

**CITYWIDE TRAFFIC SAFETY PLANNING STUDY**  
**Phase 2 – Terrace Road and Noble Road Intersection**

**(City of East Cleveland)**

**Cuyahoga County, Ohio**

**Prepared For:**

**Honorable Mayor Eric J. Brewer  
City of East Cleveland  
14340 Euclid Avenue  
East Cleveland, Ohio 44112**

**AND**

**Northeast Ohio Areawide Coordinating Agency  
1299 Superior Avenue  
Cleveland, Ohio 44114**

**March 2009**

**CITYWIDE TRAFFIC SAFETY PLANNING STUDY**  
**Phase 2 – Terrace Road and Noble Road Intersection**

**(City of East Cleveland)**

**Cuyahoga County, Ohio**

**Prepared For:**

**Honorable Mayor Eric J. Brewer  
City of East Cleveland  
14340 Euclid Avenue  
East Cleveland, Ohio 44112**

**AND**

**Northeast Ohio Areawide Coordinating Agency  
1299 Superior Avenue  
Cleveland, Ohio 44114**

**March 2009**

**ENGINEER'S SEAL**

**PREPARED BY:**

\_\_\_\_\_  
Gerald J. Babroski, P.E.  
Registration No. 46674

**Date:** \_\_\_\_\_



## TABLE OF CONTENTS

<b>I.</b>	Study Area .....	1
<b>II.</b>	Executive Summary .....	2
	Purpose and Need .....	2
	Background .....	2
	Brief Overview of Possible Causes .....	2
	Recommended Countermeasures and Related Costs .....	2
<b>III.</b>	Purpose and Background .....	4
	Purpose and Need .....	4
<b>IV.</b>	Existing Conditions .....	5
<b>V.</b>	Crash Analysis .....	10
<b>VI.</b>	Rate of Return Analysis .....	11
	Short Term Improvement .....	11
	Long Term Improvement .....	12
<b>VII.</b>	Other Traffic Studies .....	13
	Traffic Signal Warrants Analysis .....	13
	Intersection Capacity Analysis .....	13
<b>VIII.</b>	Conclusions and Recommendations.....	16

## LIST OF APPENDICES

Appendix A:	Traffic Counts
Appendix B:	Traffic Signal Warrants Worksheets
Appendix C:	Site Photographs
Appendix D:	Collision Diagram
Appendix E:	Crash Data Summaries
Appendix F:	Crash Data Charts
Appendix G:	Crash Data Analysis Calculations
Appendix H:	Estimates of Countermeasures Effectiveness Reduction (CFR) Factors
Appendix I:	Rate of Return Worksheets
Appendix J:	Cost Estimate
Appendix K:	HCS Printouts



## LIST OF TABLES

Table 1:	Crash Data Analysis Summary Chart
Table 2:	Rate of Return Summary Chart
Table 3:	HCS Capacity Analysis Summary – AM Peak Hour
Table 4:	HCS Capacity Analysis Summary – PM Peak Hour

## LIST OF FIGURES

Figure 1:	Conditions Diagram
Figure 2:	Traffic Count Summary – AM Peak Hour
Figure 3:	Traffic Count Summary – PM Peak Hour
Figure 4:	Aerial Photograph





## II. Executive Summary:

### Purpose and Need:

This Traffic Safety Study was performed for the Intersection of Terrace Road and Noble Road in the City of East Cleveland, Ohio. A comprehensive study of all intersections in the City determined that this intersection was the site of the second largest number of vehicle crashes in the three years of the investigation (2005-2007). This intersection was near the top of the list with a total of 37 crashes.

The purpose of this study is to analyze the existing conditions and crash history of this intersection in order to identify actions and improvements which will enhance its safety.

### Background:

This report and study is the result of the Northeast Ohio Areawide Coordinating Agency (NOACA) Resolution No. 2007-028 in support of the Transportation for Livable Community Initiative (TLCI). NOACA uses a federal grant under the U.S. Department of Transportation, Federal Highway Administration (FHWA) Surface Transportation Program Funds to assist local communities and agencies for planning transportation improvements

### Brief Overview of Possible Causes:

There are a high number of angle crashes (20) involving motorists on all four legs of the intersection. The existing signal installation does not meet current standards as there is only one signal face for each approach. A minimum of two faces per approach is required to not only assure visibility, but to provide redundancy in the event of signal bulb failure(s). The single signal head displayed to each approach may not be meeting driver expectancy or visibility needs. Pavement markings are worn and are barely visible. These markings (specifically stop lines and crosswalk lines) could provide visual reinforcement of the potential stopping requirements at the intersection. There were also eight rear-end crashes on the steep, downhill, westbound Noble Road approach to the intersection (the only rear-end crashes documented in the 3 year study period), These rear-end collisions may well be due to the grade and/or a lack of adequate warning of the intersection on that approach. No other significant crash patterns were identified in this study.

### Recommended Countermeasures and Related Costs:

Short Term: The short term improvement for this intersection is to upgrade the pavement markings, install two advanced warning signs with flashing beacons



along the east approach and to optimize the signal timings. The estimated cost for this improvement is \$3,600 with a rate of return of 4,459%

Long Term: The medium term improvement for this intersection is to upgrade the traffic signal installation, including the two warning signs with flashing beacons and new pavement markings. The estimated cost of this improvement is \$140,000 with a rate of return of 143%.



### III. Purpose and Background:

#### Purpose and Need:

This Traffic Safety Study was performed for the Intersection of Terrace Road and Noble Road in the City of East Cleveland, Ohio. A comprehensive study of all intersections in the City determined that this intersection was the site of the second largest number of vehicle crashes in the three years of the investigation (2005-2007). This intersection had a total of 37 crashes.

The purpose of this study is to analyze the existing conditions and crash history of this intersection in order to identify actions and improvements which will enhance its safety.

This report and study is the result of the Northeast Ohio Areawide Coordinating Agency (NOACA) Resolution No. 2007-028 in support of the Transportation for Livable Community Initiative (TLCI). NOACA uses a federal grant under the U.S. Department of Transportation, Federal Highway Administration (FHWA) Surface Transportation Program Funds to assist local communities and agencies for planning transportation improvements which:

- Enhance the economic viability of existing communities within the region,
- Enhance the region's quality of life,
- Enhance a community's identity,
- Foster compact land use development/redevelopment,
- Facilitate accessibility by improving the range of transportation choices by adding or improving pedestrian, transit or bicycle facilities,
- Preserve and enhance farmland, forests and open spaces,
- Assist in redevelopment of urban core communities,
- Result in projects that can compete at the regional level for capital funds through NOACA's regional transportation investment process,
- Enhance the historic, archaeological, scenic and environmental elements of the transportation system, and
- Improve the safety and efficiency of the existing transportation system.



#### IV. Existing Conditions:

The Noble Road and Terrace Road intersection is a signalized intersection located in the northeasterly quadrant of the City within an area of mixed land use with high density housing. Christ the King Church and School is located on the southwest corner of the intersection.

Noble Road is a curbed, four lane, east-west roadway, with a steep down-grade through the intersection when traveling east to west (see Conditions Diagram in Figure 1 on Page 6 and site photographs in Appendix C). The grade is approximately 8 percent at the intersection and increases to 10 percent east of the intersection. The roadway is approximately 40 feet in width and has a posted speed limit of 25 MPH.

Terrace Road runs north and south and is a relatively level, two lane, curbed roadway. Terrace Road is approximately 28 feet wide south of the intersection and 24 feet wide north of the intersection and it is also posted at 25 MPH.

The two streets intersect at nearly right angles to one another. There is a single, three section signal head facing each direction of traffic, grouped in a four-way cluster. This cluster has 12-inch lenses and is suspended at the center of the intersection on a span wire that is attached to a steel strain pole in the northeast corner of the intersection and a wooden utility pole in the southwest quadrant. There are no pedestrian signal heads, but there are sidewalks and curb ramps at the intersection. There is no vehicle detection and the signal operates with a simple, two-phase, fixed time cycle. Existing pavement markings are barely visible. There is no on-street parking.

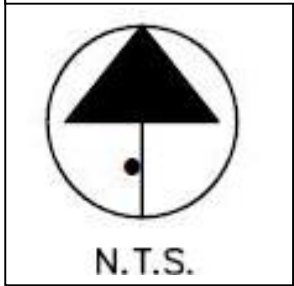
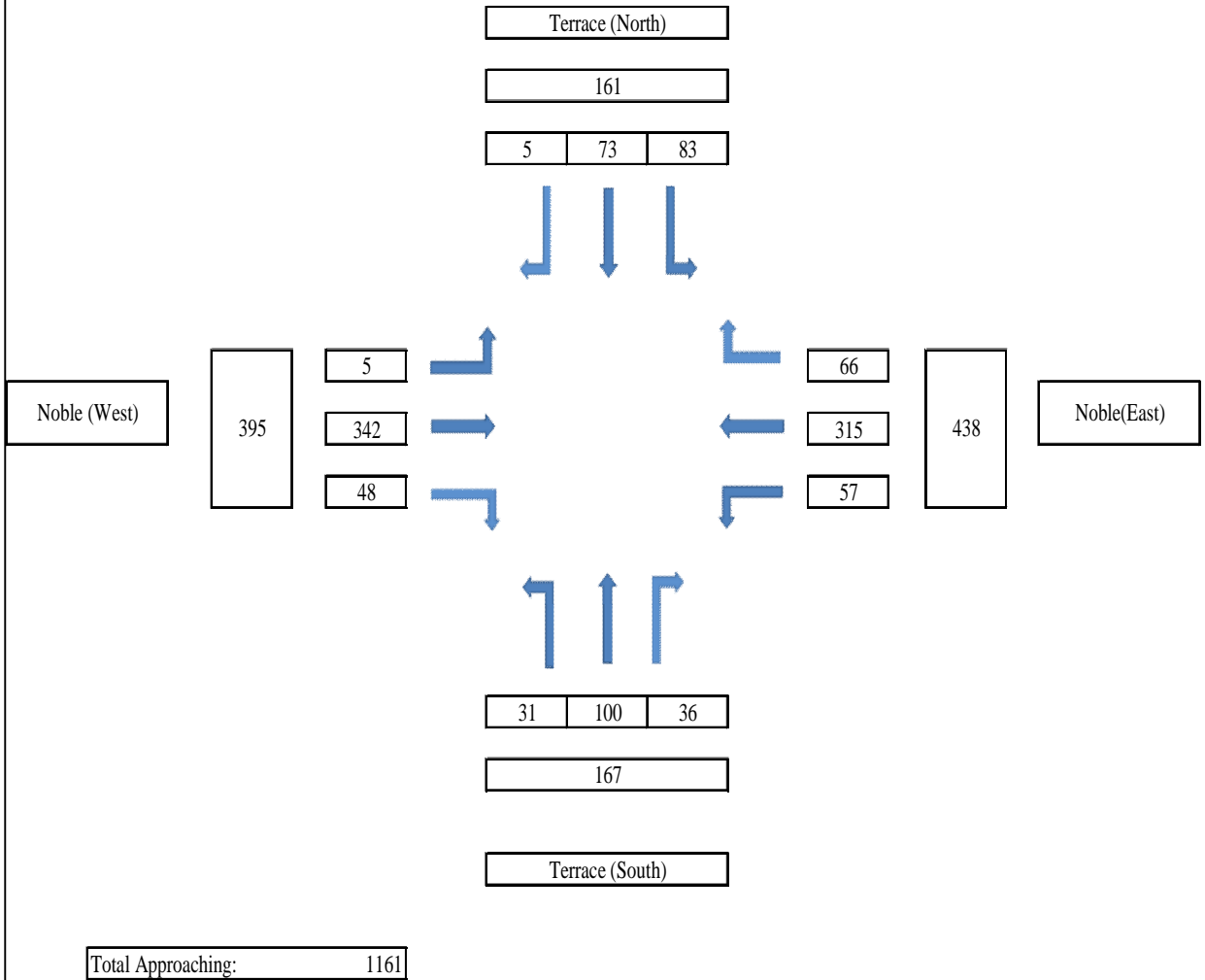
Twelve hour turning movement counts were conducted in March of 2009. Each vehicle was classified as passenger/light truck or large truck. Traffic count volumes are shown in Appendix A and summarized in Figures 1 and 2 on Pages 7 and 8. A total of 1,161 vehicles approached the intersection in the am peak hour and 1,442 vehicles in the pm peak hour.





