Hazard Elimination Project Evaluation

Project Log # 200902139

Hazard Elimination Project W-3403

Widen US 25 / US 70 / NC 213 from 0.15 Miles West of SR 1393 to 0.07 Miles East of SR 1601 to Provide a Continuous Left Turn Lane, Madison County

Documents Prepared By:

Safety Evaluation Group
Traffic Safety Systems Management Section
Transportation Mobility and Safety Division
North Carolina Department of Transportation

Principal Investigator

_____ 5/1/2009

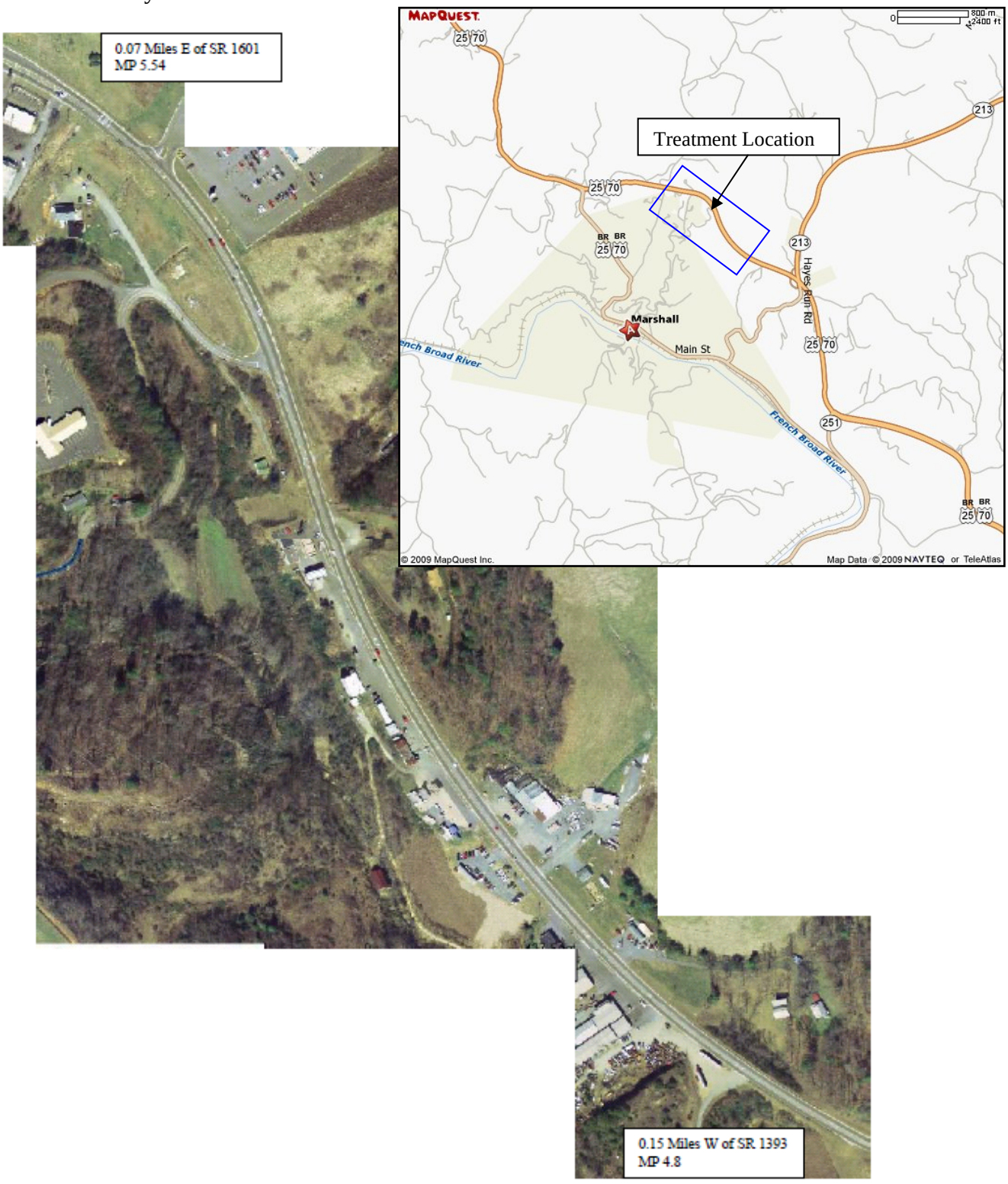
Carrie L. Simpson, PE Date

Traffic Safety Project Engineer

Hazard Elimination Project Evaluation Documentation

Subject Location

Evaluation of Hazard Elimination Project W-3403 –
On US 25 / US 70 / NC 213 from 0.15 Miles West of SR 1393 to 0.07 Miles East of SR 1601 in Madison County



