Planned Intersection Safety Improvement Program for the Borough of State College, Centre County

Part I – Prioritization of Areas of Concern

FINAL REPORT

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EXECUTIVE SUMMARY

Part I of the *Planned Intersection Safety Improvement Program* for the Borough of State College is the development of a prioritized list of areas of concern. Intersection crash records were analyzed to identify and rank intersections with the potential to improve safety. This study considered crashes where at least one motor vehicle was involved. Pedestrian – vehicle crashes are not the focus of this report as they have been analyzed in the *Comprehensive Pedestrian and Bicycle Program* report prepared by *Stahl Sheaffer Engineering, LLC* (2008).

The first section of this report summarizes the crash history for all intersections within the municipal limits of the Borough of State College for the years 2005 through 2009. Aggregate crash data were analyzed for the following categories:

- Crash frequency by year
- Crash frequency by month
- Crash frequency by day of week
- Crash frequency by time of day
- Crash frequency by severity
- Crash frequency by crash type
- Crash frequency by weather condition
- Crash frequency by lighting condition
- Crash frequency by road condition
- Crash frequency with drug or alcohol involvement

Overall the total number of vehicle-related crashes at intersections has decreased by about 52 percent from 2005 to 2009. The reduction in yearly crashes is consistent with national crash trends for the same time period. While the reduction in crashes observed in the Borough is likely due to external factors (overall decrease in economic activity, reduction in automobile transportation due to high fuel prices during part of the study period, etc.), it is still important to identify specific locations within the Borough where safety improvements can be implemented for the greatest benefit.

The second section of this report identifies a prioritized list of intersections of concern. Detailed analyses utilizing statistical methods presented in the *Highway Safety Manual* were used to rank intersections with potential to improve safety. Five network screening performance measures were calculated and considered in the analysis. In an effort to reduce total crash costs, the severity-weighted excess crash performance measure was selected to rank individual intersections. The top five intersections by severity-weighted excess crashes are:

1. Atherton Street (SR 3014) & University Drive (SR 3018)
2. Atherton Street (SR 3014) & College Avenue (SR 0026)
3. Atherton Street (SR 3014) & Branch Road (SR 3011)
4. Atherton Street (SR 3014) & Hillcrest Avenue
5. Atherton Street (SR 3014) & Nittany Avenue

Detailed rankings for all 530 intersections are presented in the appendix. A detailed engineering study will be performed at the top five intersections as part of this project. Recommendations on safety improvements will be presented in a Part II report.

INTRODUCTION

Part I of the *Planned Intersection Safety Improvement Program* for the Borough of State College is the analysis of existing crash records to determine safety trends and a prioritized list of intersections of concern. This study considered crashes where at least one motor vehicle was involved. Pedestrian – vehicle crashes are not the focus of this report as they have been analyzed in the *Comprehensive Pedestrian and Bicycle Program* report prepared by *Stahl Sheaffer Engineering, LLC* (2008).

Data were obtained for 530 intersections in the Borough of State College, including crash, roadway characteristics, and traffic volume data. Crash data were provided by the Borough of State College Police Department for years 2005 through 2009 (complete).

The first section of this report summarizes aggregate crash trends in the Borough of State College. The second section presents the methodology and analysis results for ranking the top intersections of concern based on the potential to improve safety.

SUMMARY STATISTICS ON INTERSECTION CRASHES

Unless otherwise noted, the analysis period for the following summary statistics is 2005 to 2009.

Table 1 presents the total number of vehicle intersection crashes by year in the Borough of State College. The table shows a decreasing trend in intersection crashes over the analysis period. The maximum occurred in 2005 and the minimum occurred in 2009. Figure 1 illustrates this data graphically. The total number of crashes at intersections decreased by about 52 percent from 2005 to 2009. The reduction in yearly crashes is consistent with national crash trends for the same time period.

TABLE 1. *Intersection Crash Frequency by Year.*

Year	Number of Intersection Crashes
2005	598
2006	526
2007	496
2008	434
2009	285
Total	**2,339**

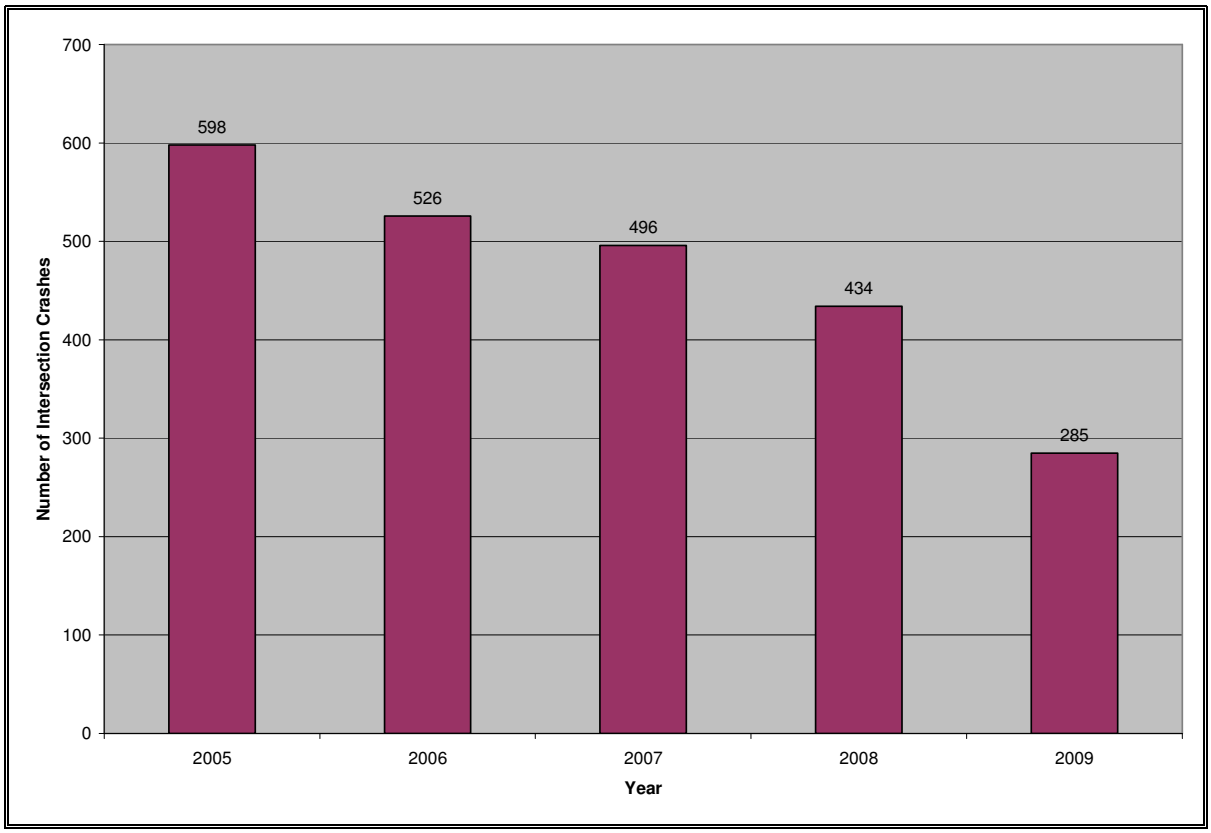

FIGURE 1. *Intersection Crash Frequency by Year.*

Table 2 presents the total number of intersection crashes by month. From the data, it is evident that the summer months (June and July) have the least number of intersection crashes. The maximum number of intersection crashes occurs in October and February. Figure 2 shows this information graphically.

TABLE 2. *Intersection Crash Frequency by Month.*

Month	Number of Intersection Crashes
January	208
February	238
March	188
April	208
May	187
June	130

July	126
August	205
September	214
October	255
November	201
December	179
Total	**2,339**

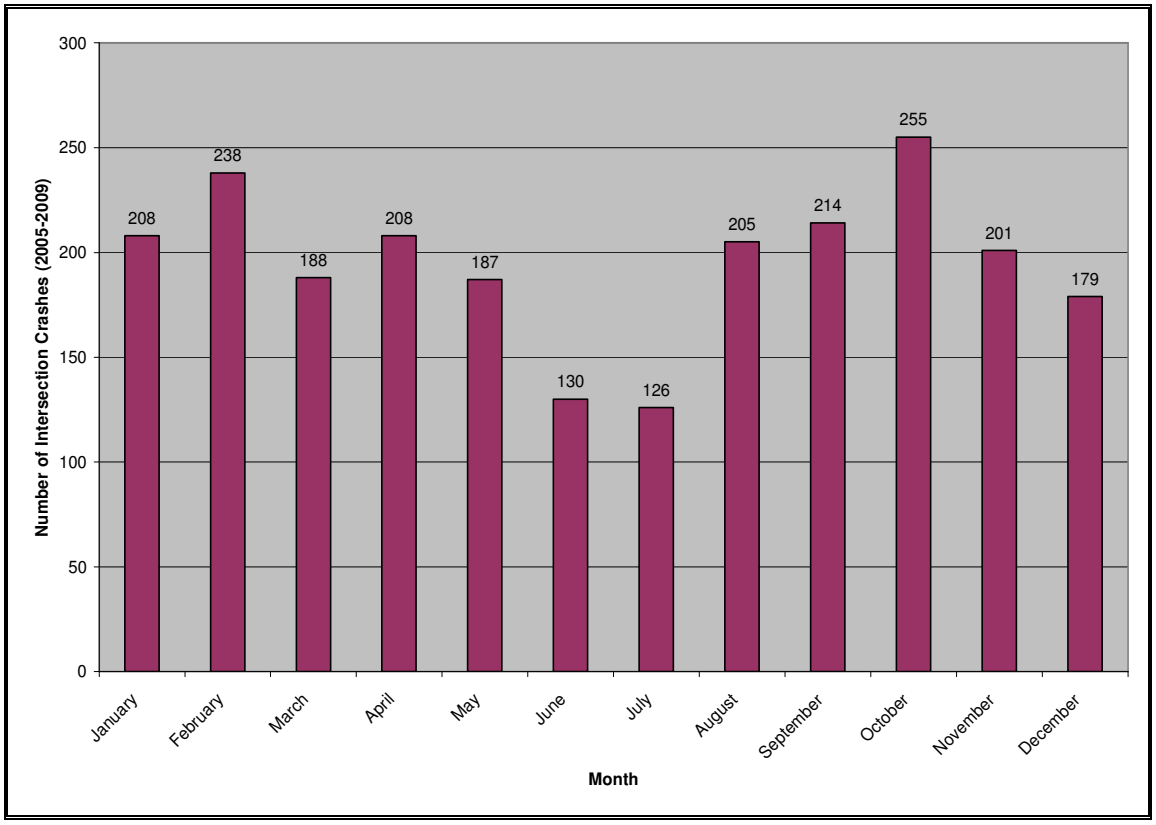

FIGURE 2. *Intersection Crash Frequency by Month.*

Table 3 shows the total number of intersection crashes by day of the week. Figure 3 represents this information graphically. The data collected over the analysis period clearly shows an increase of intersection crashes as the week progresses from Sunday to Friday with the maximum number of intersection crashes occurring on Friday.

TABLE 3. *Intersection Crash Frequency by Day of Week.*

Day of Week	Number of Intersection Crashes
Monday	266
Tuesday	315
Wednesday	319
Thursday	362
Friday	479
Saturday	341
Sunday	257
Total	**2,339**

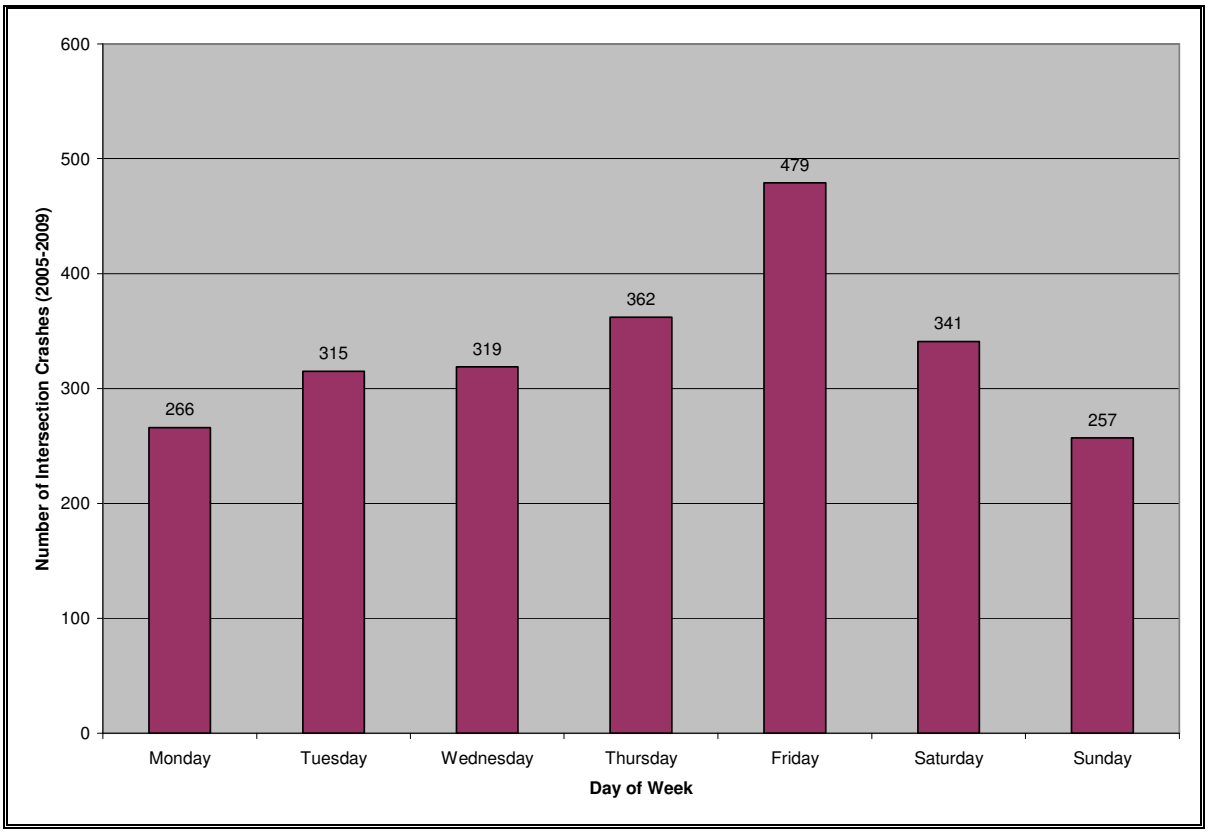

FIGURE 3. *Intersection Crash Frequency by Day of Week.*

Table 4 presents the number of intersection crashes in the Borough of State College by time, in one hour increments. The data is presented in both frequency and percentage. Figure 4 illustrates the data graphically. The least number of intersection crashes occur between 3 a.m. and 6 a.m. (3:00 – 6:00). The hours of midnight to 2 a.m. (0:00 – 2:00) and 8 p.m. to 11 p.m. (20:00 – 23:00) show a substantial increase in the number of crashes. The hours of 11 a.m. to 7 p.m. (11:00 – 19:00) show another substantial increase in the number of crashes. This data is consistent with daily traffic volume fluctuations. Figure 4 represents the data graphically.

