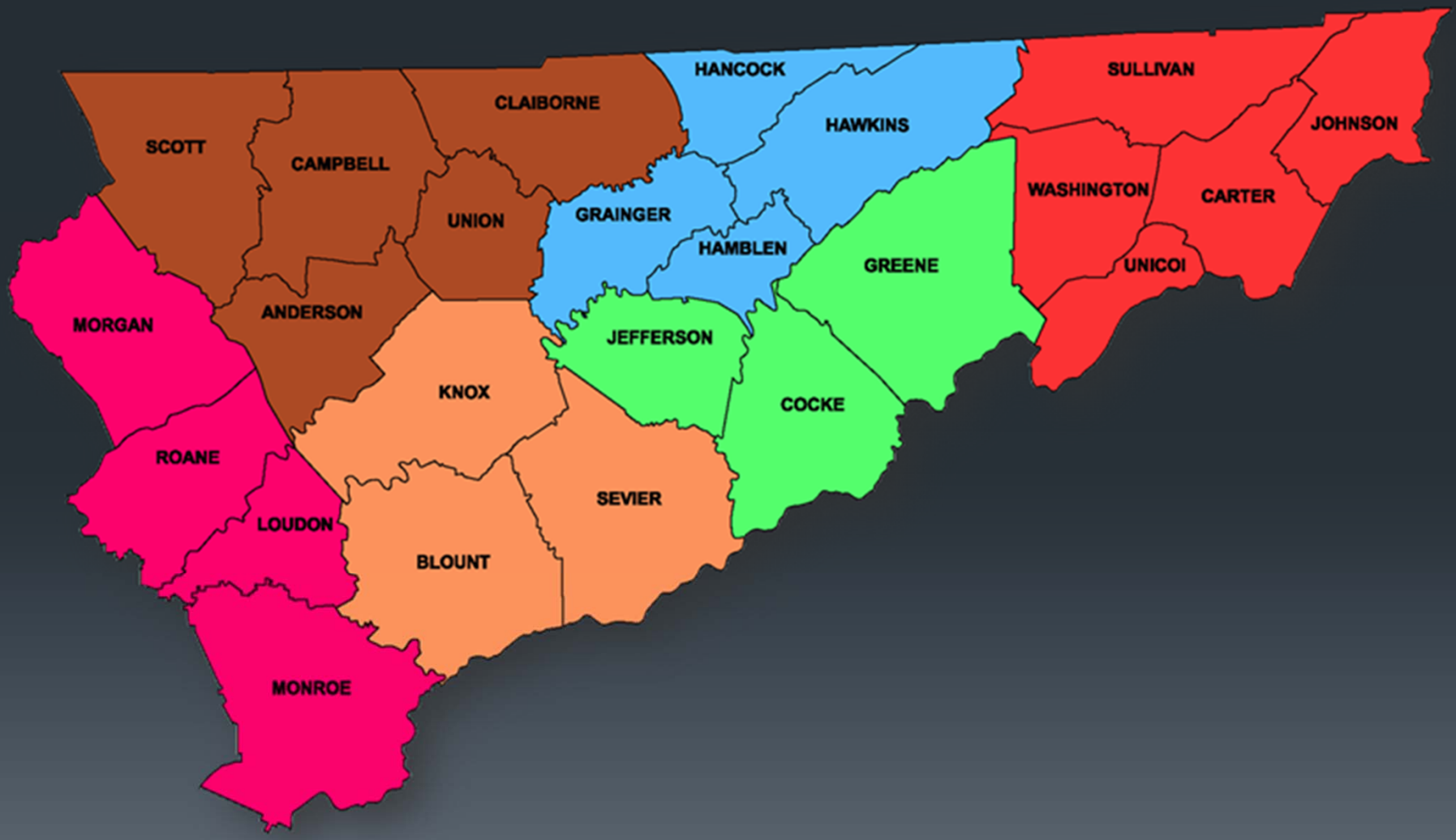
TN TDOT Department of Transportation

Over-Dimensional Vehicle Restriction Study for US 129 in TN

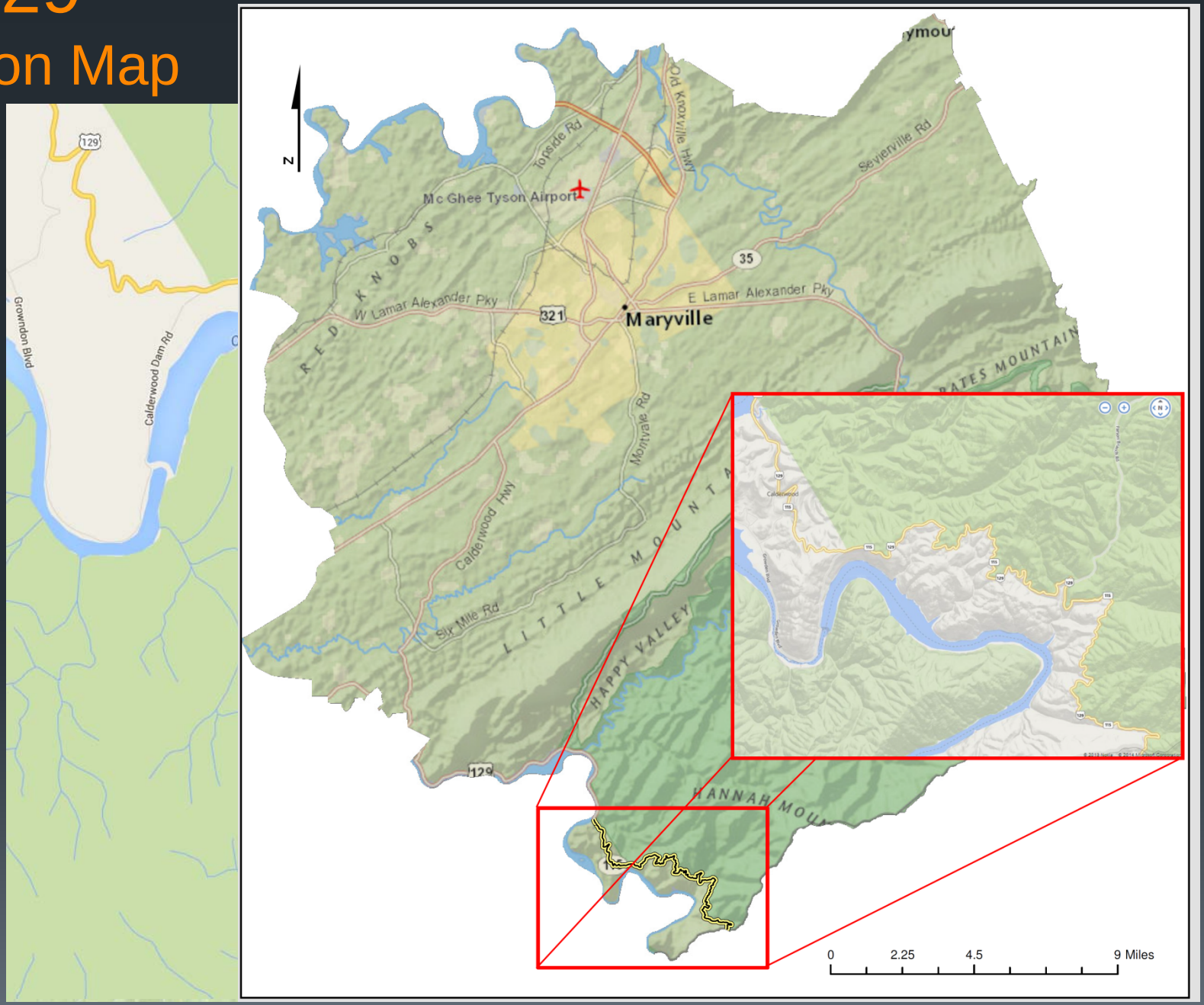
tsite TENNESSEE SECTION INSTITUTE OF TRANSPORTATION ENGINEERS

July 30,2015

TDOT Region 1



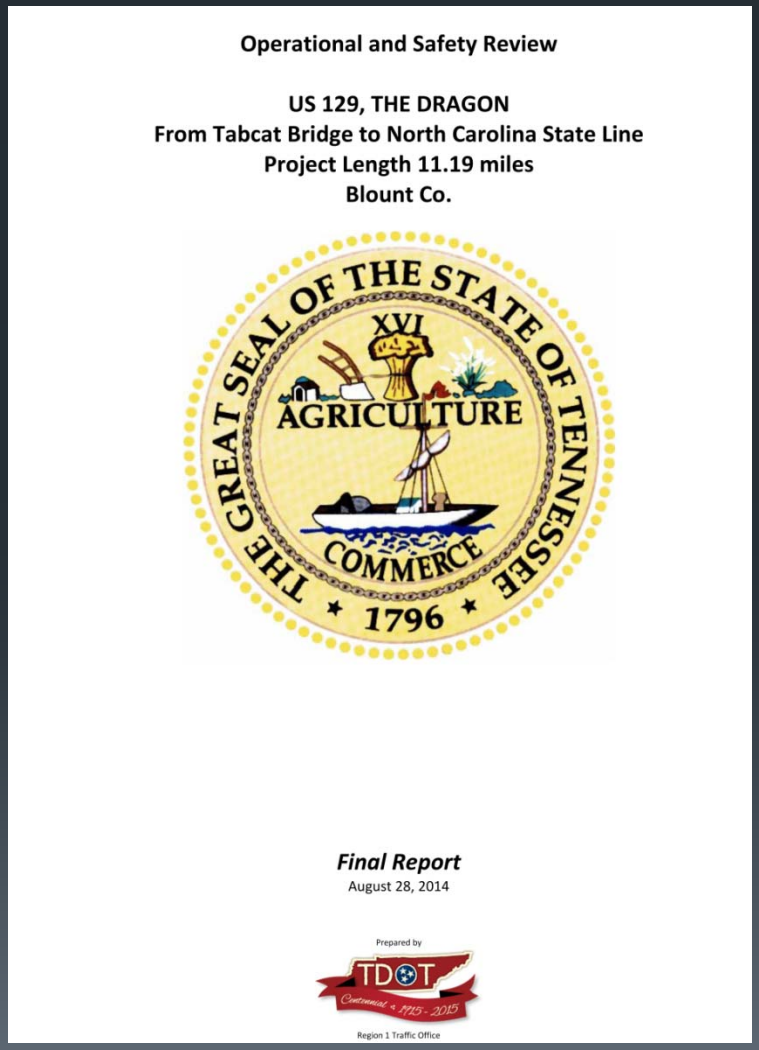
US 129
Location Map



US 129
Topography and Scenery

Operational and Safety Study

August 2014, US129


Operational and Safety Review

US 129, THE DRAGON
From Tabcat Bridge to North Carolina State Line
Project Length 11.19 miles
Blount Co.

THE GREAT SEAL OF THE STATE OF TENNESSEE
XVI
AGRICULTURE
COMMERCE
1796

Final Report
August 28, 2014

Prepared by
TDOT
Region 1 Traffic Office

Operational and Safety Review

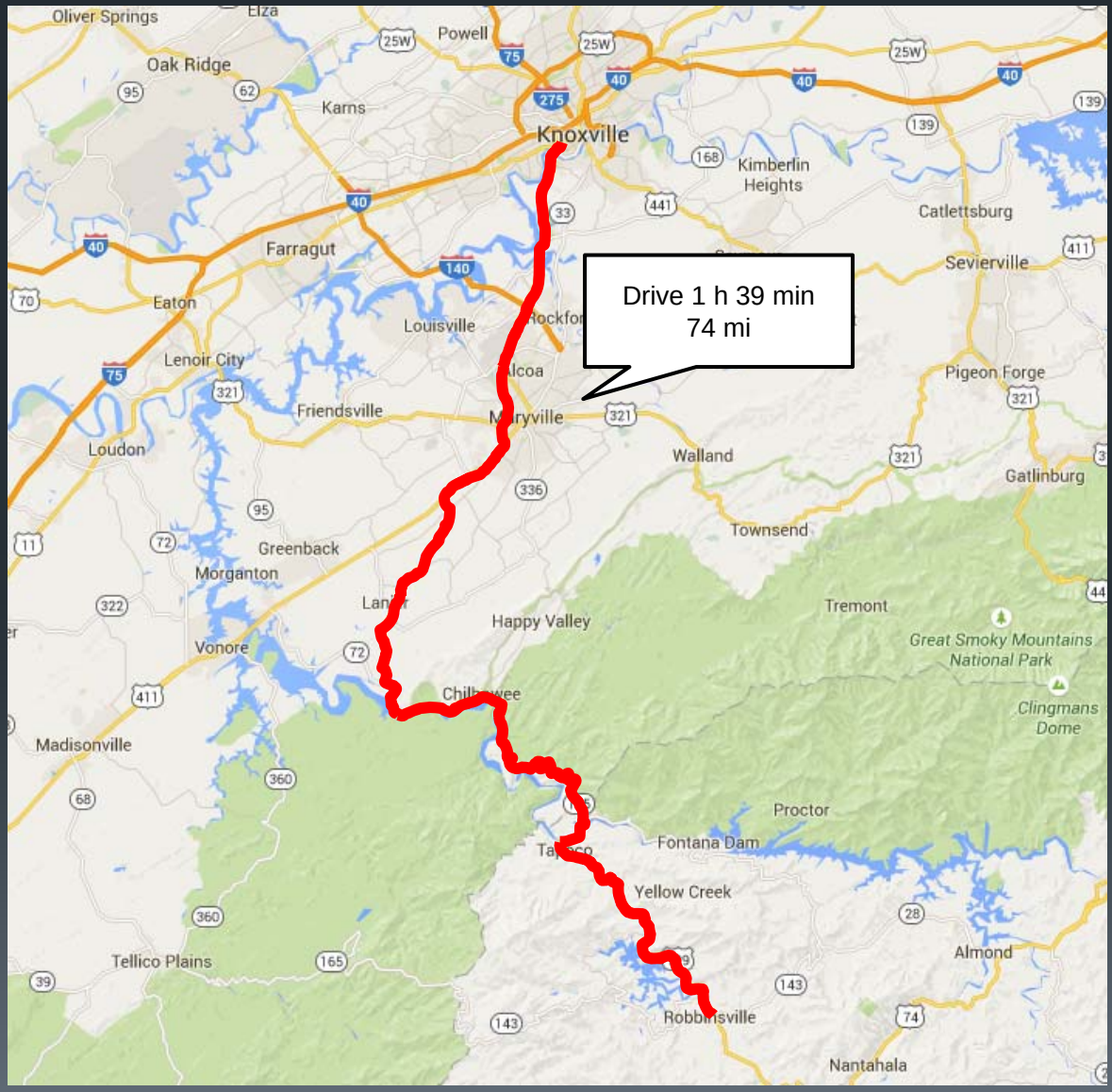
- Regional Alternative Routes
- History of Improvements
- Operational Review of US 129
- Safety Review
- Commercial Vehicle Restrictions
- Summary and Recommendations

