FACTORS**

Design hour factors were estimated from the turning movement counts as well as the class count 114B43.

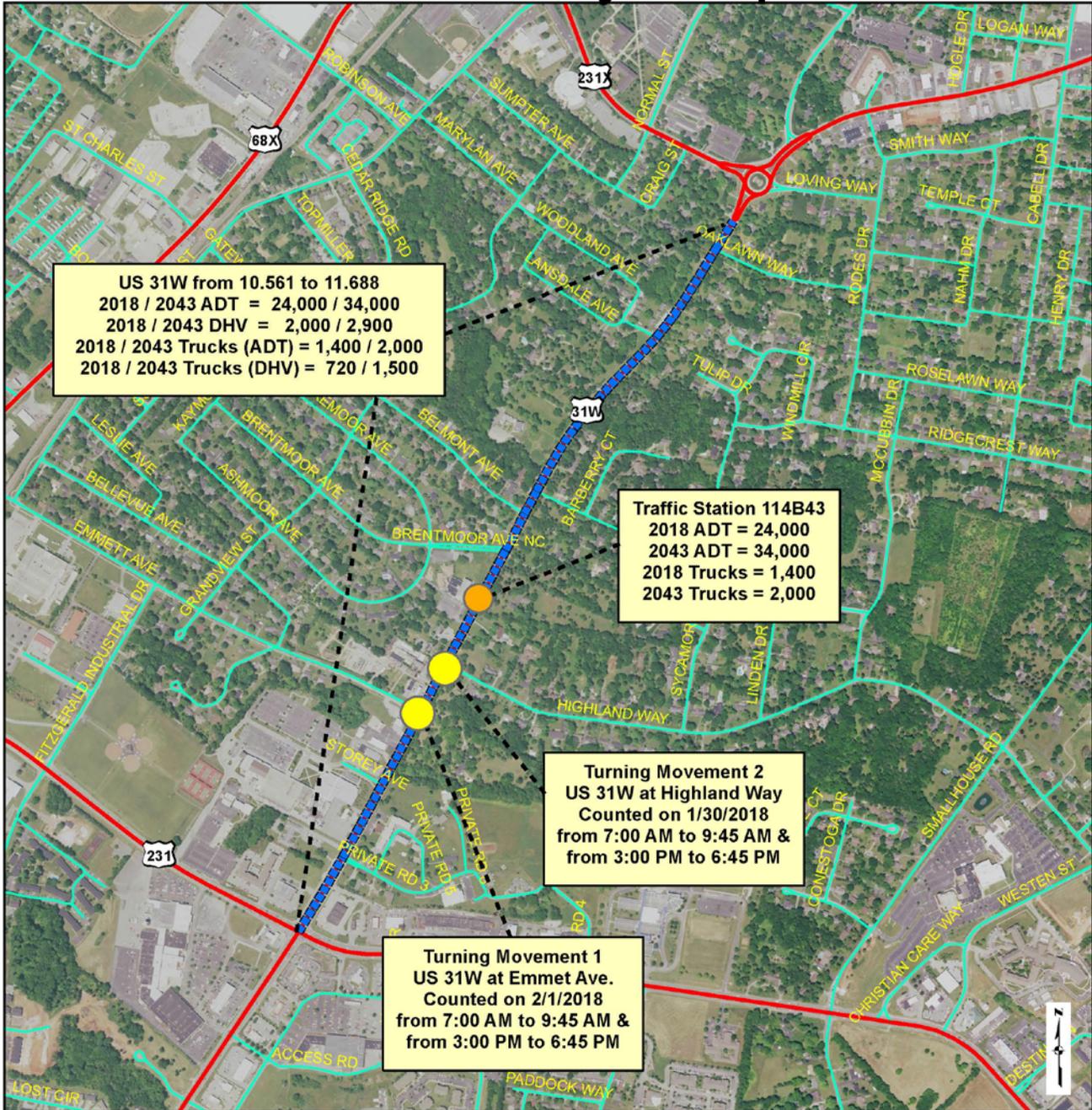
**TRUCK VOLUMES**

Truck volumes were estimated from the 2017 class count at station 114B43 on US 31W at milepoint 10.561. Despite the widening of the project to four lanes, heavy truck traffic growth may be constrained by the presence of the roundabout at the northern end of the intersection. Most truck traffic growth will be single-unit trucks. Therefore, truck volumes were increased at a rate of 1.5% to match the growth rate of overall traffic.

**TURN MOVEMENTS**

Two turning movements were counted on US 31W at the intersections of Emmet Avenue (2/1/2018) and Highland Way (1/30/2018). The turning movements were counted from 7AM to 9:45AM and from 3PM to 6:45 PM. For more information, see the turning movements on pages 6 through 9.