TABLE 4. *Intersection Crash Frequency by Time of Day.*

Hour Beginning	Frequency	Percent
0:00	80	3%
1:00	46	2%
2:00	54	2%
3:00	16	1%
4:00	9	0%
5:00	11	0%
6:00	16	1%
7:00	52	2%
8:00	80	3%
9:00	87	4%
10:00	88	4%
11:00	148	6%
12:00	171	7%
13:00	172	7%
14:00	167	7%
15:00	186	8%
16:00	198	8%
17:00	211	9%

Hour Beginning	Frequency	Percentage
18:00	144	6%
19:00	108	5%
20:00	88	4%
21:00	89	4%
22:00	64	3%
23:00	54	2%
Total	**2,339**	**100%**

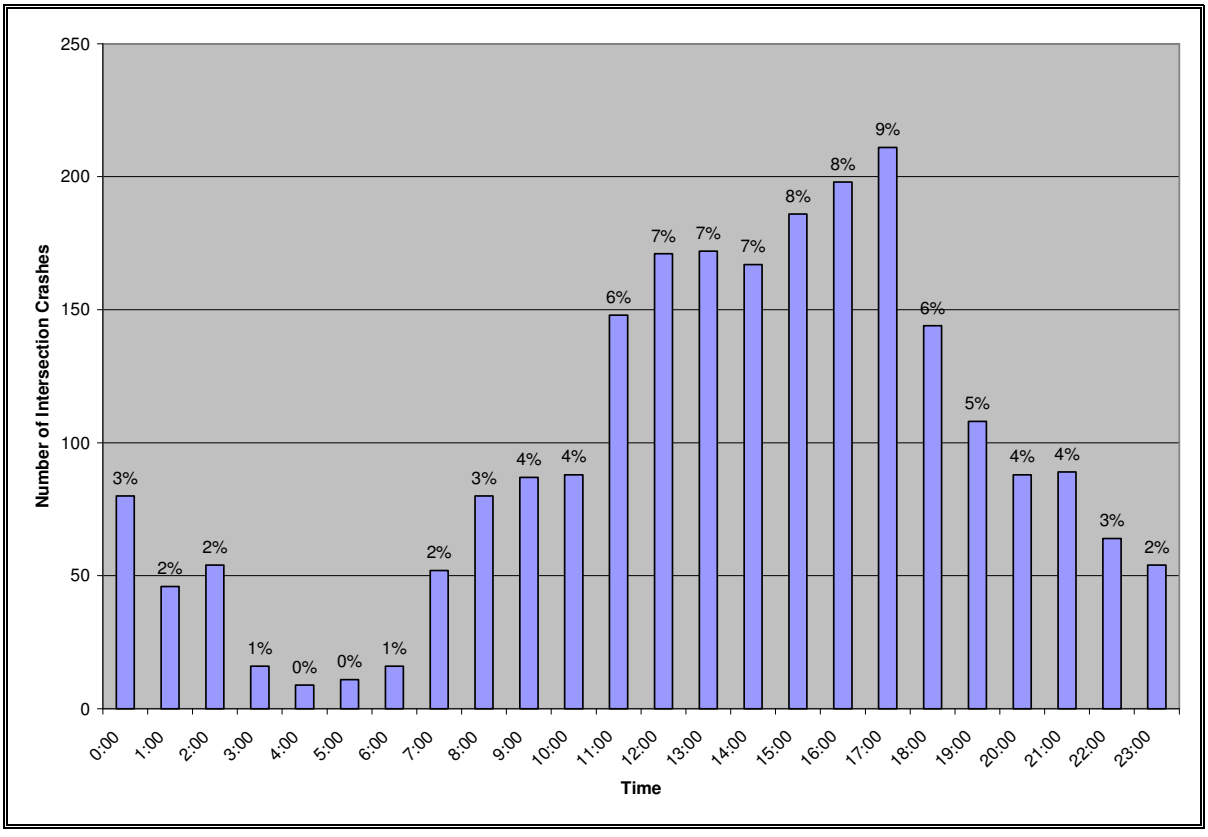

FIGURE 4. *Intersection Crash Frequency by Time of Day.*

Table 5 presents data relating to the severity of the intersection crashes during the analysis period. Reportable crashes are typically crashes with injury involvement or crashes that render vehicles inoperative. Non-reportable crashes are typically more minor in nature and generally result in property damage only (PDO). Non-reportable crashes make up the majority of all intersection crashes in the Borough of State College. No fatalities were reported due to intersection crashes in the Borough during the analysis period (excludes pedestrian crashes). Figure 5 compares the number of injuries and property damage only for both the reportable and non-reportable intersection crashes.

TABLE 5. *Crash Frequency by Severity.*

Reportable	Injury	Fatality	PDO	Number of Crashes
No	20	0	1,679	1,699
Yes	449	0	191	640
Total	**469**	**0**	**1,870**	**2,339**

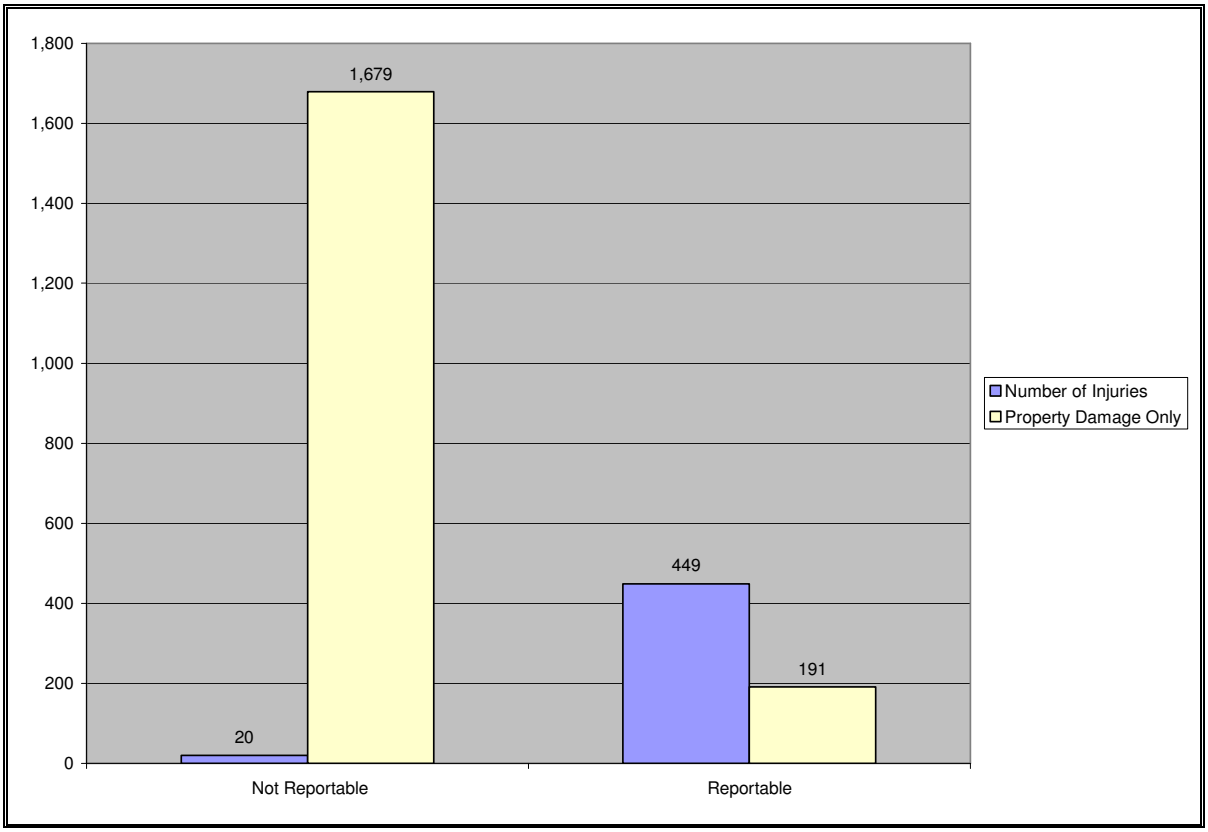

FIGURE 5. *Crash Frequency by Severity.*

Table 6 presents data on the different types of intersection crashes reported during the analysis period. The most frequent type of intersection crashes are angle crashes. Note, that this list contains only a few pedestrian crashes since these types of crashes were not requested or studied as part of this project. The pedestrian crashes reported in Table 6 are likely multiple-vehicle intersection crashes that inlcude pedestrian involvement. The data is shown graphically in Figure 6.

TABLE 6. *Crash Frequency by Crash Type.*

Type	Number of Intersection Crashes
Angle	1,040
Bike	9
Head On	22
Hit Fixed Object	163
Other/Unknown	32
Parking Garage/Lot	13
Pedestrian	5
Rear End	649
Rear to Rear (Backing)	168
Sideswipe (Opposite Direction)	16
Sideswipe (Same Direction)	222
Total	**2,339**

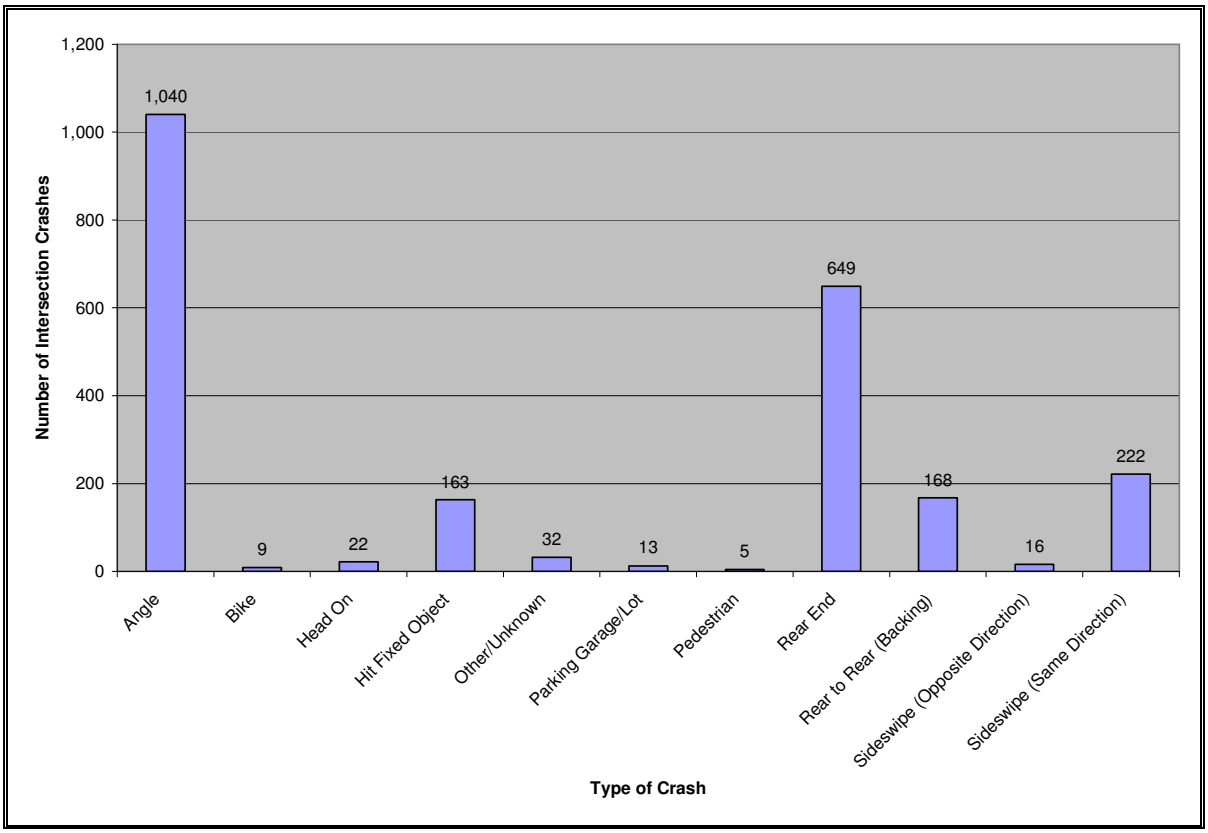

FIGURE 6. *Crash Frequency by Crash Type.*

Table 7 exhibits the intersection crash data according to the weather conditions at the time of collision. The weather conditions of more than half of the crashes are unknown or unspecified. Figure 7 illustrates the data more clearly.

TABLE 7. *Crash Frequency by Weather Condition.*

Weather	Number of Intersection Crashes
Fog	1
No Adverse Conditions	509
Rain	90
Sleet/Hail	3
Snow	36
Unknown	1,700
Total	**2,339**

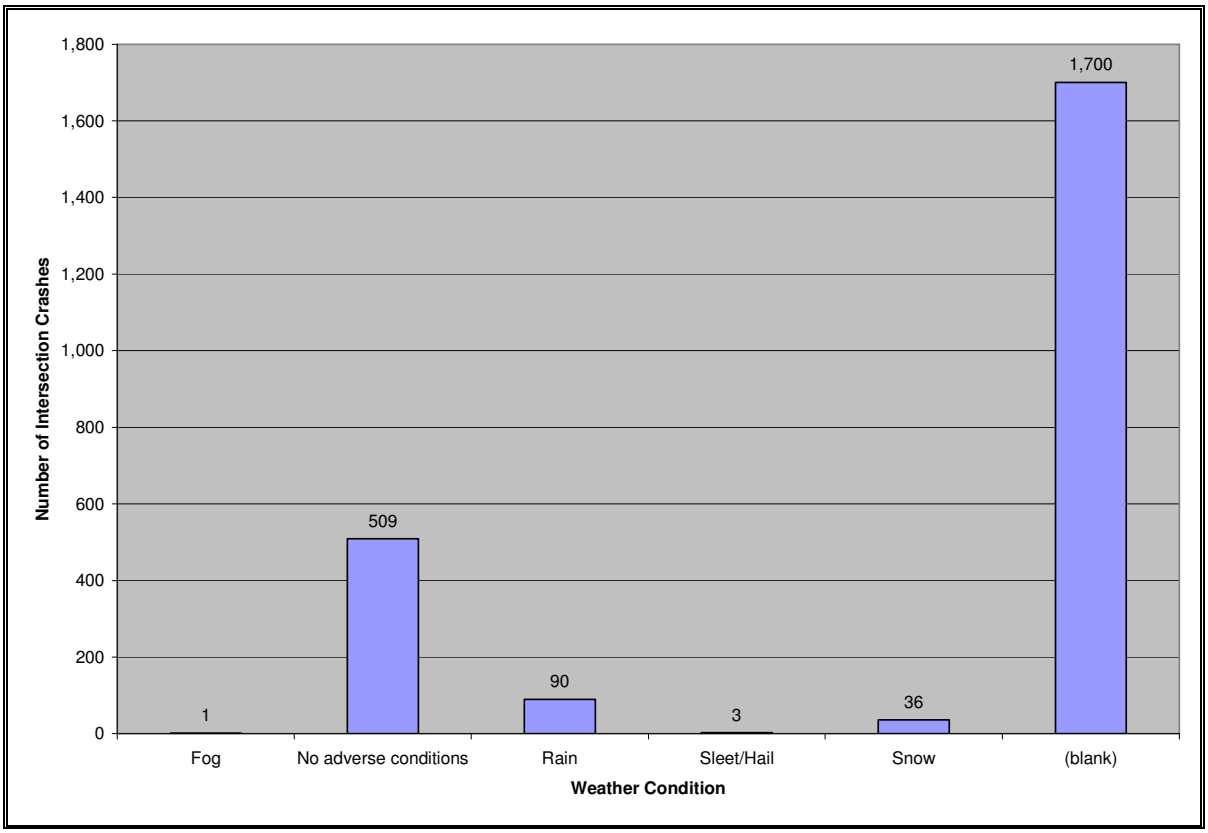

FIGURE 7. *Crash Frequency by Weather Condition*

Table 8 presents the intersection crash data according to the lighting conditions at the time of collision. The majority of crashes occur under daylight conditions. Figure 8 displays the data graphically.

