

Spot Safety Project Evaluation

Project Log # 200812035

Spot Safety Project # 12-01-231

**Spot Safety Project Evaluation of the Signal Revision and Upgrades at the Intersection of
US 29/74 (Franklin Blvd) and NC 274 (Bessemer City Blvd)/SR 2466 (Garrison Blvd)
Gaston 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, PE

5/12/2009

Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 12-01-231 – The Intersection of US 29/74 (Franklin Blvd) and NC 274 (Bessemer City Blvd)/ SR 2466 (Garrison Blvd) in Gaston County.

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was to revise the signal to provide a protected left turn phase for both approaches of US 29/74. In addition, all the signal heads were upgraded to LED lenses and the signal controller was replaced.

The subject location is a four-leg intersection which allowed only permissive left turns from US 29/74 in the before period. US 29/74 has six lanes at the subject intersection. In the before period each approach had a thru-left, a thru, and a thru-right turn lane. In the after period the westbound thru-left lane was changed to a left turn only lane and the lane that used to receive it was converted into an eastbound left turn lane. Northbound SR 2466 (Garrison Blvd) has a left, thru-left, and a right turn lane and southbound NC 274 (Bessemer City Blvd) has a thru-left, thru, and a right turn lane. The speed limit is 45 mph for eastbound US 29/74 and for SR 2466 and is 35 mph for westbound US 29/74 and for NC 274.

The original statement of problem was that westbound left turning vehicles were experiencing a significant accident pattern.

The initial crash analysis was conducted from January 1, 1998 to December 31, 2000 with a total of 68 crashes, 19 of which were Left Turn-Same Roadway Crashes and considered correctable by the chosen countermeasure. The final completion date for the improvements at the subject intersection was on June 19, 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 May 1, 2003 to July 31, 2003. The before period consisted of reported crashes from February 1, 1998 through April 30, 2003 (5 years and 3 months) and the after period consisted of reported crashes from August 1, 2003 through October 31, 2008 (5 years and 3 months). The ending date for this analysis was limited by the available crash data at the time the analysis was conducted.

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 Left Turn-Same Roadway Crashes involving vehicles on US 29/74 were the Target Crashes for the applied countermeasure. The target crashes are clearly identified in the before and after period collision diagrams.

Treatment Information			
	Before	After	Percent Reduction (-) Percent Increase (+)
Total Crashes	114	88	-22.8
Total Severity Index	5.25	2.77	-47.2
Target Crashes	33	1	-97.0
Target Crash Severity Index	9.18	1	-89.1
Volume	27,600	27,500	-0.4
Crash Severity Summary			
Fatal Crashes	1	0	-100.0
Class A Crashes	1	0	-100.0
Class B Crashes	6	2	-66.7
Class C Crashes	39	19	-51.3
PDO Crashes	67	67	0.0

The naive before and after analysis at the treatment location resulted in a 23 percent decrease in Total Crashes, a 97 percent decrease in Target Crashes, and very little change in Average Daily Traffic (ADT). The before period ADT year was 2000 and the after period ADT year was 2006.

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 23 percent decrease in Total Crashes and a 97 percent decrease in Target Crashes. The Total Severity Index decreased by 47 percent and the Target Crash Severity Index decreased by 89 percent. 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 40.74 considering total crashes. The benefit to cost ratio considering only target crashes is 38.37. 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.