**CITY OF EAST CLEVELAND  
SUMMARY OF TRAFFIC COUNTS  
AM PEAK HOUR**

LOCATION: Superior and Forest Hill  
COUNT DATE: Thursday, March 19, 2009



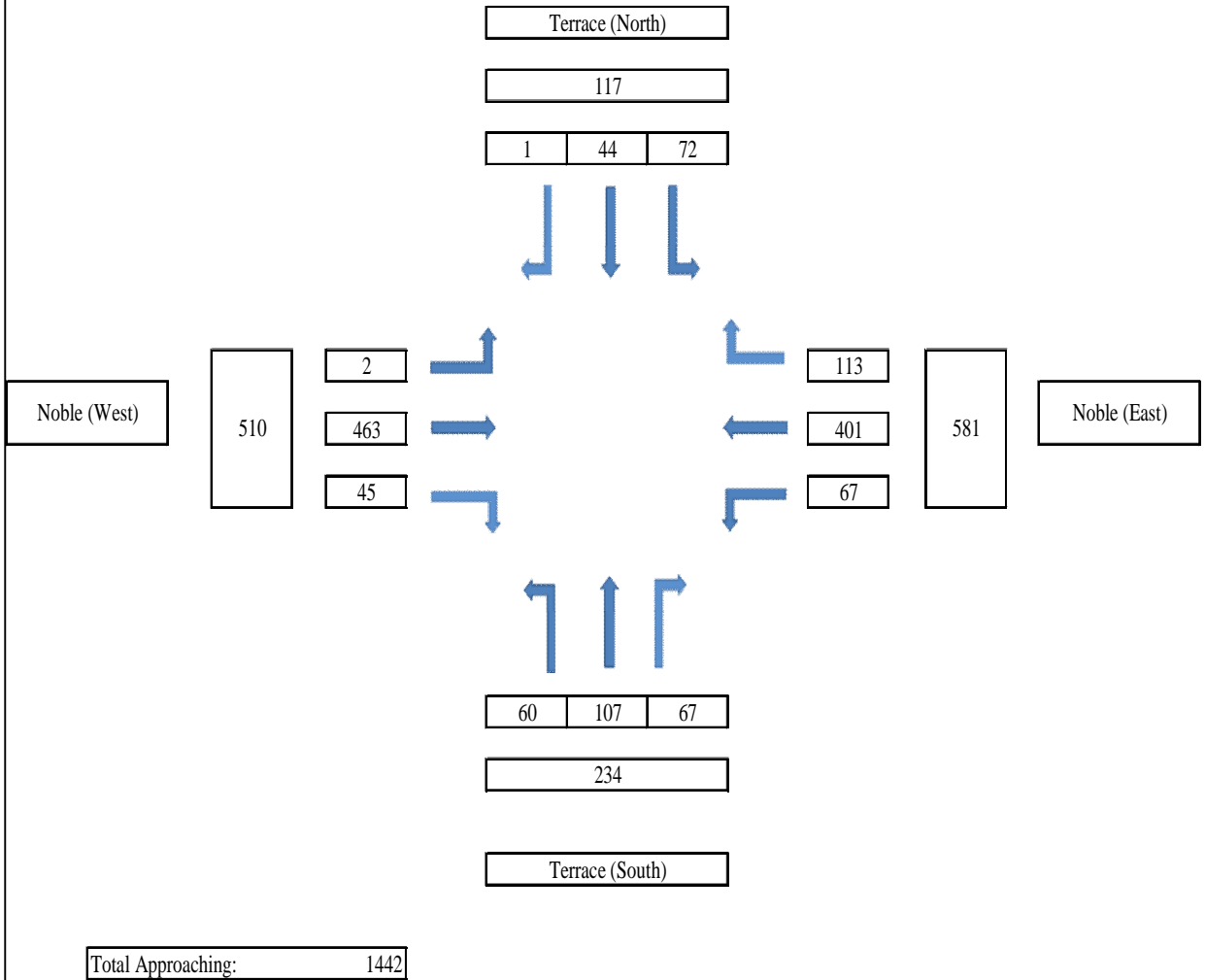
**FIGURE 2**  
**TRAFFIC COUNT SUMMARY**  
  
MARCH, 2009

GILLESPIE + SCHEMWER & PARTNERS  
& ASSOCIATES, INC.  
**GPD GROUP**  
5553 TRANSPORTATION BLVD, SUITE 100, CLEVELAND, OH 44123  
216.316.5544, Fax 216.578.5543



**CITY OF EAST CLEVELAND  
SUMMARY OF TRAFFIC COUNTS  
PM PEAK HOUR**

LOCATION: Noble and Terrace  
COUNT DATE: Thursday, March 19, 2009



**FIGURE 3**  
**TRAFFIC COUNT SUMMARY**  
  
MARCH, 2009

**GPD GROUP**  
GILLESPIE + SCHOMER SURVIS & ASSOCIATES, INC.  
5553 TRANSPORTATION BLVD, SUITE 100, CLEVELAND, OH 44123  
216.316.5544, Fax 216.578.5543





N.T.S.

FIGURE 4

AERIAL PHOTOGRAPH

MARCH 2009



GILLESPIE + SCHOMER & BURNS  
& LEVY, INC.

**GPD GROUP**

5553 TRANSPORTATION BLVD, SUITE 100, CLEVELAND, OH 44123  
216.318.5544, Fax 216.578.5543



## V. Crash Analysis:

Crash data information for the years 2005-2007 in the form of the Standard OH-1 Forms, were provided by the City Safety forces. For this period there were a total of 37 crashes at this intersection: 12 in 2005, 16 in 2006 and 9 in 2007. This was the second highest occurrence of crashes at an intersection in the City for this study period. A complete listing of the crashes with the dates, times and other pertinent information is included in Appendix E. This information is further summarized with charts in Appendix F.

Of the 37 crashes, 13 or 35% involved injuries and 24 or 65% were property damage only (PDO). There were no fatal injuries at this intersection within this time frame. The numbers of crashes with injuries, fatalities and property damage only are used to calculate a value referred to as the Severity Index. This index is calculated by assigning weighting factors to the crashes: with fatalities, a factor of twelve is used; with injuries a factor of three is used and for property damage only, a factor of one is used. These values are totaled and then divided by the total number of crashes to determine the Severity Index. For this intersection over the three years of study, the Severity Index was found to be 1.70. For comparison, the City-Wide Severity index for the year 2005 was 1.49.

The annual crash rate was also calculated. This is the average yearly crashes divided by the average daily traffic for the year. For this intersection the annual crash rate was determined to be 3.13 crashes per million approach vehicles (MAV). This was the highest rate for an intersection area within the City for this study period.

Twenty of the crashes were true angle type crashes (one vehicle being struck by a second vehicle approaching from its left or right). It is very unusual to have a high number of these types of crashes at a signalized intersection. The number of motorists cited in these crashes ranged from two, on the eastbound Noble Road approach, to eight on the northbound Terrace Road approach. The only other crash pattern consisted of 8 rear-ends, all of which were on the down-hill, westbound, Noble Road approach to the intersection. Fifty-seven percent of the crashes occurred during the daylight hours and 59% occurred on dry pavement.

Table 1: Crash Data Analysis Summary Chart

Intersection	Fatal	Injury	PDO	Total	Approach ADT	Annual Crash Rate	Severity Index
Noble and Terrace	0	13	24	37	10,787	3.13	1.70



## VI. Rate of Return Analysis:

The rate of return was calculated for the Noble Road and Terrace Road Intersection. Included for analysis are three (3) countermeasures of varying costs and improvements described below. The average property damage cost (PDO) and injury-fatality cost were obtained for the ODOT Highway Safety Program's website. Also, the Estimates of Countermeasure Effectiveness Reduction (CRF) Factors were obtained from the same website. See Appendix H for Estimates of Countermeasure Effectiveness Reduction (CRF) Factors printouts and Appendix I for the Rate of Return analysis for each improvement option

### Short Term Improvement:

In accordance with the Ohio Department of Transportation Safety Studies guidelines, the Index of Strategies-Spot Countermeasures was used. Two applicable Short Term Countermeasures were investigated. Field visits and historic photographs indicate that pavement markings are barely visible, so the first is the general upgrade of pavement markings. In addition because of the steep downgrade of the westbound approach, a second countermeasure to add an intersection warning sign with flashers is recommended. One warning sign will be W3-3 "Signal Ahead" and the other will be W3-4 "Be Prepared to Stop". These countermeasures will reduce PDO angle crashes by 1.48 and all PDO crashes by 3.08. Analysis also indicates a total reduction of injury crashes by 1.48. Work will include the striping of the approach lanes as well as the stop lines and crosswalk.

Under this scenario the intersection level of service (LOS) is anticipated to operate at a B rating with the signals optimized to a 60 second cycle length for both the AM and PM peak hours. See Appendix k for printouts of the LOS calculations.

The estimated cost for this improvement is \$3,600 with a rate of return of 4,159%. See Appendix J for worksheet of the estimated cost and Appendix I for rate of return worksheet.

### Long Term Improvement:

The recommended Long Term improvements are to upgrade the traffic signal installation to provide current state of the art equipment which meets accepted criteria of the Ohio Manual of Traffic Control Devices (OMUTCD). Currently, the single signal face in each direction is in violation of the OMUTCD which requires at least two faces for each approach. The new installation will provide improved visibility of the signals for all four approaches. Included with the installation will be all applicable pavement markings and the addition of advanced warning signs



with flashing beacons. One warning sign will be W3-3 “Signal Ahead” and the other will be W3-4 “Be Prepared to Stop”.

The signal would operate under the same phases as existing. Under this scenario the intersection level of service (LOS) is anticipated to operate at a B rating with the signals optimized to a 60 second cycle length for both the AM and PM peak hours. Because the timings and phases are identical to the short term optimized condition, the same printout for the 60 second cycle is applicable for both the short and medium term improvements. See Appendix K for printouts of the LOS calculations.

The estimated cost for this improvement is \$140,000 with a rate of return of 143%. See Appendix J for worksheet of the estimated cost and Appendix I for rate of return worksheet.

Because of the steep downgrade of the east approach a reconstruction of the intersection would normally be considered. However, in this case there appears to be no practical, cost effective, alternative to reconstruct the roadway to reduce the grade on Noble Road.

Table 2: Rate of Return Summary Chart			
	Short Term	Medium Term	Long Term
Rate of Return Results	4,159%	N/A	143%



## VII. Other Traffic Studies:

In order to properly investigate the operation of the Noble Road and Terrace Road intersection, the following studies/analyses have been conducted: Traffic Signal Warrants and Capacity Analysis.

### Traffic Signal Warrant Analysis:

In accordance with the Ohio Manual of Uniform Traffic Control Devices (OMUTCD) all traffic signals must meet at least one warrant to justify its use as a traffic control measure at an intersection. Currently there are eight different conditions which may warrant a signal, they are:

- Warrant 1, Eight-Hour Vehicular Volume.
- Warrant 2, Four-Hour Vehicular Volume.
- Warrant 3, Peak Hour.
- Warrant 4, Pedestrian Volume.
- Warrant 5, School Crossing.
- Warrant 6, Coordinated Signal System.
- Warrant 7, Crash Experience.
- Warrant 8, Roadway Network.

Traffic counts were conducted on March 19, 2009 for the purpose of determining if the volumetric warrants support the signalization of this intersection. Based on the count data it was determined that the Four-Hour Vehicular Volume warrant was satisfied. A copy of the signal warrants worksheets are included in Appendix B.

### Intersection Capacity Analysis:

Intersection capacity analyses are performed in order to determine the performance of an intersection based on the traffic demand and its physical characteristics. The quality of the operating condition experienced by an intersection is measured in terms of Level of Service (LOS) and is a calculation of vehicle delay. Levels of Service range from LOS A to LOS F. Level of Service ratings of A, B, and C are considered to be in the acceptable range. Level of Service D may be acceptable in highly urban settings but generally is considered undesirable as traffic volumes are approaching capacity limits. Levels of Service E and F are considered unacceptable with a LOS F representing a failure state of the intersection, or gridlock. Based on criteria established by ODOT, Highway Capacity Software (HCS) is used to determine the required number of lanes and the lane assignments at intersections (i.e. the needed intersection capacity). The software is also used to optimize the operation of the intersection by determining the best phasing patterns and timings for the traffic demand given the fixed geometrics and characteristics of the study site.