# Summary Map



Major Widening & Reconstruction  
 of US 31W from MP 10.561 to  
 11.688  
 Item # 03-8857.00



**Legend**

- ▬▬▬▬▬ Project Location
- Traffic Stations
- Turning Movements

0      0.15      0.3  
 Miles

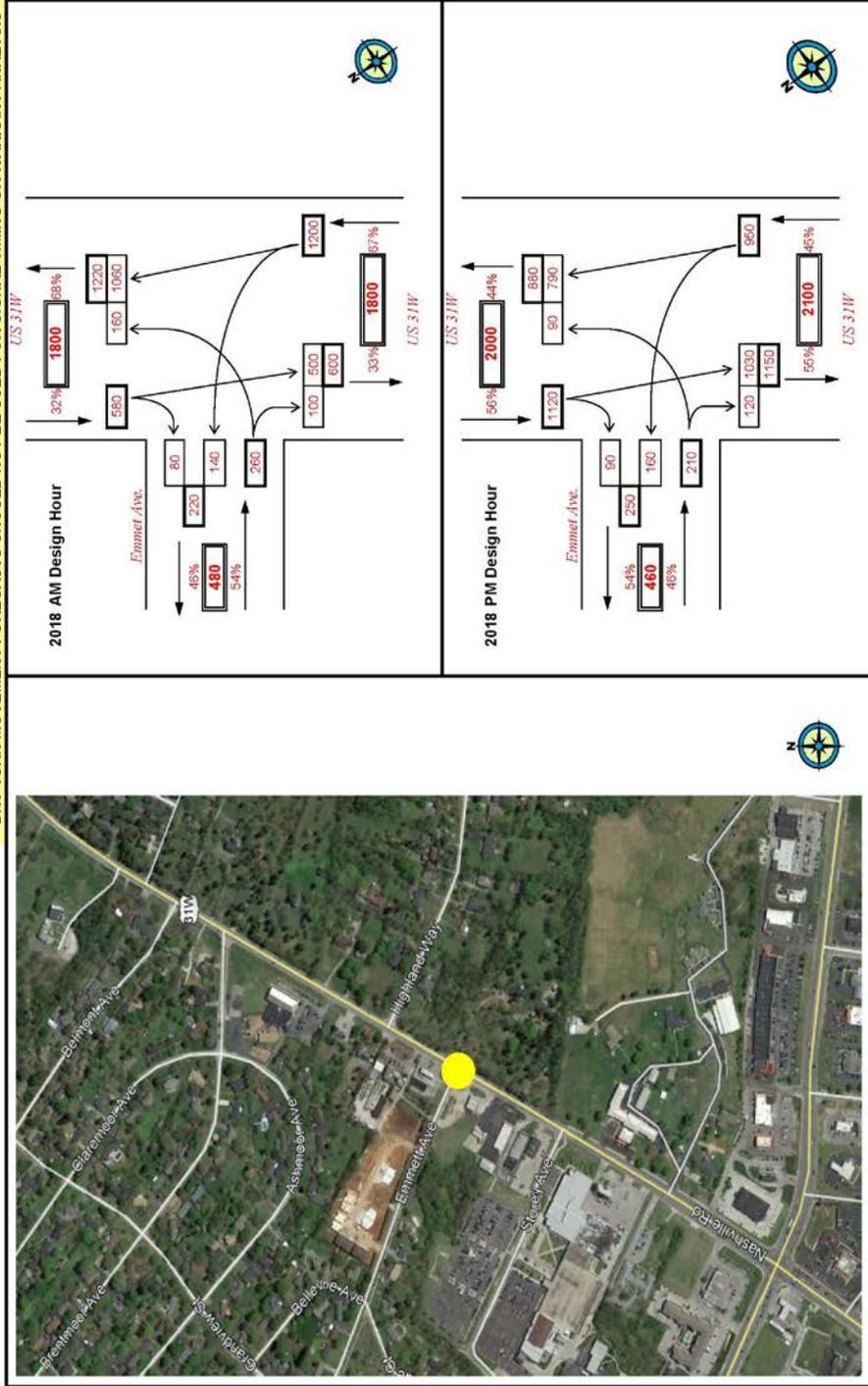
Traffic Forecast Technical Report  
 Warren County: US 31W Major Widening from MP 10.561 to 11.688  
 Item No. 03-8857.00

NOTE: K-Factors, Directional Distributions, and Peak Hour Factors were determined from a 2018 Turning Movement Count. AM and PM DHVs represent 30th highest hour estimates for each turn maneuver.