TABLE 8. *Crash Frequency by Lighting Condition.*

Lighting Condition	Number of Intersection Crashes
Dark (No Streetlights)	119
Dark (Streetlights)	523
Dawn	3
Daylight	1,672
Dusk	21
Other	1
Total	**2,339**

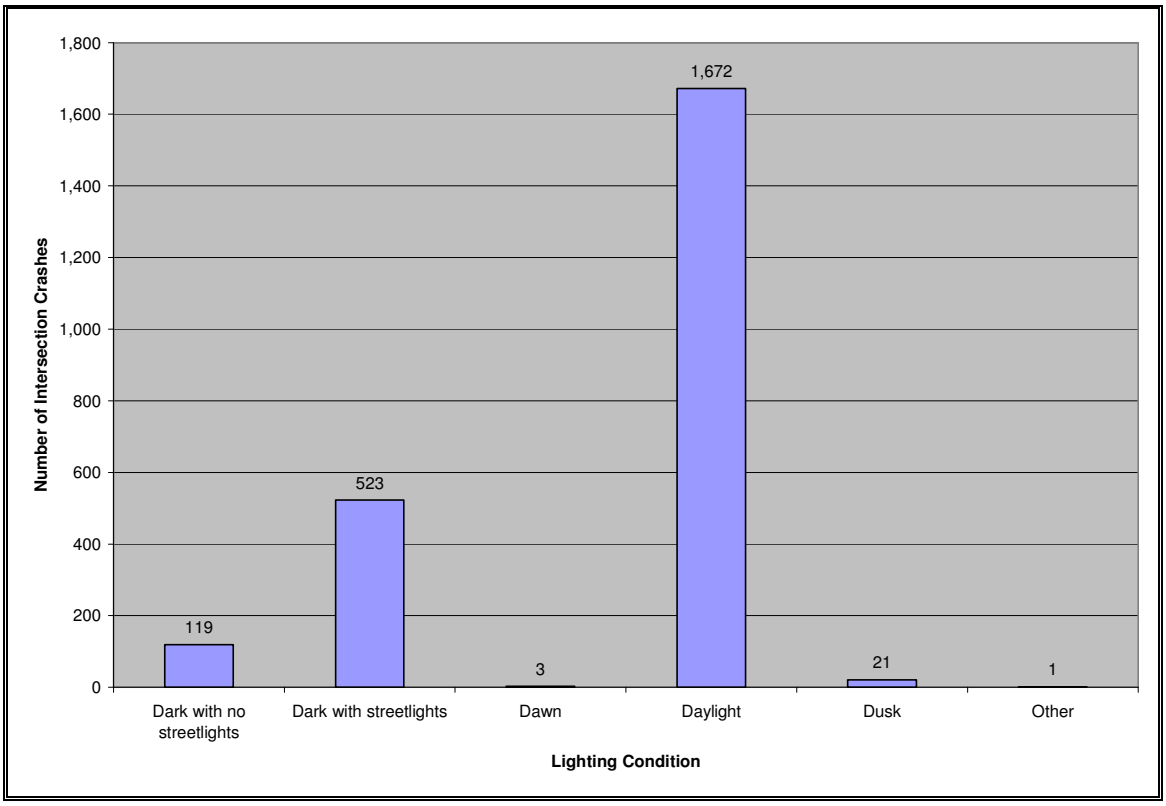

FIGURE 8. *Crash Frequency by Lighting Condition.*

Table 9 presents the number of intersection crashes by the road conditions at the time of the collision. Figure 9 more clearly illustrates this data graphically. The road conditions of more than half of the intersection crashes were not recorded, however, the majority of crashes with known conditions occurred under dry conditions.

TABLE 9. *Crash Frequency by Road Condition.*

Road Conditions	Number of Intersection Crashes
Dry	467
Ice	1
Ice Patches	7
Sand/Mud/Dirt/Oil	2
Slush	7

Snow-Covered	25
Wet	130
Unknown	1,700
Total	**2,339**

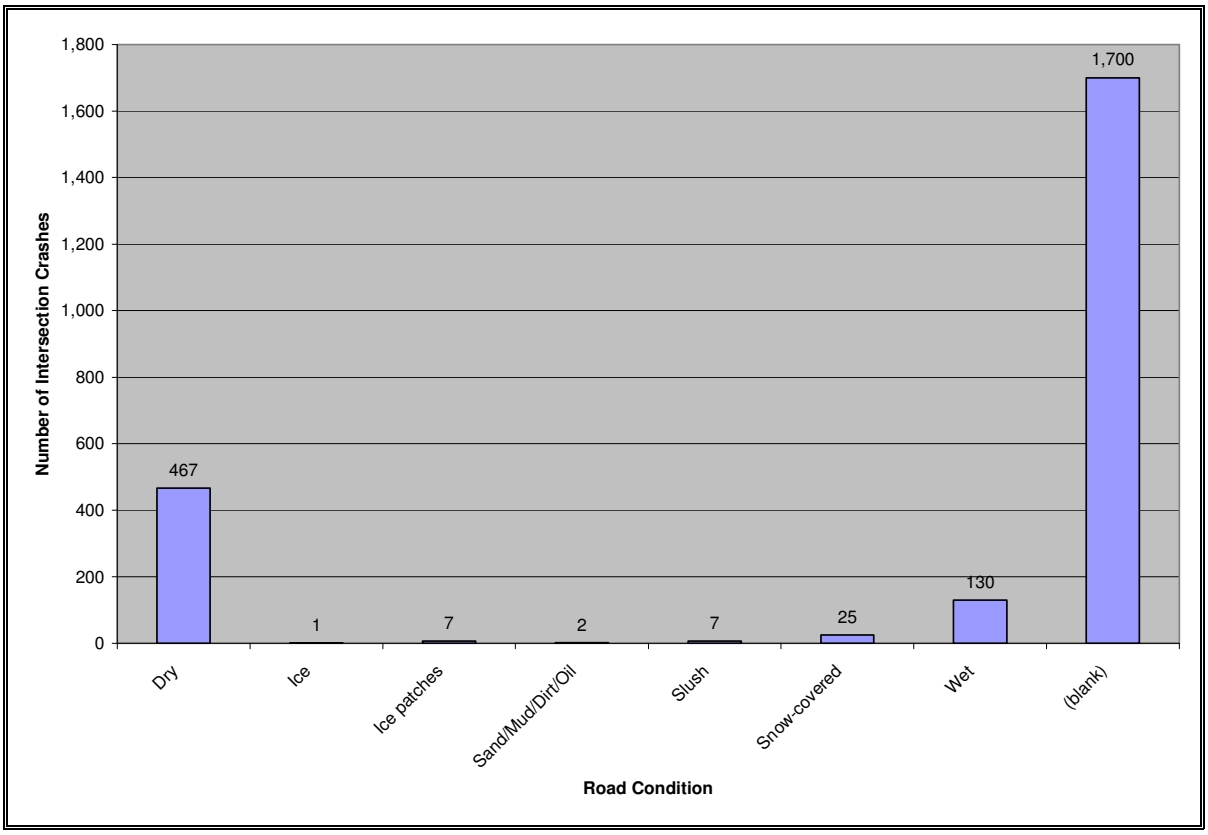

FIGURE 9. *Crash Frequency by Road Condition.*

Figure 10 illustrates the number of intersection crashes which involved drugs or alcohol compared to the total number of intersection crashes in the Borough.

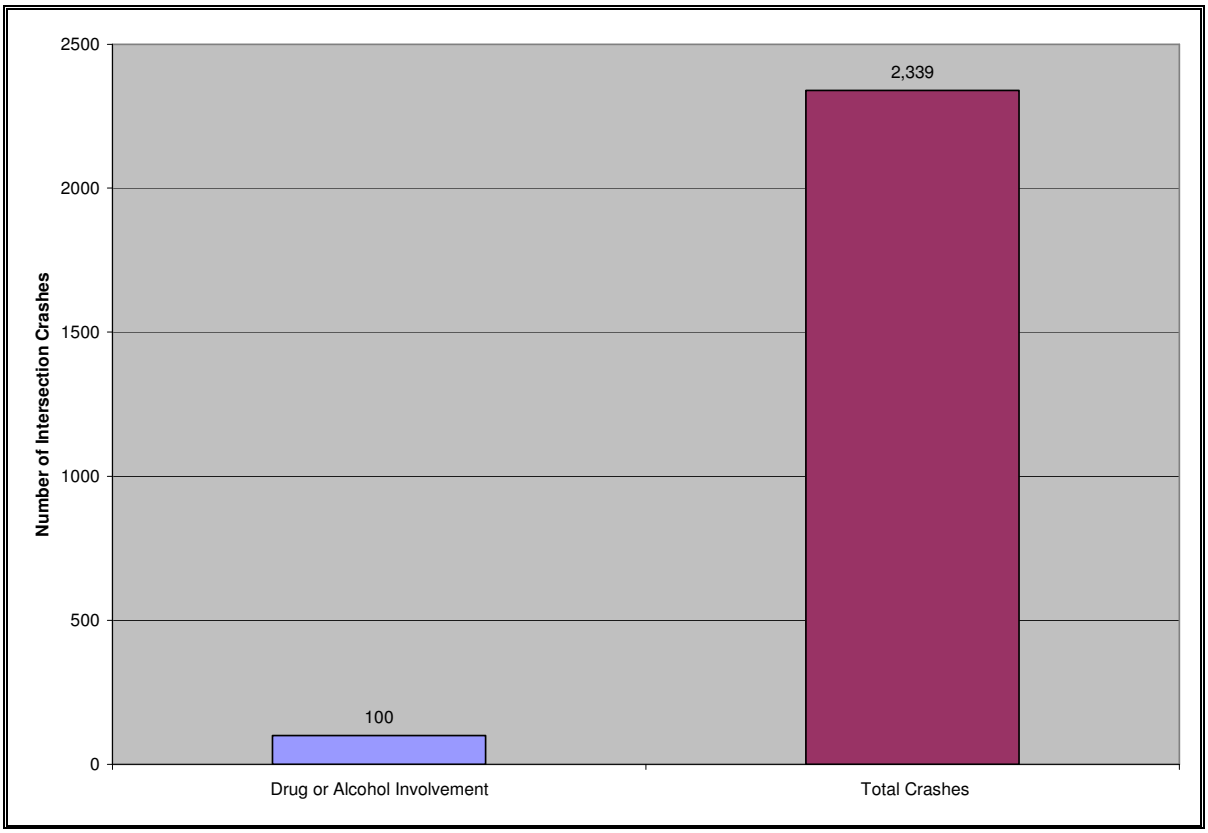

FIGURE 10. *Drug or Alcohol Involvement in Intersection Crashes.*

PRIORITIZED LIST OF AREAS OF CONCERN

OVERVIEW

The objective of this task was to conduct a rigorous analysis to identify a prioritized list of problematic intersections in the Borough of State College, PA (i.e., network screening). Network screening is discussed with a detailed explanation of the prioritization method used for this study. A summary of the data used for the analysis is then provided. Finally, the results are presented, including multiple prioritized lists of problematic intersections. It should be noted that the procedures and analysis methods used for the current study are consistent with those presented in the draft *Highway Safety Manual* (HSM).

NETWORK SCREENING

Network screening is the process of reviewing a given transportation network to identify and rank sites with respect to the potential to improve safety. The network screening process involves the following five steps:

1. Establish the focus of the network screening.
2. Identify the network and establish reference populations.
3. Select network screening performance measures.
4. Select screening method.
5. Screen and evaluate the results.

Each of the five steps is discussed below with regard to this particular task.

Step 1: Establish the focus of the network screening.
Network screening can be used to 1) identify 'sites with promise' (i.e., sites where the average crash frequency is greater than expected for similar intersections), and/or 2) target specific crash types or severities for implementation of a system-wide treatment. In this case, sites were identified based on their potential to improve safety. As such, the analysis focused on total crashes at each intersection, not on a specific crash type for the entire network.

Step 2: Identify the network and establish reference populations.
This step includes the identification of the network elements to be screened and organization of these elements into reference populations. Reference populations are sites with similar characteristics (e.g., four-legged signalized intersections, four-legged stop controlled intersections). The reference populations are formed because the expected safety (i.e., average crashes) of these entities is expected to vary among the populations. Sites are ranked within a reference population to ensure comparison of like entities (apples to apples). Depending on the performance measure(s) selected in Step 3, there is potential for comparisons across reference populations.

The network for this study included all intersections within the Borough of State College, PA. Due to the diversity of sites in the State College area, multiple reference populations were

developed. The following characteristics were used to establish reference populations for intersections in the Borough:

- Area type: downtown or residential.
- Control type: signal, partial stop-control, or all-way stop-control.
- Operation: one-way or two-way.
- Number of approaches: 3-legged or 4-legged.
- Cross-section: number of through lanes on major and minor approach.

Step 3: Select network screening performance measures.
The purpose of this step is to select one or more performance measures for estimating the potential to improve safety. Intersection safety can be quantified by crash frequency, crash rate, crash severity, expected level of safety, excess crashes, and many other performance measures. Each performance measure is associated with specific strengths and weaknesses. In general, the more rigorous performance measures (i.e., those with few or no weaknesses) require more detailed information related to the site and crash characteristics.

Data availability and the potential for regression-to-the-mean are key considerations in the selection of performance measures. The data requirements can become onerous as the level of rigor increases. For example, the use of crash frequency is relatively straightforward and requires only crash data to be identified for each site. However, the use of crash frequency does not account for differences in exposure or regression-to-the-mean. At the other end of the spectrum, the use of the empirical Bayes (EB) method can account for differences in traffic volume and regression-to-the-mean; however, the EB method requires a substantial amount of detailed data for each site. The EB method also requires the use or development of safety performance functions, which may or may not be available for specific roadway types. The following performance measures were considered in this network screening:

1. **Critical crash frequency**: rank sites from greatest to least based on the difference between observed crash history (5 year average) and expected crash frequency (average crash frequency for sites with similar characteristics).

2. **Critical crash rate**: rank sites from greatest to least based on the difference between observed crash rate (5 year average) and expected crash rate (average crash rate for sites with similar characteristics).

3. **Expected crash frequency**: rank sites from greatest to least based on expected crash frequency from EB method (using 5 year crash history to calibrate or re-calibrate safety performance functions).

4. **Excess crash frequency**: rank sites from greatest to least based on the difference between expected crash frequency from EB method and the predicted crashes from the safety performance function (using 5 year crash history to calibrate or re-calibrate safety performance functions).

5. **Severity-weighted excess crash frequency**: this is identical to #4, but crash costs are applied by severity to estimate a weighted cost of excess crashes. Sites are then ranked from greatest to least based on the weighted cost of excess crashes.

The data required to employ these five performance measures are as follows:

- Crash data: 5 year crash history for each site, including the severity of each crash.

- Traffic volume data: annual average daily traffic (or similar metric) for the major and minor road of each site. It was necessary to estimate the traffic volume for some locations based on nearby counts where traffic volumes were not available for a specific location. It was also necessary to normalize traffic volumes across the network where the data were based on counts from different years.

- Intersection data: basic intersection characteristics were required to assign the sites to reference populations and to develop safety performance functions (to be discussed in detail). The five critical characteristics (area type, control type, etc.) were identified and described in Step 2.

- Crash cost information: while national crash cost data were available from the FHWA report, *Crash Cost Estimates by Maximum Police-Reported Injury Severity within Selected Crash Geometries* (Council et al., 2005), it is more accurate to apply local or regional crash costs when possible. As such, crash cost information was obtained from the Pennsylvania Crash Facts and Statistics, 2008.