Intersection capacity analyses were performed utilizing the computer program HCS-Plus, developed by the McTrans Corporation based on the Highway Capacity Manual and the 2003 Edition of the Manual of Uniform Traffic Control Devices (MUTCD). Signalized intersection capacity analyses were performed in the AM and PM Peak Hours for the Noble and Terrace intersection for the following conditions: existing phasing, timing and geometry and optimized timing. Because the existing geometry is not being altered, the results of the optimized timings are appropriate to use for both the Short and Medium Term improvements. The Level of Service results of the HCS analyses are summarized in the Tables 3 and 4. For HCS output, see Appendix K.



Table 3 HCS Capacity Analysis Summary - AM Peak Hour				
Movement	Existing	Short Term	Medium Term	Long Term
Eastbound	B	B	N/A	B
Left-Thru-Right	B	B	N/A	B
Westbound	B	B	N/A	B
Left-Thru-Right	B	B	N/A	B
Northbound	C	B	N/A	B
Left-Thru-Right	C	B	N/A	B
Southbound	C	B	N/A	B
Left-Thru-Right	C	B	N/A	B
Overall	B	B	N/A	B

Table 4 HCS Capacity Analysis Summary - PM Peak Hour				
Movement	Existing	Short Term	Medium Term	Long Term
Eastbound	B	B	N/A	B
Left-Thru-Right	B	B	N/A	B
Westbound	B	B	N/A	B
Left-Thru-Right	B	B	N/A	B
Northbound	C	B	N/A	B
Left-Thru-Right	C	B	N/A	B
Southbound	C	B	N/A	B
Left-Thru-Right	C	B	N/A	B
Overall	B	B	N/A	B

A review of the Capacity Analyses indicates that for all cases an acceptable level of service is possible with the overall ratings maintaining an LOS of B under optimized conditions.



## VIII. Conclusions and Recommendations:

This Traffic Safety Study was performed for the Intersection of Noble Road and Terrace Road in the City of East Cleveland, Ohio. A comprehensive study of all intersections in the City determined that this intersection was the site of the second largest number of vehicle crashes (37) in the three years of the investigation (2005-2007). It was studied to determine what, if any, safety concerns exist and to determine appropriate mitigating measures.

Based on the results of the crash data analysis, rate of return analysis and traffic studies, GPD Group concludes the following:

1. Of the 37 crashes at this intersection: 12 occurred in 2005, 16 in 2006 and 9 in 2007.
2. Of the 37 crashes, 13 or 35% involved injuries and 24 or 65% were property damage only (PDO).
3. There were 20 true angle crashes, a very large number for a signalized intersection.
4. A crash pattern of 8 rear-end collisions on the westbound Noble Road approach to the intersection was identified.
5. The Severity Index was found to be 1.70. For comparison, the City-Wide Severity index for the year 2005 was 1.49.
6. For this intersection the annual crash rate was determined to be 3.13 crashes per million approach vehicles (MAV). This was the highest rate for an intersection area within the City for this study period.
7. The most applicable Short Term Countermeasure is for the improvement of pavement markings with advanced warning signs with flashing beacons. These short term countermeasures will reduce PDO angle crashes by 1.48 and all PDO crashes by 3.08. Analysis also indicates a total reduction of injury crashes by 1.48.
8. Long Term improvements include the upgrade of the traffic signal installation, two warning signs with flashing beacons and replacing pavement markings. These countermeasures will reduce PDO angle crashes by 1.98 and all PDO crashes by 4.13. Analysis also indicates a total reduction of injury crashes by 1.98.
9. The reconstruction of Noble Road to reduce the grade through its intersection with Terrace Road is not a feasible or cost effective improvement.
10. A review of the Capacity Analyses indicates that for all proposed improvement scenarios, an acceptable level of service is possible.



Based on the results of the crash data analysis, rate of return analysis and traffic studies, GPD Group recommends the following:

1. The City of East Cleveland should implement the Short Term improvements within the next three months, but this is considered a band aid fix until the full traffic signal installation is replaced.
2. The Long Term improvement for the reconstruction of the traffic signal installation with the advanced warning signs and applicable pavement markings is the recommended alternative for this intersection. It is highly recommended that this long term improvement be implemented and planned for as soon as possible. It is further recommended that the City of East Cleveland apply for safety funding for this option.



**APPENDIX A**  
**TRAFFIC VOLUMES**



Terrace Road / Noble Road Intersection

Project Number: 2008113.00  
 Project Name: City Wide Safety Study  
 Project Location: East Cleveland, OH  
 Client Name: City of East Cleveland

File Name : Terrace and Noble 3-19-09  
 Site Code : 36038113  
 Start Date : 3/19/2009  
 Page No : 1

**Groups Printed- Passenger Vehicles - Trucks - Buses**

Start Time	Noble Road Eastbound					Noble Road Westbound					Terrace Road Northbound					Terrace Road Southbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
07:00 AM	0	50	6	0	56	6	58	3	0	67	4	9	3	1	17	15	9	0	0	24	164
07:15 AM	0	45	13	0	58	3	53	14	0	70	11	18	5	0	34	21	14	4	2	41	203
07:30 AM	1	65	10	0	76	6	74	17	0	97	8	24	5	0	37	16	17	0	1	34	244
07:45 AM	1	90	17	0	108	20	74	14	0	108	9	30	9	1	49	30	23	0	5	58	323
<b>Total</b>	<b>2</b>	<b>250</b>	<b>46</b>	<b>0</b>	<b>298</b>	<b>35</b>	<b>259</b>	<b>48</b>	<b>0</b>	<b>342</b>	<b>32</b>	<b>81</b>	<b>22</b>	<b>2</b>	<b>137</b>	<b>82</b>	<b>63</b>	<b>4</b>	<b>8</b>	<b>157</b>	<b>934</b>
08:00 AM	2	107	14	0	123	20	79	24	0	123	8	25	11	0	44	20	15	3	1	39	329
08:15 AM	1	80	7	0	88	11	88	11	0	110	6	21	11	0	38	17	18	2	0	37	273
08:30 AM	1	65	5	0	71	4	76	11	0	91	10	15	10	0	35	21	8	1	0	30	227
08:45 AM	1	64	12	0	77	5	64	17	0	86	10	18	12	0	40	12	15	1	0	28	231
<b>Total</b>	<b>5</b>	<b>316</b>	<b>38</b>	<b>0</b>	<b>359</b>	<b>40</b>	<b>307</b>	<b>63</b>	<b>0</b>	<b>410</b>	<b>34</b>	<b>79</b>	<b>44</b>	<b>0</b>	<b>157</b>	<b>70</b>	<b>56</b>	<b>7</b>	<b>1</b>	<b>134</b>	<b>1060</b>
09:00 AM	0	54	6	0	60	9	62	8	0	79	6	10	7	0	23	12	9	0	0	21	183
09:15 AM	0	66	16	0	82	7	64	11	0	82	5	13	13	0	31	9	7	1	0	17	212
09:30 AM	0	66	9	0	75	7	70	9	0	86	4	12	8	0	24	6	6	1	0	13	198
09:45 AM	0	57	4	0	61	3	63	13	0	79	5	10	6	0	21	12	9	1	0	22	183
<b>Total</b>	<b>0</b>	<b>243</b>	<b>35</b>	<b>0</b>	<b>278</b>	<b>26</b>	<b>259</b>	<b>41</b>	<b>0</b>	<b>326</b>	<b>20</b>	<b>45</b>	<b>34</b>	<b>0</b>	<b>99</b>	<b>39</b>	<b>31</b>	<b>3</b>	<b>0</b>	<b>73</b>	<b>776</b>
10:00 AM	1	54	4	0	59	3	58	12	0	73	6	12	6	0	24	10	10	1	0	21	177
10:15 AM	0	53	5	0	58	4	59	11	0	74	7	14	5	0	26	11	12	1	0	24	182
10:30 AM	1	53	4	0	58	5	60	11	0	76	8	17	5	0	30	10	13	2	0	25	189
10:45 AM	0	54	5	0	59	6	59	10	0	75	9	18	4	0	31	11	14	1	0	26	191
<b>Total</b>	<b>2</b>	<b>214</b>	<b>18</b>	<b>0</b>	<b>234</b>	<b>18</b>	<b>236</b>	<b>44</b>	<b>0</b>	<b>298</b>	<b>30</b>	<b>61</b>	<b>20</b>	<b>0</b>	<b>111</b>	<b>42</b>	<b>49</b>	<b>5</b>	<b>0</b>	<b>96</b>	<b>739</b>
11:00 AM	1	54	5	0	60	6	64	9	0	79	9	19	4	0	32	11	15	2	0	28	199
11:15 AM	1	56	7	0	64	12	68	12	0	92	9	20	9	1	39	8	13	1	0	22	217
11:30 AM	1	53	9	0	63	13	58	13	0	84	7	20	11	0	38	9	8	1	1	19	204
11:45 AM	0	59	9	0	68	3	58	14	0	75	7	18	9	0	34	15	9	0	0	24	201
<b>Total</b>	<b>3</b>	<b>222</b>	<b>30</b>	<b>0</b>	<b>255</b>	<b>34</b>	<b>248</b>	<b>48</b>	<b>0</b>	<b>330</b>	<b>32</b>	<b>77</b>	<b>33</b>	<b>1</b>	<b>143</b>	<b>43</b>	<b>45</b>	<b>4</b>	<b>1</b>	<b>93</b>	<b>821</b>
12:00 PM	0	71	2	0	73	12	50	13	0	75	8	16	10	2	36	13	9	0	0	22	206
12:15 PM	1	68	17	0	86	7	68	13	0	88	9	17	16	0	42	12	10	0	1	23	239
12:30 PM	2	59	13	0	74	13	63	15	0	91	8	11	15	0	34	6	14	3	0	23	222
12:45 PM	0	78	13	0	91	9	79	23	0	111	15	15	7	0	37	11	6	2	0	19	258
<b>Total</b>	<b>3</b>	<b>276</b>	<b>45</b>	<b>0</b>	<b>324</b>	<b>41</b>	<b>260</b>	<b>64</b>	<b>0</b>	<b>365</b>	<b>40</b>	<b>59</b>	<b>48</b>	<b>2</b>	<b>149</b>	<b>42</b>	<b>39</b>	<b>5</b>	<b>1</b>	<b>87</b>	<b>925</b>
01:00 PM	2	60	7	0	69	10	58	10	0	78	7	21	6	0	34	8	5	0	0	13	194
01:15 PM	2	59	14	0	75	11	58	17	0	86	13	22	13	0	48	8	5	7	3	23	232
01:30 PM	0	68	10	0	78	9	81	12	0	102	8	20	14	0	42	10	17	1	0	28	250
01:45 PM	1	65	10	0	76	9	64	14	0	87	8	20	10	0	38	5	11	2	1	19	220
<b>Total</b>	<b>5</b>	<b>252</b>	<b>41</b>	<b>0</b>	<b>298</b>	<b>39</b>	<b>261</b>	<b>53</b>	<b>0</b>	<b>353</b>	<b>36</b>	<b>83</b>	<b>43</b>	<b>0</b>	<b>162</b>	<b>31</b>	<b>38</b>	<b>10</b>	<b>4</b>	<b>83</b>	<b>896</b>
02:00 PM	2	64	20	0	86	9	66	17	0	92	10	22	12	0	44	8	13	2	0	23	245
02:15 PM	4	60	28	0	92	10	67	19	0	96	11	24	14	0	49	11	15	3	0	29	266
02:30 PM	6	65	34	0	105	9	70	23	0	102	12	25	17	0	54	14	15	3	0	32	293
02:45 PM	7	63	44	0	114	10	71	25	0	106	13	26	19	0	58	16	16	4	0	36	314
<b>Total</b>	<b>19</b>	<b>252</b>	<b>126</b>	<b>0</b>	<b>397</b>	<b>38</b>	<b>274</b>	<b>84</b>	<b>0</b>	<b>396</b>	<b>46</b>	<b>97</b>	<b>62</b>	<b>0</b>	<b>205</b>	<b>49</b>	<b>59</b>	<b>12</b>	<b>0</b>	<b>120</b>	<b>1118</b>
03:00 PM	7	65	54	0	126	10	74	28	0	112	13	27	21	9	70	17	17	4	2	40	348
03:15 PM	3	94	29	0	126	17	71	15	0	103	11	22	17	0	50	20	13	2	0	35	314
03:30 PM	3	90	20	0	113	17	100	26	0	143	8	33	15	4	60	9	12	2	0	23	339
03:45 PM	2	95	17	0	114	10	64	28	0	102	10	28	23	0	61	16	15	0	0	31	308
<b>Total</b>	<b>15</b>	<b>344</b>	<b>120</b>	<b>0</b>	<b>479</b>	<b>54</b>	<b>309</b>	<b>97</b>	<b>0</b>	<b>460</b>	<b>42</b>	<b>110</b>	<b>76</b>	<b>13</b>	<b>241</b>	<b>62</b>	<b>57</b>	<b>8</b>	<b>2</b>	<b>129</b>	<b>1309</b>