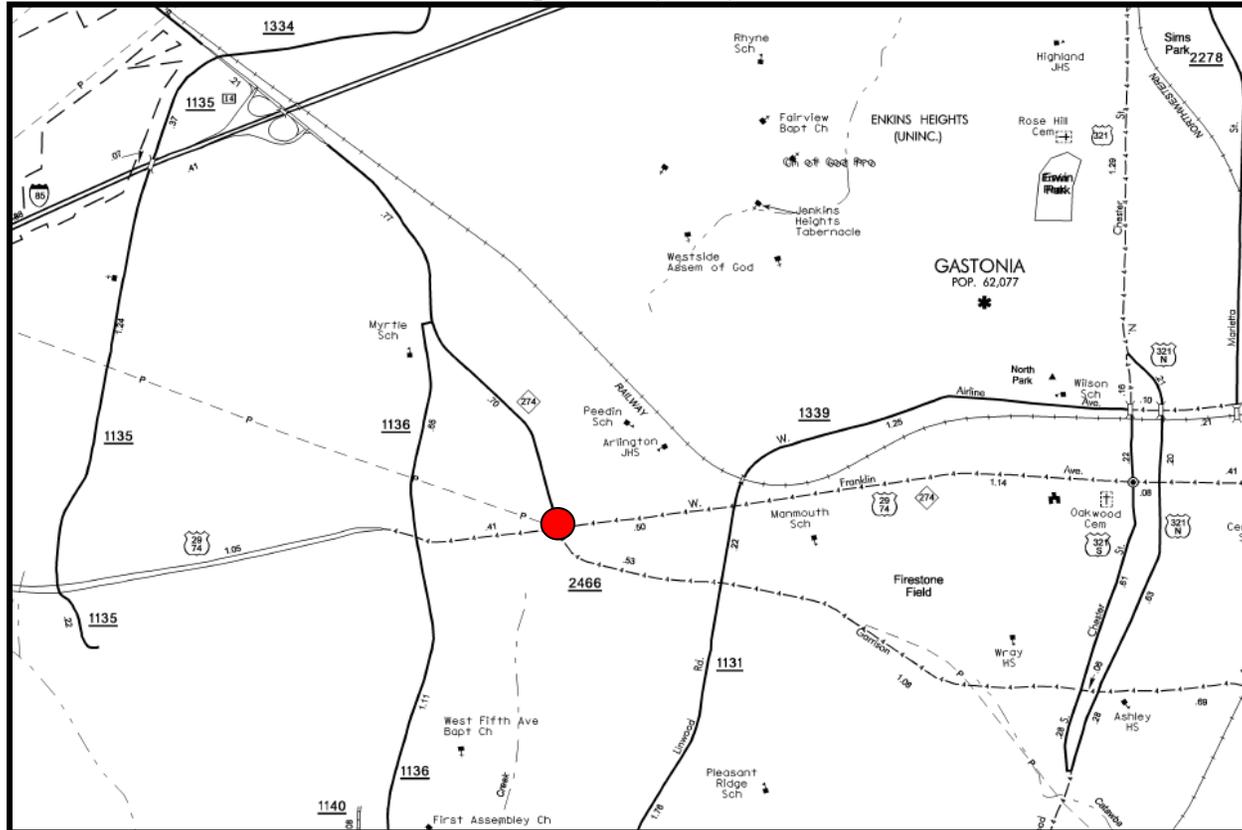
There was a total of 33 Left Turn-Same Roadway Crashes on US 29/74 in the before period. Twenty of these crashes involved westbound left-turning vehicles. The other 13 involved eastbound left-turning vehicles, one of which resulted in a Fatal Crash.

After reviewing the *Collision Diagrams* and the table on the previous page it is apparent that the signal revision was effective in reducing Left Turn-Same Roadway Crashes. In the after period there was only a single Left Turn-Same Roadway Crash involving vehicles on US 29/74. This crash involved an eastbound vehicle running the signal and hitting a left turning vehicle.

In the after period a new pattern emerged that was not present in the before period. There were 30 Sideswipe-Same Direction Crashes involving vehicles turning left onto US 29/74 from SR 2466 (Garrison Blvd). In every one of these crashes the driver on the left-hand side was the one at fault for attempting to merge into the right lane as they turned. Several of the crash reports indicated that the driver at fault did not know that both lanes were able to turn left (the lane on the right is a thru-left lane). The emergence of this pattern may have been caused by the reduction in the number of receiving lanes for the left turning traffic from three in the before period to two in the after period (as mentioned in the project background section).

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.

Location Map
Gaston County
Evaluation of Spot Safety Project # 12-01-231



Treatment Location: US 29/74 (Franklin Blvd) at NC 274 (Bessemer City Rd) / SR 2466 (Garrison Blvd)



Looking Northbound on SR 2466 (Garrison Blvd) Approaching Intersection



Looking Northbound on SR 2466 (Garrison Blvd)



Looking South on NC 274 (Bessemer City Blvd)



Looking East on US 29/74 (Franklin Blvd)



Looking West on US 29/74 (Franklin Blvd)



Looking West on US 29/74 (Franklin Blvd)

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US 29/74 at NC 274 and SR 2466
 COUNTY: Gaston
 FILE NO.: SS 12-01-231

BY: BDR
 DATE: 4/6/2009

DETAILED COST: TYPE IMPROVEMENT - Signal Revision

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 = \$400
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$300
 TOTAL ANNUAL COST= \$8,151
 TOTAL COST OF PROJECT= \$50,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