Operational Study

Alternative Routes - Knoxville, TN to Robbinsville, NC

Route 1:

- US 129 South

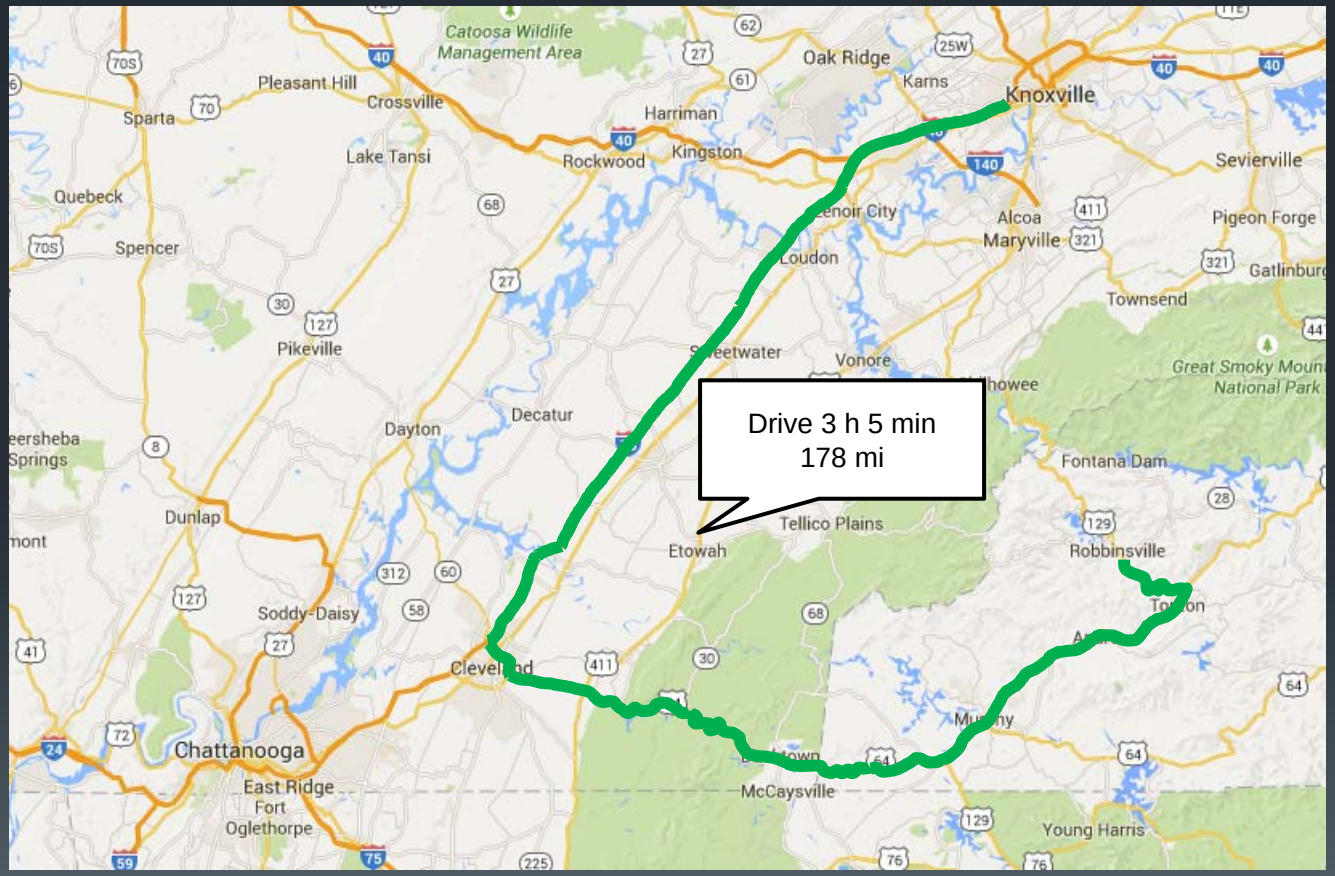


Operational Study

Alternative Routes - Knoxville, TN to Robbinsville, NC

Route 2:

- I-40 West to
- I-75 South to
- US 64 East to
- US 74 East to
- US 129 North



Operational Study

Alternative Routes - Knoxville, TN to Robbinsville, NC

Route 3:

- US 129 South to
- US 411 South to
- SR 68 South to
- US 64/74 East to
- US 129 North

Operational Study

Alternative Routes - Knoxville, TN to Robbinsville, NC

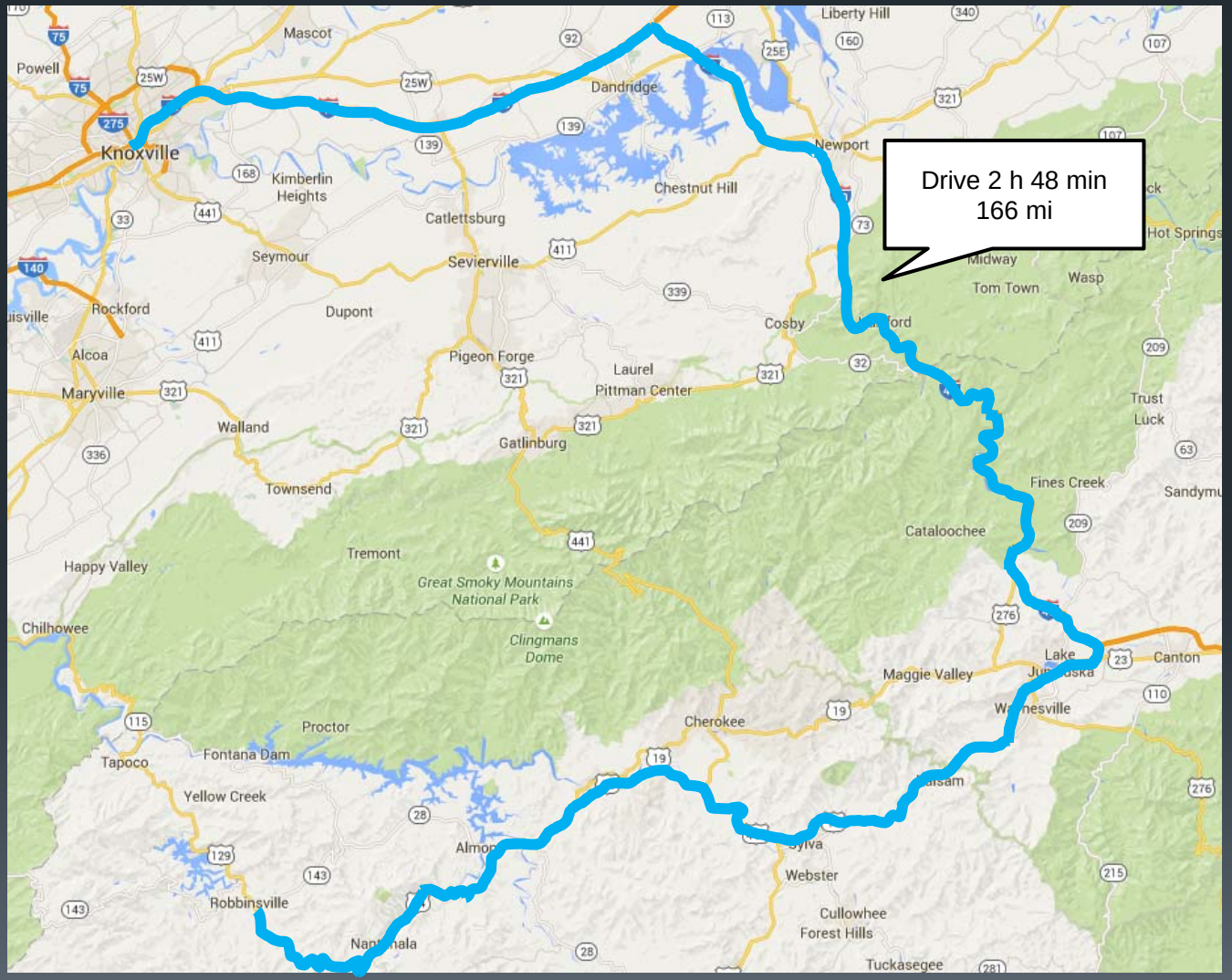
Route 4:

- I-40 East to

- US 23/74 West to

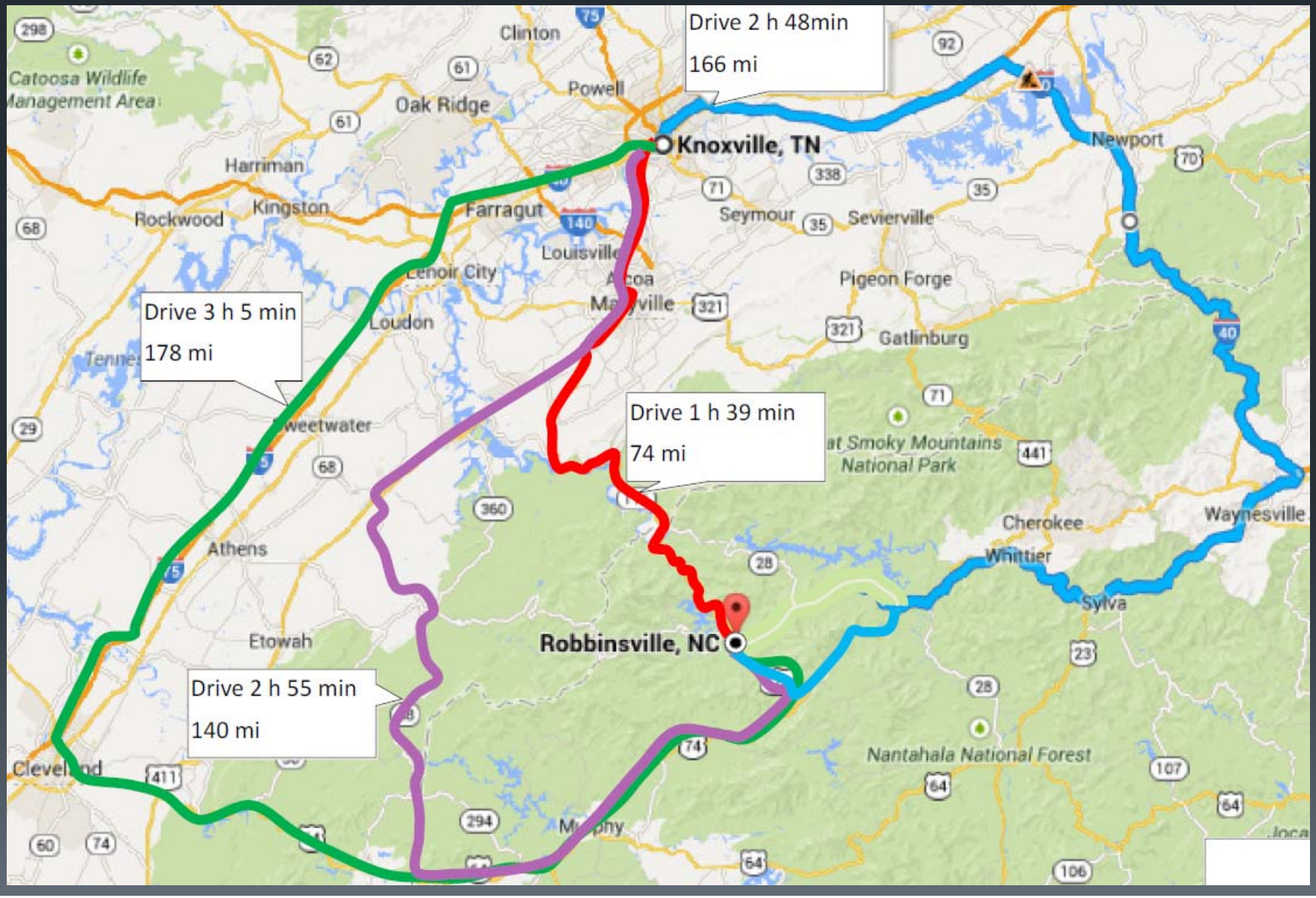
- US 19/74 West to

- US 129 North



Operational Study

Alternative Routes, US129



Past Studies and Projects
2007 Roadway Safety Audit Review

2008 RSAR Project – Blount County

Project Limits – LM 0.00 (N.C. state line) to LM 11.19 (Tabcat Bridge)