Terrace Road / Noble Road Intersection

Project Number: 2008113.00  
 Project Name: City Wide Safety Study  
 Project Location: East Cleveland, OH  
 Client Name: City of East Cleveland

File Name : Terrace and Noble 3-19-09  
 Site Code : 36038113  
 Start Date : 3/19/2009  
 Page No : 2

**Groups Printed- Passenger Vehicles - Trucks - Buses**

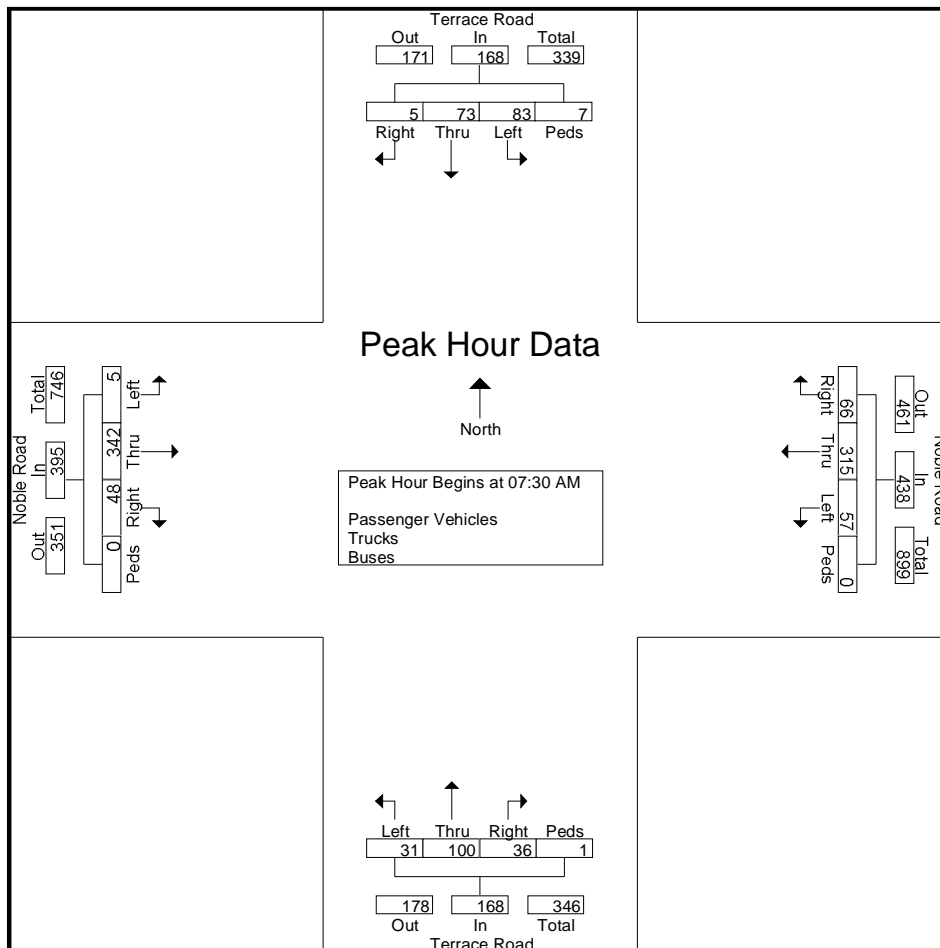
Start Time	Noble Road Eastbound					Noble Road Westbound					Terrace Road Northbound					Terrace Road Southbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
04:00 PM	4	90	17	0	111	13	92	18	0	123	15	32	18	0	65	16	9	3	1	29	328
04:15 PM	2	89	17	0	108	11	96	29	0	136	11	32	18	0	61	14	11	0	0	25	330
04:30 PM	1	84	15	0	100	18	107	25	0	150	14	31	10	1	56	13	17	1	0	31	337
04:45 PM	1	86	14	0	101	25	102	22	0	149	6	31	26	0	63	10	8	0	1	19	332
<b>Total</b>	<b>8</b>	<b>349</b>	<b>63</b>	<b>0</b>	<b>420</b>	<b>67</b>	<b>397</b>	<b>94</b>	<b>0</b>	<b>558</b>	<b>46</b>	<b>126</b>	<b>72</b>	<b>1</b>	<b>245</b>	<b>53</b>	<b>45</b>	<b>4</b>	<b>2</b>	<b>104</b>	<b>1327</b>
05:00 PM	0	115	11	0	126	22	103	35	0	160	14	28	18	0	60	22	11	0	0	33	379
05:15 PM	0	103	12	0	115	17	109	31	0	157	13	19	15	0	47	17	12	0	2	31	350
05:30 PM	0	125	11	0	136	11	106	26	0	143	23	29	20	0	72	15	10	0	1	26	377
05:45 PM	2	120	11	0	133	17	83	21	0	121	10	31	14	0	55	18	11	1	1	31	340
<b>Total</b>	<b>2</b>	<b>463</b>	<b>45</b>	<b>0</b>	<b>510</b>	<b>67</b>	<b>401</b>	<b>113</b>	<b>0</b>	<b>581</b>	<b>60</b>	<b>107</b>	<b>67</b>	<b>0</b>	<b>234</b>	<b>72</b>	<b>44</b>	<b>1</b>	<b>4</b>	<b>121</b>	<b>1446</b>
06:00 PM	2	81	15	0	98	14	90	27	0	131	12	26	7	0	45	10	13	0	0	23	297
06:15 PM	0	77	15	0	92	13	92	17	0	122	6	27	18	0	51	16	10	0	1	27	292
06:30 PM	0	79	14	0	93	20	95	18	0	133	20	24	15	0	59	11	11	2	0	24	309
06:45 PM	0	79	15	0	94	11	127	26	0	164	26	15	11	0	52	7	5	1	0	13	323
<b>Total</b>	<b>2</b>	<b>316</b>	<b>59</b>	<b>0</b>	<b>377</b>	<b>58</b>	<b>404</b>	<b>88</b>	<b>0</b>	<b>550</b>	<b>64</b>	<b>92</b>	<b>51</b>	<b>0</b>	<b>207</b>	<b>44</b>	<b>39</b>	<b>3</b>	<b>1</b>	<b>87</b>	<b>1221</b>
<b>Grand Total</b>	<b>66</b>	<b>3497</b>	<b>666</b>	<b>0</b>	<b>4229</b>	<b>517</b>	<b>3615</b>	<b>837</b>	<b>0</b>	<b>4969</b>	<b>482</b>	<b>1017</b>	<b>572</b>	<b>19</b>	<b>2090</b>	<b>629</b>	<b>565</b>	<b>66</b>	<b>24</b>	<b>1284</b>	<b>12572</b>
<b>Apprch %</b>	<b>1.6</b>	<b>82.7</b>	<b>15.7</b>	<b>0</b>		<b>10.4</b>	<b>72.8</b>	<b>16.8</b>	<b>0</b>		<b>23.1</b>	<b>48.7</b>	<b>27.4</b>	<b>0.9</b>		<b>49</b>	<b>44</b>	<b>5.1</b>	<b>1.9</b>		
<b>Total %</b>	<b>0.5</b>	<b>27.8</b>	<b>5.3</b>	<b>0</b>	<b>33.6</b>	<b>4.1</b>	<b>28.8</b>	<b>6.7</b>	<b>0</b>	<b>39.5</b>	<b>3.8</b>	<b>8.1</b>	<b>4.5</b>	<b>0.2</b>	<b>16.6</b>	<b>5</b>	<b>4.5</b>	<b>0.5</b>	<b>0.2</b>	<b>10.2</b>	
<b>Passenger Vehicles</b>	<b>65</b>	<b>3425</b>	<b>659</b>	<b>0</b>	<b>4149</b>	<b>511</b>	<b>3531</b>	<b>828</b>	<b>0</b>	<b>4870</b>	<b>477</b>	<b>1007</b>	<b>562</b>	<b>19</b>	<b>2065</b>	<b>619</b>	<b>557</b>	<b>64</b>	<b>24</b>	<b>1264</b>	<b>12348</b>
<b>% Passenger Vehicles</b>	<b>98.5</b>	<b>97.9</b>	<b>98.9</b>	<b>0</b>	<b>98.1</b>	<b>98.8</b>	<b>97.7</b>	<b>98.9</b>	<b>0</b>	<b>98</b>	<b>99</b>	<b>99</b>	<b>98.3</b>	<b>100</b>	<b>98.8</b>	<b>98.4</b>	<b>98.6</b>	<b>97</b>	<b>100</b>	<b>98.4</b>	<b>98.2</b>
<b>Trucks</b>	<b>0</b>	<b>18</b>	<b>3</b>	<b>0</b>	<b>21</b>	<b>0</b>	<b>25</b>	<b>1</b>	<b>0</b>	<b>26</b>	<b>4</b>	<b>1</b>	<b>8</b>	<b>0</b>	<b>13</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>64</b>
<b>% Trucks</b>	<b>0</b>	<b>0.5</b>	<b>0.5</b>	<b>0</b>	<b>0.5</b>	<b>0</b>	<b>0.7</b>	<b>0.1</b>	<b>0</b>	<b>0.5</b>	<b>0.8</b>	<b>0.1</b>	<b>1.4</b>	<b>0</b>	<b>0.6</b>	<b>0.6</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.3</b>	<b>0.5</b>
<b>Buses</b>	<b>1</b>	<b>54</b>	<b>4</b>	<b>0</b>	<b>59</b>	<b>6</b>	<b>59</b>	<b>8</b>	<b>0</b>	<b>73</b>	<b>1</b>	<b>9</b>	<b>2</b>	<b>0</b>	<b>12</b>	<b>6</b>	<b>8</b>	<b>2</b>	<b>0</b>	<b>16</b>	<b>160</b>
<b>% Buses</b>	<b>1.5</b>	<b>1.5</b>	<b>0.6</b>	<b>0</b>	<b>1.4</b>	<b>1.2</b>	<b>1.6</b>	<b>1</b>	<b>0</b>	<b>1.5</b>	<b>0.2</b>	<b>0.9</b>	<b>0.3</b>	<b>0</b>	<b>0.6</b>	<b>1</b>	<b>1.4</b>	<b>3</b>	<b>0</b>	<b>1.2</b>	<b>1.3</b>

Terrace Road / Noble Road Intersection

Project Number: 2008113.00  
 Project Name: City Wide Safety Study  
 Project Location: East Cleveland, OH  
 Client Name: City of East Cleveland

File Name : Terrace and Noble 3-19-09  
 Site Code : 36038113  
 Start Date : 3/19/2009  
 Page No : 3

Start Time	Noble Road Eastbound					Noble Road Westbound					Terrace Road Northbound					Terrace Road Southbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 07:00 AM to 09:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	1	65	10	0	76	6	74	17	0	97	8	24	5	0	37	16	17	0	1	34	244
07:45 AM	1	90	17	0	108	20	74	14	0	108	9	30	9	1	49	30	23	0	5	58	323
08:00 AM	2	107	14	0	123	20	79	24	0	123	8	25	11	0	44	20	15	3	1	39	329
08:15 AM	1	80	7	0	88	11	88	11	0	110	6	21	11	0	38	17	18	2	0	37	273
Total Volume	5	342	48	0	395	57	315	66	0	438	31	100	36	1	168	83	73	5	7	168	1169
% App. Total	1.3	86.6	12.2	0		13	71.9	15.1	0		18.5	59.5	21.4	0.6		49.4	43.5	3	4.2		
PHF	.625	.799	.706	.000	.803	.713	.895	.688	.000	.890	.861	.833	.818	.250	.857	.692	.793	.417	.350	.724	.888