Step 4: Select screening method.
Screening methods include the peak searching, sliding window, and simple ranking techniques. For intersection network screening, the simple ranking method is the appropriate screening method. Using the simple ranking method, the performance measures were calculated for all sites under consideration, and the results were ordered from high to low. The outcome was several lists showing each site and the value of the selected performance measure.

Step 5: Screen and evaluate the results.
The five performance measures can be used to identify the top sites in each reference population. The results from the five performance measures can be used individually or in combination. Sites at the top of one list may appear at the top of the list for other performance measures. If this is the case (i.e., the results are consistent among the various methods), the ranking of sites is straightforward. If the five methods produce different rankings, it is necessary to either select one method for the final ranking or combine the results from the multiple rankings.

PRIORITIZATION METHOD

As discussed in Step 3 of the Network Screening section, there are several potential performance measures that may be employed to rank sites. The strengths and weaknesses of the five performance measures considered for this study are summarized in Table 10.

TABLE 10. *Summary of Potential Performance Measures.*

Performance Measure	Strengths	Weaknesses
Critical crash frequency	• Simple • Considers variance in crash data • Establishes a threshold for comparison	• Does not account for regression-to-the-mean • Does not account for traffic volume
Critical crash rate	• Simple • Considers variance in crash data • Establishes a threshold for comparison • Reduces exaggerated effect of sites with low volumes	• Does not account for regression-to-the-mean
Expected crash frequency	• Accounts for regression-to-the-mean	• Requires development or recalibration of safety performance functions • Does not allow for equal comparison among sites with different characteristics • Does not account for differences in crash cost by severity
Excess expected crash frequency	• Accounts for regression-to-the-mean • Sets threshold to identify sites with a high number of crashes relative to similar sites	• Requires development or recalibration of safety performance functions • Does not account for differences in crash cost by severity
Severity-weighted excess expected crash frequency	• Accounts for regression-to-the-mean • Sets threshold to identify sites with a high number of crashes relative to similar sites • Accounts for differences in crash cost by severity	• Requires development or recalibration of safety performance functions

Based on the availability of detailed data, it was decided that the simple critical crash frequency and critical crash rate are not necessary for this evaluation. Instead, it was possible to employ the more rigorous **Severity-Weighted Excess Expected Crash Frequency** as the performance measure. As part of the calculation, it is necessary to estimate the **Expected Crash Frequency** and the **Excess Expected Crash Frequency**. As such, the results from these two performance measures are presented in addition to the results from the **Severity-Weighted Excess Expected Crash Frequency**.

In general, the following steps are necessary to estimate the severity-weighted excess expected crash frequency, subsequently referred to as severity-weighted excess.

1. Develop local safety performance function (SPF) or recalibrate existing SPF.
2. Apply SPFs to predict PDO and injury crashes for location of interest.
3. Calculate expected number of PDO and injury crashes for location of interest using EB method.
4. Determine "excess" PDO and injury crashes by subtracting predicted from expected crashes.
5. Weight the excess crashes by severity using relative crash costs.
6. Rank sites in order from highest to lowest.

The remainder of this section describes the specific procedure for estimating the severity-weighted excess for a given intersection.

Step 1. Develop Local Safety Performance Function or Recalibrate Existing SPF
The HSM provides several safety performance functions (SPFs) to predict crashes for various facility types. For urban and suburban arterials, the HSM provides SPFs for both three-legged and four-legged intersections with signal-control and stop-control on the minor road. There are three primary concerns related to the use of SPFs from the HSM.

1. The SPFs were developed from a number of past studies using data from multiple states and do not necessarily represent local conditions (e.g., differences in crash reporting, vehicle fleet, driver populations, etc.). Before applying the SPFs, it is recommended that the SPFs be recalibrated to reflect local conditions.
2. SPFs are only available for specific conditions. There are no SPFs (or adjustments) provided in the HSM for one-way streets or all way stop-controlled intersections. These two conditions are present at several of the intersections in State College, PA.
3. Crash modification factors (CMFs) must be applied to the base prediction to adjust for specific site characteristics (e.g., number of lanes, speed limit, etc.).

The HSM describes an alternative to recalibrating existing SPFs, namely developing new SPFs based on local data. While recalibration of models from the HSM can produce satisfactory results, the benefits of developing SPFs based on local data are as follows.

1. SPFs developed from local data may provide more reliable estimates for that jurisdiction than recalibration of SPFs from the HSM.
2. SPFs can be developed for specific facility types that are not represented in the HSM (e.g., all-way stop-controlled intersections and one-way approaches).
3. There is no need to recalibrate SPFs that were developed from local data.
4. There is no need to apply CMFs if the variables are properly included in the SPF.

The development of new SPFs is not a nominal task, but the study team has extensive experience developing SPFs. The HSM provides the following guidance to users who wish to develop new SPFs.

1. SPFs should be developed with a statistical technique such as negative binomial regression that accounts for over-dispersion, which is often found in crash data.
2. The statistical technique should quantify the over-dispersion parameter so that the model's predictions can be combined with observed crash data using the EB Method.
3. The SPF should include the effects of major- and minor-road average annual daily traffic volumes for intersections.

The HSM identifies two options for developing new SPFs.

1. SPFs may be developed for base conditions, using only major and minor traffic volumes as predictors.
2. SPFs may be developed for a broader set of conditions, including major and minor traffic volumes plus additional variables to represent specific characteristics. In this case, it is not necessary to apply CMFs to the base model if all applicable variables are included in the model. This was the preferred method in the present study.

Negative binomial regression is a common method for developing relationships between crashes and roadway characteristics (e.g., traffic volume, area type, etc). The negative binomial regression model was applied in this evaluation to develop SPFs for PDO and injury crashes. The general functional form of the model assumed for this analysis is shown in Equation 1.

$$Y = \exp(\alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n) \quad (1)$$

Where:
Y = *predicted number of crashes.*
α *and* β_1 - β_n = *parameters estimated in the model calibration process.*
X_1 - X_n = *covariates included in the model.*

Traffic volume was included as a predictor in all models developed. Preliminary models were developed using various forms of AADT, including:

1. Separate terms for major and minor AADT.
2. Separate terms for the natural log of major and minor AADT.
3. Total entering AADT.
4. Natural log of total entering AADT.

For the final model, separate terms were used for the natural log of major and minor AADT. This decision was based on an evaluation of parameter estimates and other goodness of fit measures

(i.e., log-likelihood and pseudo R-square). Additional variables were considered based on available data and included in the models if the following conditions were met:

1. The variable significantly improved the model.
2. The effect of the variable was intuitive (e.g., crashes increase as number of approaches increases).

The following additional variables were considered in the model development.

- Traffic control (signal- or stop-control indicator).
- Type of stop-control (minor road only or all-way stop-control indicator).
- Number of approaches (3-legged or 4-legged indicator).
- Area type (central business district or residential indicator).
- Operation of major and minor road (one-way versus two-way operation indicator).
- Number of through lanes by major and minor road (1 or 2 lanes versus 3+ lanes indicator).
- Speed limit by major and minor road (25 mph versus 30+ mph indicator).

These variables entered the model form as adjustments to the base value of α in Equation 1. The base value of α was estimated for a particular baseline condition (e.g., residential, stop-controlled, three-legged intersections with speed limit less than 30 mph). When the condition of the intersection is anything other than the baseline, an adjustment was applied to the base value of α. The parameter values (β's) indicate the magnitude and direction of the adjustment to the base α value.

Step 2. Apply SPFs to Predict PDO and Injury Crashes

The recalibrated or newly developed SPFs from the previous step are now applied to the location(s) of interest to predict the number of crashes using the site-specific characteristics as input to the SPF. If the SPF represents base conditions only, it is then necessary to apply CMFs to adjust the predicted value based on other site characteristics. For this study, a new SPF was developed, which included all relevant variables in the SPF. As such, it was not necessary to apply additional CMFs to adjust the prediction. The result of this step is a **predicted** number of crashes. When available, SPFs should be used to predict PDO and injury crashes separately. These individual estimates will be used later in the weighting process.

Step 3. Calculate Expected Number of PDO and Injury Crashes using EB Method

The next step is to combine the prediction from the SPF with the observed crashes from the location of interest. This is accomplished using the EB method and produces an estimate of the **expected** number of crashes. The EB method properly accounts for regression-to-the-mean (i.e., the natural tendency for a site with a high crash count to have fewer crashes in the subsequent time period, regardless of treatment). The EB Method helps to assure that this natural change in

crashes is not mistaken for the effect of a true shift in the long-term expected crash frequency. Equation 2 is used to combine the predicted and observed crashes in the EB method.

$$N_{expected} = wN_{predicted} + (1 - w)N_{observed} \quad (2)$$

$$w = \frac{1}{1 + k(\sum N_{predicted})} \quad (3)$$

Where:
$N_{expected}$ = *estimate of expected average crash frequency for the study period.*
$N_{predicted}$ = *estimate of average crash frequency from the SPF for the study period.*
$N_{observed}$ = *observed crash frequency at the site of interest over the study period.*
w = *weighted adjustment for the SPF prediction.*
k = *over-dispersion parameter estimated during the development of the SPF.*

Equation 3 indicates the inverse relationship between the over-dispersion parameter k, and the weight, w. If the SPF has little over-dispersion, more weight is placed on the crash predicted from the SPF, $N_{predicted}$, and less weight on the observed crash frequency, $N_{observed}$. The opposite also holds; as the over-dispersion increases, less reliance is placed on the SPF estimate and more weight is given to the observed crash frequency.

Step 4. Determine "Excess" PDO and Injury Crashes
The next step is to calculate the excess PDO and injury crashes. The excess is calculated from Equation 4 and represents the difference between the EB estimate and the prediction from the SPF. Again, the computation should be completed separately for PDO and injury crashes when possible. If the total excess crashes are to be used for ranking sites, the excess PDO and excess injury crashes can be combined at this point to estimate the excess total crashes. This estimate is then used to rank sites from highest to lowest.

$$Excess_i = N_{expected} - N_{predicted} \quad (4)$$

Where:
i = *crash group of interest (e.g., total, PDO, or injury crashes).*
All other variables are as previously defined.

Step 5. Weight the Excess Crashes by Severity
The severity-weighted excess is then computed using the estimates from the previous step and severity-specific crash costs. In this case, crash cost data were obtained from the Pennsylvania Crash Facts and Statistics, 2008. Specifically, the costs associated with various severity levels in Pennsylvania are shown in Table 11.

TABLE 11. *Average Crash Costs by Severity.*

Severity	Average Cost	Number of Crashes	Total Cost
Fatal	$5,800,000	1,468	$8,514,400,000
Major Injury	$1,306,346	3,831	$5,004,611,526
Moderate Injury	$87,175	14,306	$1,247,125,550
Minor Injury	$6,885	46,704	$321,557,040
Property Damage Only	$2,754	60,521	$166,674,834
Unknown Injury	$6,885	23,868	$164,331,180

Based on the crash data received from the Borough Police Department, severity information is aggregated into just three categories: fatal, injury, and PDO. As such, it was necessary to develop a cost estimate for an average injury crash. This was done by summing the crash costs for major, moderate, and minor injury crashes ($6,573,294,116) and dividing by the total number of crashes in these categories (64,841). The resulting average injury crash cost is $101,376.

The severity-weighted excess is calculated from Equation 5.

$$Excess_{sw} = \left[C_{PDO}\left[N\right]_{expected(PDO)} - N_{predicted(PDO)}\right] + \left[C_{Inj}\left[N\right]_{expected(Inj)} - N_{predicted(Inj)}\right] \quad (5)$$

Where:
$Excess_{sw}$ = *severity-weighted excess.*
C_{PDO} = *cost of PDO crash.*
C_{injury} = *cost of injury crash.*
All other variables are as previously defined.

Step 6. Rank Sites in Order from Highest to Lowest
The final step in the process is to rank sites based on the selected performance measure(s). In this case, the severity-weighted excess is used as the primary performance measure. However, other performance measures are also used to rank sites for comparison purposes.

DATA SUMMARY

Data were obtained for a total of 530 intersections in the Borough of State College, including crash, roadway, and traffic volume data. Crash data were provided by the Borough Police Department for years 2005 through 2009. Table 12 presents a summary of the 530 intersections by geometric characteristics. It is evident from Table 12 that several categories have very small sample sizes. As such, the remaining data summary aggregates the data by traffic control and number of approaches to provide a more meaningful summary.

TABLE 12. *Summary of Intersection Characteristics.*

Traffic Control	Approaches	Location	Major Road One-Way	Intersection Frequency
All Way Stop	3	CBD	No	0
			Yes	0
		Residential	No	15
			Yes	0
	4	CBD	No	0
			Yes	0
		Residential	No	3
			Yes	0
Partial Stop	3	CBD	No	6
			Yes	16
		Residential	No	227
			Yes	18
	4	CBD	No	12
			Yes	4
		Residential	No	176
			Yes	20
Signal	3	CBD	No	3
			Yes	4
		Residential	No	3
			Yes	0
	4	CBD	No	4
			Yes	9
		Residential	No	9
			Yes	1

Table 13 provides an aggregated summary, including a breakdown by traffic control and number of approaches as well as the crashes and average major and minor road AADT associated with each category. Several points can be made from the summary data.

- There are relatively few crashes at all-way stop-control intersections; however, there are relatively few intersections in this category and the traffic volumes are relatively low at these locations so one might expect the low occurrence of crashes.
- While there are relatively few signalized intersections, this category represents nearly 50 percent of all intersection-related crashes. However, these intersections are also associated with the greatest entering traffic volumes.
- There were no fatal intersection-related crashes at the study sites during the five year study period.
- Due to the differences among the various intersection categories, it is not appropriate to make a straight comparison by crash frequency or rate to rank sites for further study. Instead, it is necessary to employ more sophisticated methods to account for differences in traffic volumes and other site characteristics to make a fair comparison.

TABLE 13. *Summary of Intersection and Crash Counts.*

Traffic Control	Approaches	Intersection Frequency	Total Crashes	Injury Crashes	PDO Crashes	Average Major AADT	Average Minor AADT
All Way Stop	3	15	1	0	1	100	100
	4	3	2	2	0	258	103
Partial Stop	3	267	470	60	410	3,005	302
	4	212	735	176	559	2,539	392
Signal	3	10	263	50	213	9,903	1,299
	4	23	836	181	655	11,569	4,805
Total	**NA**	**530**	**2,307**	**469**	**1,838**	**3,222**	**545**

ANALYSIS AND RESULTS

This section presents the results and analysis procedure for each of the six steps used in the computation of the severity-weighted excess (discussed in the Prioritization Method section).

Step 1. Develop Local Safety Performance Function or Recalibrate Existing SPF
SPFs were developed using five years of crash data from all 530 intersections. The SPFs were developed for a broader set of conditions, including the natural log of major and minor road AADT and several indicator variables to represent various intersection characteristics. The HSM presents separate SPFs for single vehicle and multi-vehicle intersection crashes. In this case, it was not possible to develop separate SPFs for single and multi-vehicle crashes due to the limited number of single vehicle intersection crashes as shown in Table 14. Instead, a local SPF is calibrated for intersection crashes using both single and multi-vehicle crashes combined.

TABLE 14. *Distribution of Crashes by Number of Vehicles.*

Number of Vehicles Involved	Crash Count
1	193
2	2027
3	94
4	21
5	3
6	1

Models were, however, developed separately for PDO and injury crashes, which is consistent with the models presented in the HSM. Table 15 shows the model results for PDO crashes and Table 16 shows the model results for injury crashes.