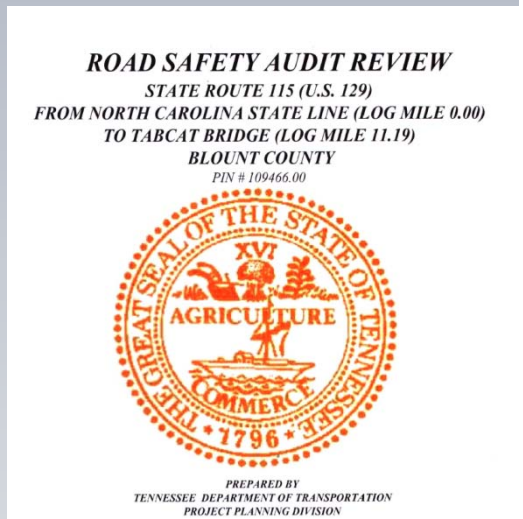
Cost - $900,900

1. **Geometric Warning, Regulatory, Guide Signs**

Hairpin Curve	Reverse Curve
Standard Curve	Dip
Winding Road	One directional arrows
Truck Advisory	Speed limit
Route Markers	Stay in Lane
Do Not Pass	Scenic Overlook

2. **Pavement Markings**
3. **Earthen Berms**
4. **Paving of 60 gravel pulloffs**
5. **Increase in Enforcement**

   The GHSO awarded a $60,000 grant for increased enforcement of the traffic laws


ROAD SAFETY AUDIT REVIEW
STATE ROUTE 115 (U.S. 129)
FROM NORTH CAROLINA STATE LINE (LOG MILE 0.00)
TO TABCAT BRIDGE (LOG MILE 11.19)
BLOUNT COUNTY
PIN # 109466.00

PREPARED BY
TENNESSEE DEPARTMENT OF TRANSPORTATION
PROJECT PLANNING DIVISION

Past Studies and Projects

2007 Roadway Safety Audit Review

Road Safety Audit Review

Blount County
State Route 115 (U.S.129)
From Log Mile 0.00 to Log mile 11.19
Date of Review: May 17, 2007

Description of Project and Background

This project involves approximately 11 miles of State Route 115 known as the "Tail of the Dragon". This segment of roadway has become a popular tourist attraction for motorcyclists and sports car enthusiasts for its twisting turns and natural setting. The Project Planning Division was asked to evaluate this segment to determine what safety measures can be applied to reduce the high number of crashes which occur at various points along the roadway. The study segment is eligible for Hazard Elimination Safety Program funds.

Team Members

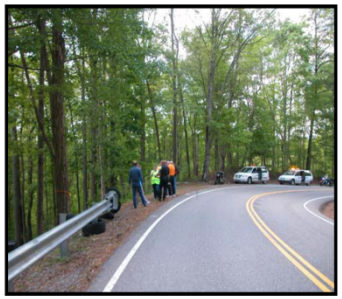
- Steve Allen - Director, TDOT Project Planning Division.
- Dudley Daniel - Transportation Manager 1, TDOT Conceptual & NEPA Planning Office.
- Amanda Snowden - Operations Specialist Supervisor 2, TDOT Region 1 Traffic Engineering Office.
- Nathan Vatter - Operations Specialist 3, TDOT Region 1 Traffic Engineering Office.
- Tony Armstrong - Transportation Manager 1, TDOT Project Planning Division.
- Michelle Powell - Operations Specialist, TDOT/Headquarters Traffic Engineering Office.
- Eric Jackson - Graduate Transportation Associate, TDOT Headquarters/Traffic Engineering Office.
- Paul Lane - Transportation Specialist 1, TDOT Project Planning Division.
- Ron Johnson - Webmaster of tailofthedragon.com and motorcycle enthusiast.
- Tim Wilson - Blount County Sheriff's Deputy.
- Houston Daugherty - Consultant, Smith Seckman Reid, Inc. (Observer).

CRUD CORNER

2. Log Mile 1.55 (The Wall) – This location is the site of a fatality. Install a "Reverse Curve" sign (W1-4) on the northbound approach to this spot.

THE WALL

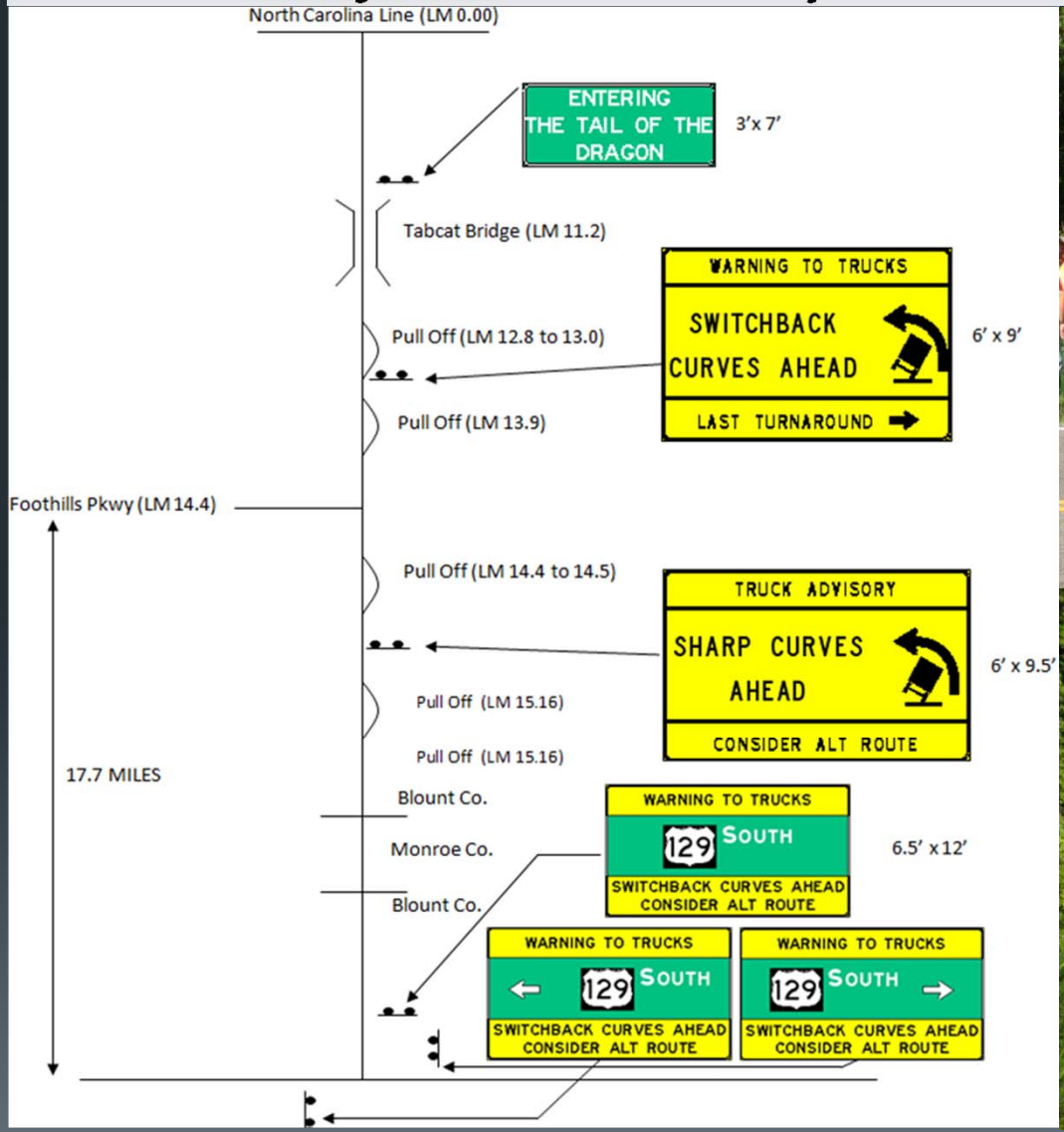
5. Log Mile 7.20 (Guardrail Cliff) – Loss of control on the curve in advance of the guardrail results in crashes both before and into the barrier. Build an earthen berm along the outside of the curve from the existing berm to the guardrail terminus.



GUARDRAIL CLIFF

Past Studies and Projects

2008 RSAR Project – Blount County



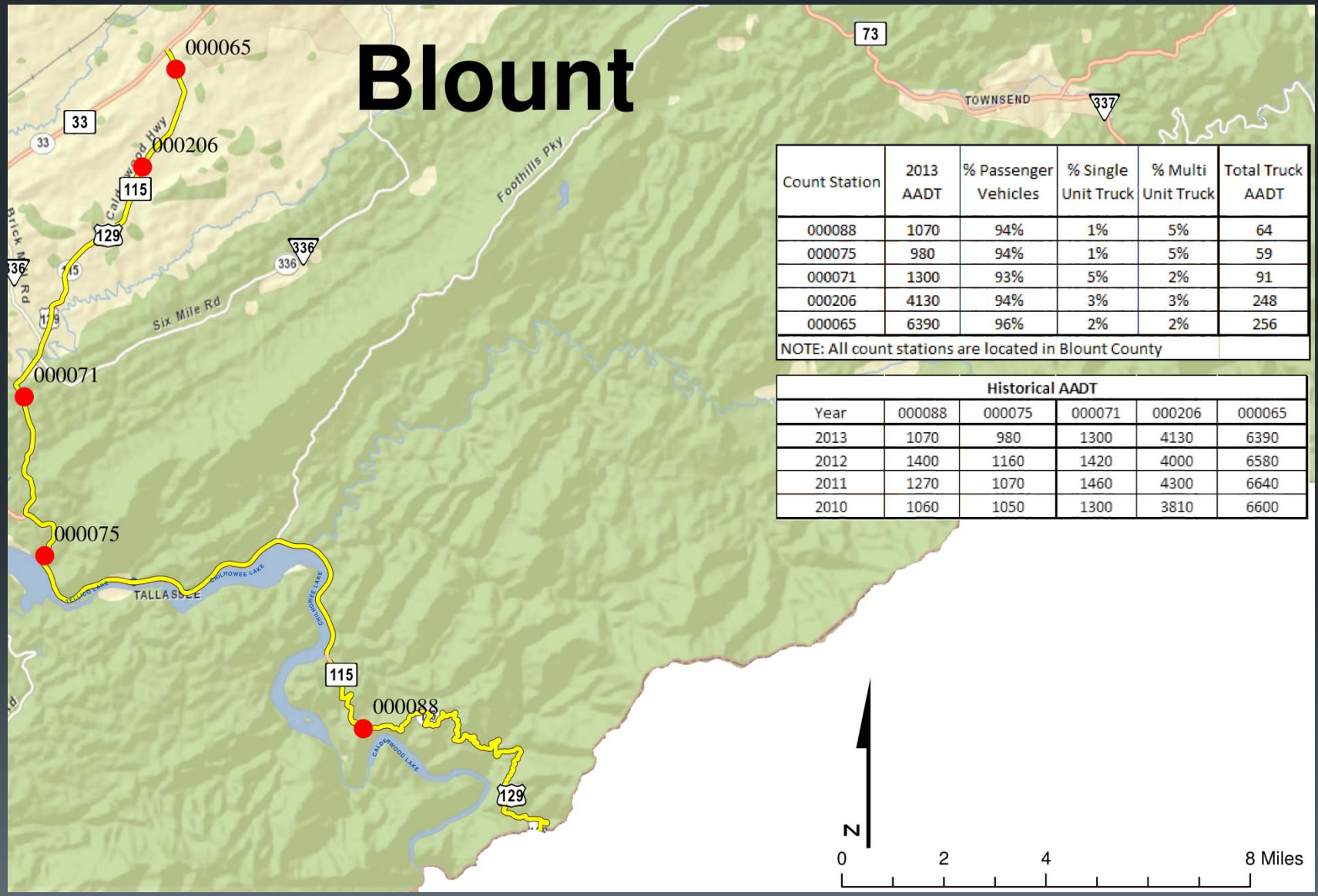
Past Studies and Projects

2009 Traffic Operation Improvements – Blount and Monroe Counties
Project Limits – LM 11.19 (Tabcat Bridge) to US 411
Project Length – 20.84 miles
Cost - $50,000

1. **Raised Pavement Markers –** Beginning at the Tabcat Bridge and ending at US 411, length 20.84-mile
2. **Centerline Rumble Stripes & Spray Thermo Plastic Markings –** Beginning near LM 20.0 in Blount County and ending at US 411, Length 12.04-mile
3. **Improvements at the intersection of US 129 with SR 72**
    - **Channelized Markings shoulders near radii of intersection**
    - **Dotted skips on Centerline and Edgeline**
    - **New Stop Lines**
    - **Extend Double Yellow toward intersection on SR 72**
    - **Additional Warning and Route signs for intersection**