TIME PERIOD	YEARS	ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES				PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
		K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR			
BEFORE	5.24	2	0.38	45	8.59	67	\$465,916	
AFTER	5.24	0	0.00	21	4.01	67	\$133,855	

Annual Benefits from Crash Cost Savings \$332,061

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$323,910

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 40.74

TOTAL COST OF PROJECT - \$50,000 COMPREHENSIVE B/C RATIO - 40.74

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US 29/74 at NC 274 and SR 2466
 COUNTY: Gaston
 FILE NO.: SS 12-01-231 Target Crashes

BY: BDR
 DATE: 4/6/2009

DETAILED COST: TYPE IMPROVEMENT - Signal Revision

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 = \$400
 ESTIMATED INCREASE IN ANNUAL UTILITY COST = \$300
 TOTAL ANNUAL COST= \$8,151
 TOTAL COST OF PROJECT= \$50,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

TIME PERIOD	YEARS	ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES				PDO		ANNUAL COSTS
		K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	CRASHES	CRASHES PER YR	
BEFORE	5.24	2	0.38	16	3.05	15	2.86	\$313,550
AFTER	5.24	0	0.00	0	0.00	1	0.19	\$802

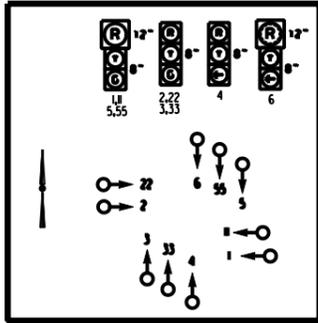
Annual Benefits from Crash Cost Savings \$312,748

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = \$304,597

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 38.37

TOTAL COST OF PROJECT - \$50,000 COMPREHENSIVE B/C RATIO - 38.37

Gaston County US 29/74 (Franklin Blvd) at NC 274 (Bessemer City Blvd) and SR 2466 (Garrison Blvd) BEFORE Period 2/1/1998-4/30/2003