TABLE 15. *SPF for PDO Crashes.*

Variable	Coefficient	Standard Error	z-statistic	P-value	Lower 95% Interval	Upper 95% Interval
Ln(Major AADT)	0.4826	0.0371	13.01	0.000	0.4099	0.5552
Ln(Minor AADT)	0.3243	0.0471	6.89	0.000	0.2321	0.4165
Area type (1=CBD)	1.3148	0.1698	7.74	0.000	0.9819	1.6476
Traffic control (1=signal)	0.3927	0.1878	2.09	0.037	0.0246	0.7609
Approaches (1=4-legged)	0.5437	0.1141	4.77	0.000	0.3201	0.7674
Operation (1=one-way)	0.3715	0.1466	2.53	0.011	0.0841	0.6589
Constant	-5.3230	0.3146	-16.92	0.000	-5.9396	-4.7063
Over-dispersion (k)	0.6793	0.0934	*	*	0.52	0.889
Number of observations = 530 Log-likelihood = -854.5985 Pseudo R^2 = 0.2200		LR chi2(6) = 481.94 Prob > chi2 = 0.0000		Likelihood-ratio test of alpha=0 chibar2(01) = 428.92 Prob>=chibar2 = 0.000		

TABLE 16. *SPF for Injury Crashes.*

Variable	Coefficient	Standard Error	z-statistic	P-value	Lower 95% Interval	Upper 95% Interval
Ln(Major AADT)	0.6480	0.1021	6.35	0.000	0.4480	0.8481
Ln(Minor AADT)	0.5187	0.0762	6.81	0.000	0.3694	0.6681
Traffic control (1=signal)	0.4355	0.2422	1.80	0.072	-0.0392	0.9102
Approaches (1=4-legged)	0.6870	0.1972	3.48	0.000	0.3006	1.0735
Major road speed (1=30+ mph)	0.6417	0.2249	2.85	0.004	0.2009	1.0824
Constant	-9.8490	0.8771	-11.23	0.000	-11.5681	-8.1300
Over-dispersion (k)	0.5897	0.1680	*	*	0.34	1.031
Number of observations = 530 Log-likelihood = -297.38726 Pseudo R^2 = 0.3277		LR chi2(6) = 289.92 Prob > chi2 = 0.0000		Likelihood-ratio test of alpha=0 chibar2(01) = 45.46 Prob>=chibar2 = 0.000		

Table 17 and Table 18 compare the model coefficients from the local PDO and injury SPFs with those from the HSM. The HSM does not include additional variables as part of the SPFs so it is only possible to compare the coefficients for the constant, major and minor AADT, and the over-dispersion terms. It should also be noted that the HSM combines fatal and injury crashes in the same SPF. In this study, there were no fatal crashes at the study sites during the study period, so the SPFs are simply referred to as injury crashes. Comparing the model coefficients from the locally calibrated SPFs with the coefficients presented in the HSM, it is apparent that the local SPFs provide reasonable crash prediction model. Specifically, the coefficients from the local SPFs are within the range of the coefficients from the single and multi-vehicle crash models from the HSM. It is expected that the coefficients from the local SPFs would fall in between the HSM model coefficients as the local SPFs included both single and multi-vehicle crashes, while the HSM presents separate models for single and multi-vehicle crashes.

TABLE 17. *Comparison of Model Coefficients for PDO Crashes.*

Variable	Local SPF	HSM Single Vehicle SPF	HSM Multi-Vehicle SPF
Constant	-5.32	-7.04 to -11.34	-8.74 to -15.38
ln(Major AADT)	0.48	0.25 to 0.78	0.77 to 1.20
ln(Minor AADT)	0.32	0.25 to 0.55	0.23 to 0.51
Overdispersion (k)	0.68	0.44 to 1.29	0.36 to 0.77

TABLE 18. *Comparison of Model Coefficients for Injury Crashes.*

Variable	Local SPF	HSM Single Vehicle SPF	HSM Multi-Vehicle SPF
Constant	-9.85	-9.25 to -9.75	-11.13 to -14.01
ln(Major AADT)	0.65	0.27 to 0.43	0.93 to 1.18
ln(Minor AADT)	0.52	0.29 to 0.51	0.17 to 0.30
Overdispersion (k)	0.59	0.09 to 0.24	0.30 to 0.69

Step 2. Apply SPFs to Predict PDO and Injury Crashes

The two SPFs were applied to each study site individually to predict the number of PDO and injury crashes. The final SPFs for PDO and injury crashes are presented in Equation 6 and Equation 7, respectively.

$$N_{predicted(PDO)} = \exp[-5.3230 + 0.4826(X_1) + 0.3243(X_2) + 1.3148(X_3) + 0.3927(X_4) + 0.5497(X_5) + 0.3715(X_6)] \quad (6)$$

$$N_{predicted(injury)} = \exp[-9.8490 + 0.6480(X_1) + 0.5187(X_2) + 0.4355(X_4) + 0.6870(X_5) + 0.6417(X_7)] \quad (7)$$

Where:

X_1 = *Natural log of major road AADT.*

X_2 = *Natural log of minor road AADT.*

X_3 = *Area type (1 = central business district).*

X_4 = Traffic control (1 = signal-control).
X_5 = Number of approaches (1 = 4-legged).
X_6 = Operation (1=one-way).
X_7 = Major road posted speed (1=30+ mph).

Step 3. Calculate Expected Number of PDO and Injury Crashes using EB Method
At this point, the number of predicted crashes, $N_{predicted}$, has been estimated for each site for both PDO and injury. It is now necessary to combine the predicted and observed values to estimate the number of expected crashes, $N_{expected}$, using the EB method. The over-dispersion parameter, k, was first used to calculate the weight, w, for the predicted values. Recall that the over-dispersion parameter was 0.6793 for PDO crashes and 0.5897 for injury crashes (from Table 15 and Table 16). The weight is calculated from Equation 3 above. It should be noted that the weight will differ by site depending on the number of predicted crashes, $N_{predicted}$.

$$w_{PDO} = \frac{1}{1 + 0.6793(N_{predicted})}$$

$$w_{Injury} = \frac{1}{1 + 0.5897(N_{predicted})}$$

The number of expected crashes is calculated from Equation 2 above. The calculations are not shown here for each site. Instead, a sample calculation is shown using Equation 2 and summarized in Table 19. Complete results are presented in Appendix A.

Sample Calculation
Assume the number of observed and predicted crashes is as shown in Table 19. The weight is first calculated for PDO and injury crashes and then combined with the predicted and observed crashes to estimate the expected crashes. Note the expected value is always somewhere between the observed and predicted value.

$$w_{PDO} = \frac{1}{1 + 0.6793(112.7)} = 0.013$$

$$w_{Injury} = \frac{1}{1 + 0.5897(13.9)} = 0.109$$

$$N_{expected(PDO)} = 0.013(112.7) + (1 - 0.013)(96) = 96.2$$

$$N_{expected(Injury)} = 0.109(13.9) + (1 - 0.109)(18) = 17.5$$

TABLE 19. *Sample Calculation of Expected Crashes.*

Site	$Observed_{PDO}$	$Observed_{Injury}$	$N_{predicted(PDO)}$	$N_{predicted(Injury)}$	w_{PDO}	W_{Injury}	$N_{expected(PDO)}$	$N_{expected(Injury)}$
1	96	18	112.7	13.9	0.013	0.109	96.2	17.6

Step 4. Determine "Excess" PDO and Injury Crashes
The excess crashes are calculated separately for PDO and injury crashes using Equation 4 from above. Assuming the values presented in Table 19, the excess PDO and injury crashes are calculated as follows. Complete results are presented in Appendix A.

$$Excess_{PDO} = 96.2 - 112.7 = -16.5$$

$$Excess_{Injury} = 17.5 - 13.9 = 3.6$$

Step 5. Weight the Excess Crashes by Severity
The severity-weighted excess crashes are calculated by weighting the excess PDO and excess injury crashes with the assumed crash costs using Equation 4 from above. Recall the crash costs developed earlier were $2,754 for PDO crashes and $101,376 for injury crashes. Assuming the values presented in Table 19, the severity-weighted excess is calculated as follows. Complete results are presented in Appendix A.

$$Excess_{sw} = \$2{,}754[96.2 - 112.7] + \$101{,}376[17.5 - 13.9] = \$319{,}513$$

Step 6. Rank Sites in Order from Highest to Lowest
Once the severity-weighted excess was calculated for each site, the sites were ranked in order of greatest to least. Again, the severity-weighted excess is a measure of the potential for safety improvement, accounting for the relative costs of PDO and injury crashes. A comparison can be made across intersections with various characteristics because these differences were accounted for in the modeling process. The excess is computed for each site relative to a specific baseline, not a common baseline for all sites combined.

The final ranking is presented in Appendix A. The top 10 sites from the severity-weighted excess are shown in Table 20. For comparison purposes, the rankings are also shown for each of the 10 sites using the *Expected Crashes* measure (expected PDO plus expected injury) and *Excess Crashes* measure (excess PDO plus excess injury). Note that some sites rank relatively high on all three lists (e.g., Atherton and University). These sites have a high number of total expected crashes relative to all other intersections and relative to the average expected crashes for similar intersections. Other sites rank relatively high on only one or two of the three lists (e.g., Atherton and College). In this case, the site ranks high relative to total excess crash costs and total expected crashes compared to all other intersections; however, the site ranks relatively low based on total excess crashes. In other words, the excess PDO crashes are not unusual when compared to the average PDO crashes at similar sites, but the injury crashes are in excess compared to similar sites, which drives up the excess crash cost.

Sites may be prioritized based on a single performance measure or some combination of multiple measures depending on the strategic plan of the Borough. Examples of overall objectives include the following:

1. If the objective is to reduce crash costs, the top intersections from the severity-weighted excess may be selected for further investigation.
2. If the objective is to reduce crashes at intersections with the greatest number of crashes, the top intersections from the list of expected crashes may be selected for further investigation.
3. If the objective is to reduce crashes at those intersections with the greatest potential for improvement with respect to total crashes, the top intersections from the list of excess crashes may be selected for further investigation.
4. If the objective is to reduce crashes at those intersections with the greatest potential for improvement and with the greatest number of crashes, the intersections that are ranked relatively high on both the list of excess crashes and the list of expected crashes may be selected for further investigation.

TABLE 20. *Summary of Top 10 Sites by Severity-Weighted Excess.*

Intersection	Observed PDO	Observed Injury	Severity-Weighted Excess	Rank by Expected Crashes	Rank by Excess Crashes
Atherton and University	50	19	$809,173	5	1
Atherton and College	96	18	$537,957	1	6
Atherton and Branch	21	11	$510,701	19	53
Atherton and Hillcrest	50	9	$413,807	6	2
Atherton and Nittany	14	9	$359,275	21	509
Atherton and White Course	29	7	$292,486	17	3
Beaver and Barnard	16	5	$180,751	28	12
College and Patterson	6	5	$154,916	67	82
College and Burrowes	58	7	$145,686	4	514
Park and Allen	15	4	$139,901	34	13

CONCLUSIONS

Detailed rankings for all 530 intersections are presented in the Appendix. A detailed engineering study will be performed at five intersections as part of this project. Consensus on the top five intersections to perform the detailed engineering study will be developed through meetings with the State College Borough Transportation Commission and Borough Staff. Recommendations on intersection safety improvements will be presented in a Part II report.

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APPENDIX A. *Complete Results by Site*[1]

Intersection	Obs.[2] PDO	Obs. Injury	Pred.[3] PDO	w PDO	Pred. Injury	w Injury	Exp.[4] PDO	Exp. Injury	Exp. Total	Excess Total	Severity Weighted Excess	Rank by Exp. Total	Rank by Excess Total
Atherton and University	50	19	14.37	0.093	10.78	0.136	46.69	17.88	64.57	39.42	$809,173	5	1
Atherton and College	96	18	87.93	0.016	12.20	0.122	95.87	17.29	113.16	13.03	$537,957	1	6
Atherton and Branch	21	11	22.83	0.061	3.31	0.339	21.11	8.40	29.51	3.36	$510,701	19	53
Atherton and Hillcrest	50	9	30.03	0.047	3.88	0.304	49.07	7.44	56.51	22.60	$413,807	6	2
Atherton and Nittany	14	9	23.47	0.059	3.22	0.345	14.56	7.01	21.56	-5.12	$359,275	21	509
Atherton and White Course	29	7	13.73	0.097	1.36	0.555	27.52	3.87	31.39	16.30	$292,486	17	3
Beaver and Barnard	16	5	6.97	0.174	1.22	0.582	14.43	2.80	17.22	9.03	$180,751	28	12
College and Patterson	6	5	6.78	0.178	1.13	0.601	6.14	2.67	8.81	0.91	$154,916	67	82
College and Burrowes	58	7	70.60	0.020	4.57	0.271	58.26	6.34	64.60	-10.57	$145,686	4	514
Park and Allen	15	4	4.66	0.240	1.59	0.517	12.52	2.75	15.27	9.02	$139,901	34	13
Allen and Hamilton	13	4	4.67	0.240	1.16	0.595	11.01	2.31	13.31	7.49	$134,295	44	16
University and Marylyn	6	4	2.75	0.348	1.04	0.620	4.87	2.17	7.04	3.24	$119,923	82	55
Easterly and Pugh	20	3	5.71	0.205	1.53	0.525	17.07	2.23	19.30	12.06	$101,851	26	9
Atherton and Curtin	23	3	2.33	0.387	0.65	0.722	15.01	1.31	16.31	13.33	$101,111	31	5
Pugh and Prospect	10	4	2.74	0.350	0.54	0.759	7.46	1.37	8.83	5.56	$97,489	66	26
University and Hastings	12	5	7.68	0.161	3.75	0.311	11.31	4.61	15.92	4.48	$97,185	32	36
College and Allen	47	3	34.72	0.041	1.76	0.490	46.50	2.39	48.89	12.41	$96,383	7	8
Waupelani and O'Bryan	13	3	4.10	0.264	1.10	0.606	10.65	1.85	12.50	7.30	$93,826	51	17
College and Fraser	37	3	31.59	0.045	1.52	0.528	36.76	2.22	38.97	5.87	$85,270	11	23
Garner and Prospect	10	3	3.68	0.286	0.85	0.666	8.19	1.57	9.76	5.23	$85,245	61	30
Easterly and Garner	4	3	3.83	0.278	0.81	0.677	3.95	1.52	5.47	0.83	$72,104	97	83
Atherton and Fairmount	19	4	6.56	0.183	3.43	0.331	16.72	3.81	20.53	10.54	$66,384	23	11
Atherton and Norma	2	3	1.86	0.441	0.60	0.739	1.94	1.22	3.17	0.70	$63,709	123	91
Atherton and Logan	14	3	16.34	0.083	1.80	0.485	14.19	2.42	16.61	-1.53	$56,603	30	491
Pugh and Foster	12	2	3.64	0.288	0.85	0.666	9.60	1.23	10.83	6.34	$55,320	55	20
Pugh and Fairmount	11	2	3.38	0.304	0.75	0.693	8.68	1.13	9.82	5.69	$53,482	59	24

[1] The values in this table have been rounded for formatting. Using the rounded values to calculate expected and excess crashes may not match exactly with the final values presented in the table.

[2] Obs. = Observed.

[3] Pred. = Predicted.

[4] Exp. = Expected.