Operational Study

Traffic Volumes,US129



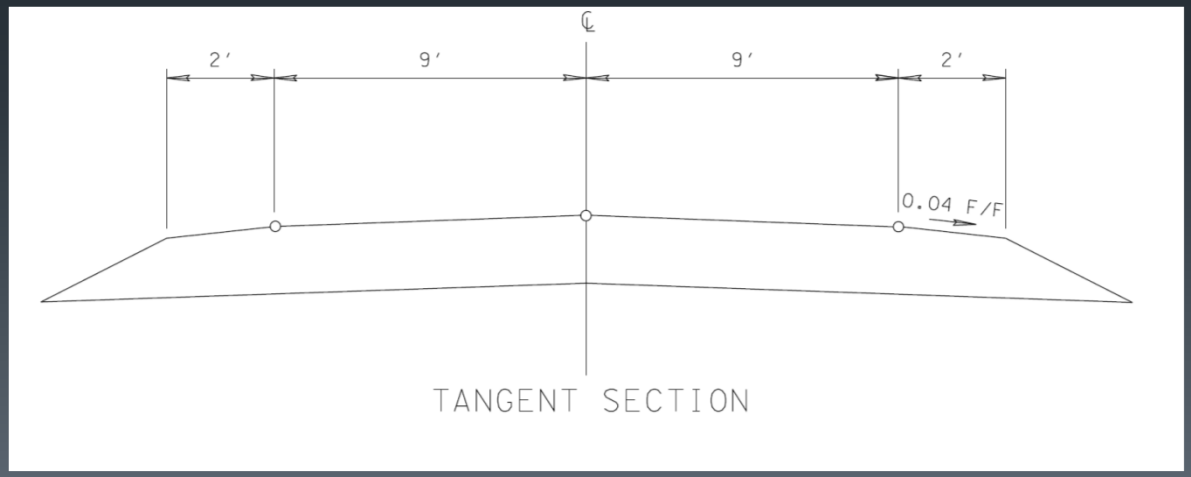
Count Station	2013 AADT	% Passenger Vehicles	% Single Unit Truck	% Multi Unit Truck	Total Truck AADT
000088	1070	94%	1%	5%	64
000075	980	94%	1%	5%	59
000071	1300	93%	5%	2%	91
000206	4130	94%	3%	3%	248
000065	6390	96%	2%	2%	256

NOTE: All count stations are located in Blount County

Historical AADT					
Year	000088	000075	000071	000206	000065
2013	1070	980	1300	4130	6390
2012	1400	1160	1420	4000	6580
2011	1270	1070	1460	4300	6640
2010	1060	1050	1300	3810	6600

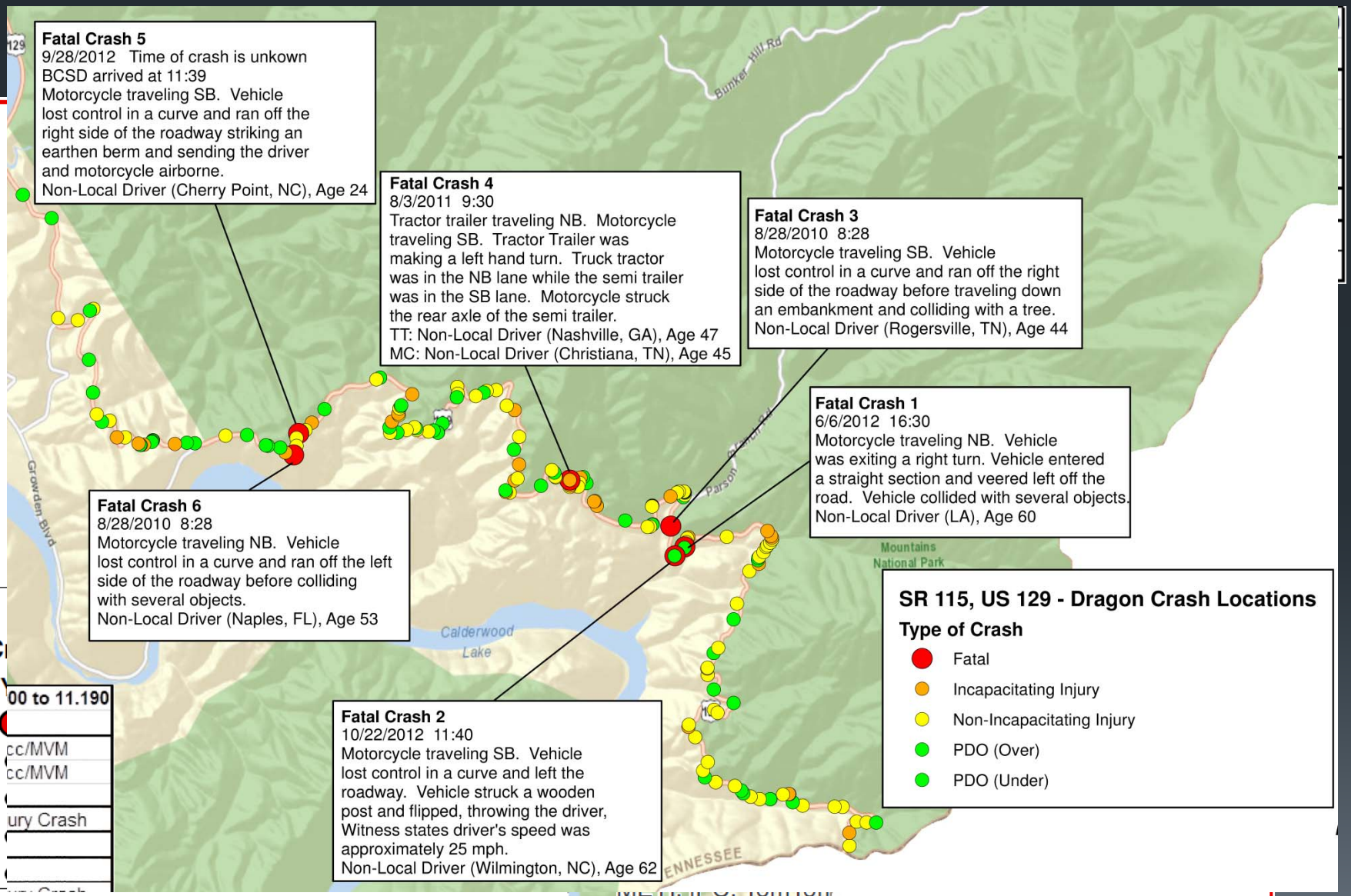
Operational Study
Roadway Geometry

- Mountainous Terrain
- Grades
- 318 Curves in 11-miles
- Curves and Embankments limit SSD
- 9 feet Lane Widths
- Limited Shoulder Width



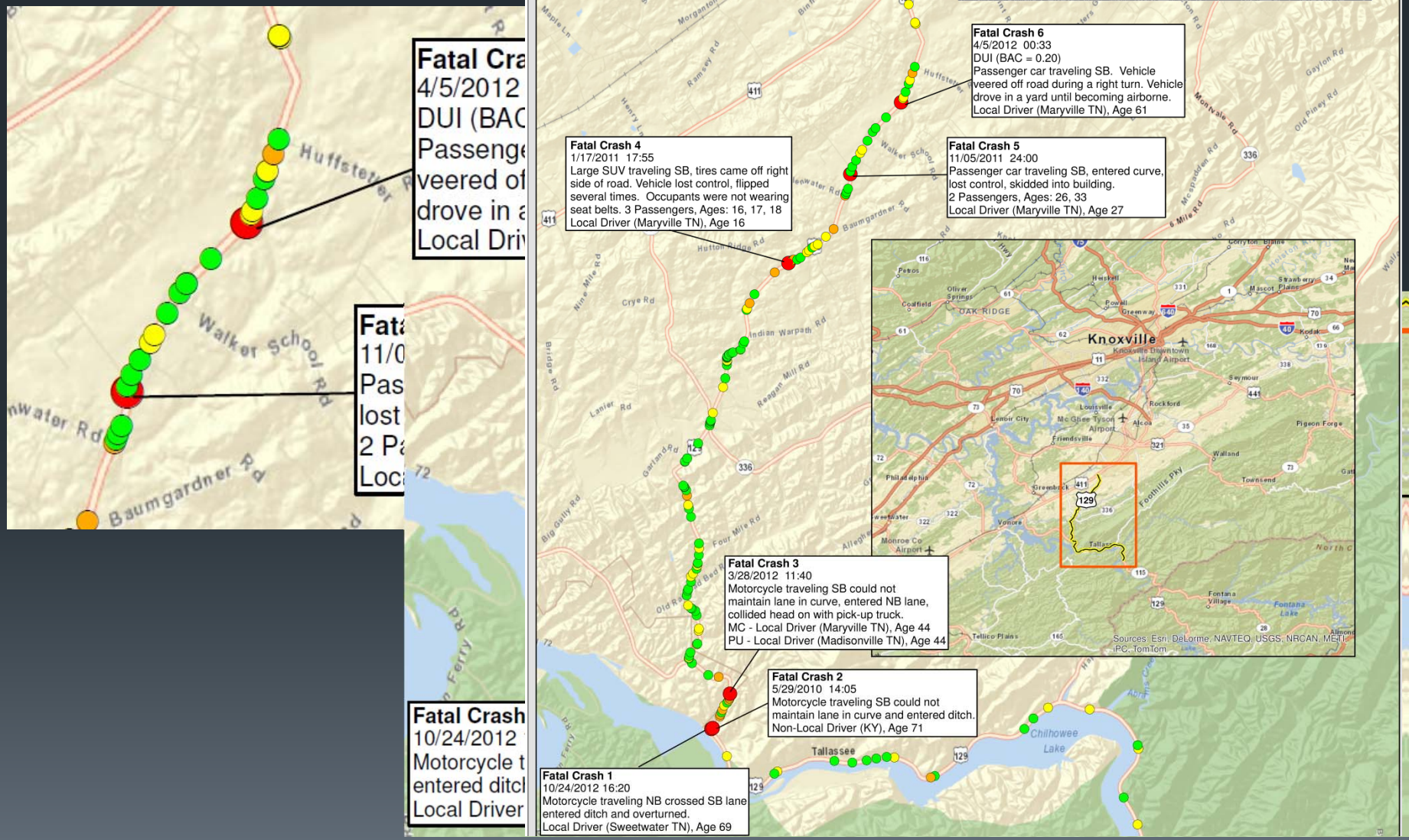
Operational Study

GIS Crash Mapping,US129

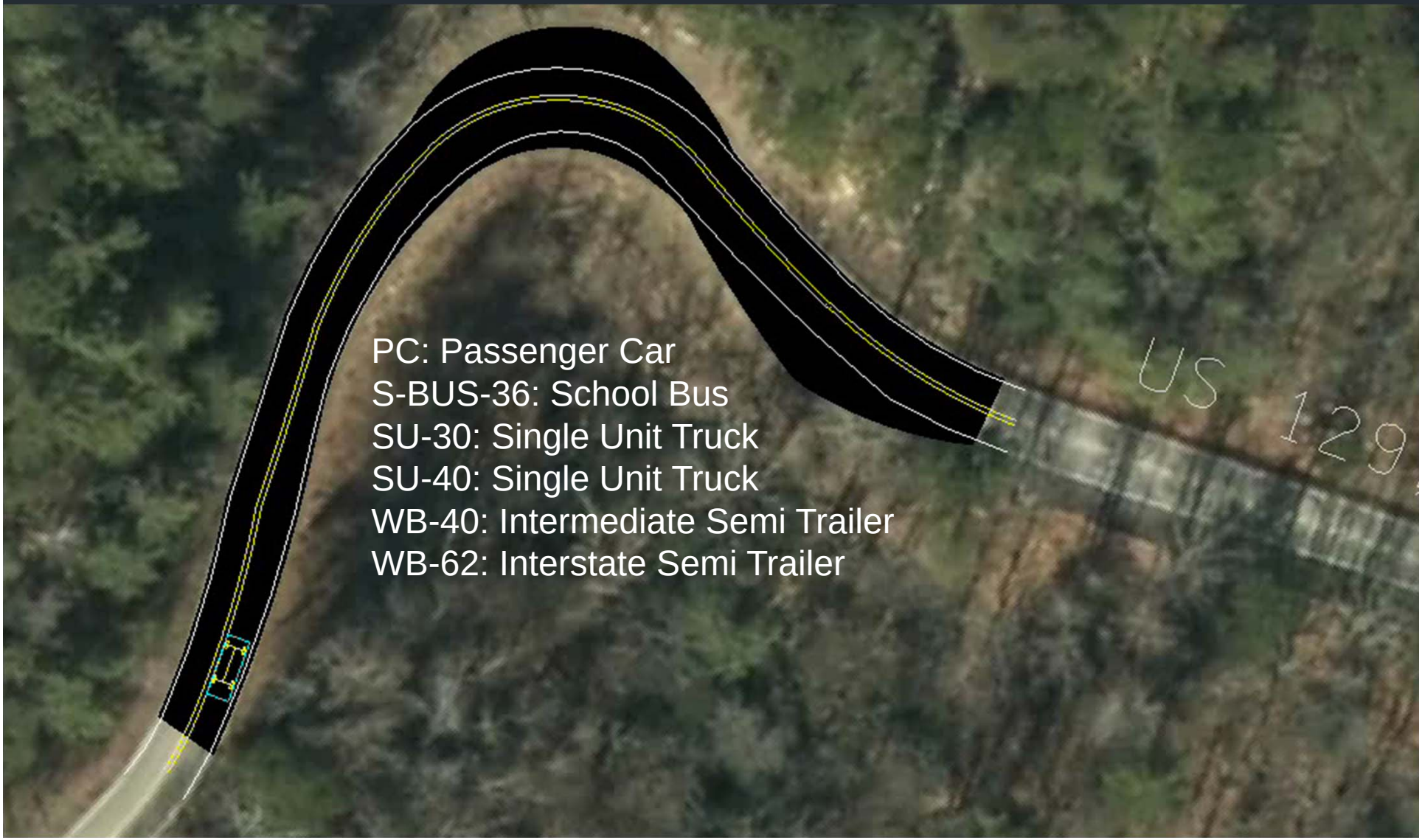


Operational Study

GIS Crash Mapping,US129



Operational Study
Vehicle Simulation



Sight Distance

- Length of roadway ahead that is visible to a driver

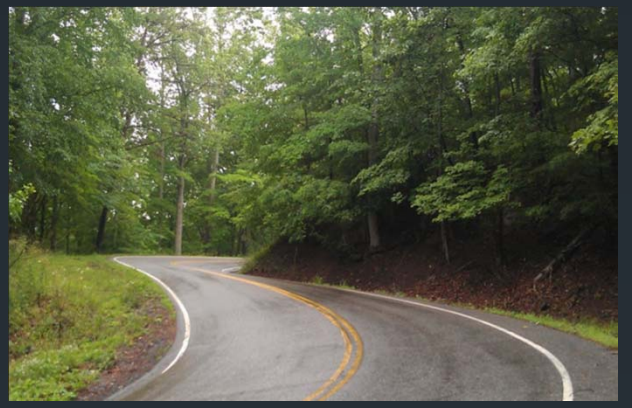
- 4 Types
  - Intersection
  - Stopping
  - Passing
  - Complex Decisions