PROJECT: US 31W Widening  
 ITEM NUMBER: 03-8857.00  
 MARS NUMBER: 93337.01D  
 REQUEST DATE: Friday, October 20, 2017  
 ANALYST: Daniel Hulker  
 YEAR: 2018  
 INTERSECTION: US 31W at Emmet Avenue

**TURN MOVEMENT 1 (2018)**

**\*\*DHV TURN MOVEMENT FORECASTS SHOULD NOT BE USED FOR SIGNAL TIMING OR WARRANT ANALYSIS**



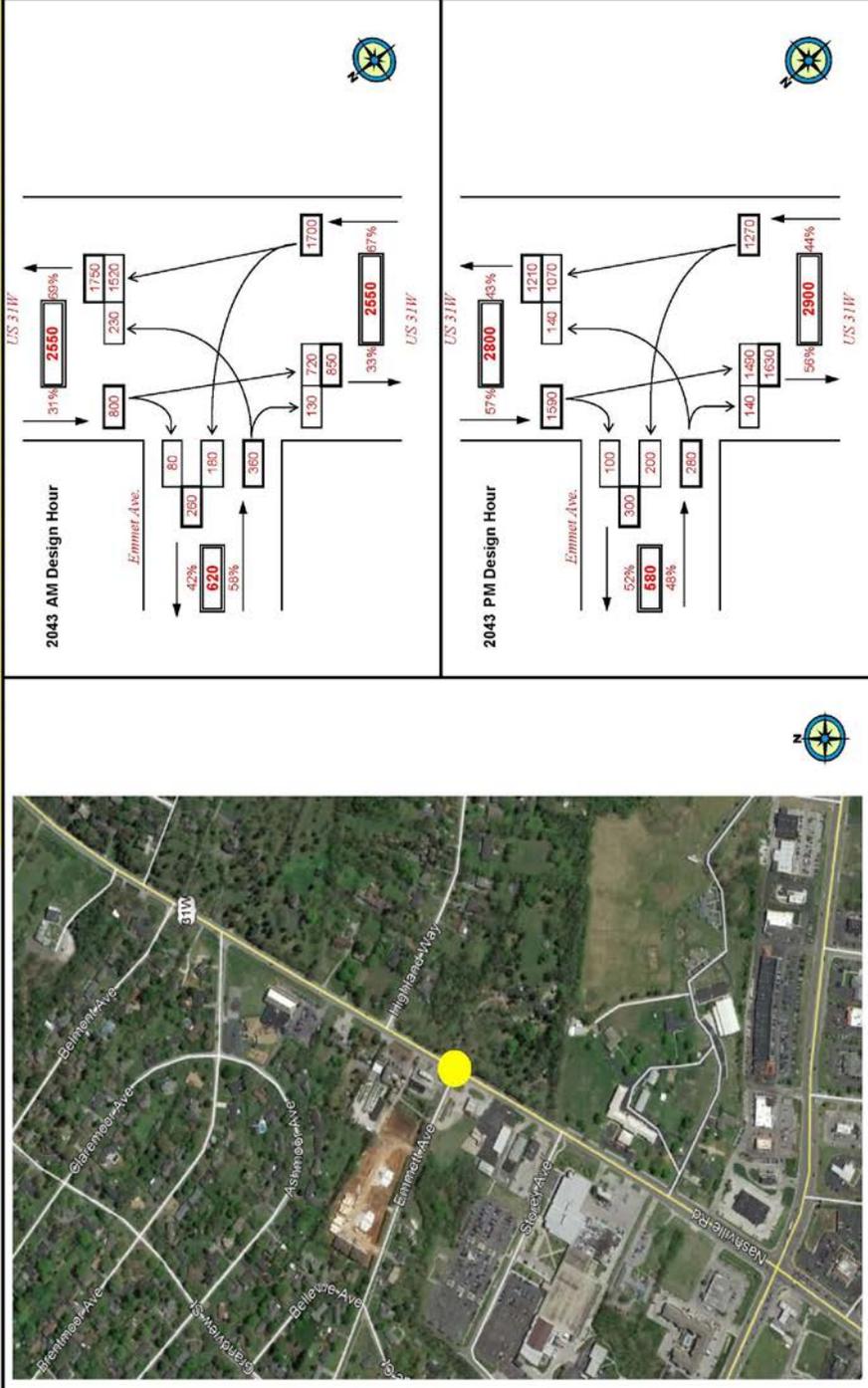
Traffic Forecast Technical Report  
 Warren County: US 31W Major Widening from MP 10.561 to 11.688  
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NOTE: K-Factors, Directional Distributions, and Peak Hour Factors were determined from a 2043 Turning Movement Count. AM and PM DHVs represent 30th highest hour estimates for each turn maneuver.