Intersection	Obs.[2] PDO	Obs. Injury	Pred.[3] PDO	w PDO	Pred. Injury	w Injury	Exp.[4] PDO	Exp. Injury	Exp. Total	Excess Total	Severity Weighted Excess	Rank by Exp. Total	Rank by Excess Total
Atherton and Mitchell	11	2	2.19	0.402	0.70	0.708	7.46	1.08	8.54	5.65	$53,012	69	25
Beaver and Locust	35	2	28.01	0.050	1.29	0.569	34.65	1.59	36.25	6.95	$49,484	14	19
Park and Bigler	8	2	3.15	0.319	1.03	0.623	6.45	1.39	7.85	3.67	$46,320	72	47
Allen and Nittany	9	2	4.41	0.250	1.05	0.617	7.85	1.42	9.27	3.80	$46,248	65	44
Pugh and Nittany	9	2	2.54	0.367	0.48	0.781	6.63	0.81	7.44	4.42	$45,129	78	39
Atherton and Sunrise Terrace	7	2	3.06	0.324	1.02	0.625	5.72	1.39	7.11	3.03	$44,686	80	57
College and Hiester	23	1	8.16	0.153	0.21	0.889	20.73	0.30	21.03	12.66	$43,472	22	7
Atherton and Old Boalsburg	5	2	2.72	0.351	0.91	0.650	4.20	1.29	5.50	1.86	$42,628	96	65
Westerly and Oneida	4	4	1.23	0.545	0.17	0.908	2.49	0.52	3.01	1.61	$39,132	126	71
College and Sowers	21	1	8.16	0.153	0.21	0.889	19.04	0.30	19.33	10.97	$38,806	25	10
Foster and Locust	8	2	3.00	0.329	0.37	0.821	6.36	0.66	7.02	3.64	$38,773	83	48
Garner and Fairmount	7	2	2.26	0.395	0.39	0.813	5.13	0.69	5.82	3.17	$38,428	93	56
College and Buckhout	9	2	3.10	0.322	0.32	0.841	7.10	0.59	7.69	4.27	$38,114	74	42
Atherton and Woodland	4	2	1.72	0.461	0.48	0.781	2.95	0.81	3.76	1.56	$37,261	116	76
College and Barnard	18	2	8.96	0.141	1.76	0.491	16.72	1.88	18.60	7.89	$33,902	27	14
Atherton and Highland	13	2	12.81	0.103	1.22	0.581	12.98	1.55	14.53	0.49	$33,464	38	97
Fraser and Hamilton	2	2	1.78	0.452	0.32	0.839	1.90	0.59	2.50	0.39	$27,630	130	113
Garner and McCormick	1	2	1.80	0.450	0.28	0.857	1.36	0.53	1.89	-0.19	$23,720	152	411
Allen and Calder Alley	17	1	12.10	0.108	0.36	0.824	16.47	0.47	16.94	4.48	$23,399	29	37
Westerly and Plaza	6	2	1.38	0.516	0.17	0.909	3.62	0.34	3.95	2.40	$23,081	114	59
College and McAllister	14	1	8.16	0.153	0.21	0.889	13.11	0.30	13.40	5.04	$22,476	43	32
University and Stony	8	1	1.62	0.476	0.43	0.796	4.96	0.55	5.51	3.46	$20,894	95	51
Atherton and Arbor	8	1	2.16	0.405	0.69	0.711	5.64	0.78	6.42	3.56	$18,692	88	50
College and Sparks	12	1	5.78	0.203	0.87	0.660	10.74	0.92	11.66	5.00	$18,016	53	33
Garner and Hamilton	8	1	3.33	0.307	0.73	0.700	6.57	0.81	7.38	3.32	$17,264	79	54
Fraser and Fairmount	6	1	3.47	0.298	0.48	0.780	5.25	0.59	5.84	1.89	$16,521	92	64
Beaver and Hiester	15	0	7.60	0.162	0.19	0.898	13.80	0.17	13.97	6.18	$15,104	41	21
Beaver and Hetzel	11	2	21.00	0.065	0.80	0.679	11.66	1.19	12.84	-8.96	$13,247	48	512
Westerly and Corl	3	1	2.15	0.407	0.42	0.802	2.65	0.53	3.19	0.62	$13,061	122	93
Beaver and McAllister	14	0	7.60	0.162	0.19	0.898	12.96	0.17	13.13	5.34	$12,796	45	27
Easterly and Old Boalsburg	3	1	2.78	0.346	0.49	0.774	2.92	0.61	3.53	0.26	$11,967	117	123
Calder Alley and Sowers	13	0	0.80	0.648	0.02	0.991	5.10	0.02	5.11	4.30	$11,820	101	40

Intersection	Obs.[2] PDO	Obs. Injury	Pred.[3] PDO	w PDO	Pred. Injury	w Injury	Exp.[4] PDO	Exp. Injury	Exp. Total	Excess Total	Severity Weighted Excess	Rank by Exp. Total	Rank by Excess Total
Corl and Osmond	2	1	1.23	0.544	0.31	0.844	1.58	0.42	2.00	0.46	$11,820	147	98
Fraser and Nittany	4	1	3.73	0.283	0.54	0.759	3.92	0.65	4.57	0.30	$11,810	104	120
Garner and Foster	10	1	4.21	0.259	1.01	0.627	8.50	1.00	9.50	4.29	$11,549	63	41
Fairmount and Sparks	2	1	1.67	0.468	0.29	0.855	1.85	0.39	2.24	0.28	$10,969	135	121
Atherton and Railroad	9	1	8.69	0.145	0.65	0.722	8.95	0.75	9.71	0.36	$10,488	62	117
Calder Alley and High	9	0	1.45	0.503	0.02	0.988	5.20	0.02	5.22	3.75	$10,303	98	45
Whitehall and Blue Course	4	2	3.87	0.276	1.81	0.483	3.96	1.91	5.87	0.19	$10,033	91	125
College and Gill	11	0	3.10	0.322	0.32	0.841	8.45	0.27	8.72	5.31	$9,572	68	28
Calder Alley and McAllister	9	0	1.16	0.559	0.02	0.991	4.62	0.02	4.63	3.46	$9,503	103	52
Blue Course and Southgate	1	1	2.34	0.386	0.48	0.779	1.52	0.60	2.11	-0.71	$9,360	139	467
Garner and Calder Alley	15	0	9.72	0.132	0.26	0.869	14.31	0.22	14.53	4.55	$9,234	39	34
Allen and Prospect	6	1	3.87	0.275	0.86	0.665	5.41	0.90	6.32	1.59	$9,138	89	74
Park and McKee	4	1	2.42	0.378	0.81	0.677	3.40	0.87	4.27	1.04	$8,942	107	79
Park and Burrowes	4	1	2.45	0.376	0.82	0.673	3.42	0.88	4.30	1.03	$8,485	106	80
Sparks and Hamilton	1	1	1.46	0.502	0.21	0.888	1.23	0.30	1.53	-0.14	$8,321	172	389
Pugh and Calder Alley	16	0	10.83	0.120	0.31	0.845	15.38	0.26	15.65	4.50	$7,609	33	35
Park and Fischer	0	1	2.65	0.357	0.52	0.767	0.95	0.63	1.58	-1.59	$6,757	165	493
Branch and Country Club	0	1	1.48	0.498	0.21	0.892	0.74	0.29	1.03	-0.66	$6,662	214	465
University and Bellaire	14	2	4.60	0.242	2.24	0.431	11.72	2.10	13.83	6.98	$5,575	42	18
Barnard and Calder Alley	0	1	1.13	0.566	0.14	0.925	0.64	0.20	0.84	-0.43	$5,177	240	449
Sparks and Calder Alley	1	1	0.85	0.634	0.09	0.948	0.90	0.14	1.04	0.10	$4,937	211	168
Atherton and Hamilton	10	2	4.34	0.253	2.13	0.443	8.57	2.06	10.63	4.15	$4,259	56	43
Burrowes and Highland	5	0	1.36	0.520	0.11	0.941	3.11	0.10	3.21	1.74	$4,176	121	67
Prospect and Locust	5	0	1.39	0.515	0.11	0.938	3.14	0.10	3.25	1.75	$4,133	120	66
Foster and Patterson	1	1	0.65	0.694	0.07	0.961	0.76	0.11	0.86	0.14	$4,007	238	132
Burrowes and Nittany	5	0	0.75	0.662	0.04	0.976	2.19	0.04	2.23	1.43	$3,847	136	77
Foster and Barnard	1	1	0.63	0.699	0.06	0.964	0.74	0.10	0.84	0.14	$3,704	239	133
Calder Alley and Kelly	4	0	1.16	0.559	0.02	0.991	2.41	0.02	2.43	1.25	$3,433	131	78
Pugh and Highland	6	0	1.68	0.467	0.25	0.873	3.98	0.21	4.20	2.27	$3,183	110	60
Foster and Sparks	5	0	1.16	0.559	0.18	0.906	2.86	0.16	3.02	1.68	$2,969	125	68
Locust and Highland	4	0	0.64	0.696	0.04	0.977	1.66	0.04	1.70	1.02	$2,712	157	81
Burrowes and Hamilton	0	1	0.41	0.780	0.05	0.973	0.32	0.07	0.40	-0.07	$2,399	340	346

Intersection	Obs.[2] PDO	Obs. Injury	Pred.[3] PDO	w PDO	Pred. Injury	w Injury	Exp.[4] PDO	Exp. Injury	Exp. Total	Excess Total	Severity Weighted Excess	Rank by Exp. Total	Rank by Excess Total
Calder Alley and Hetzel	3	0	1.00	0.595	0.02	0.988	1.81	0.02	1.83	0.81	$2,205	154	84
Calder Alley and Hiester	3	0	1.45	0.503	0.02	0.988	2.22	0.02	2.24	0.77	$2,092	134	88
Garner and Bradley	1	1	0.34	0.814	0.03	0.983	0.46	0.05	0.51	0.14	$2,036	310	134
Fraser and Highland	3	0	0.77	0.657	0.05	0.970	1.54	0.05	1.59	0.76	$1,954	164	89
Fairmount and Locust	5	0	2.21	0.400	0.23	0.882	3.88	0.20	4.08	1.65	$1,897	112	69
Nittany and Locust	3	0	0.96	0.605	0.08	0.955	1.77	0.08	1.84	0.80	$1,857	153	86
Foster and "G" Alley	3	0	0.70	0.679	0.07	0.960	1.44	0.07	1.50	0.74	$1,746	174	90
Prospect and Apple Alley	3	0	0.90	0.622	0.10	0.944	1.69	0.09	1.79	0.79	$1,629	155	87
Barnard and Clay Alley	4	0	0.27	0.845	0.02	0.988	0.85	0.02	0.87	0.58	$1,565	237	94
Robin Alley and "F" Alley	1	1	0.27	0.845	0.02	0.988	0.38	0.03	0.41	0.12	$1,464	337	149
Orlando and Taylor	3	0	0.37	0.800	0.03	0.982	0.89	0.03	0.92	0.53	$1,395	230	96
Sparks and Nittany	3	0	1.10	0.573	0.14	0.926	1.91	0.13	2.03	0.80	$1,226	145	85
Calder Alley and Humes	2	0	0.84	0.636	0.01	0.994	1.27	0.01	1.28	0.42	$1,154	187	99
Calder Alley and "H" Alley	4	0	0.16	0.904	0.01	0.994	0.53	0.01	0.54	0.37	$1,010	301	115
Allen and Foster	13	1	5.15	0.222	1.35	0.557	11.26	1.20	12.45	5.95	$1,010	52	22
Irvin and Walnut	2	0	0.55	0.727	0.05	0.969	0.95	0.05	1.00	0.39	$916	219	110
Foster and Berry Alley	2	0	0.60	0.711	0.06	0.965	1.00	0.06	1.06	0.40	$903	209	108
Fairmount and "C" Alley	2	0	0.62	0.704	0.06	0.964	1.03	0.06	1.09	0.41	$894	206	106
Southgate and Highlandon	2	0	0.63	0.702	0.06	0.963	1.04	0.06	1.10	0.41	$889	205	105
Norma and Fry	2	0	0.47	0.759	0.05	0.972	0.84	0.05	0.88	0.37	$881	235	116
Nittany and Berry Alley	2	0	0.99	0.597	0.07	0.961	1.40	0.07	1.46	0.40	$839	176	107
Barnard and Highland	2	0	0.73	0.670	0.08	0.957	1.15	0.07	1.22	0.42	$834	190	102
Nittany and "G" Alley	2	0	0.75	0.662	0.08	0.954	1.17	0.08	1.25	0.42	$776	188	101
Pugh and Bird Alley	2	0	0.79	0.651	0.09	0.951	1.21	0.08	1.29	0.42	$725	183	100
Highland and "H" Alley	2	0	0.27	0.845	0.02	0.988	0.54	0.02	0.56	0.27	$714	293	122
Patterson and Calder Alley	2	0	0.85	0.633	0.09	0.948	1.27	0.09	1.36	0.42	$662	179	103
Garner and Holly Alley	2	0	0.92	0.616	0.11	0.940	1.33	0.10	1.43	0.41	$493	178	104
Barnard and Railroad	2	0	0.16	0.904	0.01	0.994	0.33	0.01	0.34	0.18	$482	355	126
Branch and Sandpiper	2	0	0.16	0.904	0.01	0.994	0.33	0.01	0.34	0.18	$482	355	126
Gill and Railroad	2	0	0.16	0.904	0.01	0.994	0.33	0.01	0.34	0.18	$482	355	126
Hetzel and Wilson Alley	2	0	0.16	0.904	0.01	0.994	0.33	0.01	0.34	0.18	$482	355	126
Hamilton and "C" Alley	2	0	1.01	0.592	0.12	0.935	1.41	0.11	1.53	0.39	$331	173	109

Intersection	Obs.[2] PDO	Obs. Injury	Pred.[3] PDO	w PDO	Pred. Injury	w Injury	Exp.[4] PDO	Exp. Injury	Exp. Total	Excess Total	Severity Weighted Excess	Rank by Exp. Total	Rank by Excess Total
Calder Alley and Miller	1	0	0.58	0.717	0.01	0.994	0.70	0.01	0.71	0.12	$320	261	153
Glenn Alley and Hillcrest	1	0	0.32	0.822	0.03	0.985	0.44	0.02	0.47	0.12	$297	320	152
Allen and Thomas	1	0	0.37	0.801	0.03	0.982	0.49	0.03	0.52	0.13	$291	307	147
Mitchell and Willard	1	0	0.39	0.793	0.03	0.981	0.51	0.03	0.54	0.13	$290	299	144
Foster and Apple Alley	2	0	1.03	0.589	0.12	0.934	1.43	0.11	1.54	0.39	$290	169	111
Irvin and Apple Alley	1	0	0.28	0.840	0.02	0.987	0.40	0.02	0.42	0.11	$289	335	157
Bayberry and Hedgerow	1	0	0.37	0.798	0.03	0.981	0.50	0.03	0.53	0.13	$288	305	145
Gill and Clay Alley	1	0	0.27	0.845	0.02	0.988	0.38	0.02	0.40	0.11	$288	339	160
Holmes and Lehman	1	0	0.41	0.784	0.03	0.980	0.53	0.03	0.57	0.13	$284	290	140
Patterson and Highland	1	0	0.41	0.784	0.03	0.980	0.53	0.03	0.57	0.13	$284	289	139
Allen and Lehman	1	0	0.40	0.786	0.04	0.980	0.53	0.03	0.56	0.13	$280	291	143
Elk Alley and Holly Alley	1	0	0.23	0.867	0.01	0.994	0.33	0.01	0.34	0.10	$278	362	166
High and Wilson Alley	1	0	0.23	0.867	0.01	0.994	0.33	0.01	0.34	0.10	$278	362	166
Fairmount and Buckhout	1	0	0.41	0.782	0.04	0.979	0.54	0.04	0.58	0.13	$275	288	137
McKee and Mitchell	1	0	0.21	0.877	0.01	0.992	0.30	0.01	0.32	0.10	$258	377	170
Fraser and Logan	1	0	0.43	0.776	0.04	0.976	0.55	0.04	0.59	0.13	$255	283	136
Garner and Homan	1	0	0.46	0.761	0.04	0.976	0.59	0.04	0.63	0.13	$255	275	142
Hillcrest and Martin Terrace	1	0	0.43	0.774	0.04	0.976	0.56	0.04	0.60	0.13	$252	281	135
Mitchell and Thomas	1	0	0.20	0.882	0.01	0.992	0.29	0.01	0.30	0.09	$250	381	172
William and Nimitz	1	0	0.45	0.767	0.04	0.975	0.58	0.04	0.62	0.13	$247	279	138
Glenn Alley and Orlando	1	0	0.46	0.763	0.04	0.975	0.59	0.04	0.63	0.13	$247	276	141
"D" Alley and Wren Alley	1	0	0.16	0.904	0.01	0.994	0.24	0.01	0.25	0.08	$217	419	173
Branch and Joyce	1	0	0.16	0.904	0.01	0.994	0.24	0.01	0.25	0.08	$217	419	173
Branch and Suzy	1	0	0.16	0.904	0.01	0.994	0.24	0.01	0.25	0.08	$217	419	173
Clay Alley and Orange Alley	1	0	0.16	0.904	0.01	0.994	0.24	0.01	0.25	0.08	$217	419	173
Fairmount and Glenn Alley	1	0	0.16	0.904	0.01	0.994	0.24	0.01	0.25	0.08	$217	419	173
Highland and "A" Alley	1	0	0.16	0.904	0.01	0.994	0.24	0.01	0.25	0.08	$217	419	173
Highland and "D" Alley	1	0	0.16	0.904	0.01	0.994	0.24	0.01	0.25	0.08	$217	419	173
Joyce and Suzy	1	0	0.16	0.904	0.01	0.994	0.24	0.01	0.25	0.08	$217	419	173
Sunset and Arbor	1	0	0.50	0.746	0.05	0.972	0.63	0.05	0.68	0.13	$210	270	148
Ridge and Sunset	1	0	0.52	0.738	0.05	0.972	0.65	0.05	0.69	0.12	$208	267	150
Gill and Highland	1	0	0.54	0.732	0.05	0.971	0.66	0.05	0.71	0.12	$192	260	151

