Spot Safety Project Evaluation

Project Log # 200812050

Spot Safety Project # 13-03-200

Spot Safety Project Evaluation of the Traffic Signal Installation at the Intersection of SR 1304 (Independence Blvd) and the Southern Entrance to Freedom High School Burke County

Documents Prepared By:

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

Principal Investigator

Brad Robinson

Brad Robinson, PE

7/7/09
Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 13-03-200 – The Intersection of SR 1304 (Independence Blvd) and the southern entrance to Freedom High School in Morganton, Burke County.

The Signal ID is 13-1180 for the subject location. The Signal ID for the existing signal at the northern entrance is 13-0953.

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the installation of a traffic signal at the southern-most entrance to Freedom High School.

The subject location is one of three entrance/exits to Freedom High School along SR 1304 (Independence Blvd). It was formerly a secondary access point to the school. On the recommendation of the NCDOT, the internal traffic flow of the school was improved and the southern entrance was made the primary entrance.

SR 1304 (Independence Blvd) transitions from a two-lane roadway to a four-lane roadway at the subject intersection. The speed limit is 45 mph.

The initial crash analysis was completed from January 1, 1999 to December 31, 2001 with 23 reported crashes, 18 of which were considered correctable by the chosen countermeasure. The final completion date for the improvement at the subject intersection was on September 29, 2003 with a total cost of $50,000.00.

Naive Before and After Analysis

After reviewing the spot safety 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 August 1, 2003 to November 30, 2003. The before period consisted of reported crashes from May 1, 1998 through July 31, 2003 (5 years and 3 months) and the after period consisted of reported crashes from December 1, 2003 through February 28, 2009 (5 years and 3 months). The ending date for this analysis was determined by the available crash data at the time of analysis.

The treatment data consisted of all reported crashes within 150 feet of the subject intersection.
The following data table depicts the Naive Before and After Analysis for the treatment location. Please note that Frontal Impact crash types were the Target Crashes for the applied countermeasure. These crash types are considered as follows: Left Turn, same roadway; Left Turn, different roadway; Right Turn, same roadway; Right Turn, different roadway; Head On and Angle. The target crashes are clearly identified in the before and after period collision diagrams.

Subject Intersection Treatment Information			
	Before	**After**	**Percent Reduction (-) Percent Increase (+)**
Total Crashes	13	6	-53.8
Total Severity Index	16.08	1	-93.8
Target Crashes	13	2	-84.6
Target Crash Severity Index	16.08	1	-93.8
Volume	12,000	13,000	8.3
Crash Severity Summary			
Fatal Crashes	0	0	N/A
Class A Crashes	2	0	-100.0
Class B Crashes	3	0	-100.0
Class C Crashes	3	0	-100.0
PDO Crashes	5	6	20.0

The naive before and after analysis at the treatment location resulted in a 54 percent decrease in Total Crashes, an 85 percent decrease in Target Crashes, and an 8 percent increase in Average Daily Traffic (ADT). The before period ADT year was 2000 and the after period ADT year was 2006.

The next two adjacent entrances on SR 1304 were also analyzed in order to determine any effects to the other school entrances resulting from the new signal. The entrance immediately north of the subject intersection is an unsignalized intersection similar to the subject intersection. For this reason it was difficult to differentiate the location of some crashes in the before period. Every effort was made to be as accurate as possible using the given distances and the diagrams on the crash reports.

The third entrance analyzed is located at a signalized intersection. SR 1304 also intersects NC 126 at this location and the resulting intersection is four-legged.

The treatment data consisted of all reported crashes within 150 feet of each of the three intersections. The following data table depicts the Naive Before and After Analysis for the three entrances combined.

Combined Entrances Treatment Information			
	Before	**After**	**Percent Reduction (-) Percent Increase (+)**
Total Crashes	49	20	-59.2
Total Severity Index	7.76	1	-87.1
Volume	12,000	13,000	8.3
Crash Severity Summary			
Fatal Crashes	0	0	N/A
Class A Crashes	3	0	-100.0
Class B Crashes	6	0	-100.0
Class C Crashes	8	0	-100.0
PDO Crashes	32	20	-37.5

The naive before and after analysis when looking at the three entrances combined resulted in a 59 percent decrease in Total Crashes and an 87 percent decrease in the severity index. Please see the *Collision Diagrams* for a depiction of crashes at each separate entrance.