Project Information and Background from the Project File Folder

The safety countermeasure chosen for the subject location was to widen US 25 / US 70 / NC 213 to 36' from 0.15 miles west of SR 1393 to 0.07 miles east of SR 1601. The pavement is marked for three travel lanes with the center lane used for left turns only.

Prior to improvements, this section of US 25 / US 70 / NC 213 was a 24' wide, two-lane roadway with 5-6' soil shoulders. The roadside frontage is approximately 60 percent commercially developed with the majority of the businesses being located on the south side of the roadway. There are numerous access points along this section of roadway. There is good horizontal and vertical alignment. This section of roadway is speed zoned at 45 mph.

The Project Report in the Project File Folder states that vehicles stopped or slowing to turn left were causing crashes. The TWLTL was intended to reduce Rear End crashes caused by vehicles stopping or slowing to make a left turn into properties located along the roadway. It was also intended to reduce Left Turn, Same Roadway crashes by providing left turn storage and giving vehicles a safe refuge to wait for adequate gaps in opposing traffic.

The initial crash analysis for this location was completed from June 1, 1998 through May 31, 2001 with a total of 31 reported crashes. According to the initial crash analysis, there were 20 Rear End crashes (65%) and 6 Left Turn Same Road crashes (19%), resulting in 1 fatal injury crash, 12 non-fatal injury crashes, and 13 PDO crashes. The projected Benefit Cost Ratio for the project was 4.70:1.

Please note that the initial crash analysis is not consistent with the crash analysis in this evaluation report due to differences in section length. This initial crash analysis was completed from SR 1393 to SR 1601, extending beyond the limits of the roadway widening. Therefore, there was a fatal crash included in the initial crash analysis which is not included in the crash analysis for this report.

The project was let in May 2002 and completed on May 5, 2004 at a total cost of $1,435,000.

Naïve Before and After Analysis

After reviewing the hazard elimination project file folder along with all the crashes at the subject location, the crash data omitted from this analysis to consider for an adequate construction period was from June 1, 2002 through June 30, 2004. The before period consisted of reported crashes from December 1, 1997 through May 31, 2002 (4.5 Years) and the after period consisted of reported crashes from July 1, 2004 through December 31, 2008 (4.5 Years).

The treatment data consisted of all crashes on US 25 / US 70 / NC 213 within a 0' Y-Line from 0.15 miles west of SR 1393 to 0.07 miles east of SR 1601 (approximately 0.75 miles).

Please note that the Target Crashes for the applied countermeasure include three crash types:

- Rear End Crashes,
- Left Turn-Same Roadway Crashes, and
- Sideswipe-Same Direction Crashes.

Please see the attached *Collision Diagrams*. Note that the crash numbers for Target Rear End Crashes, Left Turn-Same Roadway Crashes, and Target Sideswipe-Same Direction Crashes are circled on the diagrams in Red, Blue, and Green, respectively.

The following tables depict the Naïve Before and After Analysis for the Total Crashes and Target Crashes at the treatment location.

Total Treatment Information	**Before**	**After**	**Percent Reduction (-)/ Percent Increase (+)**
Total Crashes	32	22	-31.3%
Total Severity Index	4.01	9.24	130.4%
Target Crashes	29	11	-62.1%
Target Severity Index	4.06	10.58	160.6%
Target Rear End Crashes	24	7	-70.8%
Target Left Turn-Same Road Crashes	3	3	0.0%
Target Sideswipe-Same Dir. Crashes	2	1	-50.0%
Volume	9,800	10,000	2.0%

Total Crash Information	**Before**	**After**	**Percent Reduction (-)/ Percent Increase (+)**
Fatal Injury Crashes	0	0	N/A
Non-Fatal Injury Crashes	13	6	-53.8%
Total Injury Crashes	13	6	-53.8%
Night Crashes	1	3	200.0%
Wet Crashes	5	1	-80.0%

The naïve before and after analysis for the treatment location resulted in a 31 percent decrease in Total Crashes, a 62 percent decrease in Target Crashes, and a 2 percent increase in Average Daily Traffic (ADT). The before period ADT year was 2000 and the after period ADT year was 2006.