PROJECT: US 31W Widening  
 ITEM NUMBER: 03-8857.00  
 MARS NUMBER: 93337 01D  
 REQUEST DATE: Friday, October 20, 2017  
 ANALYST: Daniel Hulker  
 YEAR: 2043  
 INTERSECTION: US 31W at Emmet Avenue

**TURN MOVEMENT 1 (2043) Build**

**\*\*DHV TURN MOVEMENT FORECASTS SHOULD NOT BE USED FOR SIGNAL TIMING OR WARRANT ANALYSIS**



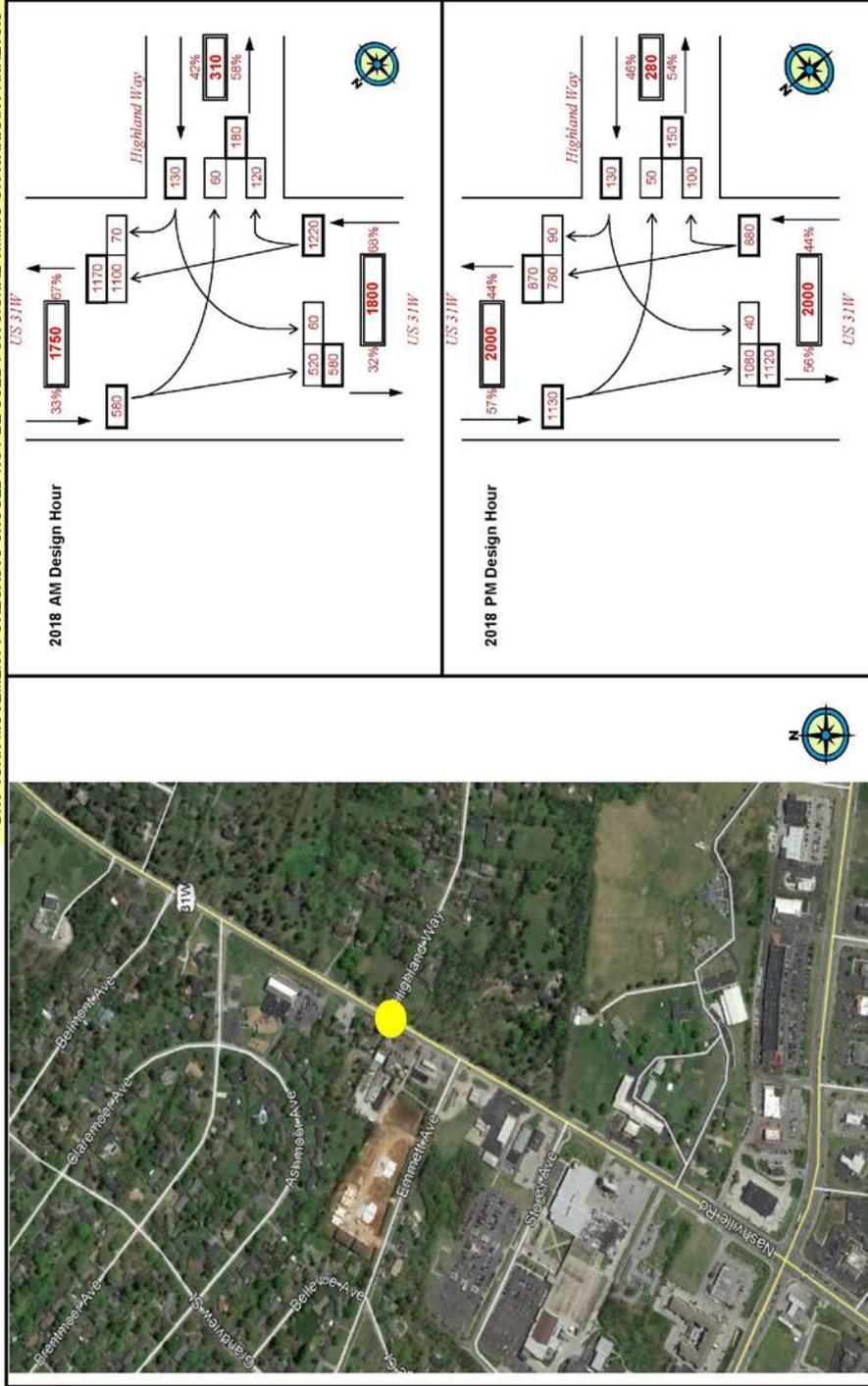
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NOTE: K-Factors, Directional Distributions, and Peak Hour Factors were determined from a 2018 Turning Movement Count. AM and PM DHVs represent 30th highest hour estimates for each turn maneuver.

PROJECT: US 31W Widening  
 ITEM NUMBER: 03-8857.00  
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 REQUEST DATE: Friday, October 20, 2017  
 ANALYST: Daniel Hulker  
 YEAR: 2018  
 INTERSECTION: US 31W at Highland Avenue