Results and Discussion

The naive before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in a 54 percent decrease in Total Crashes and an 85 percent decrease in Target Crashes. Both the Total Severity and the Target Crash Severity Indexes decreased by 94 percent. When the crashes at all three entrances were evaluated, Total Crashes experienced a 59 percent reduction. The summary results above demonstrate that both Total Crashes and Target Crashes appear to have decreased at the treatment location from the before to the after period.

The calculated benefit to cost ratio for this project is 25.32 considering total crashes. The benefit to cost ratio considering only target crashes is 25.63. 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 and utility costs. The benefit to cost ratios were calculated using the crashes at the subject intersection only.

The signal installation appears to have been very effective in reducing crashes at the subject intersection. In the before period there were 13 crashes at the intersection, all of which were Target Crashes. In the after period there were six crashes at the intersection, only two of which were Target Crashes. The non-target crashes included three Rear-End Crashes and one Animal Crash. None of the after period crashes resulted in injuries.

When analyzing all three adjacent entrances along SR 1304, the signal installation appears to have been even more effective. The unsignalized entrance immediately north of the subject intersection experienced 13 crashes in the before period, 11 of which were Frontal Impact Crashes. In the after period this intersection had only two crashes, neither of which were Frontal Impact Crashes.

The third entrance, located at the intersection of SR 1304 and NC 126, also experienced a significant reduction in crashes. In the before period there were 23 crashes at this location, while in the after period there were only 12. It is not clear that the project contributed much to this decrease. Only two of the before period crashes (both Left Turn-Same Roadway) appeared to be related to the school entrance. There were no crashes in the after period that appeared related to the school entrance.

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

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: SR 1304 at Freedom High School BY: BDR
COUNTY: Burke DATE: 6/25/2009
FILE NO.: SS 13-03-200

DETAILED COST: TYPE IMPROVEMENT - Signal

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$0	0	0.000	$0
	$50,000	10	0.149	$7,451
Right-of-Way	$0	0	0.000	$0
TOTALS	$50,000	10	0.149	$7,451

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $2,000
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $900

TOTAL ANNUAL COST= $10,351
TOTAL COST OF PROJECT= $50,000

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	5.25	2	0.38	6	1.14	5	0.95	$266,857
AFTER	5.25	0	0.00	0	0.00	6	1.14	$4,800

Annual Benefits from Crash Cost Savings $262,057

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = $251,706

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 25.32

TOTAL COST OF PROJECT - $50,000 COMPREHENSIVE B/C RATIO - 25.32

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: SR 1304 at Freedom High School BY: BDR
COUNTY: Burke DATE: 6/25/2009
FILE NO.: SS 13-03-200 Target Crashes

DETAILED COST: TYPE IMPROVEMENT - Signal

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$0	0	0.000	$0
	$50,000	10	0.149	$7,451
Right-of-Way	$0	0	0.000	$0
TOTALS	$50,000	10	0.149	$7,451

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $2,000
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $900

TOTAL ANNUAL COST= $10,351
TOTAL COST OF PROJECT= $50,000

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	5.25	2	0.38	6	1.14	5	0.95	$266,857
AFTER	5.25	0	0.00	0	0.00	2	0.38	$1,600