- Special Consideration
  - Grades
  - Speeds
  - Design Vehicles

Stopping Sight Distance

Driving along the Major Roadway

"Stopping sight distance is provided continuously along each highway or street so that drivers have a view of the roadway ahead that is sufficient to allow drivers to stop, AASHTO pg 650 & 651."



Stopping Sight Distance, SSD				
SSD=1.47Vt + V^2/(30(f+g))				
Roadway Grade	Speed	Brake Reaction Distance	Braking Distance	SSD, feet
	mph	t = 2.5 sec	ft	
No Grade	30	110	90	200
Down Grade, 3%	30	110	95	205
Down Grade, 6%	30	110	105	215
Down Grade, 9%	30	110	117	227
Upgrade, 3%	30	110	90	200
Upgrade, 6%	30	110	74	184
Upgrade, 9%	30	110	69	179

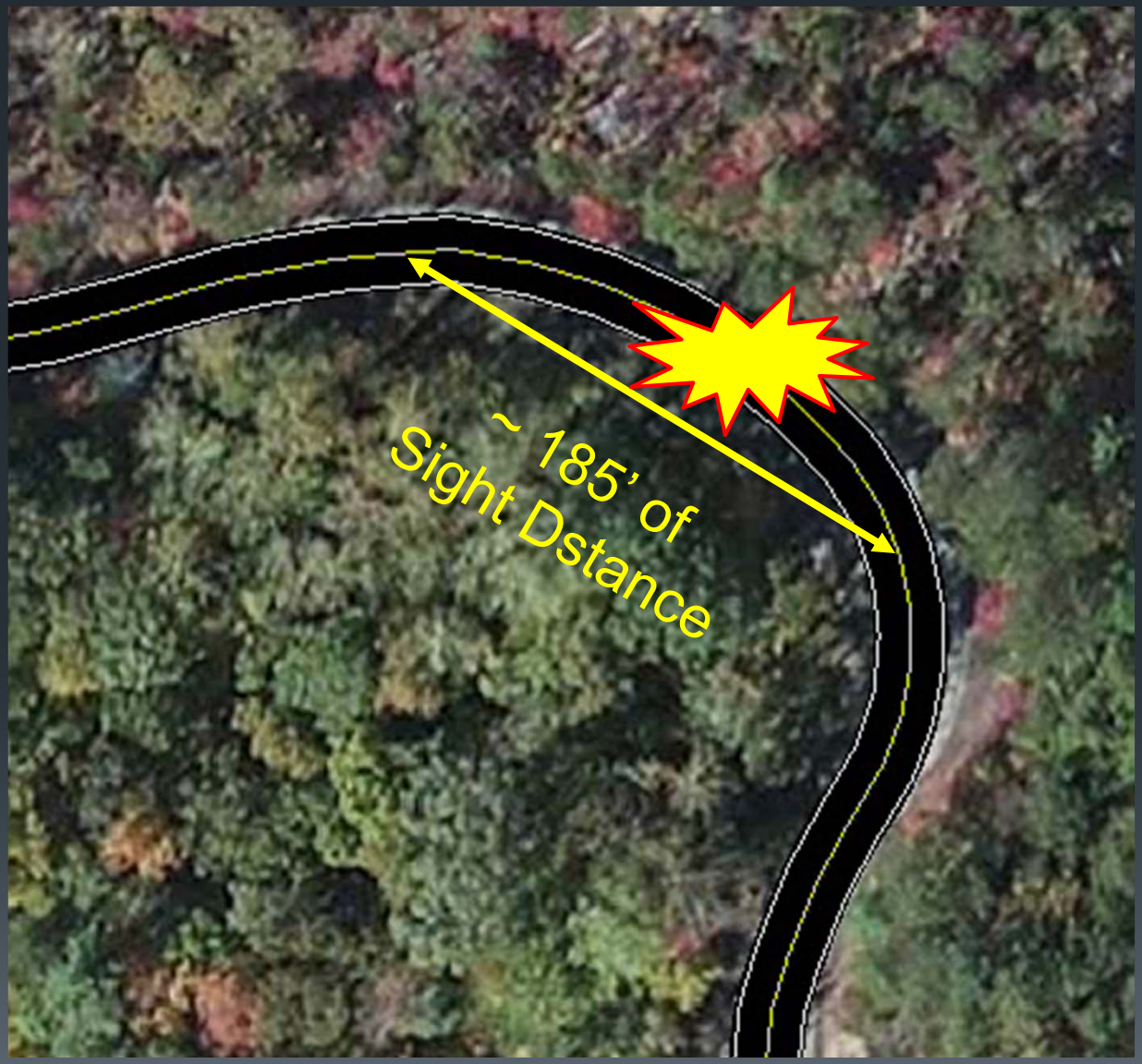
Grades and Effect on Stopping Distance

Elevation at Tabcat Bridge	880 feet
Elevation at NC State line	1,980 feet
Elevation Change	1,100 feet
Distance	11.2-miles
Average Grade	1.9%
Maximum	6.0%

Grade	Speed mph	Braking Distance for sum of approaching vehicles	Sum of Reaction Distance t=2.5 sec	Distance if approaching vehicle is in your lane
0%	30	173	221	393
3%	30	185	221	405
6%	30	179	221	399
9%	30	186	221	406

Stopping Distance with Approaching Vehicles

Stopping Distance with Approaching Vehicles



Operational Study

Restrictions in North Carolina, US129

NCDOT TEAAS Ordinance Report

Trucks Prohibited Route

COUNTY SWAIN **DIVISION** 14

DECLARE THE FOLLOWING

County	Ordinance Number	Effective Date	Route	Description
SWAIN	1065132	7/11/2012	US 129	No truck tractors with trailers longer than 30 feet between the Graham County line and the Tennessee State line unless specifically authorized by the NCDOT.

Current ordinance was effective July 11, 2012.

- They do allow exclusion to one business to operate after sunset with an escort.

Past ordinance 8/29/2008 through 7/12/2012

- Restricted no through trucks with trailers longer than 30 feet
- Prohibited all trucks with trailers longer than 48 feet between the Cheoah Dam and the Tennessee State Line.

Coordination Meetings and Partners

Restrictions in Tennessee, US129

Commissioner and Chief of Staff
Community Relations Office
HQ Traffic & Permits
Strategic Transportation Investments Division
Region 1 Director's Office
Region 1 Traffic
Region 1 Incident Management
Region 1 Sign and Marking

News Release

Restrictions in Tennessee, US129

Truck Restrictions on "The Dragon" in Blount County; Limits for commercial vehicles longer than 30 feet on US 129 (SR 115)

Tuesday, December 02, 2014 | 10:45 am

KNOXVILLE, Tenn. – Following the completion of an operational and safety review, the Tennessee Department of Transportation has determined that vehicles over 30 feet in length will no longer be allowed to utilize a mountainous section of US 129 (SR 115) in Blount County, known as "The Dragon."

From 2010 to 2012, there were 204 total crashes from the Tennessee/North Carolina State Line to Tabcat Bridge (Log Mile 11.19) in Blount County, with six of those involving fatalities. This is considered a critical number of crashes based on the type of road and number of vehicles per day on this facility. While only one of the fatal crashes involved a tractor trailer, there were a number of incidents involving large trucks. Due to the curvy and narrow roadway, incidents involving tractor trailers usually block the highway for several hours and prevent travel for all motorists.

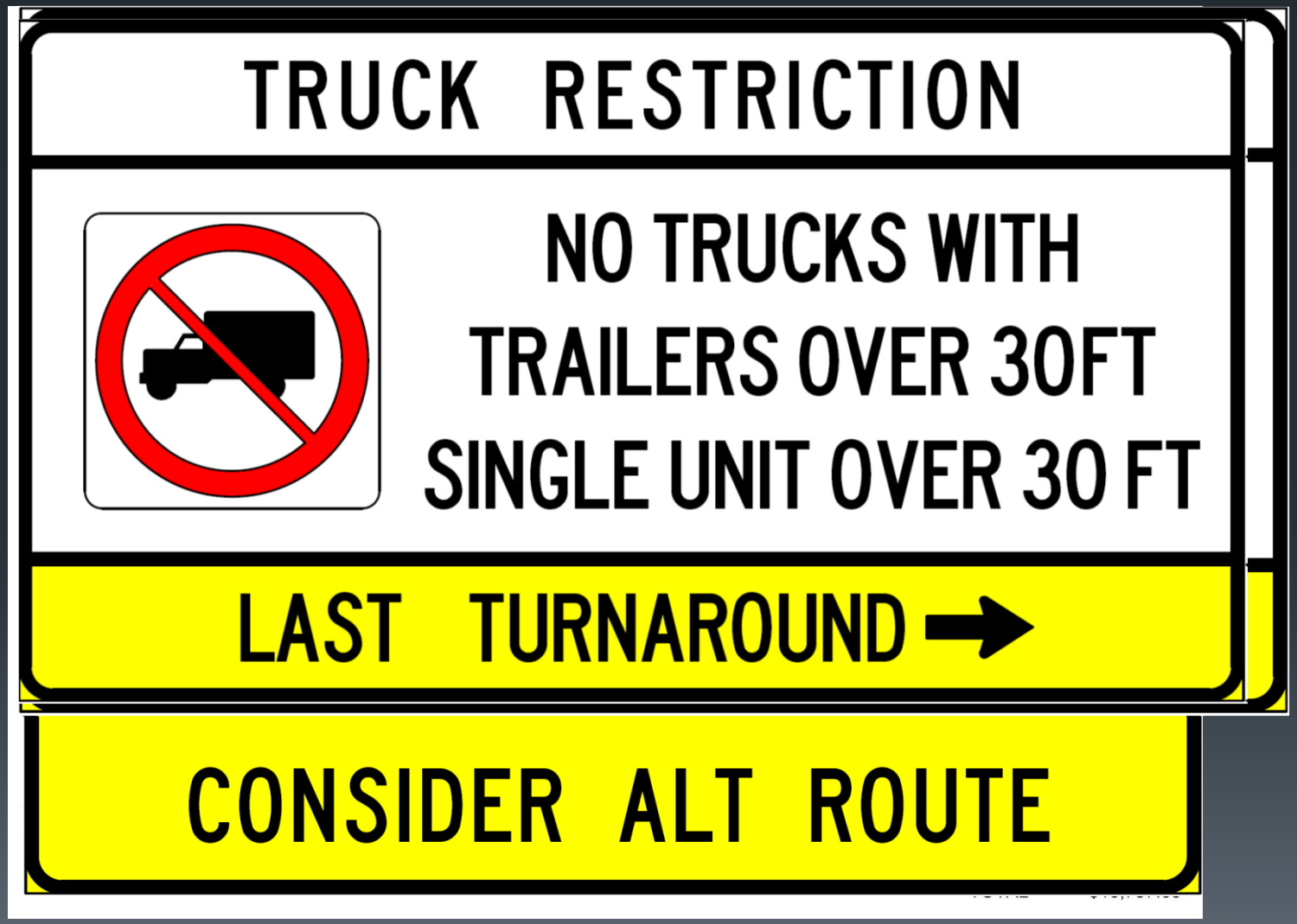
Signage detailing these restrictions will be installed in mid-January. TDOT has coordinated these efforts with the Tennessee Highway Patrol and Blount County law enforcement.

North Carolina has similar restrictions for truck traffic on US 129 from the Tennessee/North Carolina State Line to the Graham (NC) County Line.

pavement and 318 curves.