**TURN MOVEMENT 2 (2018)**

**\*\*DHV TURN MOVEMENT FORECASTS SHOULD NOT BE USED FOR SIGNAL TIMING OR WARRANT ANALYSIS**



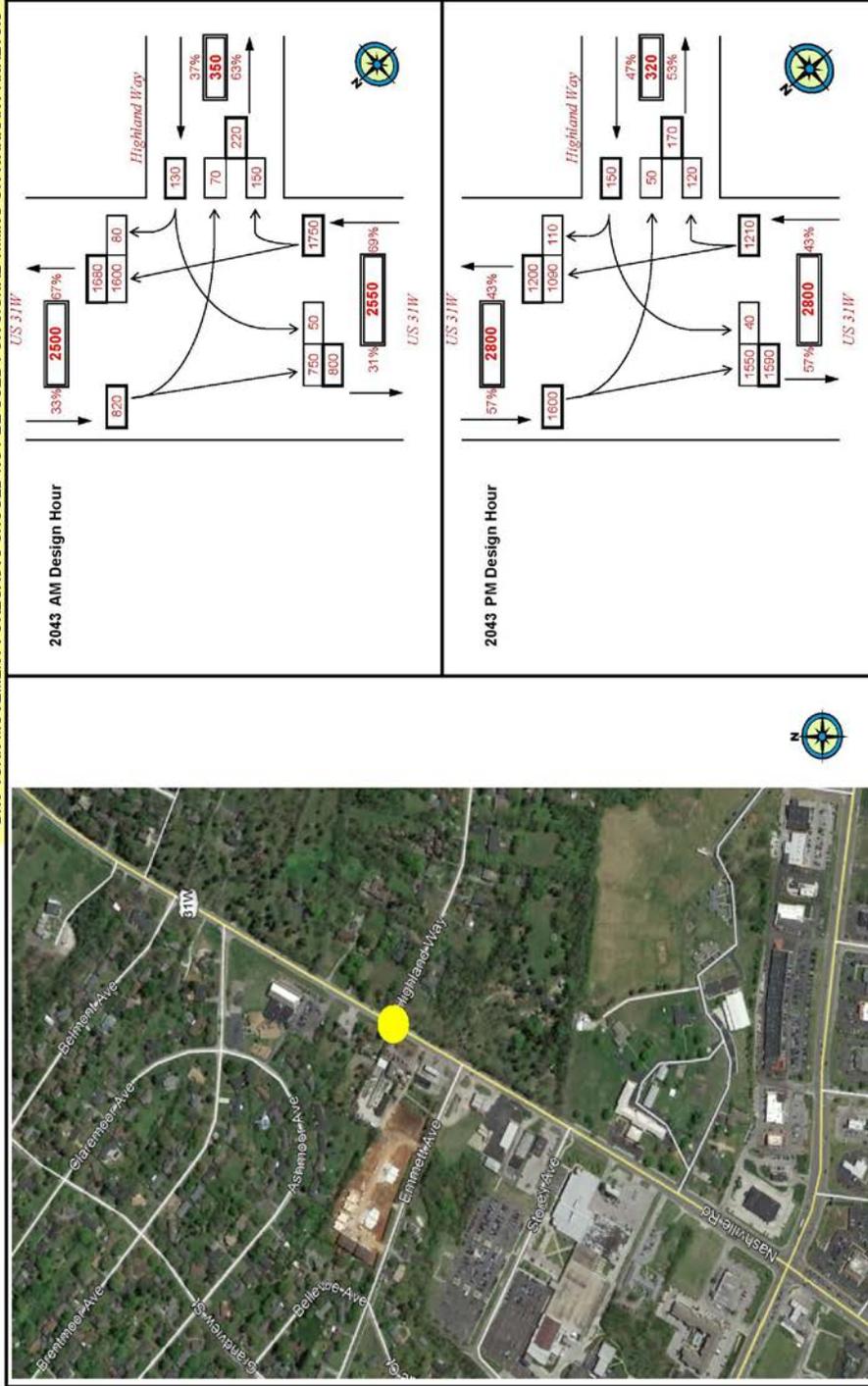
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PROJECT: US 31W Widening  
 ITEM NUMBER: 03-8857.00  
 MARS NUMBER: 93337 01D  
 REQUEST DATE: Friday, October 20, 2017  
 ANALYST: Daniel Hulker  
 YEAR: 2043  
 INTERSECTION: US 31W at Highland Avenue

NOTE: K-Factors, Directional Distributions, and Peak Hour Factors were determined from a 2043 Turning Movement Count. AM and PM DHVs represent 30th highest hour estimates for each turn maneuver.

**TURN MOVEMENT 2 (2043) Build**

**\*\*DHV TURN MOVEMENT FORECASTS SHOULD NOT BE USED FOR SIGNAL TIMING OR WARRANT ANALYSIS**



Traffic Forecast Technical Report  
 Warren County: US 31W Major Widening from MP 10.561 to 11.688  
 Item No. 03-8857.00

**Pavement Design Factors for Major Widening of US 31W**

**Project information:**

Date of Forecast	2/28/2018
Name of Forecaster	Daniel Hulker
Item Number	03-8857.00
County name	Warren
County Number	114
District	3
Emars Number	93337 01D
Function	FD52
Fund	12F0
Project Type	MAJOR WIDENING
Current Year	2018
Letting Year	2022
Construction Year	2023

Project Description: Major Widening/Reconstruction From Campbell Lane (Us 231) To University Boulevard (Us 231X). Mp 10.561 To Mp 11.688 (14Ccn)(16Ccr)