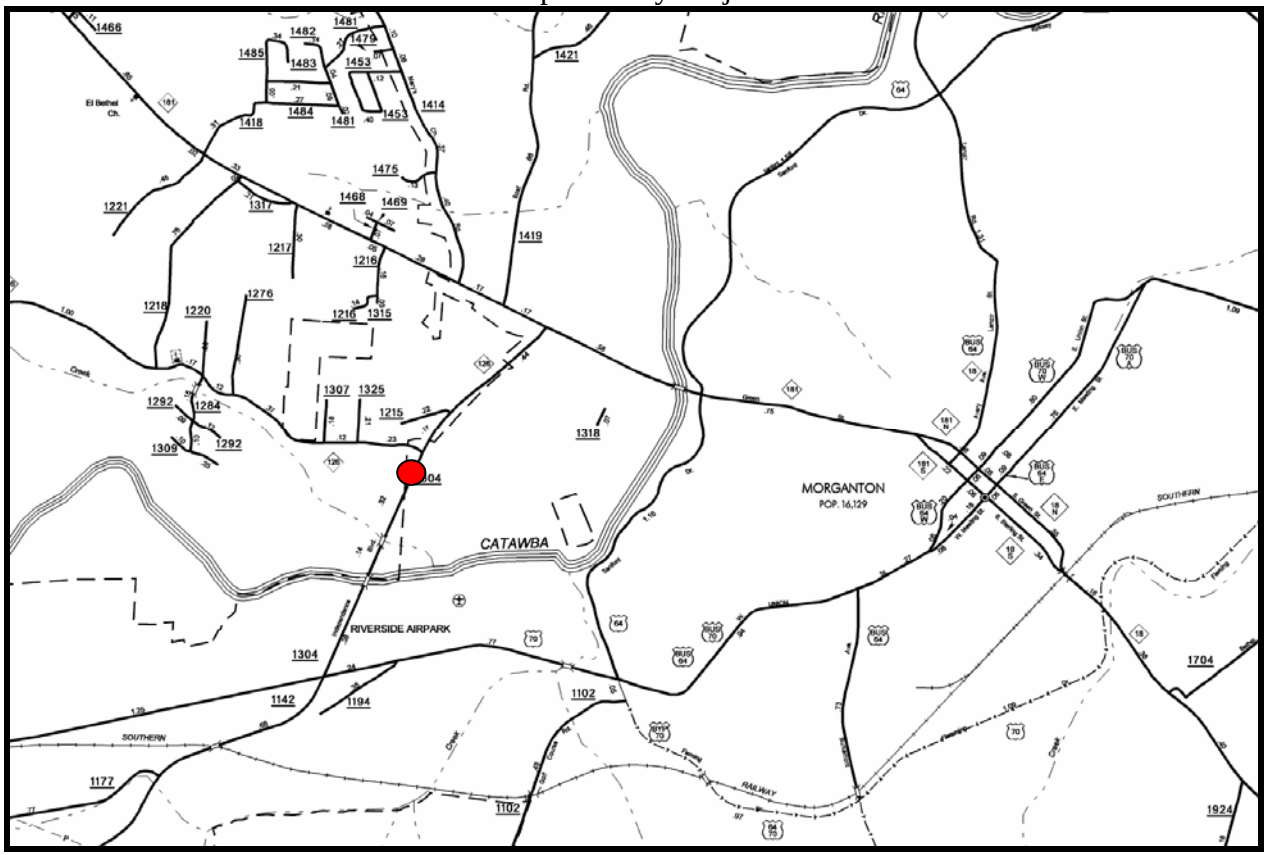
Annual Benefits from Crash Cost Savings $265,257

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = $254,906

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 25.63

TOTAL COST OF PROJECT - $50,000 COMPREHENSIVE B/C RATIO - 25.63

Location Map
Burke County
Evaluation of Spot Safety Project #13-03-200



Treatment Location: SR 1304 (Independence Blvd) at the southern entrance/exit to Freedom High School. The other two entrances were also analyzed for this evaluation.