Restriction Signs for Tennessee

Contractor Replaces Truck Advisories with Regulatory Signs



Restriction Signs for Tennessee

Placed in North Carolina

Exception Signs for Brookfield

Smoky Mountain Hydro

Project Impacts

Crash Data Evaluation							
	Years		Mile Post		Fatals	Incap Injury	Total
Pre 2007 RSAR	2006	2008	0	11.2	8	33	217
Post 2007 RSAR	2009	2011	0	11.2	5	11	74
2014 Operational Study	2010	2012	0	11.2	6	34	204
Post Study	2015						

- Past RSAR and Improvement Projects had a positive impact on Safety and Crash Reductions
- Truck Traffic was not eliminated with 2007 Warning initiative, 6% of AADT or 60 to 65 a day using the Mountainous section of US 129
- Rollover Truck Crashes also continued to occur blocking the roadway multiple times in the Past
- Future Studies to evaluate Truck Restrictions in regard to Operations and Safety of route

Thank you

Questions & Comments

NATHAN VATTER, REGION 1 TRAFFIC ENGINEER

Phone: (865)594-2456

Nathan.Vatter@tn.gov

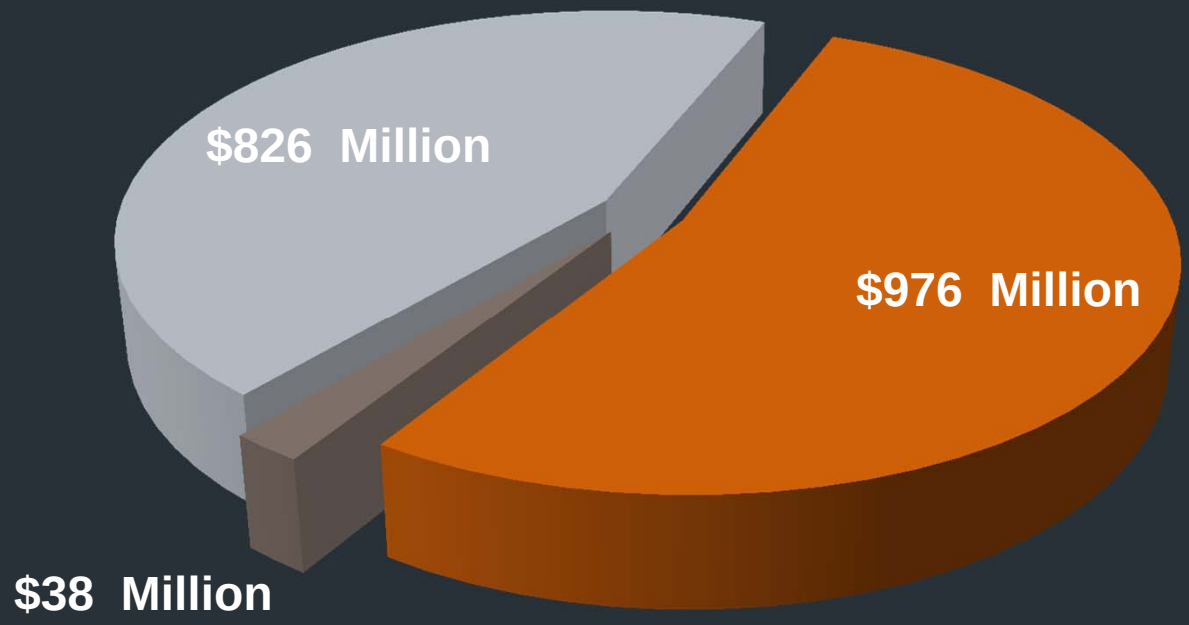
Chapman Highway
Sevier County

TN TDOT Department of Transportation

August 7th 2015

TDOT Revenue Sources

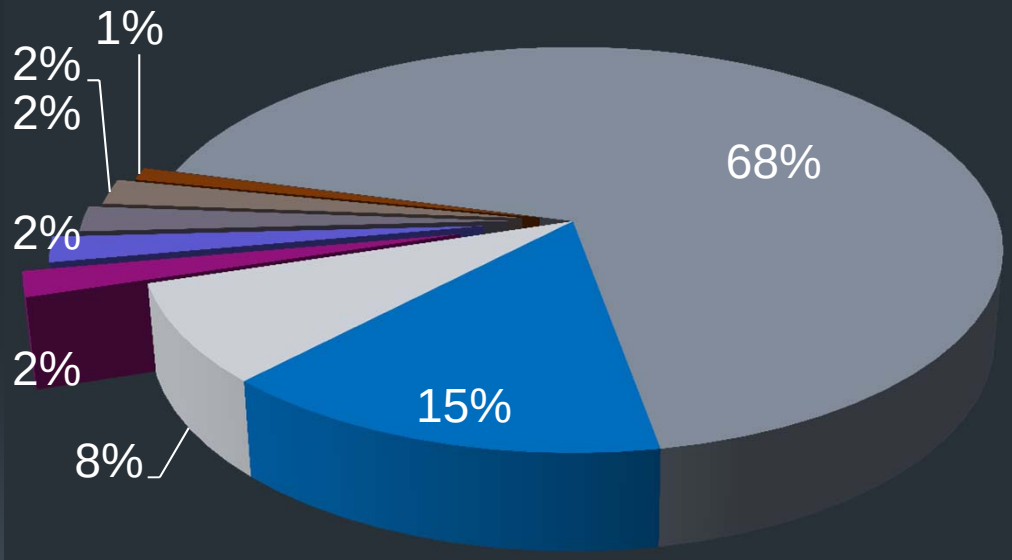
Budget FY 2015



How We Spend Our Money

2% Overhead
83% Construction Projects and Maintenance

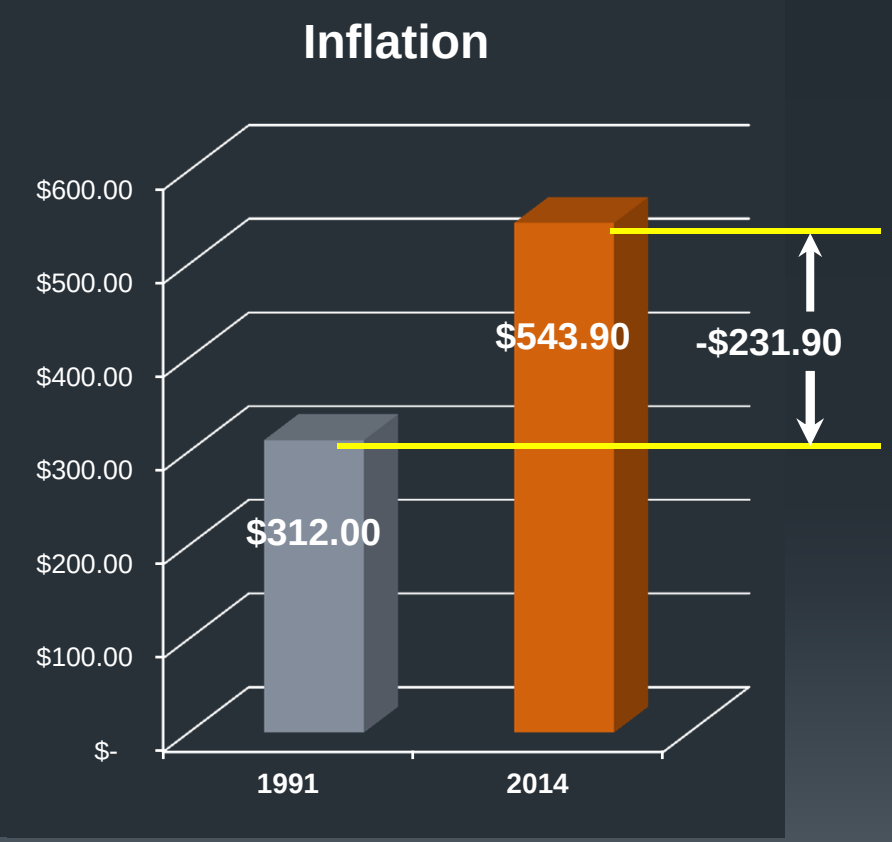
FY 2013



- Construction Projects
- Maintenance & Preservation
- Grants
- Field Operations
- Equipment & Facility
- Other State Agencies
- Administration
- Other

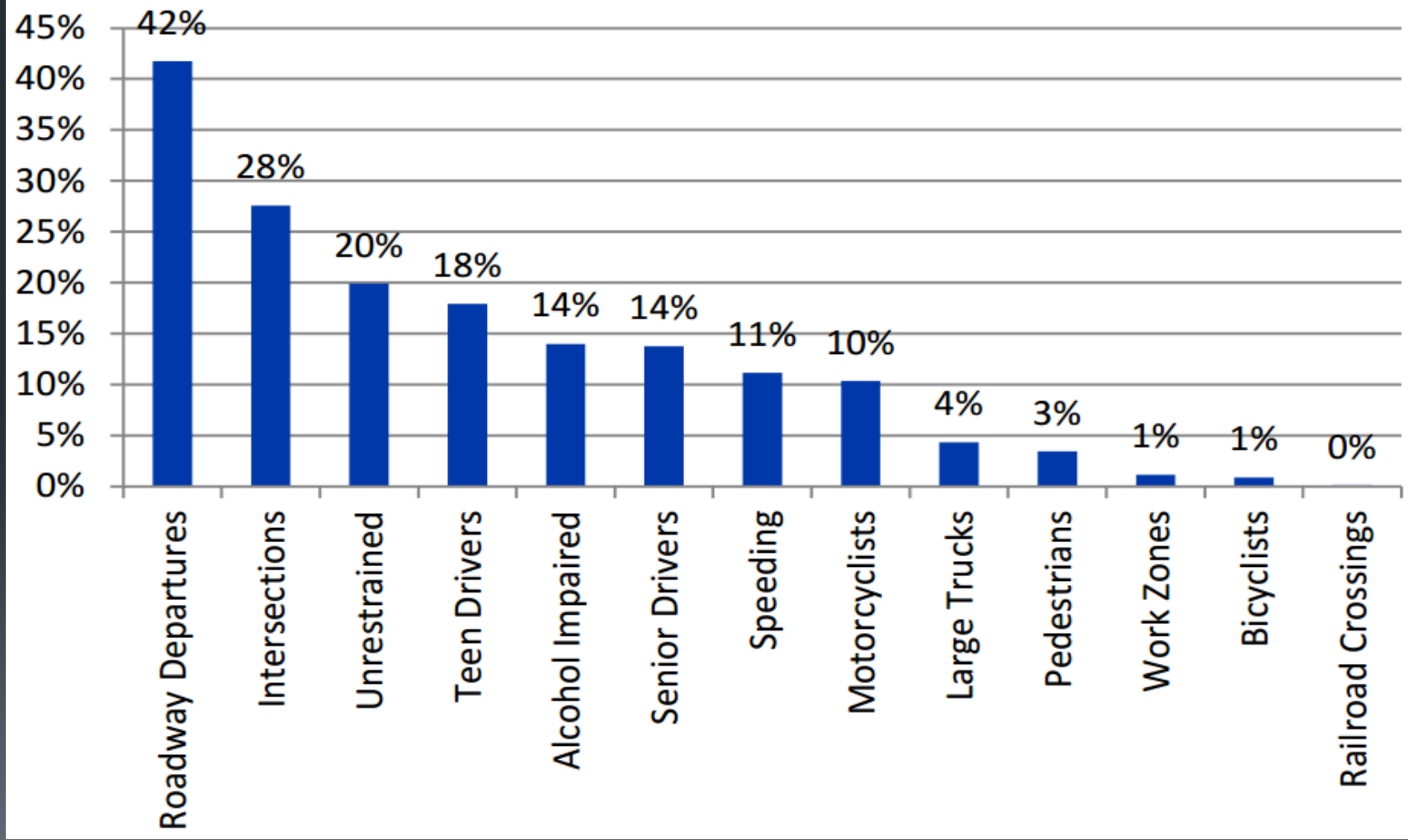
Tennessee Gas Tax

- Tennessee has a fixed-rate gas tax
  - Federal gas tax – $0.184 per gallon
  - State gas tax - $0.214 per gallon
- Last tax increase was 1989 (25 years ago)
- $312 per Capita



Fatalities & Injuries in Tennessee

Figure 10 - Serious Injuries Percent of Total by Contributing Factor (2008-2012)