**Route information:**

Route ID	114-US-0031W -000
Road Name	Nashville Rd.
BMP	10.561
EMP	11.688
Functional Class	16 - Urban Minor Arterial
Total Lanes (both ways)	4
1 or 2 way	Two way
Pavement Type	Asphalt
Are Trucks Prohibited in a lane?	NO

**Volume Information:**

Volume ADT station	114B43
Current year Volume	23000

**Truck Count and Truck Volume Information:**

Truck Count Station	114A15
Truck Count Volume	1,400
Truck Count year	2017
Truck Volume in Design Direction	800
Truck Volume in Design Lane of Design Direction	720
<b>2023 AADTT</b>	<b>1,500</b>

Truck % of ADT	6.1%
FC Average Truck %	7.9%
% of Trucks in Design Direction	55.4%
% of Trucks in Design Lane of Design Direction	90.0%
<b>Truck Volume Growth Rate</b>	<b>1.5%</b>

**Distribution Factors for Functional Class:**

Daily Volume Distribution Factors by vehicle Class

Vehicle Class	Truck Volume	Truck Percent
Bus	4	8.57%
2 axle, 6 tire single unit	5	35.00%
3 axles single unit	6	22.29%
4 or more axles, single unit	7	1.02%
3-4 axles, single trailer	8	4.43%
5 axles single trailer	9	13.07%
6 or more axles, single trailer	10	11.11%
5 or less axles, multi-trailer	11	0.00%
6 axles, multi trailer	12	0.00%
7 or more axles, multi-trailer	13	4.50%
All Truck Vehicle Classes	1,500	100.00%

**16 - Urban Minor Arterial**

Hourly Volume Distribution Factors

Hour	Volume	Percent
0 12 AM to 1 AM	2	0.15%
1 1 AM to 2 AM	3	0.22%
2 2 AM to 3 AM	4	0.29%
3 3 AM to 4 AM	9	0.58%
4 4 AM to 5 AM	4	0.29%
5 5 AM to 6 AM	14	0.94%
6 6 AM to 7 AM	45	2.98%
7 7 AM to 8 AM	143	9.51%
8 8 AM to 9 AM	82	5.45%
9 9 AM to 10 AM	82	5.45%
10 10 AM to 11 AM	77	5.16%
11 11 AM to 12 PM	147	9.80%
12 12 PM to 1 PM	107	7.12%
13 1 PM to 2 PM	118	7.84%
14 2 PM to 3 PM	143	9.51%
15 3 PM to 4 PM	112	7.48%
16 4 PM to 5 PM	121	8.06%
17 5 PM to 6 PM	99	6.61%
18 6 PM to 7 PM	53	3.56%
19 7 PM to 8 PM	64	4.28%
20 8 PM to 9 PM	36	2.40%
21 9 PM to 10 PM	16	1.09%
22 10 PM to 11 PM	11	0.73%
23 11 PM to 12 AM	8	0.51%
ALL Hours	1,500	100.00%

**Coal Haul Information:**

Total Annual Tonnage:	N/A
Daily Coal Trucks:	0
Coal Trucks as a Percent of all Trucks:	N/A



**Bicycle and Pedestrian Consideration Review for Traffic Forecast #3-8857**

**Project Overview:**

The major widening and reconstruction of US-31W from US-231 (Campbell Lane) to US-231X (University Blvd). Mile points 10.356 – 11.688

**Local/regional Bicycle & Pedestrian Planning:**

- Pedestrian & Bicycle planning map for south west Bowling Green (campus area) / [http://warrenpc.org/greenways/pdf/WKU\\_SouthCampus.pdf](http://warrenpc.org/greenways/pdf/WKU_SouthCampus.pdf) (Figure 1)
- Greenway planning map for inner loop / <http://www.warrenpc.org/maps/bowlinggreen/innerloopgreenbelt.pdf> (Figure 2)

**Existing conditions:**

US-31W (MP 10.561-11.688) / Nashville Road

- ADT is 23800
- Heavy truck ADTT is 229
- Posted speed limit is 45 MPH
- Urban curb and gutter cross section (MP 10.561-10.799 (wide sidewalks over 5') & MP 11.541-11.688) with wide a sidewalk (< 5') on the cardinal direction (north bound) of the roadway (MP 10.561-10.799 (wide sidewalks over 5') & MP 11.541-11.688). Sidewalks on the non-cardinal direction (south bound) from MP 10.561-10.683 & MP 11.54-11.688
- Rural cross section (MP 10.80-11.54)
- Bike lanes on both sides of the roadway (MP 10.993-11.53)
- Mixed commercial, industrial, and residential (includes the Potter Children's Home)
- Bicycle Comfort Index (BCI) rating is D (MP 10.993-11.53) and a rating E for 10.561-10.993 & 11.53-11.688)

