Spot Safety Project Evaluation

Order # 41000015395

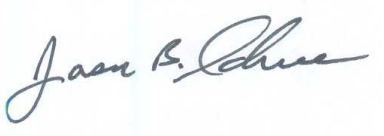
Spot Safety Project # 12-02-218

Spot Safety Project Evaluation of the Signal Phase Change
NC 16 (now NC 16 Business) at NC 150
Catawba County

Documents Prepared By:

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

Principal Investigator



Jason B. Schronce

Traffic Safety Project Engineer

12-1-2011
Date

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 12-02-218 located at the Intersection of NC 16 and NC 150 in Catawba County, north the City of Denver.

The Sig ID is 12-0654 for this modified traffic signal.

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the signal revision to include a northbound NC 16 left turn protected-permitted phase. NC 16 (now listed as NC 16 Business) and NC 150 are both two-lane facilities at the subject intersection that widen for left turn lanes on all approaches and have speed limits of 45 mph. The subject location is a four-leg crossroads type intersection, which is controlled by an existing traffic signal (Sig ID 12-0654).

The original statement of problem was the presence of delay and crashes on the northbound approach to the subject intersection. The intended purpose of the new left turn signal phase is to alleviate the crash potential and assist the operations of the traffic signal.

The initial crash analysis was completed from April 1, 1999 to March 31, 2002 with twenty-five (25) reported crashes, four (4) of which were deemed correctable including one A-injury crash. The final completion date for the improvement at the subject intersection was on April 30, 2007 with a total cost of $22,600.

In addition, NC 16 Bypass near this location was opened to traffic in early 2011 which reduced the volume (especially truck volume) at this location; however the Safety Evaluation Section cannot evaluate the impact at this time. Upon completion of the new bypass route, the former NC 16 is not listed as NC 16 Business.

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 were the months of March through April 2007. The before period consisted of reported crashes from November 1, 2002 through February 28, 2007 (4 years and 4 months); and the after period consisted of reported crashes from May 1, 2007 through August 31, 2011 (4 years and 4 months). The ending date for this analysis was determined by the date of available crash data at the time of analysis.

The treatment data consisted of all crashes within 150 feet of the subject intersection. *Please see attached location map, aerial map, and photos for further details.*

The following data table depicts the Naive Before and After Analysis for the treatment location. Please note that Northbound NC 16 Left Turn Same-Roadway Crashes were the target crashes for the applied countermeasure.

Treatment Information	**Before**	**After**	**Percent Reduction (-) Percent Increase (+)**
Total Crashes	41	39	- 4.9 %
Total Severity Index	4.64	5.41	16.6 %
Target Crashes	3	2	- 33.3 %
Target Crash Severity Index	3.47	4.70	35.4 %
Volume (2004, 2009)	21,300	21,500	0.9 %

Injury Crash Summary	**Before**	**After**	**Percent Reduction (-) Percent Increase (+)**
Fatal injury Crashes	0	1	100.0 %
Class A injury Crashes	1	0	- 100.0 %
Class B injury Crashes	3	3	0.0 %
Class C Injury Crashes	7	10	42.9 %
Total Injury Crashes	11	14	27.3 %

The naive before and after analysis at the treatment location resulted in a 5 percent decrease in Total Crashes, an 33 percent decrease in Target Crashes, but a 17 percent increase in the Total Severity Index. The before period ADT year was 2004 and the after period ADT year was 2009.

Results and Discussion

Referencing the *Collision Diagrams*, the total crashes and target crashes at this location stayed nearly the same through the evaluation with a slight increase in the intersection ADT. However, particular patterns did change. The countermeasure affected the northbound NC 16 left turn movement which improved from three (3) to two (2) crashes, all resulting from motorists choosing the insufficient gap.

Also, the southbound NC 16 left turn crash pattern (all permissive) reduced from five (5) before period collisions to one (1) in the after period. The westbound NC 150 right turn slip ramp reduced rear-end crashes from five (5) to three (3) through the analysis. Rear-end crashes approaching the signal (not including the slip ramp) increased from six (6) in the before period to twelve (12) in the after period.