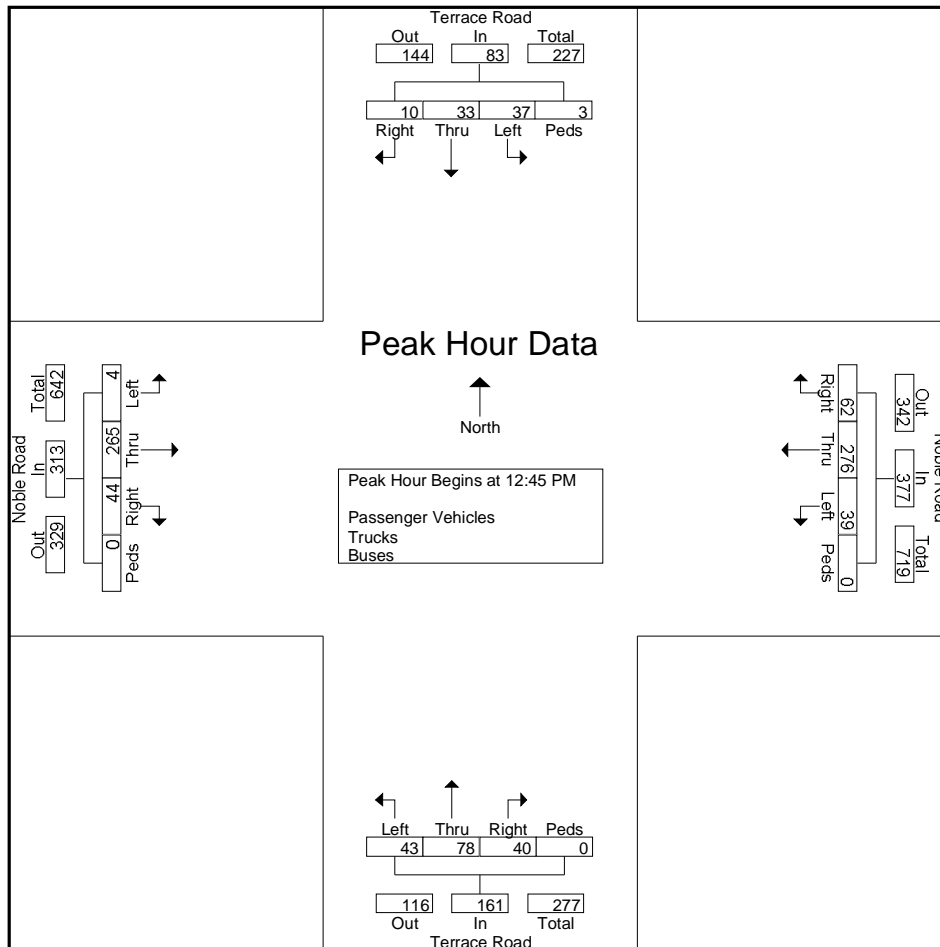


Terrace Road / Noble Road Intersection

Project Number: 2008113.00  
 Project Name: City Wide Safety Study  
 Project Location: East Cleveland, OH  
 Client Name: City of East Cleveland

File Name : Terrace and Noble 3-19-09  
 Site Code : 36038113  
 Start Date : 3/19/2009  
 Page No : 4

Start Time	Noble Road Eastbound					Noble Road Westbound					Terrace Road Northbound					Terrace Road Southbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 10:00 AM to 01:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 12:45 PM																					
12:45 PM	0	78	13	0	91	9	79	23	0	111	15	15	7	0	37	11	6	2	0	19	258
01:00 PM	2	60	7	0	69	10	58	10	0	78	7	21	6	0	34	8	5	0	0	13	194
01:15 PM	2	59	14	0	75	11	58	17	0	86	13	22	13	0	48	8	5	7	3	23	232
01:30 PM	0	68	10	0	78	9	81	12	0	102	8	20	14	0	42	10	17	1	0	28	250
Total Volume	4	265	44	0	313	39	276	62	0	377	43	78	40	0	161	37	33	10	3	83	934
% App. Total	1.3	84.7	14.1	0		10.3	73.2	16.4	0		26.7	48.4	24.8	0		44.6	39.8	12	3.6		
PHF	.500	.849	.786	.000	.860	.886	.852	.674	.000	.849	.717	.886	.714	.000	.839	.841	.485	.357	.250	.741	.905

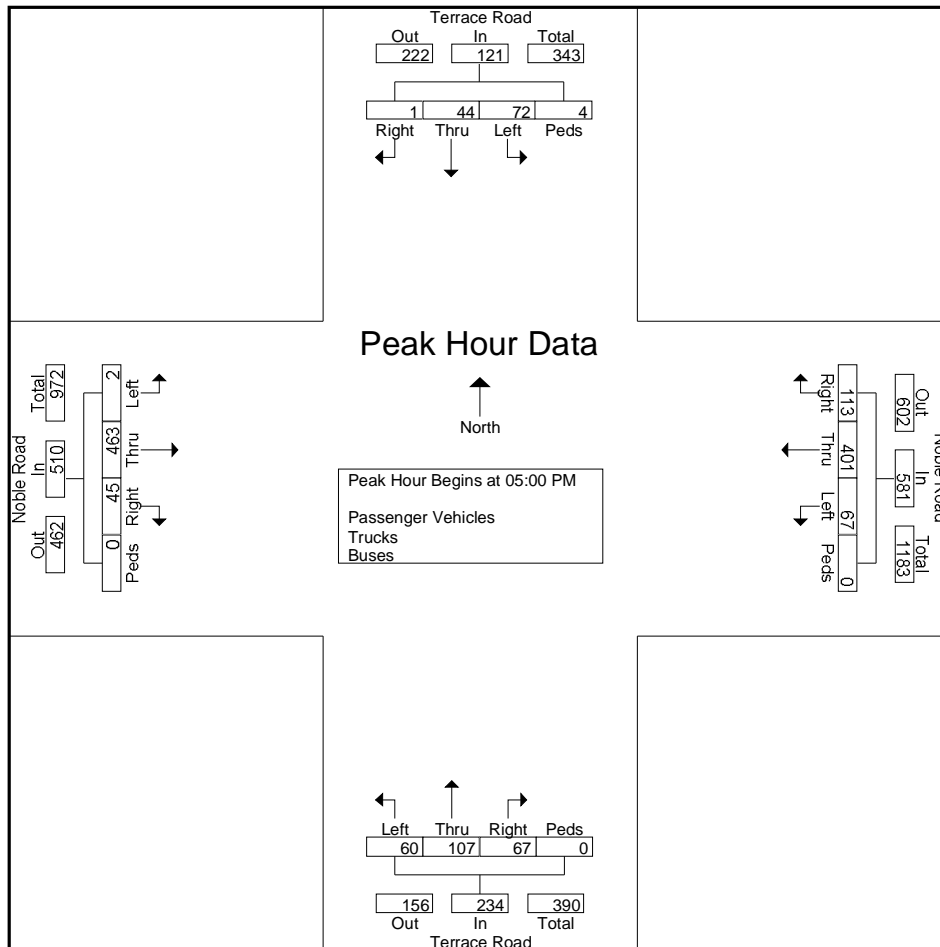


Terrace Road / Noble Road Intersection

Project Number: 2008113.00  
 Project Name: City Wide Safety Study  
 Project Location: East Cleveland, OH  
 Client Name: City of East Cleveland

File Name : Terrace and Noble 3-19-09  
 Site Code : 36038113  
 Start Date : 3/19/2009  
 Page No : 5

Start Time	Noble Road Eastbound					Noble Road Westbound					Terrace Road Northbound					Terrace Road Southbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
Peak Hour Analysis From 02:00 PM to 06:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	0	115	11	0	126	22	103	35	0	160	14	28	18	0	60	22	11	0	0	33	379
05:15 PM	0	103	12	0	115	17	109	31	0	157	13	19	15	0	47	17	12	0	2	31	350
05:30 PM	0	125	11	0	136	11	106	26	0	143	23	29	20	0	72	15	10	0	1	26	377
05:45 PM	2	120	11	0	133	17	83	21	0	121	10	31	14	0	55	18	11	1	1	31	340
Total Volume	2	463	45	0	510	67	401	113	0	581	60	107	67	0	234	72	44	1	4	121	1446
% App. Total	0.4	90.8	8.8	0		11.5	69	19.4	0		25.6	45.7	28.6	0		59.5	36.4	0.8	3.3		
PHF	.250	.926	.938	.000	.938	.761	.920	.807	.000	.908	.652	.863	.838	.000	.813	.818	.917	.250	.500	.917	.954



## **APPENDIX B**

### **TRAFFIC SIGNAL WARRANTS WORKSHEETS**

**GPD Group**  
Terrace Road / Noble Road Intersection  
City of East Cleveland, Ohio

Study Name : **Terrace & Noble**  
Study Date : **03/23/09**  
Page No. : **1**

**Signal Warrants - Summary**

**Major Street Approaches**

**Eastbound: Noble Road**

Number of Lanes: 2  
Approach Speed: 25  
Total Approach Volume: **4,229**

**Westbound: Noble Road**

Number of Lanes: 2  
Approach Speed: 25  
Total Approach Volume: **4,969**

**Minor Street Approaches**

**Northbound: Terrace Road**

Number of Lanes: 1  
  
Total Approach Volume: **2,071**

**Southbound: Terrace Road**

Number of Lanes: 1  
  
Total Approach Volume: **1,260**

**Warrant Summary** (Urban values apply.)

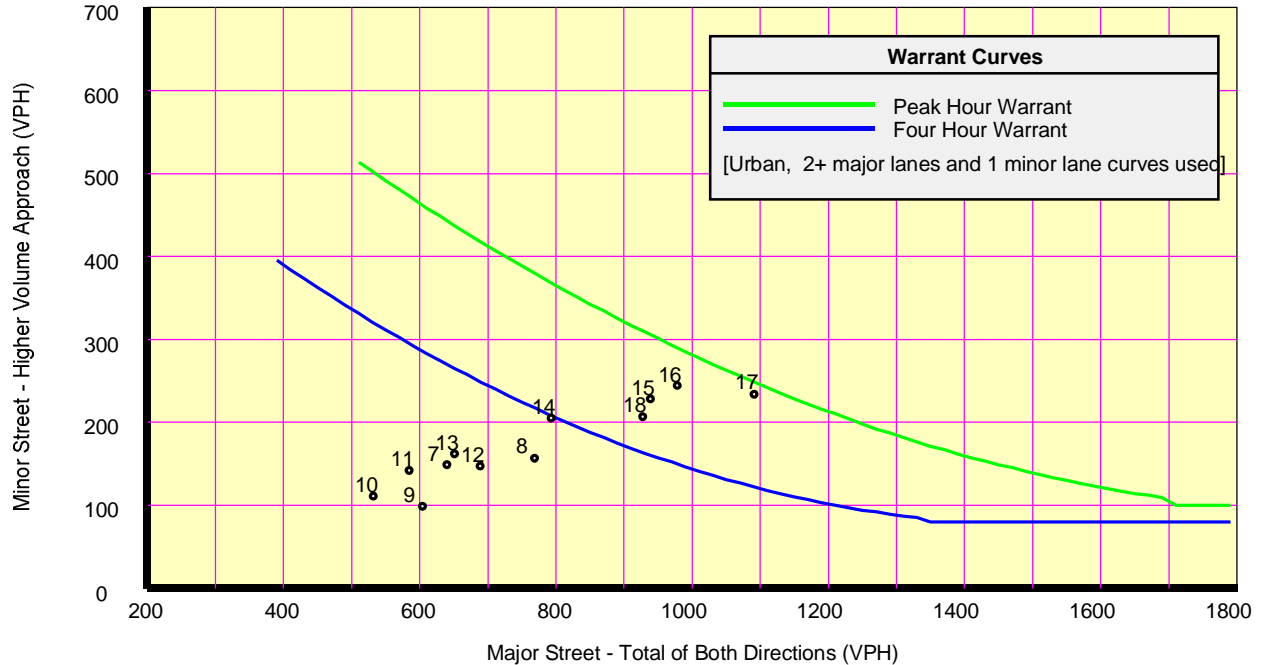
<b>Warrant 1 - Eight Hour Vehicular Volumes</b> .....	<b>Not Satisfied</b>
<b>Warrant 1A - Minimum Vehicular Volume</b> ..... <b>Not Satisfied</b>	
Required volumes reached for 7 hours, 8 are needed	
<b>Warrant 1B - Interruption of Continuous Traffic</b> ..... <b>Not Satisfied</b>	
Required volumes reached for 4 hours, 8 are needed	
<b>Warrant 1 A&amp;B - Combination of Warrants</b> ..... <b>Not Satisfied</b>	
Required volumes reached for 6 hours, 8 are needed	
<b>Warrant 2 - Four Hour Volumes</b> .....	<b>Satisfied</b>
Number of hours (4) volumes exceed minimum >= minimum required (4).	
<b>Warrant 3 - Peak Hour</b> .....	<b>Not Satisfied</b>
<b>Warrant 3A - Peak Hour Delay</b> ..... <b>Not Satisfied</b>	
Total approach volumes and delays on minor street do not exceed minimums for any hour.	
<b>Warrant 3B - Peak Hour Volumes</b> ..... <b>Not Satisfied</b>	
Volumes do not exceed minimums for any hour.	
<b>Warrant 4 - Pedestrian Volumes</b> .....	Not Evaluated
<b>Warrant 5 - School Crossing</b> .....	Not Evaluated
<b>Warrant 6 - Coordinated Signal System</b> .....	Not Evaluated
<b>Warrant 7 - Crash Experience</b> .....	Not Evaluated
<b>Warrant 8 - Roadway Network</b> .....	Not Evaluated