Intersection	Obs.[2] PDO	Obs. Injury	Pred.[3] PDO	w PDO	Pred. Injury	w Injury	Exp.[4] PDO	Exp. Injury	Exp. Total	Excess Total	Severity Weighted Excess	Rank by Exp. Total	Rank by Excess Total
Barnard and Nittany	1	0	0.58	0.716	0.06	0.968	0.70	0.05	0.76	0.12	$142	256	154
Barnard and Sparrow Alley	1	0	0.58	0.716	0.06	0.968	0.70	0.05	0.76	0.12	$142	256	154
Hamilton and Hetzel	1	0	0.59	0.715	0.06	0.965	0.70	0.06	0.76	0.12	$106	253	156
College and Hetzel	13	0	10.75	0.120	0.33	0.838	12.73	0.27	13.00	1.93	$90	47	63
McKee and Hartswick	1	0	0.62	0.704	0.06	0.964	0.73	0.06	0.79	0.11	$84	248	161
Foster and "H" Alley	1	0	0.63	0.699	0.06	0.964	0.74	0.06	0.81	0.11	$75	245	164
Bayberry and Grace	1	0	0.59	0.713	0.07	0.962	0.71	0.06	0.77	0.11	$60	252	158
Bayberry and Saxton	1	0	0.60	0.712	0.07	0.961	0.71	0.07	0.78	0.11	$55	250	159
Prospect and Wolf Alley	1	0	0.64	0.696	0.07	0.962	0.75	0.06	0.82	0.11	$40	244	165
Foster and Keller	1	0	0.62	0.703	0.07	0.961	0.73	0.07	0.80	0.11	$39	247	162
Martin Terrace and Taylor	2	0	1.02	0.592	0.14	0.924	1.42	0.13	1.55	0.39	$35	166	112
Whitehall and Fry	1	0	0.62	0.703	0.07	0.960	0.73	0.07	0.80	0.11	$20	246	163
Gill and Nittany	1	0	0.66	0.690	0.07	0.959	0.77	0.07	0.84	0.10	-$20	241	169
Redgate and Redgate Lane	0	0	0.11	0.928	0.01	0.996	0.11	0.01	0.11	-0.01	-$25	530	196
McKee and Ferguson	0	0	0.12	0.927	0.01	0.996	0.11	0.01	0.11	-0.01	-$26	528	198
William and Bradley	0	0	0.11	0.928	0.01	0.996	0.11	0.01	0.11	-0.01	-$26	529	197
Penfield and Stony	0	0	0.12	0.924	0.01	0.996	0.11	0.01	0.12	-0.01	-$28	527	199
Barley and Wintergreen	0	0	0.14	0.915	0.01	0.995	0.13	0.01	0.13	-0.01	-$36	526	201
Jackson and Alley	0	0	0.14	0.914	0.01	0.995	0.13	0.01	0.14	-0.01	-$37	525	202
Thomas and November Alley	0	0	0.15	0.909	0.01	0.995	0.13	0.01	0.14	-0.01	-$42	524	204
High and Holly Alley	0	0	0.15	0.909	0.01	0.995	0.13	0.01	0.14	-0.01	-$42	523	205
Wheatfield and Greenfield	0	0	0.15	0.907	0.01	0.994	0.14	0.01	0.15	-0.01	-$45	522	206
Adams and Jackson	0	0	0.15	0.905	0.01	0.994	0.14	0.01	0.15	-0.01	-$46	521	208
Burrowes and Daisy	0	0	0.15	0.905	0.01	0.994	0.14	0.01	0.15	-0.01	-$46	520	209
"D" Alley and Hill Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
"D" Alley and Lytle Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
"E" Alley and Wren Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
"H" Alley and Hawk Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Allen and Curtin	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Allen and Waypoint	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Apple Alley and Ash Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Apple Alley and Birch Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210

Intersection	Obs.[2] PDO	Obs. Injury	Pred.[3] PDO	w PDO	Pred. Injury	w Injury	Exp.[4] PDO	Exp. Injury	Exp. Total	Excess Total	Severity Weighted Excess	Rank by Exp. Total	Rank by Excess Total
Apple Alley and Chestnut Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Apple Alley and Elm Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Apple Alley and Orchard Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
August Alley and Grove Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Berry Alley and Ash Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Berry Alley and Birch Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Berry Alley and Chestnut Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Berry Alley and Elm Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Buckhout and Grass Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Calder Alley and Keller	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Calder Alley and Lark Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Clay Alley and Coal Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Clay Alley and Wood Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Clover Alley and Oak Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Fairmount and "E" Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Foster and "D" Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Fraser and Marigold Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Fraternity Row and Holly Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Gill and Hamilton	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Grass Alley and Thorn Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Hedgerow and Hadden	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Highland and "F" Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Highland and "I" Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Highland and "K" Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Highland and "L" Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Highland and "M" Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Highland and "N" Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Lews Alley and October Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Lews Alley and September Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Linden and Maple	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Linden and Tulip	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Maple and Elm Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210

Intersection	Obs.[2] PDO	Obs. Injury	Pred.[3] PDO	w PDO	Pred. Injury	w Injury	Exp.[4] PDO	Exp. Injury	Exp. Total	Excess Total	Severity Weighted Excess	Rank by Exp. Total	Rank by Excess Total
Maple and Tulip	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
McKee and November Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Nimitz and Inverary	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Orchard Alley and "L" Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Orchard Alley and "M" Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Osage Alley and Holly Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Osage Alley and Oak Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Railroad and Coal Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Railroad and Orange Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Railroad and Thorn Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Railroad and Wood Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Ridge and Glenn Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Sandpiper and Colonial	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Sandpiper and Sawgrass	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Shortlidge and Pollock	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Sparks and Clay Alley	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Sparks and Railroad	0	0	0.16	0.904	0.01	0.994	0.14	0.01	0.15	-0.02	-$47	463	210
Walnut and Sunrise Terrace	0	0	0.16	0.900	0.01	0.994	0.15	0.01	0.16	-0.02	-$52	462	267
Mitchell and Jackson	0	0	0.17	0.898	0.01	0.994	0.15	0.01	0.16	-0.02	-$53	461	269
Wheatfield and Webster	0	0	0.17	0.899	0.01	0.994	0.15	0.01	0.16	-0.02	-$53	460	268
Franklin and Clarence	0	0	0.18	0.891	0.01	0.994	0.16	0.01	0.17	-0.02	-$61	458	271
Thomas and October Alley	0	0	0.18	0.892	0.01	0.993	0.16	0.01	0.17	-0.02	-$61	459	270
Mitchell and Holmes	0	0	0.18	0.891	0.01	0.993	0.16	0.01	0.17	-0.02	-$62	457	272
Adams and Thomas	0	0	0.18	0.890	0.01	0.993	0.16	0.01	0.17	-0.02	-$64	456	273
Smithfield and Smithfield Cir. North	0	0	0.19	0.887	0.01	0.993	0.17	0.01	0.18	-0.02	-$68	453	275
Smithfield and Smithfield Cir. South	0	0	0.19	0.887	0.01	0.993	0.17	0.01	0.18	-0.02	-$68	453	275
Burrowes and Hillcrest	0	0	0.18	0.889	0.01	0.992	0.16	0.01	0.18	-0.02	-$69	455	274
Old Boalsburg and Lytle Alley	0	0	0.20	0.881	0.01	0.992	0.18	0.01	0.19	-0.02	-$77	452	277
Penfield and Royal	0	0	0.20	0.880	0.02	0.991	0.18	0.01	0.19	-0.02	-$80	451	278
Buckhout and Calder Alley	0	0	0.23	0.867	0.01	0.994	0.20	0.01	0.21	-0.03	-$89	442	283
Buckhout and Harley	0	0	0.23	0.867	0.01	0.994	0.20	0.01	0.21	-0.03	-$89	442	283
Burrowes and Hill Alley	0	0	0.23	0.867	0.01	0.994	0.20	0.01	0.21	-0.03	-$89	442	283

Intersection	Obs.[2] PDO	Obs. Injury	Pred.[3] PDO	w PDO	Pred. Injury	w Injury	Exp.[4] PDO	Exp. Injury	Exp. Total	Excess Total	Severity Weighted Excess	Rank by Exp. Total	Rank by Excess Total
Fraser and Iris Alley	0	0	0.23	0.867	0.01	0.994	0.20	0.01	0.21	-0.03	-$89	442	283
Linden and Entrance	0	0	0.23	0.867	0.01	0.994	0.20	0.01	0.21	-0.03	-$89	442	283
McKean and Mifflin	0	0	0.23	0.867	0.01	0.994	0.20	0.01	0.21	-0.03	-$89	442	283
Shortlidge and McKean	0	0	0.23	0.867	0.01	0.994	0.20	0.01	0.21	-0.03	-$89	442	283
Calder Alley and Thrush Alley	0	0	0.21	0.873	0.02	0.991	0.19	0.02	0.20	-0.03	-$89	450	279
McCormick and Redgate	0	0	0.22	0.871	0.01	0.991	0.19	0.01	0.20	-0.03	-$90	449	280
Amelia and Lillian	0	0	0.23	0.867	0.02	0.990	0.20	0.02	0.21	-0.03	-$99	440	282
William and Ellen	0	0	0.23	0.867	0.02	0.990	0.20	0.02	0.21	-0.03	-$99	441	281
Barnard and Prospect	0	0	0.23	0.866	0.02	0.990	0.20	0.02	0.21	-0.03	-$101	439	291
Kemmer and Legion	0	0	0.23	0.866	0.02	0.990	0.20	0.02	0.21	-0.03	-$102	438	290
Metz and Butz	0	0	0.23	0.865	0.02	0.990	0.20	0.02	0.22	-0.03	-$102	437	292
Burrowes and Ridge	0	0	0.24	0.860	0.02	0.989	0.21	0.02	0.22	-0.03	-$113	436	294
Old Boalsburg and Hutchinson	0	0	0.24	0.858	0.02	0.989	0.21	0.02	0.23	-0.03	-$115	435	295
Walnut and Lytle Alley	0	0	0.26	0.852	0.02	0.989	0.22	0.02	0.24	-0.04	-$125	432	297
Walnut and Marigold Alley	0	0	0.26	0.852	0.02	0.989	0.22	0.02	0.24	-0.04	-$125	432	297
Old Boalsburg and Ellen	0	0	0.25	0.853	0.02	0.989	0.22	0.02	0.24	-0.04	-$125	434	296
Walnut and Crestmont	0	0	0.26	0.851	0.02	0.989	0.22	0.02	0.24	-0.04	-$126	431	300
Irvin and "C" Alley	0	0	0.26	0.852	0.02	0.989	0.22	0.02	0.24	-0.04	-$127	430	299
Park and Fairway	0	0	0.26	0.851	0.02	0.987	0.22	0.02	0.24	-0.04	-$135	428	301
Park and Franklin	0	0	0.26	0.851	0.02	0.987	0.22	0.02	0.24	-0.04	-$135	428	301
William and Homan	0	0	0.27	0.845	0.02	0.989	0.23	0.02	0.25	-0.04	-$138	405	320
Allen and Fischer	0	0	0.27	0.845	0.02	0.988	0.23	0.02	0.25	-0.04	-$138	406	305
Cresson and New Alley	0	0	0.27	0.845	0.02	0.988	0.23	0.02	0.25	-0.04	-$138	406	305
Fairmount and "D" Alley	0	0	0.27	0.845	0.02	0.988	0.23	0.02	0.25	-0.04	-$138	406	305
Fraser and Hill Alley	0	0	0.27	0.845	0.02	0.988	0.23	0.02	0.25	-0.04	-$138	406	305
Hillcrest and Franklin	0	0	0.27	0.845	0.02	0.988	0.23	0.02	0.25	-0.04	-$138	406	305
Holmes and August Alley	0	0	0.27	0.845	0.02	0.988	0.23	0.02	0.25	-0.04	-$138	406	305
McKee and Alley	0	0	0.27	0.845	0.02	0.988	0.23	0.02	0.25	-0.04	-$138	406	305
McKee and August Alley	0	0	0.27	0.845	0.02	0.988	0.23	0.02	0.25	-0.04	-$138	406	305
Orchard Alley and "N" Alley	0	0	0.27	0.845	0.02	0.988	0.23	0.02	0.25	-0.04	-$138	406	305
Patterson and Grass Alley	0	0	0.27	0.845	0.02	0.988	0.23	0.02	0.25	-0.04	-$138	406	305
Ridge and Fairway	0	0	0.27	0.845	0.02	0.988	0.23	0.02	0.25	-0.04	-$138	406	305