Results and Discussion

The naïve before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in a 31 percent decrease in Total Crashes and a 62 percent decrease in Target Crashes. The Total Severity Index and Target Severity Index increased by 130 percent and 161 percent, respectfully. The Treatment Location appears to have had a decrease in the number of Total and Target Crashes, but an increase in crash severity, from the before to the after period using naïve methodologies.

The calculated benefit to cost ratio for this project is **-1.58** considering total crashes. The benefit to cost ratio considering only target crashes is **-0.63**. The benefits are calculated using the change in annual crash costs from the before to the after period. Operational and other benefits related to the project are not considered in this analysis. The costs of the project include the actual construction costs as well as the increase in annual maintenance costs.

The Target Crashes for the TWLTL countermeasure include Rear End Crashes, Left Turn-Same Direction Crashes, and Sideswipe-Same Direction Crashes. Rear End Crashes are considered treatable by the countermeasure because a TWLTL separates turning traffic from the thru traffic. Left Turn-Same Direction Crashes are considered treatable by the countermeasure because a TWLTL relieves the pressure for left-turning vehicles to make left turns without acceptable gaps. Finally, Sideswipe-Same Direction Crashes are considered treatable by the countermeasure because a TWLTL will reduce avoidance crashes caused by motorists attempting to avoid turning vehicles.

Rear End Crashes were the predominant crash type in the before period. In the before period there were 24 Rear End Crashes at the treatment location, accounting for 75 percent of all crashes. Rear End Crashes were concentrated between a car dealership (MP 4.95) and an Exxon Gas Station (MP 5.26), in an area of densely spaced commercial driveways. In the after period there were 7 Rear End crashes dispersed along the treatment area, a 71 percent reduction in this crash type.

The TWLTL appears to have had a minimal effect on the number of Left Turn-Same Direction Crashes and Sideswipe-Same Direction Crashes. The number of Left Turn-Same Direction Crashes remained the same, with 3 crashes in the before and after period. Sideswipe-Same Direction Crashes decreased by 50 percent, from 2 crashes in the before period to 1 in the after period.

The Severity Index increased due to two Class-A Injury crashes in the after period. One was a Rear End crash involving a vehicle turning into the BP Gas Station (Crash #9), and the other was a Left Turn-Different Roadway crash at SR 1392 (Crash #17). Please see the attached *Collision Diagrams*.

The number of Total Wet Crashes decreased (by 80 percent) from 5 crashes in the before period to 1 in the after period. The pavement resurfacing may have contributed to this crash decrease by providing the roadway with better drainage and pavement friction.

As the Safety Evaluation Group completes additional reviews for this type of countermeasure, we will be able to provide more objective and definite information regarding actual crash reduction factors.

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US25/70 -TOTAL
COUNTY: Madison
FILE NO.: W-3403

BY: CLS
DATE: 4/16/2009

DETAILED COST: TYPE IMPROVEMENT - Center Turn Lane

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$1,435,000	20	0.102	$146,158
	$0	0	0.000	$0
Right-of-Way	$0	0	0.000	$0
TOTALS	$1,435,000	20	0.102	$146,158

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $3,840
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $0

TOTAL ANNUAL COST= $149,998
TOTAL COST OF PROJECT= $1,435,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

TIME PERIOD	YEARS	K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
BEFORE	4.50	0	0.00	13	2.89	19	4.22	$75,511
AFTER	4.50	2	0.44	4	0.89	16	3.56	$312,711

Annual Benefits from Crash Cost Savings ($237,200)

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = ($387,198)

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = -1.58

TOTAL COST OF PROJECT - $1,435,000 COMPREHENSIVE B/C RATIO - -1.58

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US25/70 -TARGET
COUNTY: Madison
FILE NO.: W-3403