Examining the intersection as a whole, angle crashes reduced from eleven (11) in the before period to four (4) in the after period. However, there was an after period fatal angle collision where a westbound NC 150 vehicle ran the red light and was struck by a northbound NC 16 vehicle. No intersection improvements where listed considering the on-going construction of the NC 16 Bypass.

The calculated benefit to cost ratio for this project is **(-2.39) considering total crashes**. The benefit to cost ratio **considering only target crashes is 0.27**. 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.

Please see the attached *Treatment Site Photos*. Photos are provided from our field visit on October 31st, 2011 for all four approaches to the treatment intersection. 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.

Treatment Site Photos (Field Visit on 10/31/2011)

Travelling North on NC 16 (Business) – New Signal Phase

Travelling South on NC 16 (Business)

Travelling East on NC 150

Travelling West on NC 150

BENEFIT-COST ANALYSIS WORKSHEET - Total Crashes

LOCATION: NC 16 at NC 150 BY: JBS
COUNTY: Catawba DATE: 11/21/2011
FILE NO.: SS 12-02-218

DETAILED COST: TYPE IMPROVEMENT - NC 16 Left Turn Signal Phase

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$22,600	10	0.149	$3,368
	$0	0	0.000	$0
Right-of-Way	$0	0	0.000	$0
TOTALS	$22,600	10	0.149	$3,368

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $200
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $150

TOTAL ANNUAL COST= $3,718
TOTAL COST OF PROJECT= $22,600

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	4.34	1	0.23	10	2.30	30	6.91	$220,968
AFTER	4.34	1	0.23	13	3.00	25	5.76	$229,839

Annual Benefits from Crash Cost Savings ($8,871)

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = ($12,589)

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = -2.39

TOTAL COST OF PROJECT - $22,600 COMPREHENSIVE B/C RATIO - -2.39

BENEFIT-COST ANALYSIS WORKSHEET - Target Crashes

LOCATION: NC 16 at NC 150 BY: JBS
COUNTY: Catawba DATE: 11/21/2011
FILE NO.: SS 12-02-218 NC 16 Left Turn Same-Rd Crashes

DETAILED COST: TYPE IMPROVEMENT - NC 16 Left Turn Signal Phase

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$22,600	10	0.149	$3,368
	$0	0	0.000	$0
Right-of-Way	$0	0	0.000	$0
TOTALS	$22,600	10	0.149	$3,368

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $200
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $150