# GPD Group

Terrace Road / Noble Road Intersection  
City of East Cleveland, Ohio

Study Name : Terrace & Noble  
Study Date : 03/23/09  
Page No. : 2

## Signal Warrants - Summary



### Analysis of 8-Hour Volume Warrants:

Hour Begin	Major Total	Higher Minor Vol	Dir	War-1A			War-1B			War-1A&B		
				Major Crit	Minor Crit	Meets?	Major Crit	Minor Crit	Meets?	Major Crit	Minor Crit	Meets?
00:00	0	0	NB	600-No	150-No	---	900-No	75-No	---	720-No	120-No	---
01:00	0	0	NB	600-No	150-No	---	900-No	75-No	---	720-No	120-No	---
02:00	0	0	NB	600-No	150-No	---	900-No	75-No	---	720-No	120-No	---
03:00	0	0	NB	600-No	150-No	---	900-No	75-No	---	720-No	120-No	---
04:00	0	0	NB	600-No	150-No	---	900-No	75-No	---	720-No	120-No	---
05:00	0	0	NB	600-No	150-No	---	900-No	75-No	---	720-No	120-No	---
06:00	0	0	NB	600-No	150-No	---	900-No	75-No	---	720-No	120-No	---
07:00	640	149	SB	600-Yes	150-No	Major	900-No	75-Yes	Minor	720-No	120-Yes	Minor
08:00	769	157	NB	600-Yes	150-Yes	Both	900-No	75-Yes	Minor	720-Yes	120-Yes	Both
09:00	604	99	NB	600-Yes	150-No	Major	900-No	75-Yes	Minor	720-No	120-No	---
10:00	532	111	NB	600-No	150-No	---	900-No	75-Yes	Minor	720-No	120-No	---
11:00	585	142	NB	600-No	150-No	---	900-No	75-Yes	Minor	720-No	120-Yes	Minor
12:00	689	147	NB	600-Yes	150-No	Major	900-No	75-Yes	Minor	720-No	120-Yes	Minor
13:00	651	162	NB	600-Yes	150-Yes	Both	900-No	75-Yes	Minor	720-No	120-Yes	Minor
14:00	793	205	NB	600-Yes	150-Yes	Both	900-No	75-Yes	Minor	720-Yes	120-Yes	Both
15:00	939	228	NB	600-Yes	150-Yes	Both	900-Yes	75-Yes	Both	720-Yes	120-Yes	Both
16:00	978	244	NB	600-Yes	150-Yes	Both	900-Yes	75-Yes	Both	720-Yes	120-Yes	Both
17:00	1,091	234	NB	600-Yes	150-Yes	Both	900-Yes	75-Yes	Both	720-Yes	120-Yes	Both
18:00	927	207	NB	600-Yes	150-Yes	Both	900-Yes	75-Yes	Both	720-Yes	120-Yes	Both
19:00	0	0	NB	600-No	150-No	---	900-No	75-No	---	720-No	120-No	---
20:00	0	0	NB	600-No	150-No	---	900-No	75-No	---	720-No	120-No	---
21:00	0	0	NB	600-No	150-No	---	900-No	75-No	---	720-No	120-No	---
22:00	0	0	NB	600-No	150-No	---	900-No	75-No	---	720-No	120-No	---
23:00	0	0	NB	600-No	150-No	---	900-No	75-No	---	720-No	120-No	---

**APPENDIX C**  
**SITE PHOTOGRAPHS**



Photo 1 East Approach (looking west)



Photo 3 South Approach



Photo 2 North Approach (looking south)



Photo 4 West Approach (looking east)

**APPENDIX D**  
**COLLISION DIAGRAM**



**LEGEND**

- MOVING VEHICLE
  - FIXED OBJECT
  - ↔ HEAD ON CRASH
  - ↔ REAR END CRASH
  - ↔ RIGHT ANGLE CRASH
  - ↔ LEFT TURN CRASH
  - ↔ SIDESWIPE CRASH
  - \*↔ BACKING CRASH
  - INJURY
  - BICYCLE
  - \* UNKNOWN FAULT
  - ∞ SIGNAL NOT FUNCTIONAL
- DATE / HOUR / LIGHT / PAVEMENT
- LIGHT**  
D = DAY  
N = NIGHT
- PAVEMENT CONDITIONS**  
D = DRY  
W = WET  
S = SNOW  
I = ICE
- ↔ SIGNALIZED INTERSECTION

**TERRACE ROAD**

- 3-28-2005/1305/D/D
- 3-19-2005/1325/N/W
- 8-17-2005/1120/D/D
- 11-16-2006/0800/N/W
- 1-02-2006/1325/D/D
- 2-12-2006/0315/N/W
- 7-17-2006/2155/N/D
- 10-09-2006/1540/D/D
- 12-08-2007/0959/D/D

**NOBLE ROAD**

- 1-07-2007/2330/N/W
- 6-27-2007/0015/N/D

- 11-14-2005/1400/D/D
- 5-27-2007/1130/D/D

- \* 6-14-2006/1320/D/D
- \* 3-21-2006/1900/N/D

- 10-09-2007/1320/D/D
- 12-25-2006/1525/D/W
- 12-01-2006/1600/D/D
- 6-03-2006/1815/D/W
- 2-07-2006/0650/N/D
- 4-21-2006/2045/N/W
- 12-29-2005/1425/D/W
- 2-27-2005/1020/D/D

- 11-25-2005/1150/D/W
- 7-29-2005/2120/N/D
- 1-20-2006/2056/N/W


- 4-27-2005/1510/D/D
- 3-29-2007/2240/N/D

- 3-12-2007/0750/D/S
- 5-14-2006/1545/D/W
- 1-25-2007/1134/D/W
- 7-23-2005/1900/D/D
- 10-16-2006/0000/N/D
- 3-25-2007/1110/D/D
- 1-06-2005/1620/N/W
- 6-19-2006/0025/N/W

**TERRACE ROAD**

CITY OF EAST CLEVELAND  
SAFETY STUDY  
TERRACE ROAD AND NOBLE ROAD  
CUYAHOGA COUNTY, OHIO

**FIGURE D  
COLLISION DIAGRAM  
YEARS 2005-2007**

Prepared By:  GPD ASSOCIATES  
5595 Transportation Blvd.  
Cleveland, Ohio 44125  
(216) 518-5544

Prepared For: THE CITY OF EAST CLEVELAND  
MARCH, 2009

**APPENDIX E**  
**CRASH DATA SUMMARY**

APPENDIX E  
CITY OF EAST CLEVELAND SAFETY STUDY  
TERRACE ROAD AND NOBLE ROAD  
CRASH DATA REPORT FOR YEARS 2005 - 2007

Document Number	Local Report Number	Crash Severity	Total Units Involved	Date	Time	Day of Week	Pavement Conditions	Crash Type	Weather Conditions	Light Conditions	Alcohol Related	Drug Related	Total Injured	Total Killed	Speed Related	Pedestrian Related
20058010766	EC0500158	PROPERTY DAMAGE ONLY	2	1062005	1620	THURSDAY	WET	ANGLE *	CLOUDY	DUSK	NO	NO	0	0	NO	NO
20058068714	EC0501396	PROPERTY DAMAGE ONLY	2	2272005	1020	SUNDAY	DRY	REAR-END	CLEAR	DAYLIGHT	NO	NO	0	0	NO	NO
20058082928	EC0501851	PROPERTY DAMAGE ONLY	2	3192005	1925	SATURDAY	WET	ANGLE *	RAIN	DARK-LIGHTED ROADWAY	NO	NO	0	0	NO	NO
20058112079	EC0502037	INJURY	2	3282005	1305	MONDAY	DRY	ANGLE	CLEAR	DAYLIGHT	NO	NO	1	0	NO	NO
20058137045	EC0502724	INJURY	3	4272005	1510	WEDNESDAY	DRY	ANGLE *	CLOUDY	DAYLIGHT	NO	NO	2	0	YES	NO
20058198489	EC0505114	PROPERTY DAMAGE ONLY	2	7232005	1900	SATURDAY	DRY	ANGLE	CLEAR	DAYLIGHT	NO	NO	0	0	NO	NO
20058211092	EC0505272	INJURY	2	7292005	2120	FRIDAY	DRY	ANGLE *	CLEAR	DARK-LIGHTED ROADWAY	NO	NO	1	0	NO	NO
20058218419	EC0505792	INJURY	2	8172005	1120	WEDNESDAY	DRY	ANGLE	CLEAR	DAYLIGHT	NO	NO	1	0	NO	NO
20058300865	EC0508210	PROPERTY DAMAGE ONLY	2	11142005	1400	MONDAY	DRY	ANGLE	CLEAR	DAYLIGHT	NO	NO	0	0	NO	NO
20058315856	EC0508468	PROPERTY DAMAGE ONLY	2	11252005	1150	FRIDAY	WET	ANGLE	CLEAR	DAYLIGHT	NO	NO	0	0	NO	NO
20058350656	EC0509034	PROPERTY DAMAGE ONLY	2	12192005	1915	MONDAY	DRY	SIDESWIPE, SAME DIRECTION *	CLEAR	DARK-LIGHTED ROADWAY	NO	NO	0	0	NO	NO
20058359524	EC0509293	PROPERTY DAMAGE ONLY	2	12292005	1425	THURSDAY	WET	REAR-END	RAIN	DAYLIGHT	NO	NO	0	0	NO	NO
20068007835	EC0600034	PROPERTY DAMAGE ONLY	2	1022006	1325	MONDAY	DRY	ANGLE	CLEAR	DAYLIGHT	NO	NO	0	0	NO	NO
20068054152	EC0600567	INJURY	2	1202006	2056	FRIDAY	WET	ANGLE *	CLOUDY	DARK-LIGHTED ROADWAY	NO	NO	2	0	YES	NO
20068068671	EC0601053	PROPERTY DAMAGE ONLY	2	2072006	650	TUESDAY	DRY	REAR-END	CLEAR	DARK-LIGHTED ROADWAY	NO	NO	0	0	NO	NO
20068068680	EC0601168	PROPERTY DAMAGE ONLY	2	2122006	315	SUNDAY	WET	ANGLE	CLOUDY	DARK-LIGHTED ROADWAY	YES	NO	0	0	NO	NO
20068070988	EC062049	PROPERTY DAMAGE ONLY	2	3212006	1900	TUESDAY	DRY	BACKING	CLEAR	DARK-LIGHTED ROADWAY	NO	NO	0	0	NO	NO
20068086499	EC0602746	INJURY	3	4212006	2045	FRIDAY	WET	REAR-END	CLOUDY	DARK-LIGHTED ROADWAY	NO	NO	1	0	NO	NO
20068113964	EC0603425	PROPERTY DAMAGE ONLY	2	5142006	1545	SUNDAY	WET	ANGLE	RAIN	DAYLIGHT	NO	NO	0	0	NO	NO
20068137642	EC0603975	PROPERTY DAMAGE ONLY	2	6142006	1320	WEDNESDAY	DRY	BACKING	CLEAR	DAYLIGHT	NO	NO	0	0	NO	NO
20068137643	EC0603761	PROPERTY DAMAGE ONLY	2	6032006	1815	SATURDAY	WET	REAR-END *	RAIN	DAYLIGHT	NO	NO	0	0	NO	NO
20068137645	EC0604058	INJURY	2	6192006	25	MONDAY	WET	ANGLE	RAIN	DARK-LIGHTED ROADWAY	NO	NO	1	0	YES	NO
20068158743	EC06-04746	INJURY	2	7172006	2155	MONDAY	DRY	ANGLE	CLEAR	DARK-LIGHTED ROADWAY	NO	NO	2	0	NO	NO
20068233049	EC0606668	INJURY	2	10092006	1540	MONDAY	DRY	ANGLE	CLEAR	DAYLIGHT	NO	NO	1	0	YES	NO
20068256693	EC0606817	PROPERTY DAMAGE ONLY	2	10162006	0	MONDAY	DRY	ANGLE	CLEAR	DARK-LIGHTED ROADWAY	NO	NO	0	0	NO	NO
20068276082	EC0607594	PROPERTY DAMAGE ONLY	2	11162006	800	THURSDAY	WET	ANGLE	RAIN	DARK-LIGHTED ROADWAY	NO	NO	0	0	YES	NO
20068287727	EC0607971	PROPERTY DAMAGE ONLY	2	12012006	1600	FRIDAY	DRY	REAR-END	CLEAR	DAYLIGHT	NO	NO	0	0	NO	NO
20068316755	EC0608457	INJURY	2	12252006	1525	MONDAY	WET	REAR-END	RAIN	DAYLIGHT	NO	NO	2	0	NO	NO
20074000840	EC0700568	INJURY	2	1252007	1134	THURSDAY	UNKNOWN	ANGLE	SNOW	DAYLIGHT	NO	NO	1	0	NO	NO
20074000851	EC07-00955	PROPERTY DAMAGE ONLY	2	2122007	730	MONDAY	SNOW	NOT 2 VEHICLES MOVING *	SNOW	DAYLIGHT	NO	NO	0	0	NO	NO
20078002094	EC0700138	INJURY	2	1072007	2330	SUNDAY	WET	SIDESWIPE, SAME DIRECTION *	RAIN	DARK-LIGHTED ROADWAY	NO	NO	1	0	NO	NO
20078062231	EC07-01910	PROPERTY DAMAGE ONLY	2	3252007	1110	SUNDAY	DRY	ANGLE	CLEAR	DAYLIGHT	NO	NO	0	0	NO	NO
20078067845	EC0702040	PROPERTY DAMAGE ONLY	2	3292007	2240	THURSDAY	DRY	SIDESWIPE, OPPOSITE DIRECTION	CLOUDY	DARK-LIGHTED ROADWAY	NO	NO	0	0	YES	NO
20078107934	EC0703373	PROPERTY DAMAGE ONLY	2	5272007	1130	SUNDAY	DRY	ANGLE	CLOUDY	DAYLIGHT	NO	NO	0	0	NO	NO
20078126387	EC0704070	PROPERTY DAMAGE ONLY	2	6272007	15	WEDNESDAY	DRY	SIDESWIPE, SAME DIRECTION *	CLEAR	DARK-LIGHTED ROADWAY	NO	NO	0	0	YES	NO
20078191344	EC0706272	INJURY	2	10092007	1320	TUESDAY	DRY	REAR-END	CLEAR	DAYLIGHT	NO	NO	1	0	NO	NO
20078228250	EC0707917	PROPERTY DAMAGE ONLY	2	12082007	959	SATURDAY	DRY	ANGLE *	CLOUDY	DAYLIGHT	NO	NO	0	0	NO	NO