BY: CLS
DATE: 4/16/2009

DETAILED COST: TYPE IMPROVEMENT - Center Turn Lane

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$1,435,000	20	0.102	$146,158
	$0	0	0.000	$0
Right-of-Way	$0	0	0.000	$0
TOTALS	$1,435,000	20	0.102	$146,158

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $3,840
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $0

TOTAL ANNUAL COST= $149,998
TOTAL COST OF PROJECT= $1,435,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

TIME PERIOD	YEARS	K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
BEFORE	4.50	0	0.00	12	2.67	17	3.78	$69,200
AFTER	4.50	1	0.22	4	0.89	6	1.33	$163,378

Annual Benefits from Crash Cost Savings ($94,178)

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = ($244,176)

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = -0.63

TOTAL COST OF PROJECT - $1,435,000 COMPREHENSIVE B/C RATIO - -0.63

Treatment Photos

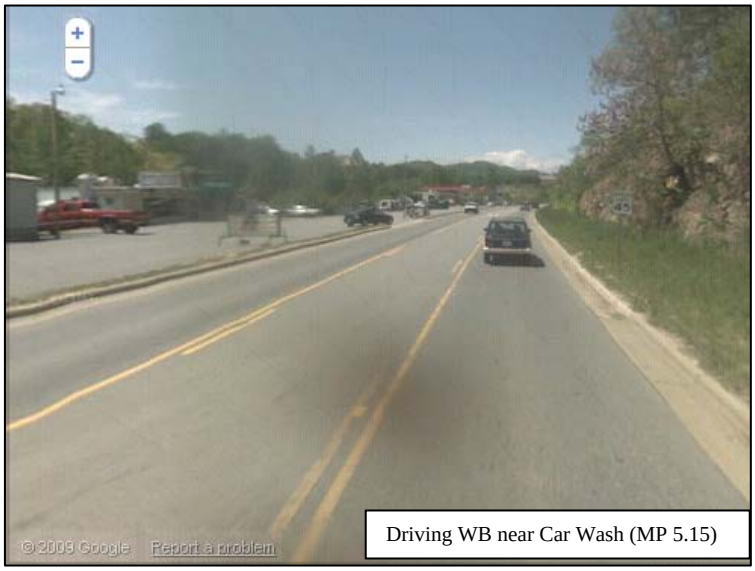
Driving WB near Car Dealership (MP 4.95)

Driving WB near Car Dealership (MP 5)

Driving WB near Tire & Auto Shop (MP 5.05)

Treatment Photos

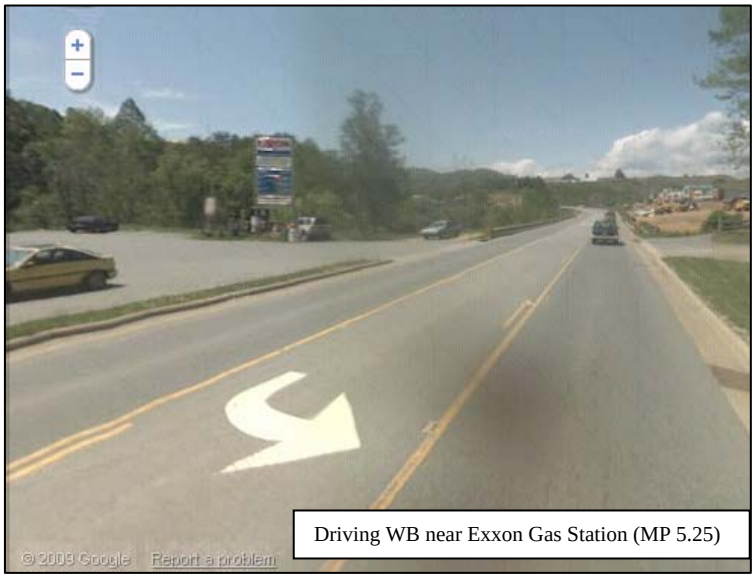
Driving WB BP Gas Station (MP 5.1)



Driving WB near Car Wash (MP 5.15)

Driving WB near Exxon Gas Station (MP 5.25)