TOTAL ANNUAL COST= $3,718
TOTAL COST OF PROJECT= $22,600

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

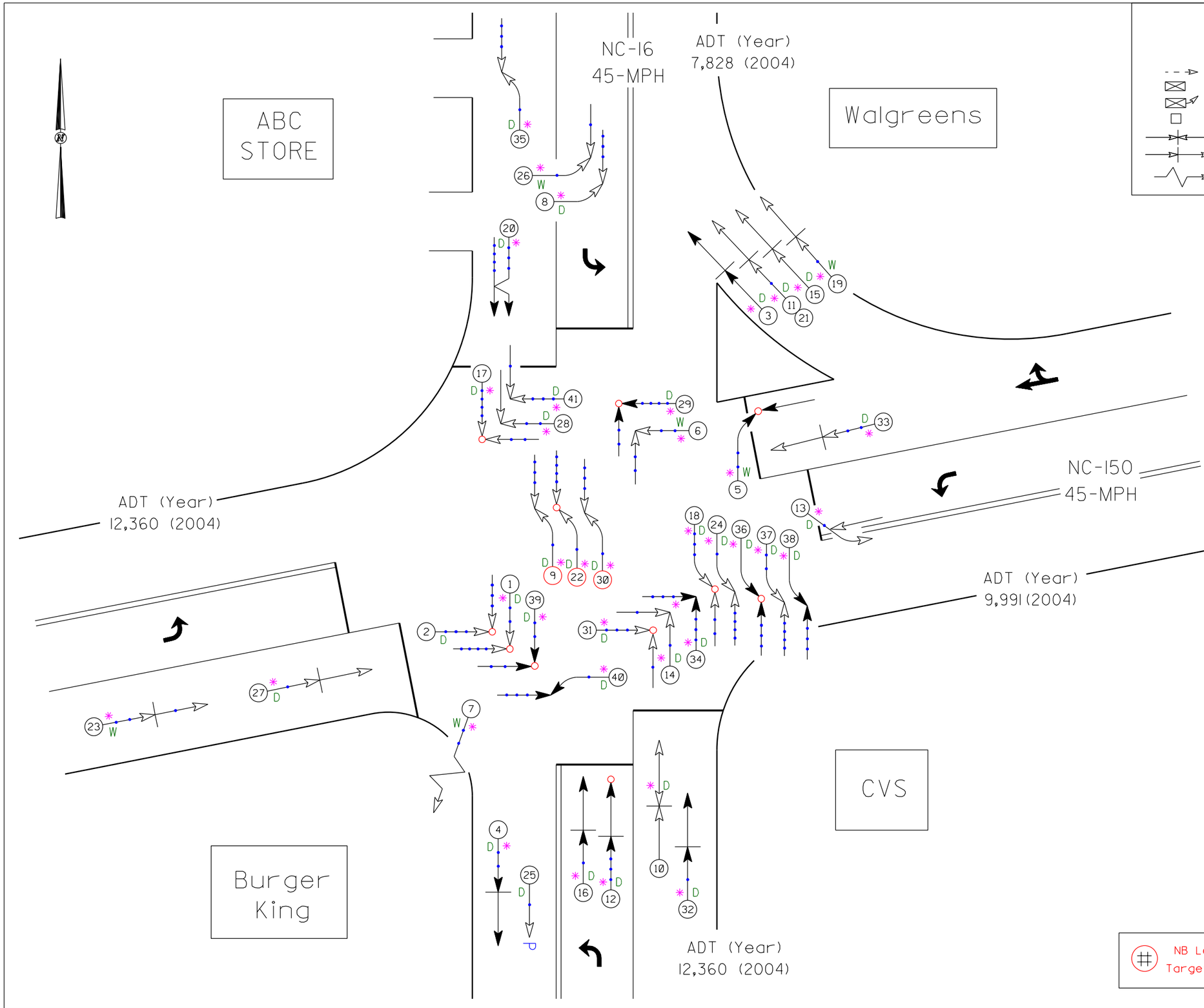
TIME PERIOD	YEARS	K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
BEFORE	4.34	0	0.00	1	0.23	2	0.46	$6,590
AFTER	4.34	0	0.00	1	0.23	1	0.23	$5,599

Annual Benefits from Crash Cost Savings $991

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = ($2,727)

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 0.27

TOTAL COST OF PROJECT - $22,600 COMPREHENSIVE B/C RATIO - 0.27



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

P PEDESTRIAN
T TRAIN
* DRIVER AT FAULT
D DRY
W WET
I ICY OR SNOWY
O OILY

SS# 12-02-218
Order# 41000015395
Catawba County
BEFORE Period
11/1/02 - 2/28/07

R
Y
G
Signalized Intersection
Sig-ID 12-0654
(All Permissive)