\* REVISED CRASH TYPE BASED ON REVIEW OF THE OH-1 FORMS

**APPENDIX F**  
**CRASH DATA CHARTS**

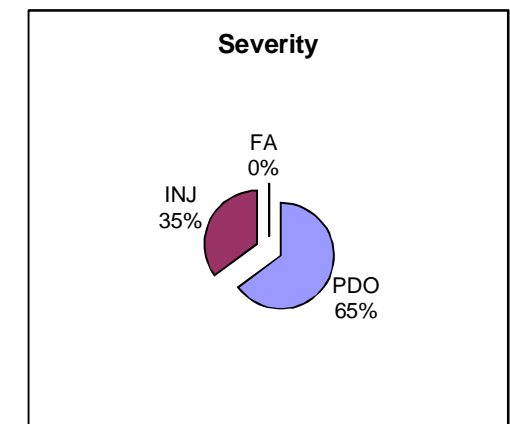
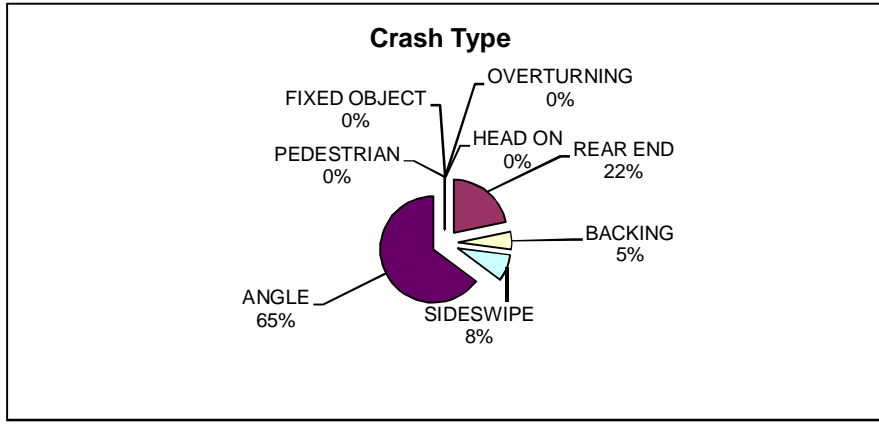
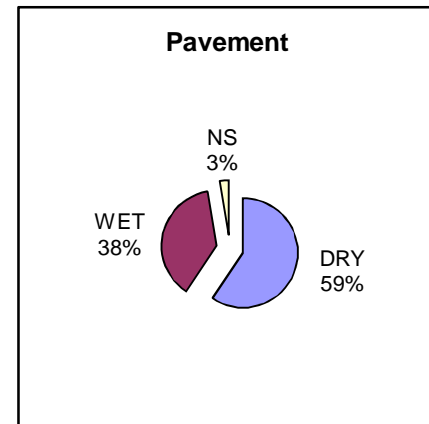
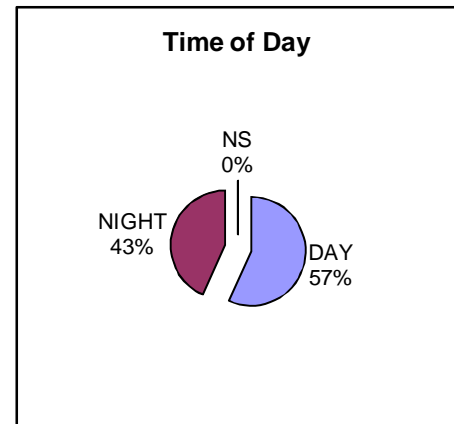
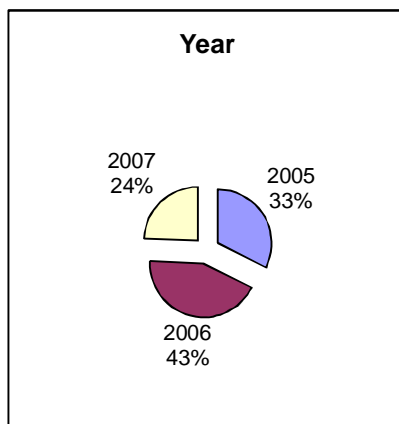
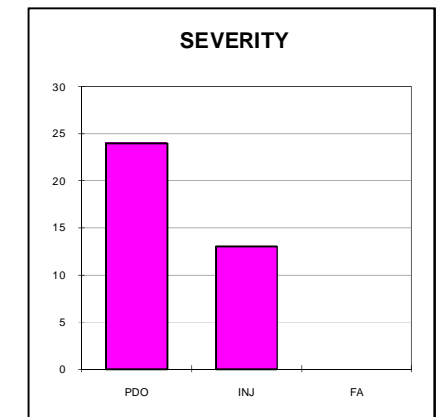
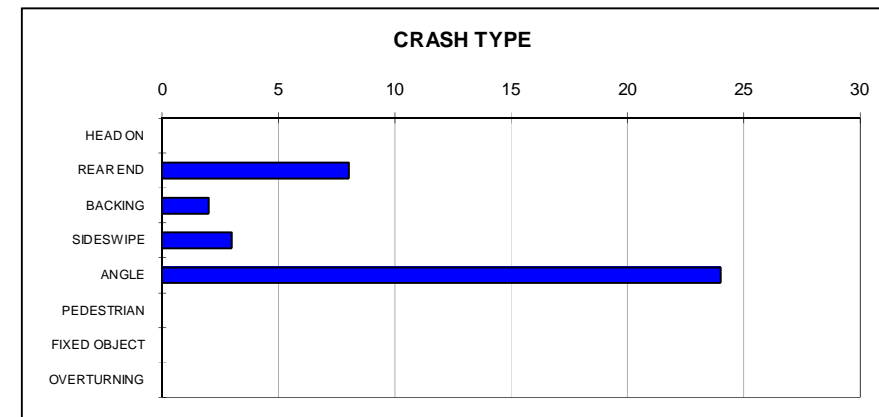
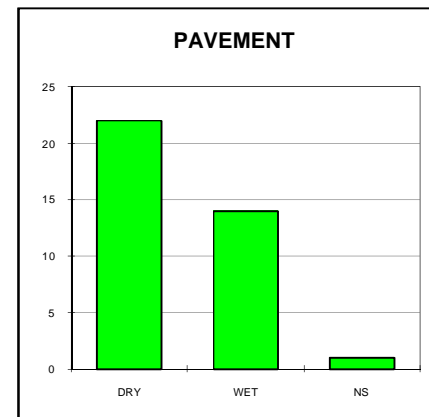
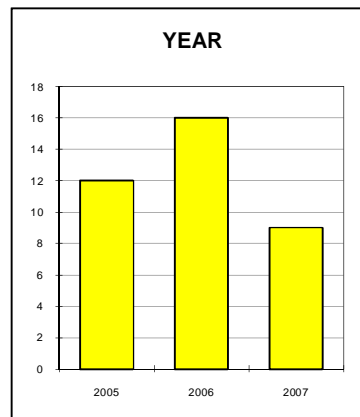
# CITY OF EAST CLEVELAND SAFETY STUDY TERRACE ROAD AND NOBEL ROAD TRAFFIC CRASH ANALYSIS

County **Cuyahoga**

Primary Roadway **Superior Avenue**  
Secondary Roadway **Forest Hill Avenue**

Begin SLM **2005** End SLM **2007**  
Begin Year **2005** End Year **2007**

Year	TIME OF DAY									PAVEMENT CONDITION									CRASH TYPE																		Total									
	DAY			NIGHT			NS			DRY			WET			NS			HEAD ON			REAR END			BACKING			SIDESWIPE			ANGLE			PEDESTRIAN				FIXED OBJECT			OVERTURNING			Subtotal		
	PDO	INJ	FA	PDO	INJ	FA	PDO	INJ	FA	PDO	INJ	FA	PDO	INJ	FA	PDO	INJ	FA	PDO	INJ	FA	PDO	INJ	FA	PDO	INJ	FA	PDO	INJ	FA	PDO	INJ	FA	PDO	INJ	FA		PDO	INJ	FA	PDO	INJ	FA			
2005	5	3	0	3	1	0	0	0	0	4	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	5	4	0	0	0	0	0	0	0	0	0	0	0	8	4	0	12	
2006	5	2	0	5	4	0	0	0	0	6	2	0	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	6	0	16
2007	4	2	0	2	1	0	0	0	0	5	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	1	1	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	6	3	0	9
Subtotal	14	7	0	10	6	0	0	0	0	15	7	0	9	5	0	0	1	0	0	0	0	0	0	0	2	1	0	15	9	0	0	0	0	0	0	0	0	0	0	0	0	24	13	0	37	
Average	4.67	2.33	0.00	3.33	2.00	0.00	0.00	0.00	0.00	5.00	2.33	0.00	3.00	1.67	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.67	0.33	0.00	5.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	4.33	0.00	12.33
Total	21			16			0			22			14			1			0			8			2			3			24			0			0			0			37			