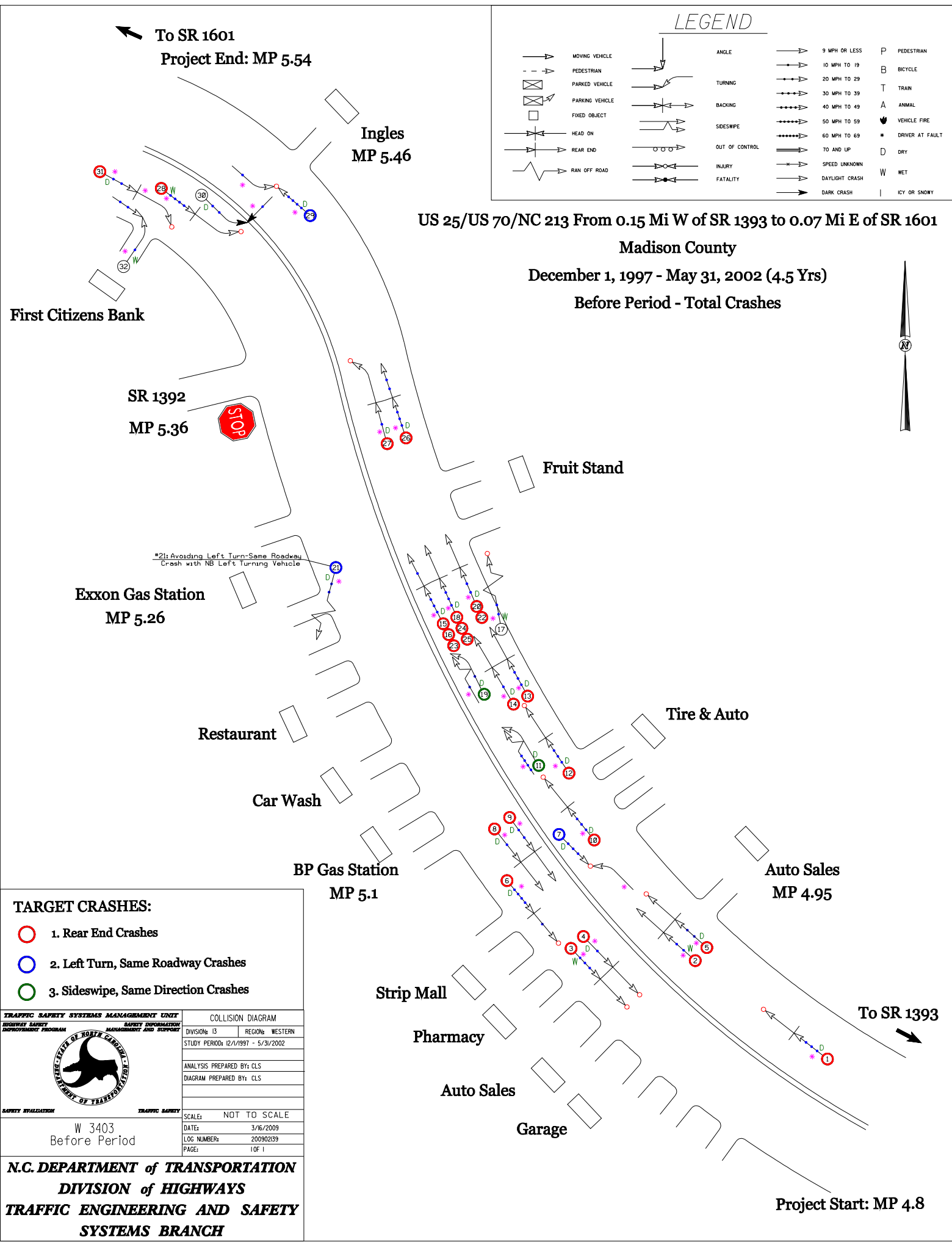
Treatment Photos

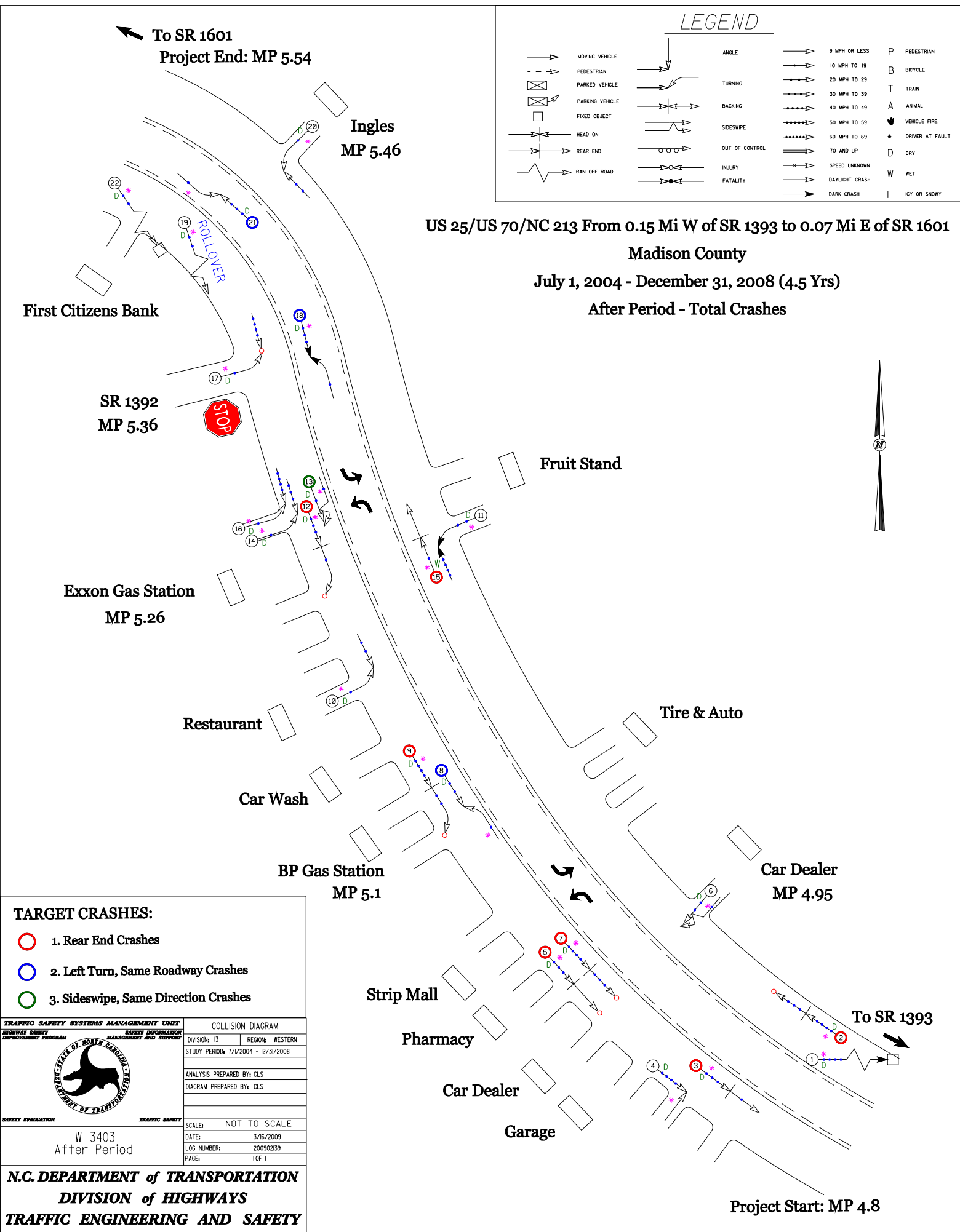


Driving WB near Exxon Gas Station (MP 5.25)

Driving WB near SR 1392 (MP 5.35)

Driving WB near Ingles (MP 5.45)