Aerial Photo of Freedom High School and Entrances

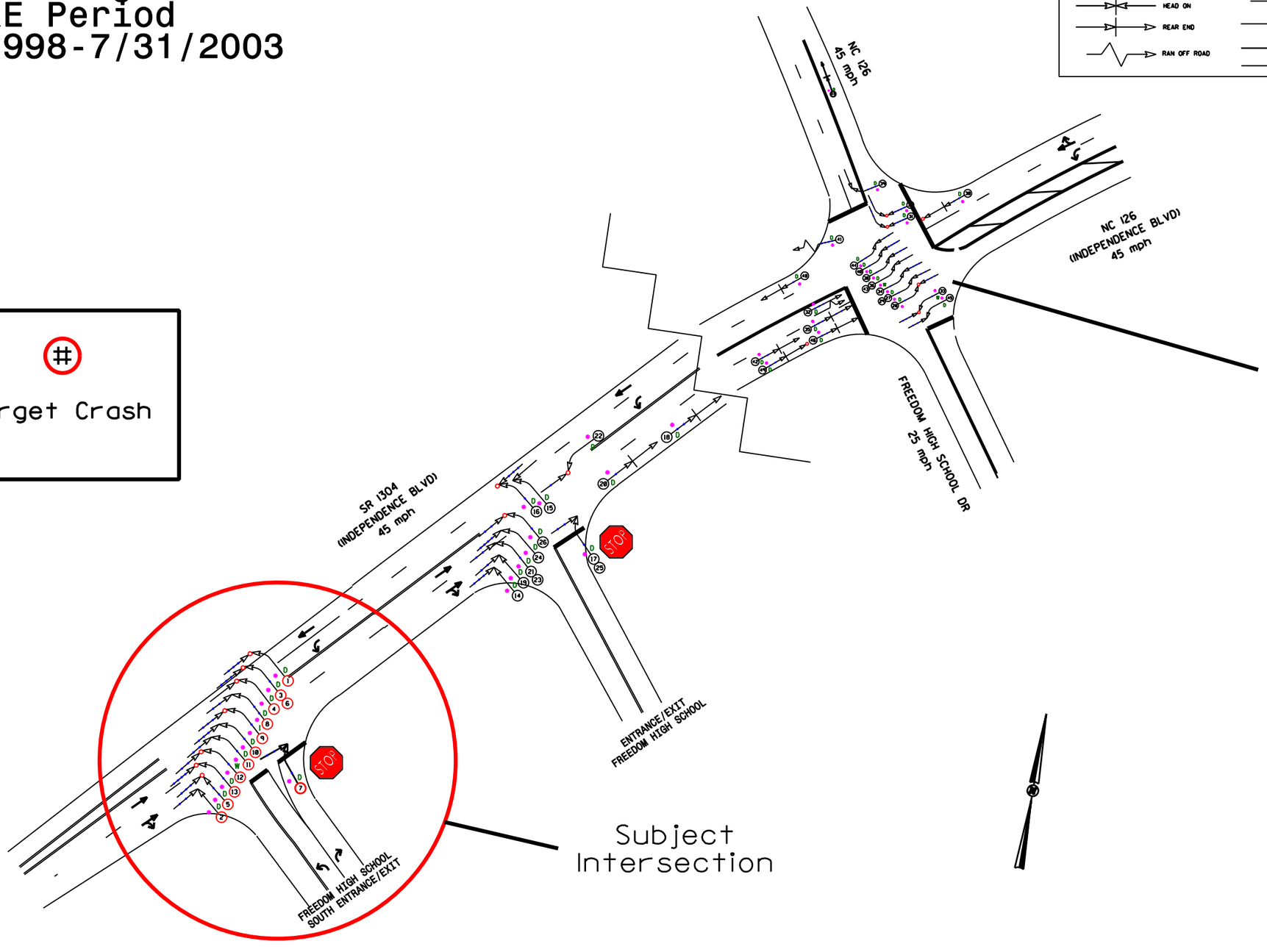
Entrance Signalized in Spot Safety Project

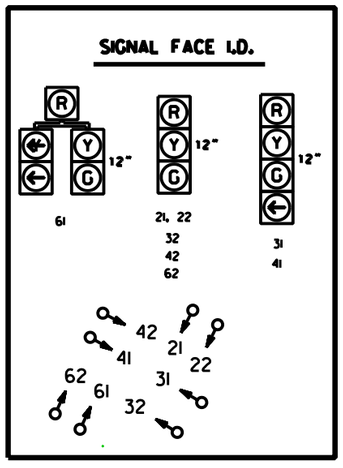
Burke County
SR 1304 (Indepenece Blvd)
at Entrances to
Freedom High School
BEFORE Period
5/1/1998-7/31/2003