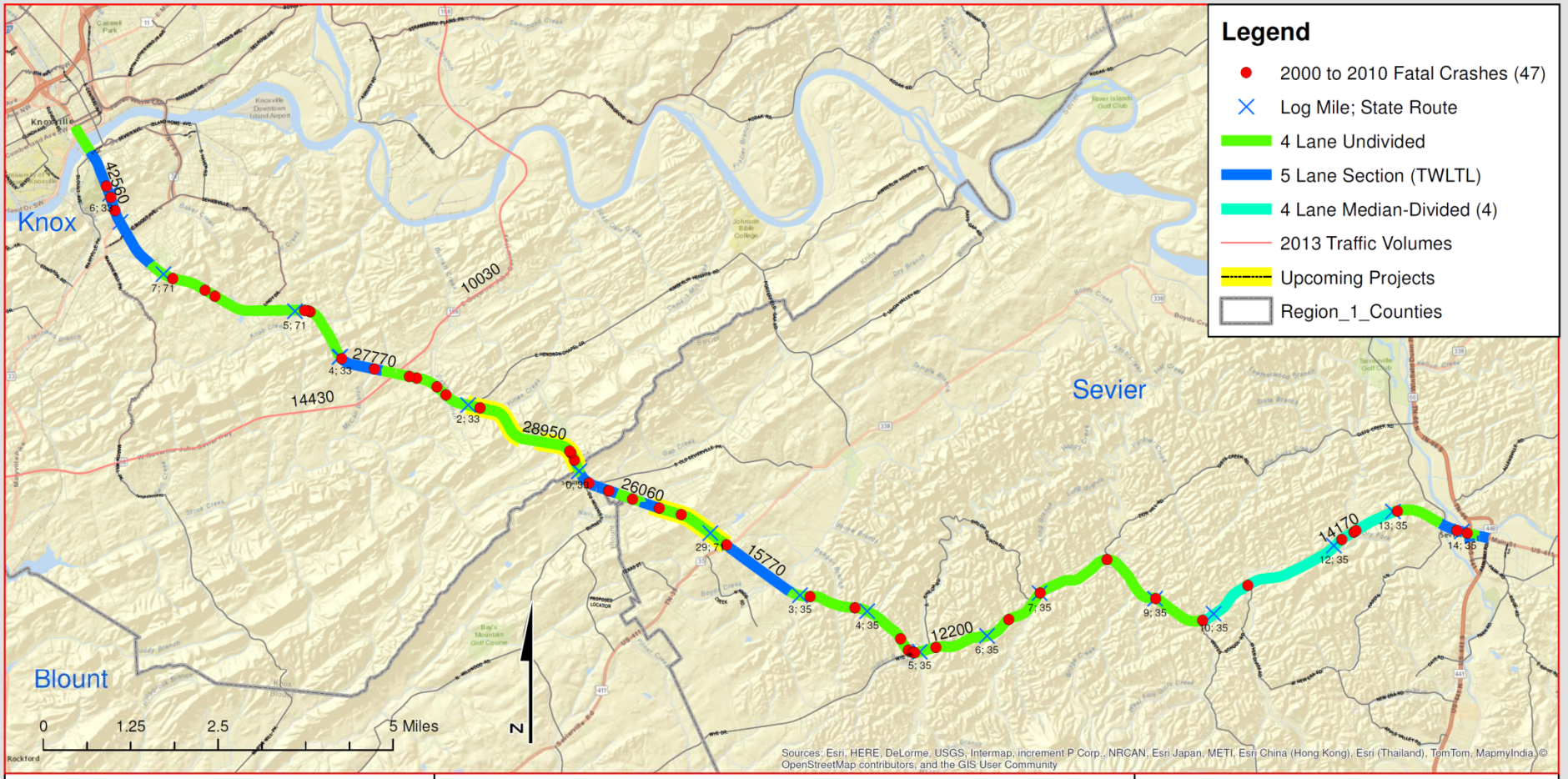


GHSO - Chapman Safety Meeting

- Stakeholder Meeting – January 21st 2014
  - Attendees –
    - Governor's Highway Safety Office (Organizer)
    - Sevier County
    - Sevier County Sheriff's Office
    - TN Highway Patrol
    - Knoxville Police Department
    - TDOT
- Meeting Purpose – Discuss recent fatal and serious injury crashes and possible counter measures

Crash Map (2000-2010)

Henley Bridge to Sevierville



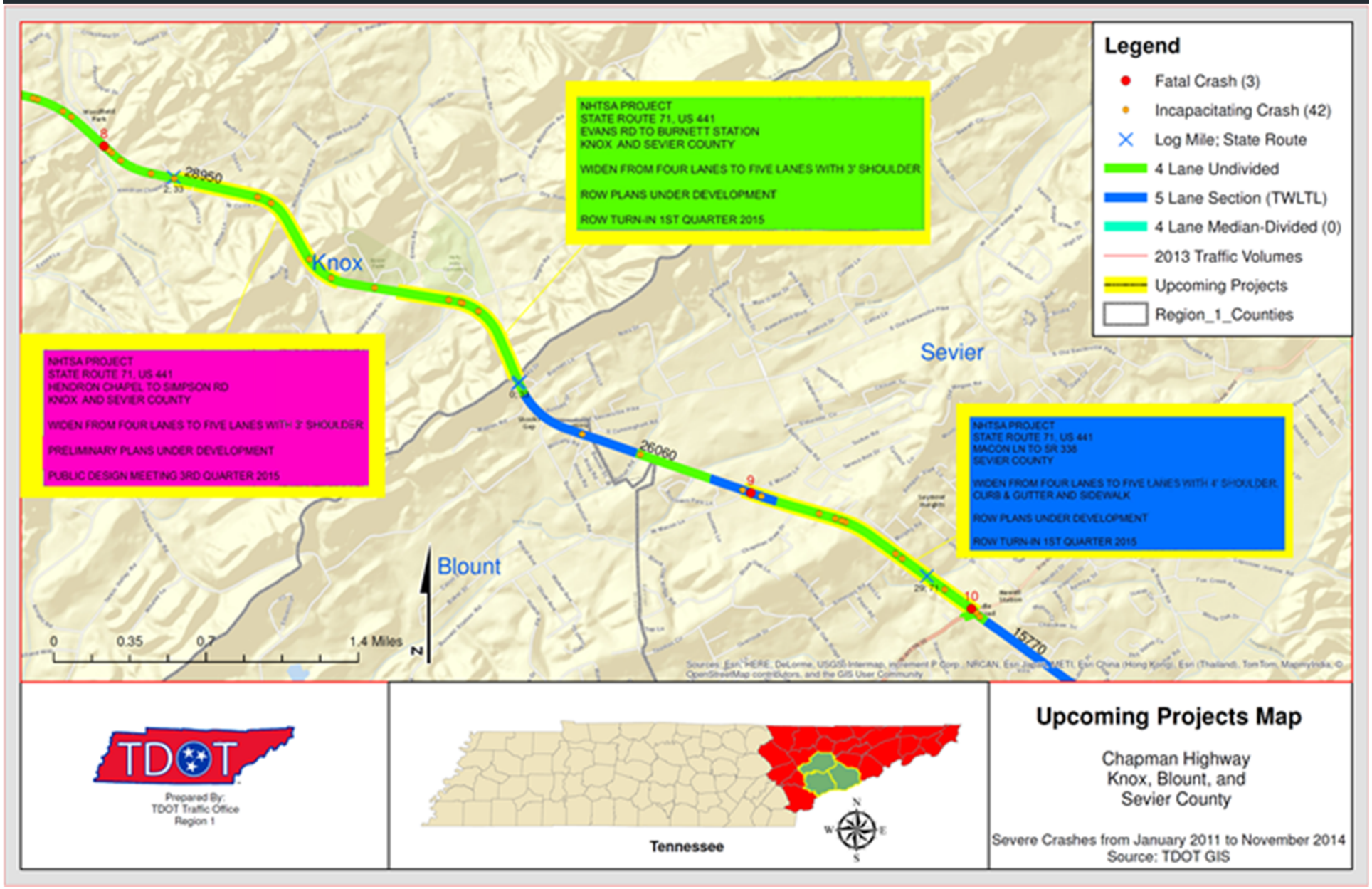
Prepared By:
TDOT Traffic Office
Region 1

Crash Location Map

Chapman Highway
Knox, Blount, and
Sevier County

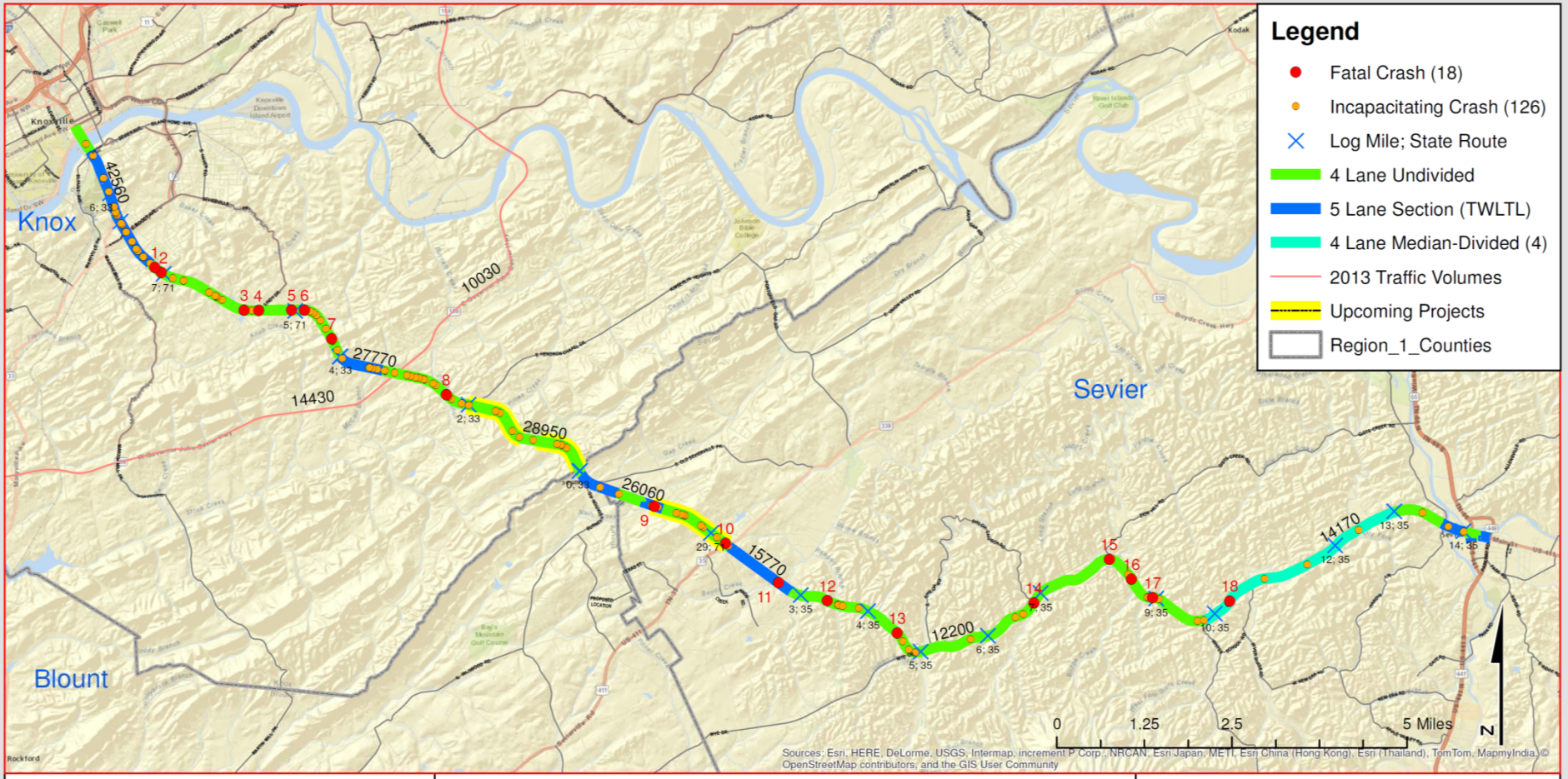
Fatal Crashes from 2000 to 2010
Source: TDOT GIS

Safety Projects Underway



Updated Crash Map (2011-2014)

Henley Bridge to Sevierville



Prepared By:
TDOT Traffic Office
Region 1

Crash Location Map

Chapman Highway
Knox, Blount, and
Sevier County

Severe Crashes from January 2011 to November 2014
Source: TDOT GIS

Fatal Crashes (2011-2014)