US-321X (MP 2.1-2.2) / University Drive

- ADT range is 20000
- Heavy truck ADTT is 2000
- Posted speed limit is 35MPH
- No paved shoulder
- Urban curb and gutter cross section
- Sidewalks along both sides of roadway (MP 2.5-2.6) with marked pedestrian crosswalks at all signalized intersections
- Residential and commercial areas
- Transit service along route area (Figure 3)
- The Bicycle Comfort Index (BCI) average rating is a level E (the lowest)

US-231 (MP 12.9-13.1) / Campbell Lane

- a. ADT is 23500-30300
  - b. Heavy Truck ADTT is 680-900
  - c. Posted speed limit is 45 MPH
  - d. Urban curb and gutter with sidewalks on both sides of the roadway
  - e. Mixed commercial and residential areas
  - f. The Bicycle Comfort Index (BCI) rating is a level E (the lowest)
- Strava Heat Map indicates moderate bicycle travel estimated volume for the project area <http://labs.strava.com/heatmap/#15/-86.46197/36.98041/gray/bike> (Figure 4)
  - Strava Heat Map indicates moderate pedestrian travel estimated volume/usage along the project area <http://labs.strava.com/heatmap/#15/-86.45129/36.97870/gray/run> (Figure 5)

**The KYTC Bicycle and Pedestrian program team recommendations are:**

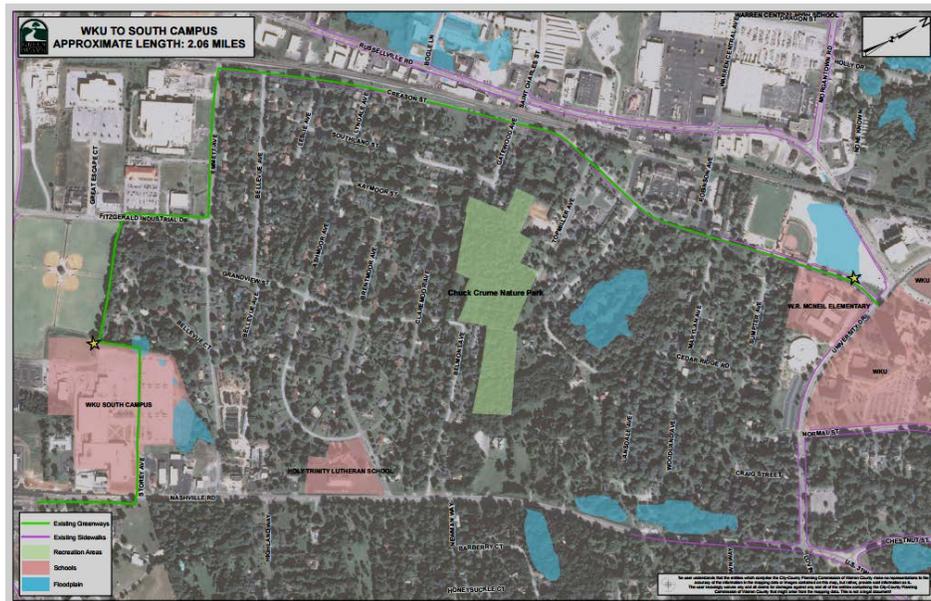
**For US-31W (MP 10.561-11.688) / Nashville Road:**

Best: Construct a wide sidewalks (6' or wider) on the non-cardinal direction (south bound) of the roadway (entire project area from MP 10.561-11.688) to complete pedestrian network connections along the project area. Construct a shared use path (10' or wider) along the cardinal direction (north bound) of the roadway (entire project area from MP 10.561-11.688), as desired by the local government and included in their bike/ped master plan. Coordinate with the local government and the transit agency for opportunities to accommodate pedestrian access to transit stops (see figure 3) along this roadway (shared use path area/cardinal direction is desired). This would serve the current and future local planning and residential/commercial development for pedestrian travel (including ADA access). Create an agreement or update an existing agreement with the local government regarding the pedestrian and bicycle facility maintenance responsibilities. The BCI average would improve to a level C.

Good: Construct wide sidewalks (6' or wider) on both sides of roadway (entire project area from MP 10.561-11.688) to complete pedestrian network connections along the project area. Coordinate with the local government and the transit agency (see figure 3) for opportunities to accommodate pedestrian access to transit stops along this roadway. This would serve the current and future local planning and residential/commercial development for pedestrian travel (including ADA access). Construct bike lanes, (5' or wider) with a 2' minimum buffer space from MP 10.561-11.688. Install Sharrow pavement markings as the bike lanes end and the route approaches the roundabout at MP 11.7, and continue to all cross streets as they enter the roundabout. Create an agreement or update an existing agreement with the local government regarding the pedestrian and bicycle facility maintenance responsibilities. The BCI average would improve to a level C.