LEGEND

MOVING VEHICLE	ANGLE	9 MPH OR LESS	P	PEDESTRIAN
PEDESTRIAN		10 MPH TO 19	T	TRAIN
PARKED VEHICLE	TURNING	20 MPH TO 29	*	DRIVER AT FAULT
PARKING VEHICLE	BACKING	30 MPH TO 39	D	DRY
FIXED OBJECT	SIDESWIPE	40 MPH TO 49	W	WET
HEAD ON	OUT OF CONTROL	50 MPH TO 59	I	ICY OR SNOWY
REAR END	INJURY	60 MPH TO 69	O	OILY
RAN OFF ROAD	FATALITY	70 AND UP		
		SPEED UNKNOWN		

Target Crash





TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

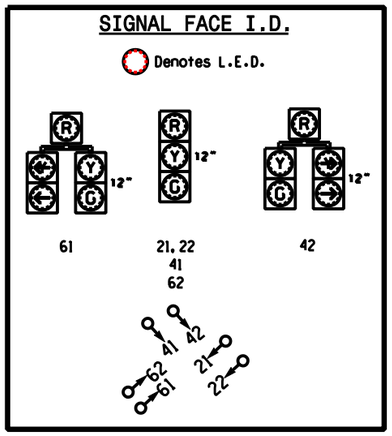
COLLISION DIAGRAM	
DIVISION: 13	AREA:
STUDY PERIOD: 5/1/1998-7/31/2003	
DISTANCE:	Y-LINE = 150FT
ANALYSIS PREPARED BY: BDR	
ANALYSIS CHECKED BY:	
DIAGRAM PREPARED BY: BDR	
DIAGRAM REVIEWED BY:	
SCALE: NOT TO SCALE	
DATE: June 2009	
LOG NUMBER: 20081205O	

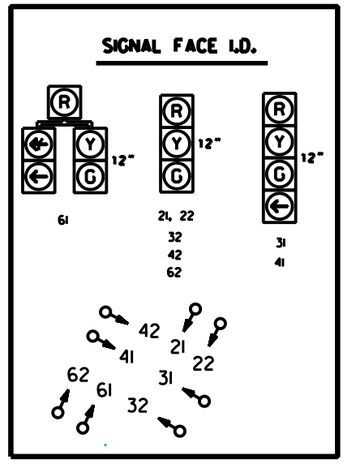
N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRANSPORTATION MOBILITY AND SAFETY DIVISION

Burke County
SR 1304 (Indepenence Blvd)
at Entrances to
Freedom High School
AFTER Period
12/1/2003-2/28/2009

LEGEND

MOVING VEHICLE	ANGLE	9 MPH OR LESS	P	PEDESTRIAN
PEDESTRIAN		10 MPH TO 19	T	TRAIN
PARKED VEHICLE	TURNING	20 MPH TO 29	*	DRIVER AT FAULT
PARKING VEHICLE		30 MPH TO 39		
FIXED OBJECT	BACKING	40 MPH TO 49	D	DRY
HEAD ON	SIDESWIPE	50 MPH TO 59	W	WET
REAR END		60 MPH TO 69		
RAN OFF ROAD	OUT OF CONTROL	70 AND UP	I	ICY OR SNOWY
	INJURY	SPEED UNKNOWN	O	OILY
	FATALITY			





Target Crash

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

COLLISION DIAGRAM	
DIVISION: 13	AREA:
STUDY PERIOD: 12/1/2003-2/28/2009	
DISTANCE: Y-LINE = 150FT	
ANALYSIS PREPARED BY: BDR	
ANALYSIS CHECKED BY:	
DIAGRAM PREPARED BY: BDR	
DIAGRAM REVIEWED BY:	
SCALE: NOT TO SCALE	
DATE: June 2009	
LOG NUMBER: 20081205O	

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DIVISION of HIGHWAYS
TRANSPORTATION MOBILITY AND SAFETY DIVISION