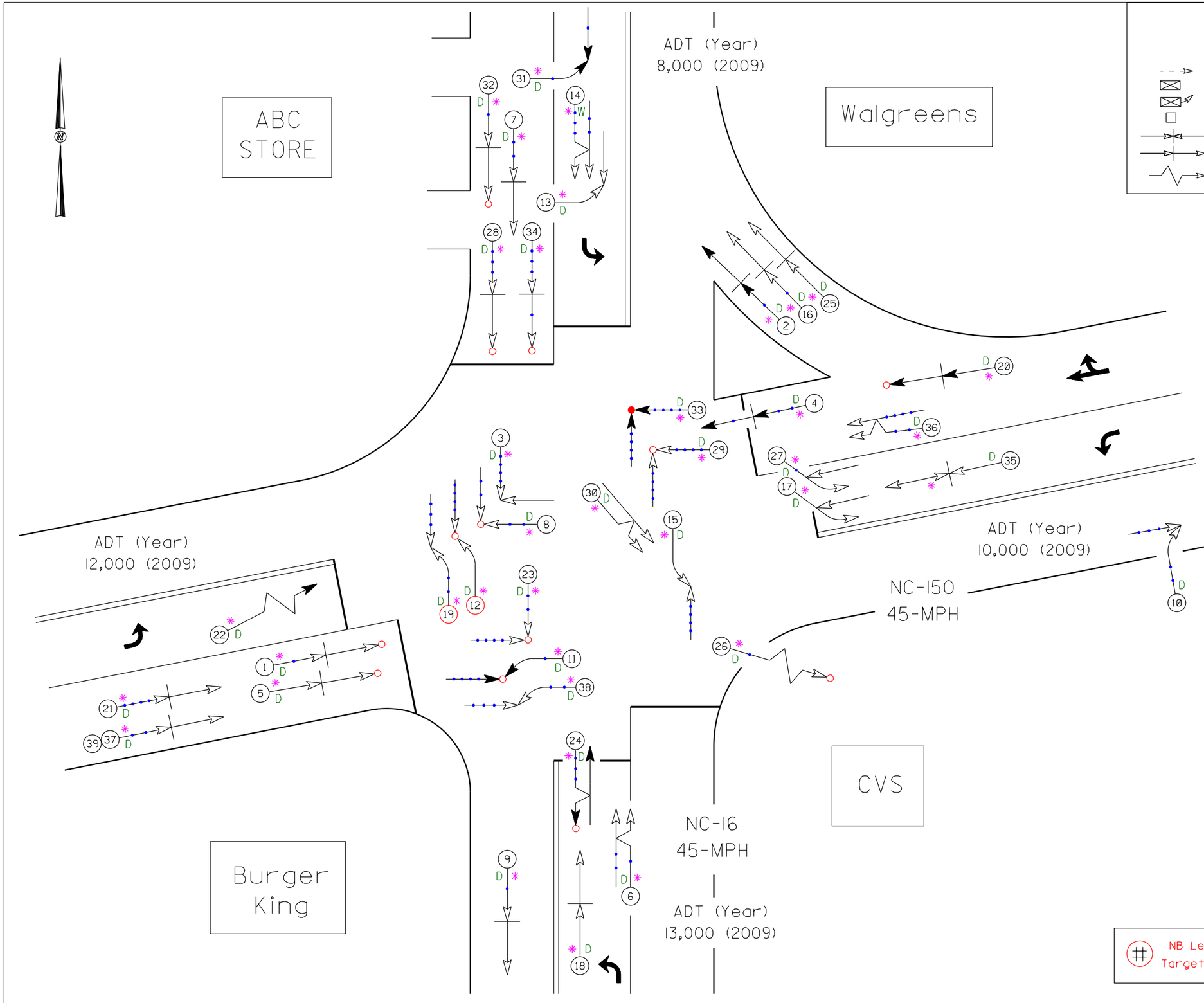
NB Left-Turn Target Crashes

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

TRAFFIC SAFETY UNIT

Date: 10–25–2011

Prepared By: J. Schronce



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

P PEDESTRIAN
T TRAIN
* DRIVER AT FAULT
D DRY
W WET
I ICY OR SNOWY
O OILY

SS# 12-02-218
Order# 41000015395
Catawba County
AFTER Period
5/1/07 - 8/31/11

R
Y
G

Modified
Signalized
Intersection
Sig-ID 12-0654

Signal Change:
Northbound NC-16
Protected-Permitted
Left Turn Phase

(#) NB Left-Turn Target Crashes

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

TRAFFIC SAFETY UNIT

Date: 10–25–2011 | Prepared By: J. Schronce