*Traffic Forecast Technical Report*  
*Warren County: US 31W Major Widening from MP 10.561 to 11.688*  
*Item No. 03-8857.00*

Fair: Construct sidewalks (5' or wider) on both sides of roadway (entire project area from MP 10.561-11.688) to complete pedestrian network connections along the project area. Coordinate with the local government and the transit agency for opportunities to accommodate pedestrian access to transit stops along this roadway (see figure 3) . This would serve the current and future local planning and residential/commercial development for pedestrian travel (including ADA access). Construct bike lanes, 5' from MP 10.561-11.688. Create an agreement or update an existing agreement with the local government regarding the pedestrian and bicycle facility maintenance responsibilities. The BCI average would improve to a level C.



*Figure 1 / Bowling Green Greenway Planning Map*

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 Warren County: US 31W Major Widening from MP 10.561 to 11.688  
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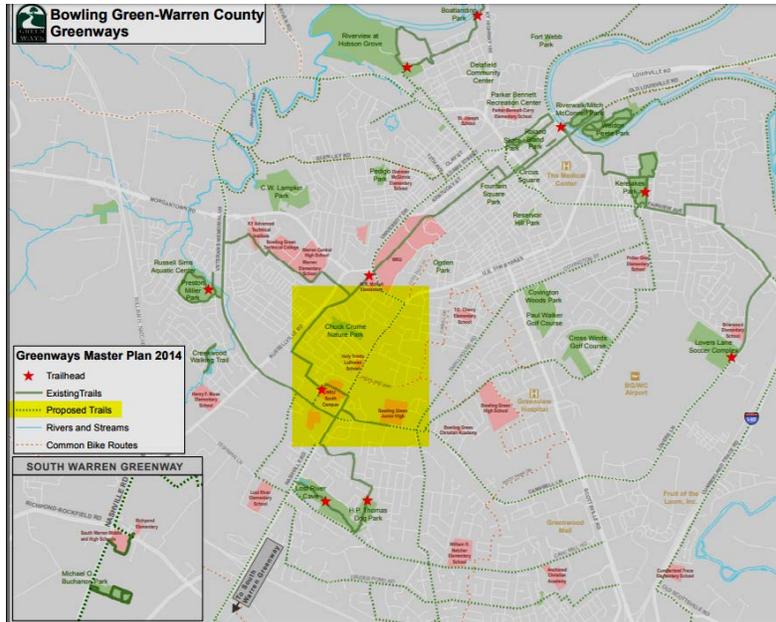


Figure 2 / Greenway Master Plan Map

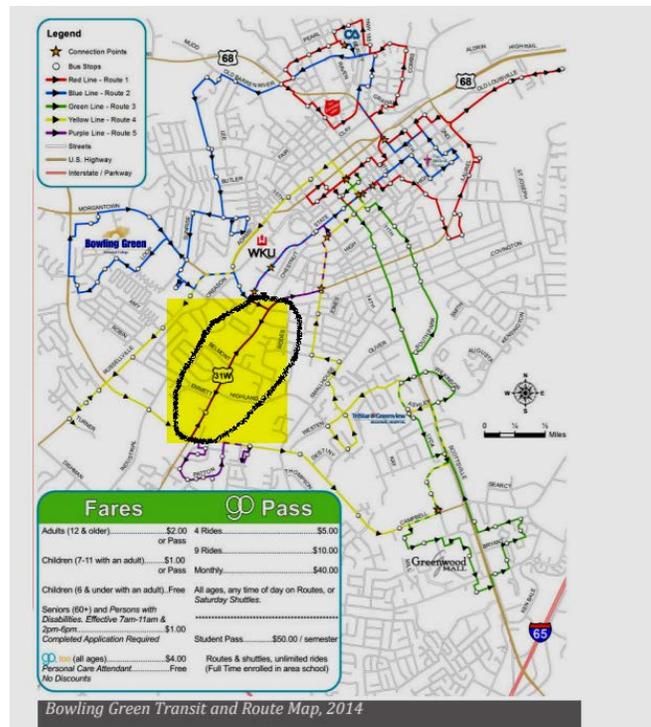


Figure 3 / Bowling Green Public Transit Service Route Map / <http://www.casoky.org/transportation>



Figure 4 / Strava Heat Map for Bicycling Activity / <http://labs.strava.com/heatmap/#15/-86.46193/36.98041/gray/bike>



Figure 5 / Strava heat map for Pedestrian Activity / <http://labs.strava.com/heatmap/#15/-86.46313/36.98216/gray/run>

- 1 <http://transportation.ky.gov/Bike-Walk/Documents/Bicycle%20Comfort%20Index%20Rating%20%202014.pdf>
- 2 KYTC Pedestrian and Bicycle Travel Policy: <http://transportation.ky.gov/Bike-Walk/Documents/KYTC%20Pedestrian%20and%20Bicycle%20Travel%20Policy%20%202002.pdf>

Prepared by:  
**Troy Hearn, Bicycle & Pedestrian Program Coordinator**  
Division of Planning, [www.transportation.ky.gov/Bike-Walk](http://www.transportation.ky.gov/Bike-Walk)  
Kentucky Transportation Cabinet  
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