To SR 1601
Project End: MP 5.54
Ingles
MP 5.46
First Citizens Bank
SR 1392
MP 5.36
STOP
Fruit Stand
*21: Avoiding Left Turn-Same Roadway
Crash with NB Left Turning Vehicle
Exxon Gas Station
MP 5.26
Restaurant
Tire & Auto
Car Wash
BP Gas Station
MP 5.1
Auto Sales
MP 4.95
Strip Mall
Pharmacy
Auto Sales
Garage
To SR 1393
Project Start: MP 4.8
LEGEND
MOVING VEHICLE
PEDESTRIAN
PARKED VEHICLE
PARKING VEHICLE
FIXED OBJECT
HEAD ON
REAR END
RAN OFF ROAD
ANGLE
TURNING
BACKING
SIDESWIPE
OUT OF CONTROL
INJURY
FATALITY
9 MPH OR LESS
10 MPH TO 19
20 MPH TO 29
30 MPH TO 39
40 MPH TO 49
50 MPH TO 59
60 MPH TO 69
70 AND UP
SPEED UNKNOWN
DAYLIGHT CRASH
DARK CRASH
P PEDESTRIAN
B BICYCLE
T TRAIN
A ANIMAL
VEHICLE FIRE
* DRIVER AT FAULT
D DRY
W WET
I ICY OR SNOWY
US 25/US 70/NC 213 From 0.15 Mi W of SR 1393 to 0.07 Mi E of SR 1601
Madison County
December 1, 1997 - May 31, 2002 (4.5 Yrs)
Before Period - Total Crashes
N
TARGET CRASHES:
1. Rear End Crashes
2. Left Turn, Same Roadway Crashes
3. Sideswipe, Same Direction Crashes
TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT
HIGHWAY SAFETY IMPROVEMENT PROGRAM
SAFETY INFORMATION MANAGEMENT AND SUPPORT
SAFETY EVALUATION
TRAFFIC SAFETY
COLLISION DIAGRAM
DIVISION: 13
REGION: WESTERN
STUDY PERIOD: 12/1/1997 - 5/31/2002
ANALYSIS PREPARED BY: CLS
DIAGRAM PREPARED BY: CLS
SCALE: NOT TO SCALE
DATE: 3/16/2009
LOG NUMBER: 20090239
PAGE: 1 OF 1
W 3403
Before Period
N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY
SYSTEMS BRANCH


To SR 1601
Project End: MP 5.54
Ingles
MP 5.46
ROLLOVER
First Citizens Bank
SR 1392
MP 5.36
STOP
Fruit Stand
Exxon Gas Station
MP 5.26
Restaurant
Tire & Auto
Car Wash
BP Gas Station
MP 5.1
Car Dealer
MP 4.95
Strip Mall
Pharmacy
Car Dealer
Garage
To SR 1393
Project Start: MP 4.8
LEGEND
MOVING VEHICLE
PEDESTRIAN
PARKED VEHICLE
PARKING VEHICLE
FIXED OBJECT
HEAD ON
REAR END
RAN OFF ROAD
ANGLE
TURNING
BACKING
SIDESWIPE
OUT OF CONTROL
INJURY
FATALITY
9 MPH OR LESS
10 MPH TO 19
20 MPH TO 29
30 MPH TO 39
40 MPH TO 49
50 MPH TO 59
60 MPH TO 69
70 AND UP
SPEED UNKNOWN
DAYLIGHT CRASH
DARK CRASH
P PEDESTRIAN
B BICYCLE
T TRAIN
A ANIMAL
VEHICLE FIRE
* DRIVER AT FAULT
D DRY
W WET
| ICY OR SNOWY
US 25/US 70/NC 213 From 0.15 Mi W of SR 1393 to 0.07 Mi E of SR 1601
Madison County
July 1, 2004 - December 31, 2008 (4.5 Yrs)
After Period - Total Crashes
TARGET CRASHES:
1. Rear End Crashes
2. Left Turn, Same Roadway Crashes
3. Sideswipe, Same Direction Crashes
TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT
HIGHWAY SAFETY IMPROVEMENT PROGRAM
SAFETY INFORMATION MANAGEMENT AND SUPPORT
SAFETY EVALUATION
TRAFFIC SAFETY
STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
COLLISION DIAGRAM
DIVISION: 13
REGION: WESTERN
STUDY PERIOD: 7/1/2004 - 12/31/2008
ANALYSIS PREPARED BY: CLS
DIAGRAM PREPARED BY: CLS
SCALE: NOT TO SCALE
DATE: 3/16/2009
LOG NUMBER: 20090239
PAGE: 1 OF 1
W 3403
After Period
N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY
SYSTEMS BRANCH