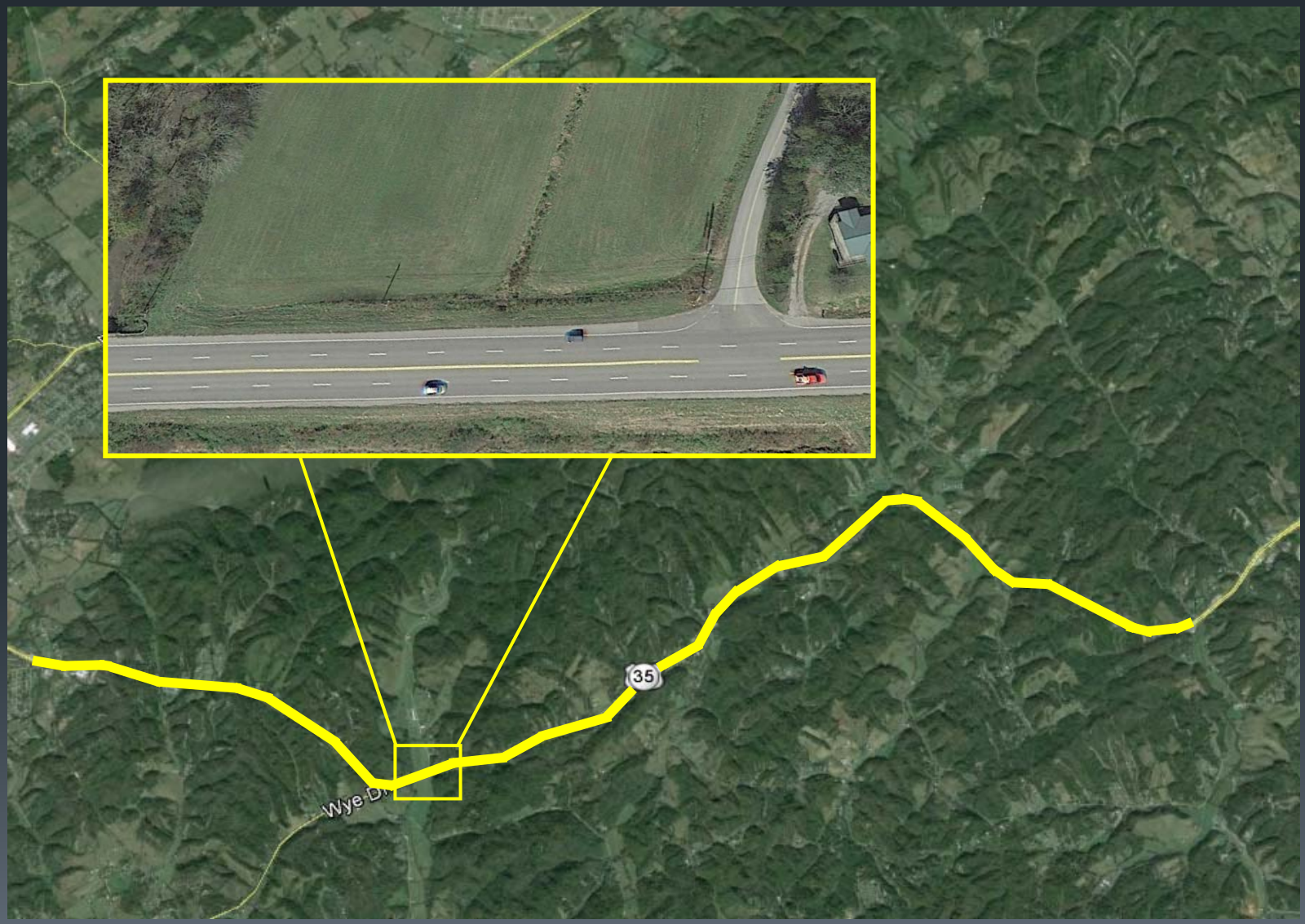
Henley Bridge to Sevierville

Chapman Highway 2011-2014 Fatalities

Fatality Number	Driver Age		Speed Limit	Type of Crash	Injury		Driver at Fault	Correctable?	Comments
	Vehicle 1	Vehicle 2			Driver 1	Driver 2			
1	78	N/A	45	Run-Off Road	Non-Incap	N/A	1	No	Passenger (Age 83) Died
2	54	N/A	45	Run-Off Road	Fatal	N/A	1	No	Alcohol was present
3	73	71	45	Angle	Unknown	Fatal	1	No	V1 failed to yield and turned left in front of Motorcycle
4	67	43	45	Angle	Non-Incap	Non-Incap	1	No	V1 attempted to cross Chapman and failed to yield
5	41	Ped = 45	45	Pedestrian	None	Fatal	Ped	Maybe	Ped crossing at Meridian St (Old Wal-Mart)
6	74	82	50	Head-On	Fatal	Incap	1	Maybe	Head On, 4-L undivided past (Old Wal-Mart)
7	60	23	50	Angle	None	Fatal	1	No	NB V1 (Age 60) made U-turn and NB V2 Motorcycle was unable to stop (near Ye Old)
8	58	N/A	50	Run-Off Road	Fatal	N/A	1	No	Alcohol Related
9	85	29	45	Head-On	Fatal	None	2	No	V2 fell ill while driving
10	61	38	45	Angle	Fatal	None	1	No	Left-turning vehicle failed to yield
11	39	17	45	Angle	Non-Incap	Fatal	1	No	Driver 1 Ran Red Light/ V2 Passenger (Age 56) Fatal
12	19	N/A	55	Run-Off Road	Fatal	N/A	1	Maybe	High Speed (From Crash Report)
13	19	51	55	Angle	Fatal	None	1	Maybe	V1 (Age19) left-turning from Canyon Hills struck by NB V2
14	57	55	55	Angle	Non-Incap	Fatal	1	Yes	V1 lost control when braking for stopped vehicle attempting left-turn (D1 was on opiates and other drugs)
15	26	N/A	55	Run-Off Road	Fatal	N/A	1	No	Ran-off the road, Alcohol and drugs were present/ Passenger (Age 2) possibly injured
16	21	45	55	Head-On	Incap	Fatal	1	Maybe	Drugs were pesent in V1/ V2 was church bus w/ 12 pass and 1 Fatal
17	59	N/A	55	Run-Off Road	Fatal	N/A	1	Yes	Ran off Right side of road and overturned
18	22	Ped = 27	55	Pedestrian	Unknown	Fatal	Ped	No	Ped had BAC of 0.33, was either walking or standing in travel lane
19	45	Ped = 53	50	Pedestrian	None	Fatal	Ped	No	Pedestrian wore dark clothes/ did not respond to any vehicle horns

Chapman Hwy

Typical Section from Seymour and Sevierville



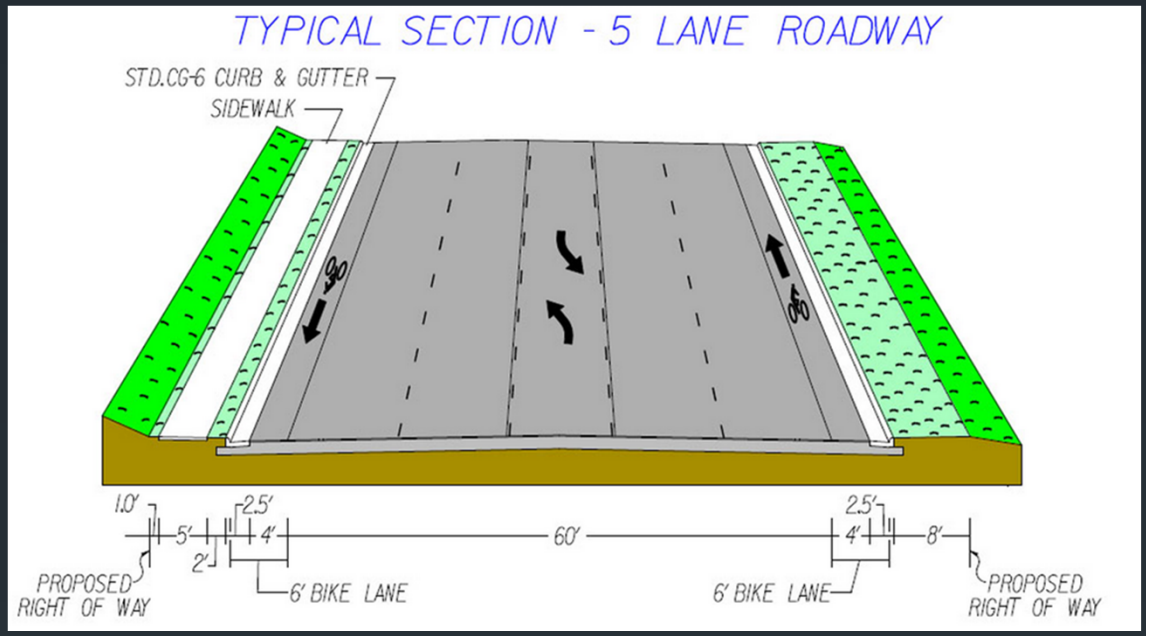
Alternative 1
Widen to 5-Lane

Pros

- Provides Efficient Operations
- Improves Future Capacity
- Improves Travel Time Reliability
- Improves Safety

Cons

- Cost $40 to 50 million
- Time for Delivery
  - Volume do not support concept in near future
  - Competes for funding with other Regional Projects
- Project Impacts
  - ROW Acquisition
  - Utility Relocations



Alternative 2
3-Lane

Pros

- Improves Safety
- Provides Center Turn Lane
  - Buffer between opposing traffic
  - Safe Refuge for turning traffic
  - Reduces Rear-end crashes
  - Improves access
- Provides 7 ft. paved shoulders
  - Refuge for emergency or disabled vehicles
  - Recovery area for errant vehicle
  - Safe refuge for mail carrier
  - Use for right turning traffic
- Traffic Calming and Reduces speed differentials
- Eliminates Weaving
- Simplifying road scanning and gap selection for entering vehicles
- Cost $1.5 to 2.5 million, Potential Safety Project through HSIP funds

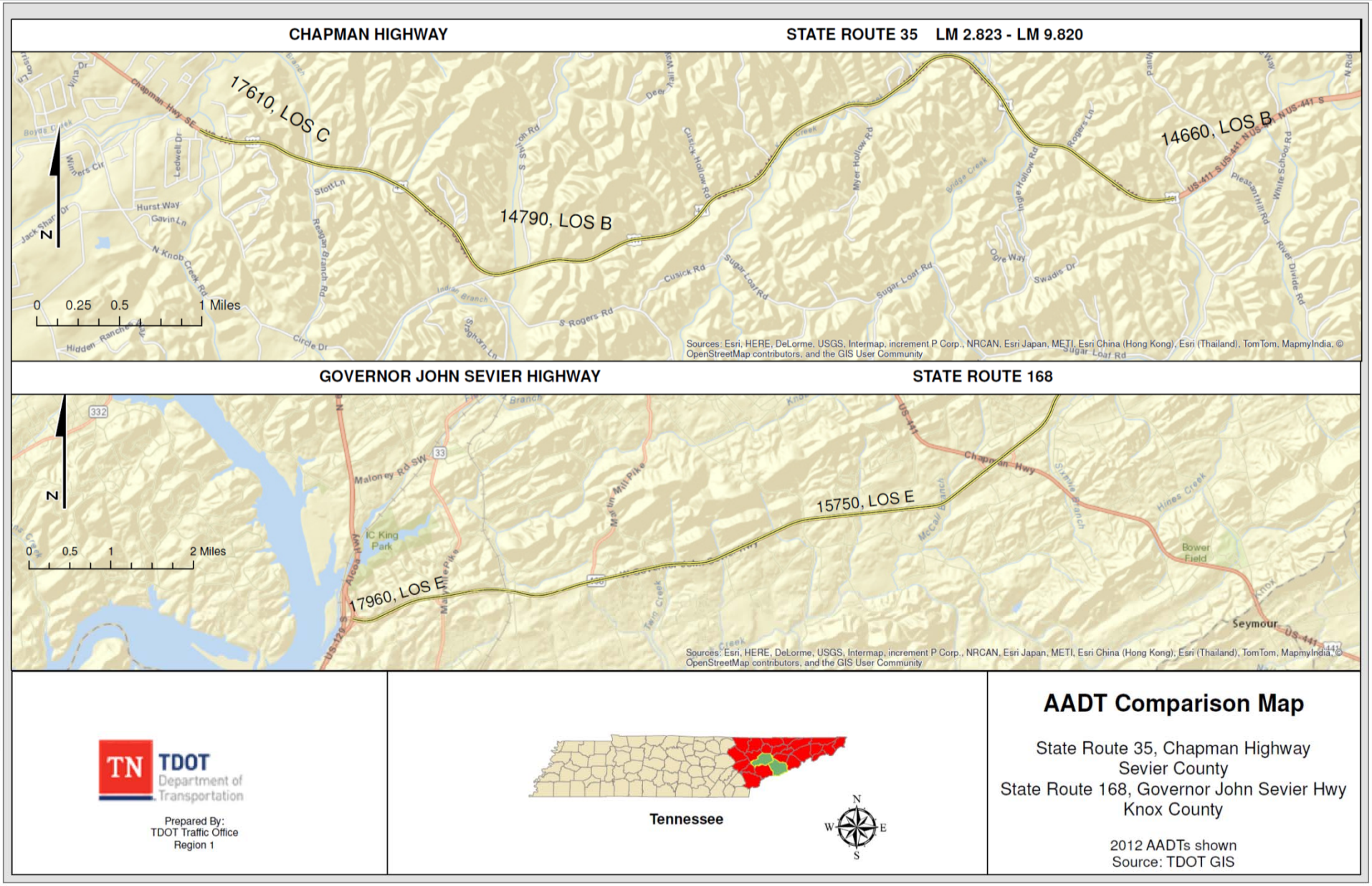
Cons

- Increases time spent following
- Limits Future Capacity

Correctable Problems with 3-Lane

Category	Problem
Safety	Rear-end crashes with left-turning traffic due to speed discrepancies
	Sideswipe crashes due to lane changes
	Left-turn crashes due to negative offset left turns from the inside lanes.
	Bicycle and pedestrian crashes
Operational	Delays associated with left-turning traffic
	Side street delays at unsignalized intersections
	Bicycle operational delay due to shared lane with vehicles or sidewalk use.
Other	Bicycle and pedestrian accommodation due to lack of facilities
	Aesthetics
	Traffic calming

Route Comparison



Alternative 3
Modified 3-Lane with Passing

Pros

- Improves Safety
- Provide safe designated passing areas
- Provides Center Turn Lane
  - Buffer between opposing traffic
  - Safe Refuge for turning traffic
  - Reduces Rear-end crashes
  - Improves access
- Provides 7 ft. paved shoulders
  - Refuge for emergency or disabled vehicles
  - Recovery area for errant vehicle
  - Safe refuge for mail carrier
  - Use for right turning traffic
- Traffic Calming and Reduces speed differentials
- Eliminates Weaving
- Simplifying road scanning & gap selection for entering vehicles
- Cost $1.5 to 2.5 million, Potential Safety Project, HSIP funds

Cons

- Some time spent following
- Limits Future Capacity

Thank you

Questions & Comments

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