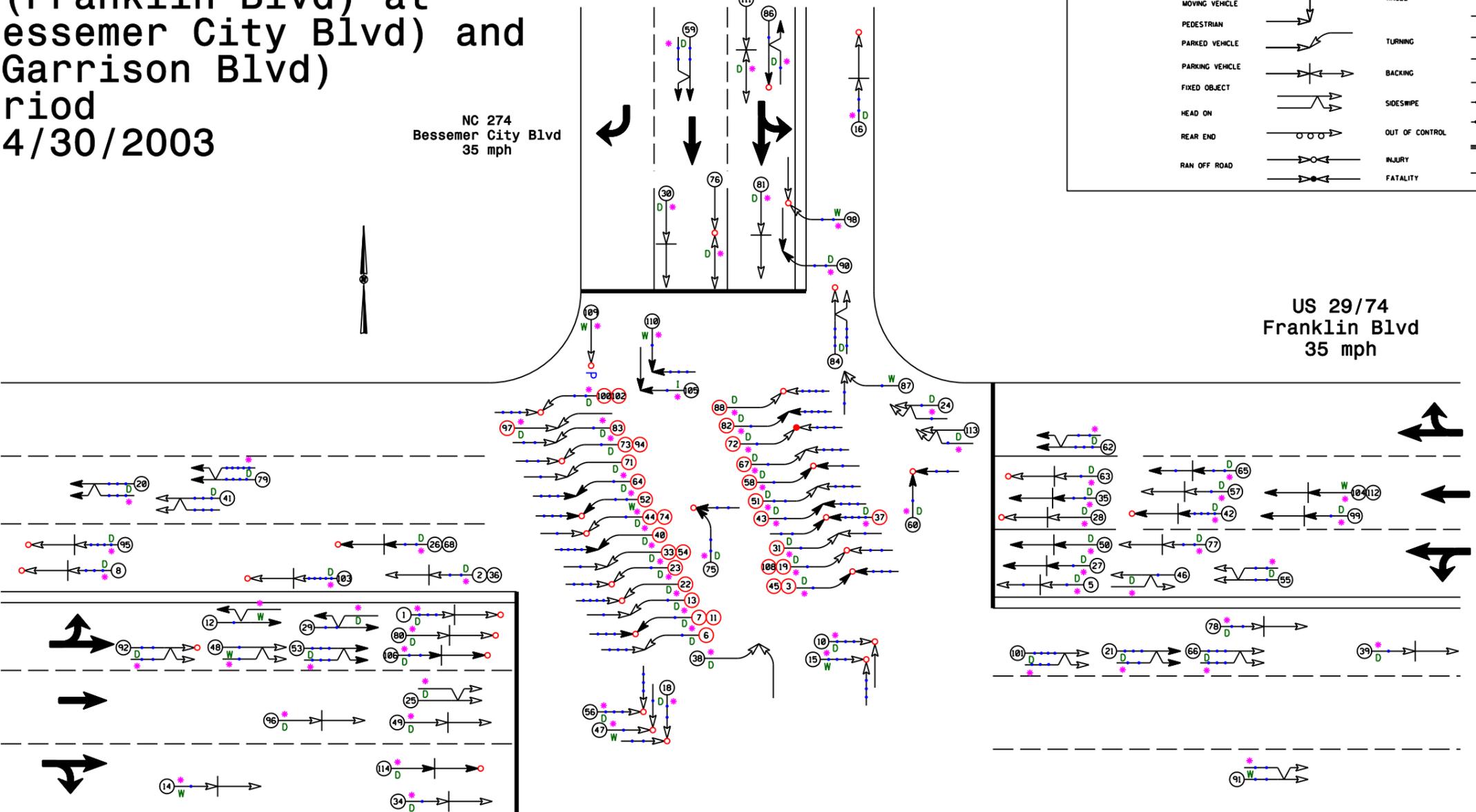


NC 274
Bessemer City Blvd
35 mph

LEGEND

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

US 29/74
Franklin Blvd
35 mph



US 29/74
Franklin Blvd
45 mph

SR 2466
Garrison Blvd
45 mph

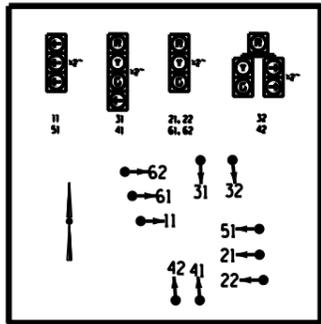
Target Crash

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 12	AREA:
	STUDY PERIOD: 2/1/1998-4/30/2003	
	DISTANCE: Y-LINE + 150 FT	
ANALYSIS PREPARED BY: BDR		
ANALYSIS CHECKED BY:		
DIAGRAM PREPARED BY: BDR		
DIAGRAM REVIEWED BY:		
SCALE: NOT TO SCALE		
DATE: Apr 11 2009		
LOG NUMBER: 20082035		