**APPENDIX G**  
**CRASH DATA ANALYSIS CALCULATIONS**

## CITY OF EAST CLEVELAND - HIGH CRASH INTERSECTIONS

		CRASHES 2005-2007				Approach ADT	Annual Crash Rate	Severity Index	
Street	Intersecting Street	Fatal	Injury	PDO	Total				
SUPERIOR	FOREST HILL		12	27	39	15391	2.31	1.62	
NOBLE	TERRACE		13	24	37	10787	3.13	1.70	
EUCLID	TAYLOR		9	25	35	17460	1.83	1.49	*
EUCLID	NOBLE		8	25	33	25809	1.17	1.48	*
EUCLID	SHAW		4	25	29	20484	1.29	1.28	
LEE	TERRACE		6	19	26			1.42	
EUCLID	FOREST HILLS		4	19	23			1.35	*
EUCLID	SUPERIOR		3	20	23			1.26	*
EUCLID	STANWOOD		5	17	22			1.45	*
HAYDEN	SHAW		5	16	21			1.48	
FOREST HILLS	TERRACE	1	7	10	18	18600	0.88	2.39	
HAYDEN	SUPERIOR		2	14	17			1.18	
EUCLID	EDDY		5	12	17			1.59	*
COVENTRY	SUPERIOR		5	12	17			1.59	
TAYLOR	TERRACE		4	11	15			1.53	
EUCLID	LAKEVIEW		5	9	15			1.60	
HAYDEN	LAKEFRONT		9	5	14			2.29	
NOBLE	0152ND		1	12	14			1.07	
COLLERMERE	ELDERWOOD		4	7	11			1.73	
HAYDEN	EDDY		1	10	11			1.18	
EMILY	SUPERIOR		2	7	10			1.30	
EUCLID	MARLOES		1	8	10			1.10	
FOREST HILL	LEE		2	8	10			1.40	
SUPERIOR	LUXOR		2	7	9			1.44	*
EUCLID	LEE		2	7	9			1.44	
SUPERIOR	CARLYON		3	6	9			1.67	
EUCLID	COIT		2	6	8			1.50	*
EUCLID	DELMONT		2	5	7			1.57	
EUCLID	HILLSBORO		2	5	7			1.57	
EUCLID	NELA		3	4	7			1.86	
HAYDEN	MANN	1	2	4	7			3.14	
TERRACE	BELMORE		1	5	6			1.33	
HAYDEN	ELM		1	5	6			1.33	

\* Indicates an intersection coincident with a high crash section

## **APPENDIX H**

### **ESTIMATES OF COUNTERMEASURES EFFECTIVENESS REDUCTION (CFR) FACTORS**





# **APPENDIX I**

## **RATE OF RETURN WORKSHEETS**





**APPENDIX J**  
**COST ESTIMATES**

EAST CLEVELAND SAFETY STUDY  
 NOBLE ROAD AND TERRACE ROAD  
 SHORT TERM SPOT COUNTERMEASURES ESTIMATE OF COSTS  
 GPD GROUP  
 MARCH, 2009

SHORT TERM - RESTRIPE INTERSECTION AND INSTALL FLASHING WARNING SIGNS

ITEM	EXTENSION	UNIT	DESCRIPTION	ESTIMATED QUANTITY	UNIT COST	TOTAL COST
630	79500	EACH	SIGN SUPPORT ASSEMBLY, POLE MOUNTED	2	\$50.00	\$100.00
630	80100	SQ FT	SIGN, FLAT SHEET	18	\$40.00	\$720.00
631	92000	EACH	SIGN FLASHER ASSEMBLY	2	\$1,500.00	\$3,000.00
632	64020	EACH	PEDESTAL FOUNDATION	2	\$500.00	\$1,000.00
632	70000	EACH	POWER SERVICE	2	\$500.00	\$1,000.00
632	90000	EACH	PEDESTAL, 11', TRANSFORMER BASE	2	\$500.00	\$1,000.00
642	00190	MILE	LANE LINE	0.08	\$1,000.00	\$80.00
642	00290	MILE	CENTER LINE	0.08	\$10,000.00	\$800.00
642	00490	FT	STOP LINE	66	\$12.00	\$792.00
642	00590	FT	CROSSWALK LINE	264	\$3.00	\$792.00
			MISC.			\$600.00
TOTAL						\$3,064.00

EAST CLEVELAND SAFETY STUDY  
 NOBLE ROAD AND TERRACE ROAD  
 SHORT TERM SPOT COUNTERMEASURES ESTIMATE OF COSTS  
 GPD GROUP  
 MARCH, 2009

SHORT TERM - RESTRIPE INTERSECTION AND INSTALL FLASHING WARNING SIGNS

ITEM	EXTENSION	UNIT	DESCRIPTION	ESTIMATED QUANTITY	UNIT COST	TOTAL COST
630	79500	EACH	SIGN SUPPORT ASSEMBLY, POLE MOUNTED	2	\$50.00	\$100.00
630	80100	SQ FT	SIGN, FLAT SHEET	18	\$40.00	\$720.00
631	92000	EACH	SIGN FLASHER ASSEMBLY	2	\$1,500.00	\$3,000.00
632	64020	EACH	PEDESTAL FOUNDATION	2	\$500.00	\$1,000.00
632	70000	EACH	POWER SERVICE	2	\$500.00	\$1,000.00
632	90000	EACH	PEDESTAL, 11', TRANSFORMER BASE	2	\$500.00	\$1,000.00
642	00190	MILE	LANE LINE	0.08	\$1,000.00	\$80.00
642	00290	MILE	CENTER LINE	0.08	\$10,000.00	\$800.00
642	00490	FT	STOP LINE	66	\$12.00	\$792.00
642	00590	FT	CROSSWALK LINE	264	\$3.00	\$792.00
			MISC.			\$600.00
TOTAL						\$3,064.00

**APPENDIX K**  
**HCS PRINTOUTS**

HCS+: Signalized Intersections Release 5.3

Analyst: GJB Inter.: NOBLE AND TERRACE  
 Agency: GPD GROUP Area Type: CBD or Similar  
 Date: 2/6/2009 Jurisd:  
 Period: AM PEAK Year : 2009  
 Project ID: EAST CLEVELAND SAFETY STUDY - JOB NO. 2008113  
 E/W St: NOBLE N/S St: TERRACE

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	2	0	0	2	0	0	1	0	0	1	0
LGConfig	LTR			LTR			LTR			LTR		
Volume	5	342	48	57	315	66	31	100	36	83	73	5
Lane Width	12.0			12.0			12.0			12.0		
RTOR Vol	5			5			5			0		

Duration 0.25 Area Type: CBD or Similar

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	P				NB Left	P		
Thru	P				Thru	P		
Right	P				Right	P		
Peds	X				Peds	X		
WB Left	P				SB Left	P		
Thru	P				Thru	P		
Right	P				Right	P		
Peds	X				Peds	X		
NB Right					EB Right			
SB Right					WB Right			
Green	47.0				30.0			
Yellow	4.0				4.0			
All Red	3.0				3.0			

Cycle Length: 91.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group		Approach	
			v/c	g/C	Delay	LOS	Delay	LOS

Eastbound

LTR 1569 3037 0.28 0.52 12.6 B 12.6 B

Westbound

LTR 1367 2646 0.35 0.52 13.4 B 13.4 B

Northbound

LTR 502 1522 0.36 0.33 24.2 C 24.2 C

Southbound

LTR 422 1279 0.42 0.33 25.3 C 25.3 C

Intersection Delay = 16.3 (sec/veh) Intersection LOS = B

HCS+: Signalized Intersections Release 5.3

Analyst: GJB Inter.: NOBLE AND TERRACE  
 Agency: GPD GROUP Area Type: CBD or Similar  
 Date: 2/6/2009 Jurisd:  
 Period: AM PEAK Year : 2009  
 Project ID: EAST CLEVELAND SAFETY STUDY - JOB NO. 2008113  
 E/W St: NOBLE N/S St: TERRACE

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	2	0	0	2	0	0	1	0	0	1	0
LGConfig	LTR			LTR			LTR			LTR		
Volume	5	342	48	57	315	66	31	100	36	83	73	5
Lane Width	12.0			12.0			12.0			12.0		
RTOR Vol	5			5			5			0		

Duration 0.25 Area Type: CBD or Similar

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	P				NB Left	P		
Thru	P				Thru	P		
Right	P				Right	P		
Peds	X				Peds	X		
WB Left	P				SB Left	P		
Thru	P				Thru	P		
Right	P				Right	P		
Peds	X				Peds	X		
NB Right					EB Right			
SB Right					WB Right			
Green	32.7				13.3			
Yellow	4.0				4.0			
All Red	3.0				3.0			

Cycle Length: 60.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group		Approach	
			v/c	g/C	Delay	LOS	Delay	LOS

Eastbound

LTR 1655 3036 0.26 0.55 7.4 A 7.4 A

Westbound

LTR 1462 2682 0.33 0.55 7.9 A 7.9 A

Northbound

LTR 333 1504 0.54 0.22 23.7 C 23.7 C

Southbound

LTR 294 1326 0.61 0.22 25.7 C 25.7 C

Intersection Delay = 12.5 (sec/veh) Intersection LOS = B

HCS+: Signalized Intersections Release 5.3

Analyst: GJB Inter.: NOBLE AND TERRACE  
 Agency: GPD GROUP Area Type: CBD or Similar  
 Date: 2/6/2009 Jurisd:  
 Period: PM PEAK Year : 2009  
 Project ID: EAST CLEVELAND SAFETY STUDY - JOB NO. 2008113  
 E/W St: NOBLE N/S St: TERRACE

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	2	0	0	2	0	0	1	0	0	1	0
LGConfig	LTR			LTR			LTR			LTR		
Volume	2	463	45	67	401	113	60	107	67	72	44	1
Lane Width	12.0			12.0			12.0			12.0		
RTOR Vol	5			5			5			0		

Duration 0.25 Area Type: CBD or Similar

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	P				NB Left	P		
Thru	P				Thru	P		
Right	P				Right	P		
Peds	X				Peds	X		
WB Left	P				SB Left	P		
Thru	P				Thru	P		
Right	P				Right	P		
Peds	X				Peds	X		
NB Right					EB Right			
SB Right					WB Right			
Green	51.0				28.0			
Yellow	4.0				4.0			
All Red	3.0				3.0			

Cycle Length: 93.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group		Approach	
			v/c	g/C	Delay	LOS	Delay	LOS
Eastbound								
LTR	1682	3068	0.33	0.55	11.9	B	11.9	B
Westbound								
LTR	1402	2556	0.46	0.55	13.2	B	13.2	B
Northbound								
LTR	434	1442	0.59	0.30	30.5	C	30.5	C
Southbound								
LTR	327	1086	0.40	0.30	27.6	C	27.6	C

Intersection Delay = 16.7 (sec/veh) Intersection LOS = B

HCS+: Signalized Intersections Release 5.3

Analyst: GJB Inter.: NOBLE AND TERRACE  
 Agency: GPD GROUP Area Type: CBD or Similar  
 Date: 2/6/2009 Jurisd:  
 Period: PM PEAK Year : 2009  
 Project ID: EAST CLEVELAND SAFETY STUDY - JOB NO. 2008113  
 E/W St: NOBLE N/S St: TERRACE

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	2	0	0	2	0	0	1	0	0	1	0
LGConfig	LTR			LTR			LTR			LTR		
Volume	2	463	45	67	401	113	60	107	67	72	44	1
Lane Width	12.0			12.0			12.0			12.0		
RTOR Vol	5			5			5			0		

Duration 0.25 Area Type: CBD or Similar

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	P				NB Left	P		
Thru	P				Thru	P		
Right	P				Right	P		
Peds	X				Peds	X		
WB Left	P				SB Left	P		
Thru	P				Thru	P		
Right	P				Right	P		
Peds	X				Peds	X		
NB Right					EB Right			
SB Right					WB Right			
Green	32.7				13.3			
Yellow	4.0				4.0			
All Red	3.0				3.0			

Cycle Length: 60.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios		Lane Group		Approach	
			v/c	g/C	Delay	LOS	Delay	LOS

Eastbound

LTR 1672 3067 0.33 0.55 7.9 A 7.9 A

Westbound

LTR 1415 2597 0.45 0.55 8.8 A 8.8 A

Northbound

LTR 317 1430 0.80 0.22 32.6 C 32.6 C

Southbound

LTR 252 1136 0.52 0.22 24.3 C 24.3 C

Intersection Delay = 13.5 (sec/veh) Intersection LOS = B