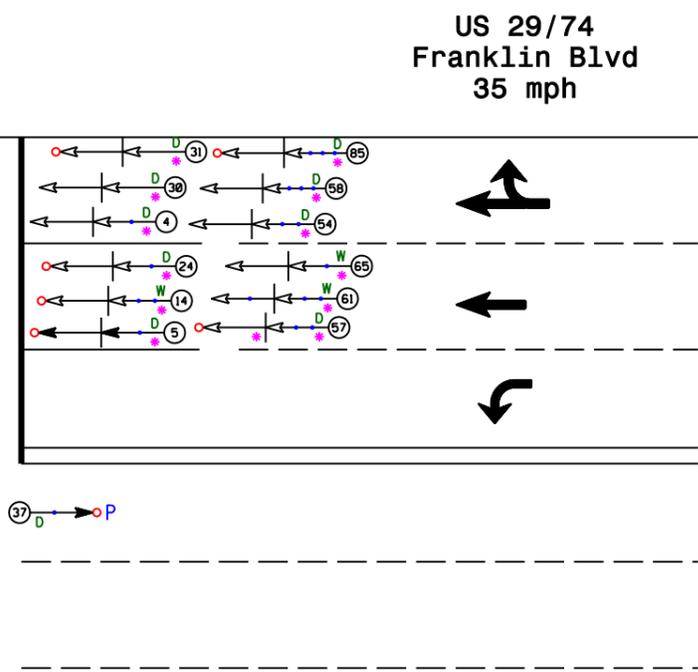
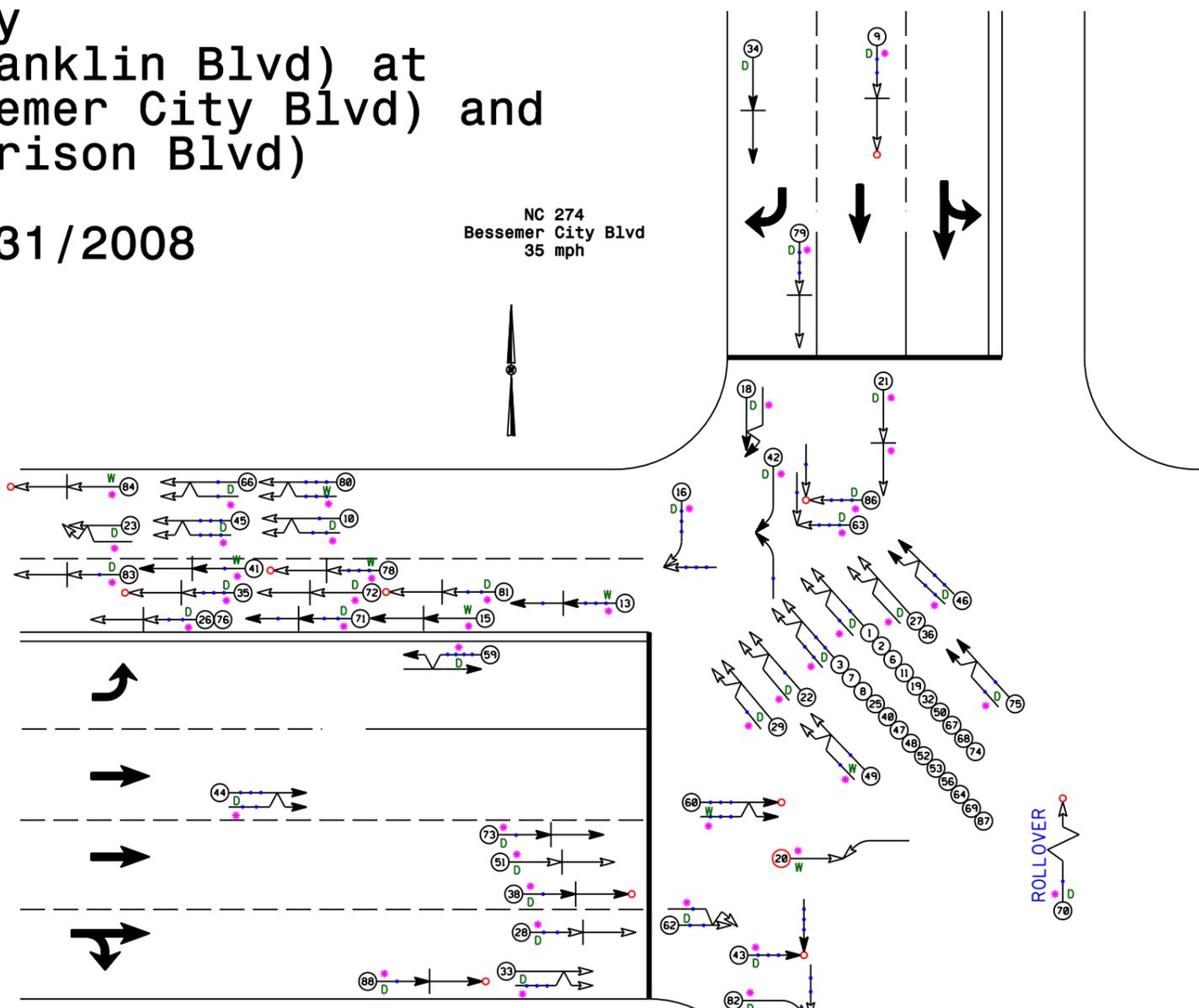
N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRANSPORTATION MOBILITY AND
SAFETY DIVISION

Gaston County
 US 29/74 (Franklin Blvd) at
 NC 274 (Bessemer City Blvd) and
 SR 2466 (Garrison Blvd)
 AFTER Period
 8/1/2003-10/31/2008



LEGEND

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



Target Crash

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

HIGHWAY SAFETY PLANNING AND ANALYSIS	HIGHWAY SAFETY IMPROVEMENT PROGRAM	COLLISION DIAGRAM	
		DIVISION: I2	AREA:
		STUDY PERIOD: 8/1/2003-10/31/2008	
		DISTANCE: Y-LINE + 150 FT	
		ANALYSIS PREPARED BY: BOR	
		ANALYSIS CHECKED BY:	
DIAGRAM PREPARED BY: BOR		SCALE: NOT TO SCALE	
DIAGRAM REVIEWED BY:		DATE: Apr 11 2009	
		LOG NUMBER: 20082035	

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