Intersection	Obs.[2] PDO	Obs. Injury	Pred.[3] PDO	w PDO	Pred. Injury	w Injury	Exp.[4] PDO	Exp. Injury	Exp. Total	Excess Total	Severity Weighted Excess	Rank by Exp. Total	Rank by Excess Total
Ridge and Franklin	0	0	0.27	0.845	0.02	0.988	0.23	0.02	0.25	-0.04	-$138	406	305
Shortlidge and Curtin	0	0	0.27	0.845	0.02	0.988	0.23	0.02	0.25	-0.04	-$138	406	305
College and Locust	14	1	17.46	0.078	0.71	0.704	14.27	0.80	15.07	-3.10	-$138	35	505
Patterson and Nittany	0	0	0.27	0.847	0.02	0.988	0.23	0.02	0.25	-0.04	-$139	427	303
McCormick and Ringneck	0	0	0.27	0.845	0.02	0.988	0.23	0.02	0.25	-0.04	-$140	404	304
Nittany and "K" Alley	0	0	0.27	0.845	0.02	0.988	0.23	0.02	0.25	-0.04	-$140	403	318
Old Boalsburg and Stuart	0	0	0.27	0.843	0.02	0.988	0.23	0.02	0.25	-0.04	-$144	402	322
Fairway and Westview	0	0	0.28	0.841	0.02	0.988	0.23	0.02	0.25	-0.04	-$147	399	323
Franklin and Westview	0	0	0.28	0.841	0.02	0.988	0.23	0.02	0.25	-0.04	-$147	399	323
Burrowes and Prospect	0	0	0.27	0.845	0.02	0.986	0.23	0.02	0.25	-0.04	-$149	401	319
McKee and Adams	0	0	0.28	0.840	0.02	0.988	0.24	0.02	0.26	-0.05	-$151	398	326
Irvin and Berry Alley	0	0	0.28	0.840	0.02	0.987	0.24	0.02	0.26	-0.05	-$152	397	325
Adams and Holmes	0	0	0.29	0.837	0.02	0.987	0.24	0.02	0.26	-0.05	-$157	395	329
Foster and "N" Alley	0	0	0.29	0.838	0.02	0.987	0.24	0.02	0.26	-0.05	-$157	396	327
Foster and High	1	0	0.77	0.656	0.08	0.954	0.85	0.08	0.93	0.07	-$158	229	182
Crabapple and Barley	0	0	0.29	0.836	0.02	0.987	0.24	0.02	0.26	-0.05	-$159	394	330
Fairway and Clarence	0	0	0.30	0.833	0.02	0.988	0.25	0.02	0.27	-0.05	-$161	391	333
Irvin and "D" Alley	0	0	0.29	0.836	0.02	0.987	0.24	0.02	0.26	-0.05	-$161	392	332
Grace and Amelia	0	0	0.29	0.837	0.02	0.986	0.24	0.02	0.26	-0.05	-$163	393	328
Allen and Hartswick	1	0	0.76	0.659	0.08	0.954	0.84	0.08	0.92	0.08	-$163	231	181
Park and Sunset	0	0	0.29	0.836	0.03	0.984	0.24	0.03	0.27	-0.05	-$173	390	331
Fairmount and "H" Alley	0	0	0.30	0.829	0.02	0.986	0.25	0.02	0.28	-0.05	-$179	389	334
Saxton and Wheatfield	0	0	0.31	0.828	0.02	0.986	0.25	0.02	0.28	-0.05	-$181	388	336
Osmond and Metz	0	0	0.31	0.828	0.03	0.985	0.25	0.03	0.28	-0.05	-$187	387	335
Fairmount and Fox	0	0	0.31	0.825	0.03	0.985	0.26	0.02	0.28	-0.05	-$187	386	337
Saxton and Edgewood	0	0	0.31	0.825	0.03	0.985	0.26	0.03	0.28	-0.06	-$189	384	338
Saxton and Windsor	0	0	0.31	0.825	0.03	0.985	0.26	0.03	0.28	-0.06	-$189	384	338
Crabapple and Thistlewood	0	0	0.32	0.824	0.03	0.985	0.26	0.03	0.29	-0.06	-$192	383	340
Allen and Doris	0	0	0.32	0.822	0.03	0.985	0.26	0.03	0.29	-0.06	-$198	382	341
Foster and "F" Alley	1	0	0.79	0.650	0.08	0.952	0.87	0.08	0.95	0.07	-$212	223	185
Bayberry and Barley	0	0	0.34	0.812	0.03	0.984	0.28	0.03	0.30	-0.06	-$223	380	345
Walnut and Iris Alley	0	0	0.37	0.799	0.02	0.989	0.30	0.02	0.31	-0.07	-$226	378	351

Intersection	Obs.[2] PDO	Obs. Injury	Pred.[3] PDO	w PDO	Pred. Injury	w Injury	Exp.[4] PDO	Exp. Injury	Exp. Total	Excess Total	Severity Weighted Excess	Rank by Exp. Total	Rank by Excess Total
Saxton and Webster	0	0	0.34	0.812	0.03	0.983	0.28	0.03	0.31	-0.06	-$227	379	344
Pugh and Orchard Alley	1	0	0.79	0.651	0.09	0.951	0.86	0.08	0.95	0.07	-$235	224	184
Prospect and Walnut	0	0	0.36	0.804	0.03	0.983	0.29	0.03	0.32	-0.07	-$247	376	348
Hillcrest and Sunset	0	0	0.36	0.804	0.03	0.982	0.29	0.03	0.32	-0.07	-$251	375	347
Orlando and Oak Alley	0	0	0.37	0.800	0.03	0.982	0.29	0.03	0.32	-0.07	-$256	374	349
Glenn Alley and Martin Terrace	0	0	0.37	0.798	0.03	0.982	0.30	0.03	0.33	-0.08	-$262	372	352
Glenn Alley and S. Glen Cir.	0	0	0.37	0.798	0.03	0.982	0.30	0.03	0.33	-0.08	-$262	372	352
Hillcrest and Fairway	0	0	0.38	0.797	0.03	0.980	0.30	0.03	0.33	-0.08	-$277	370	354
South Sparks and Storch	0	0	0.38	0.795	0.03	0.981	0.30	0.03	0.33	-0.08	-$278	369	355
Allen and November Alley	0	0	0.38	0.795	0.03	0.981	0.30	0.03	0.33	-0.08	-$278	366	356
Allen and October Alley	0	0	0.38	0.795	0.03	0.981	0.30	0.03	0.33	-0.08	-$278	366	356
Allen and September Alley	0	0	0.38	0.795	0.03	0.981	0.30	0.03	0.33	-0.08	-$278	366	356
Old Boalsburg and South Hills	0	0	0.37	0.800	0.04	0.979	0.29	0.04	0.33	-0.07	-$280	371	350
Fraser and Crestmont	0	0	0.38	0.793	0.03	0.981	0.30	0.03	0.34	-0.08	-$285	364	359
Fraser and Lytle Alley	0	0	0.38	0.793	0.03	0.981	0.30	0.03	0.34	-0.08	-$285	364	359
Allen and Lytle Alley	1	0	0.83	0.639	0.09	0.950	0.89	0.08	0.98	0.06	-$286	220	187
Gill and Hawk Alley	0	0	0.39	0.791	0.03	0.981	0.31	0.03	0.34	-0.08	-$287	360	362
Gill and Hill Alley	0	0	0.39	0.791	0.03	0.981	0.31	0.03	0.34	-0.08	-$287	360	362
Smithfield and Kemmer	0	0	0.39	0.791	0.03	0.980	0.31	0.03	0.34	-0.08	-$292	359	361
Barnard and Hill Alley	0	0	0.39	0.789	0.03	0.981	0.31	0.03	0.34	-0.08	-$294	354	364
Allen and August Alley	0	0	0.40	0.786	0.04	0.980	0.31	0.03	0.35	-0.09	-$310	353	366
Holmes and Hartswick	0	0	0.41	0.784	0.03	0.980	0.32	0.03	0.35	-0.09	-$310	352	369
Patterson and Orchard Alley	0	0	0.41	0.784	0.03	0.980	0.32	0.03	0.35	-0.09	-$311	351	370
Fairmount and Gill	1	0	0.81	0.644	0.09	0.948	0.88	0.09	0.97	0.06	-$314	222	186
Walnut and Logan	0	0	0.40	0.786	0.04	0.978	0.32	0.04	0.35	-0.09	-$322	350	367
Bayberry and Webster	0	0	0.41	0.783	0.04	0.979	0.32	0.04	0.36	-0.09	-$324	348	372
Crabapple and Amelia	0	0	0.40	0.785	0.04	0.978	0.32	0.04	0.35	-0.09	-$325	349	368
Saxton and Bayberry	1	0	0.77	0.656	0.10	0.945	0.85	0.09	0.94	0.07	-$339	226	183
Fairmount and Robin Alley	0	0	0.42	0.776	0.04	0.978	0.33	0.04	0.37	-0.10	-$347	346	374
Old Boalsburg and Whitehall	0	0	0.41	0.784	0.04	0.975	0.32	0.04	0.36	-0.09	-$348	347	371
Nimitz and Penfield	0	0	0.44	0.771	0.04	0.979	0.34	0.04	0.37	-0.10	-$353	345	376
Fraser and Prospect	2	0	1.14	0.563	0.16	0.914	1.52	0.15	1.66	0.36	-$365	160	118

Intersection	Obs.[2] PDO	Obs. Injury	Pred.[3] PDO	w PDO	Pred. Injury	w Injury	Exp.[4] PDO	Exp. Injury	Exp. Total	Excess Total	Severity Weighted Excess	Rank by Exp. Total	Rank by Excess Total
Old Boalsburg and McCormick	0	0	0.43	0.773	0.04	0.975	0.33	0.04	0.38	-0.10	-$381	344	375
Nittany and "H" Alley	0	0	0.46	0.760	0.04	0.976	0.35	0.04	0.39	-0.11	-$406	342	378
Nimitz and Smithfield	0	0	0.46	0.762	0.04	0.975	0.35	0.04	0.39	-0.11	-$414	343	377
Foster and Wolf Alley	0	0	0.47	0.760	0.04	0.975	0.35	0.04	0.40	-0.11	-$417	341	379
Beaver and Keller	3	0	2.04	0.419	0.19	0.898	2.60	0.17	2.77	0.54	-$436	128	95
Prospect and Berry Alley	1	0	0.90	0.622	0.10	0.944	0.93	0.09	1.03	0.03	-$454	215	190
Prospect and Osage Alley	1	0	0.90	0.622	0.10	0.944	0.93	0.09	1.03	0.03	-$454	215	190
Foster and Buckhout	0	0	0.49	0.750	0.04	0.974	0.37	0.04	0.41	-0.12	-$455	338	381
Calder Alley and Cresson	0	0	0.58	0.717	0.01	0.994	0.42	0.01	0.43	-0.17	-$460	332	399
Sparks and Harley	0	0	0.49	0.749	0.05	0.973	0.37	0.05	0.41	-0.12	-$468	336	382
Gill and Calder Alley	1	0	0.90	0.620	0.10	0.944	0.94	0.10	1.04	0.03	-$478	212	192
Hamilton and Elk Alley	0	0	0.50	0.745	0.05	0.972	0.37	0.05	0.42	-0.13	-$487	334	385
Prospect and Keller	1	0	0.86	0.632	0.11	0.941	0.91	0.10	1.01	0.05	-$492	218	189
Crabapple and Grace	0	0	0.50	0.746	0.05	0.969	0.37	0.05	0.43	-0.13	-$517	333	383
Hetzel and Holly Alley	0	0	0.54	0.733	0.05	0.971	0.39	0.05	0.44	-0.14	-$540	330	390
Martin Terrace and Fairway	0	0	0.54	0.732	0.05	0.971	0.39	0.05	0.44	-0.15	-$547	329	391
Allen and Ridge	0	0	0.52	0.738	0.05	0.969	0.39	0.05	0.44	-0.14	-$551	331	388
Blue Course and Bayfield	1	0	0.92	0.615	0.11	0.940	0.95	0.10	1.05	0.02	-$575	210	193
Locust and Hamilton	0	0	0.59	0.715	0.04	0.974	0.42	0.04	0.46	-0.17	-$576	322	401
Fairmount and Patterson	0	0	0.54	0.731	0.06	0.967	0.40	0.06	0.45	-0.15	-$589	328	392
Buckhout and Metz	0	0	0.54	0.731	0.06	0.968	0.40	0.06	0.45	-0.15	-$589	327	393
Hamilton and Osage Alley	0	0	0.55	0.726	0.05	0.969	0.40	0.05	0.46	-0.15	-$592	326	394
McKee and Lehman	0	0	0.56	0.724	0.05	0.969	0.41	0.05	0.46	-0.16	-$593	325	396
Sparks and Hawk Alley	0	0	0.56	0.724	0.06	0.968	0.41	0.05	0.46	-0.16	-$609	323	397
Sparks and Orchard Alley	0	0	0.56	0.724	0.06	0.968	0.41	0.05	0.46	-0.16	-$609	323	397
Locust and Orchard Alley	0	0	0.64	0.696	0.04	0.977	0.45	0.04	0.49	-0.20	-$632	315	414
Barnard and Hawk Alley	0	0	0.58	0.716	0.06	0.968	0.42	0.05	0.47	-0.17	-$640	319	400
Fraser and Irvin	0	0	0.56	0.724	0.06	0.965	0.41	0.06	0.46	-0.16	-$641	321	395
Sparks and Highland	1	0	0.97	0.603	0.11	0.939	0.98	0.10	1.09	0.01	-$659	207	194
Foster and Clover Alley	0	0	0.60	0.711	0.06	0.965	0.42	0.06	0.48	-0.17	-$687	317	404
Foster and Fraternity Row	0	0	0.60	0.711	0.06	0.965	0.42	0.06	0.48	-0.17	-$687	317	404
Burrowes and Robin Alley	1	0	1.19	0.552	0.09	0.950	1.11	0.08	1.19	-0.09	-$690	193	373

Intersection	Obs.[2] PDO	Obs. Injury	Pred.[3] PDO	w PDO	Pred. Injury	w Injury	Exp.[4] PDO	Exp. Injury	Exp. Total	Excess Total	Severity Weighted Excess	Rank by Exp. Total	Rank by Excess Total
Marylyn and Science	0	0	0.59	0.714	0.07	0.962	0.42	0.06	0.48	-0.17	-$719	316	402
Marylyn and Norma	0	0	0.59	0.713	0.07	0.962	0.42	0.06	0.49	-0.17	-$728	314	403
Hillcrest and Woodland	0	0	0.63	0.701	0.06	0.965	0.44	0.06	0.50	-0.19	-$736	313	410
Fairmount and Apple Alley	1	0	1.00	0.595	0.12	0.936	1.00	0.11	1.11	-0.01	-$753	204	195
Foster and "I" Alley	0	0	0.63	0.699	0.06	0.964	0.44	0.06	0.50	-0.19	-$755	311	412
Foster and "K" Alley	0	0	0.63	0.699	0.06	0.964	0.44	0.06	0.50	-0.19	-$755	311	412
Blue Course and Stratford Court S.	4	1	4.17	0.261	1.01	0.626	4.04	1.01	5.05	-0.13	-$763	102	384
Hamilton and "B" Alley	1	0	1.01	0.592	0.12	0.935	1.01	0.11	1.12	-0.01	-$791	201	203
Prospect and Fox	0	0	0.64	0.696	0.07	0.962	0.45	0.06	0.51	-0.20	-$798	308	415
Prospect and Glenn Alley	0	0	0.64	0.696	0.07	0.962	0.45	0.06	0.51	-0.20	-$798	308	415
Prospect and "D" Alley	0	0	0.67	0.688	0.07	0.962	0.46	0.06	0.52	-0.21	-$837	306	417
Nittany and Apple Alley	0	0	0.68	0.683	0.07	0.961	0.47	0.07	0.53	-0.22	-$877	304	420
Fraser and Robin Alley	0	0	0.77	0.657	0.05	0.970	0.51	0.05	0.56	-0.27	-$884	294	429
Fairmount and Elk Alley	0	0	0.78	0.654	0.05	0.971	0.51	0.05	0.56	-0.27	-$887	292	430
Foster and "A" Alley	0	0	0.68	0.684	0.07	0.959	0.47	0.07	0.53	-0.22	-$890	302	419
Fairmount and Barnard	0	0	0.68	0.685	0.07	0.959	0.46	0.07	0.53	-0.22	-$896	303	418
Nittany and "E" Alley	0	0	0.69	0.680	0.07	0.958	0.47	0.07	0.54	-0.22	-$920	300	421
Allen and Marylyn	0	0	0.70	0.677	0.07	0.959	0.48	0.07	0.55	-0.23	-$927	298	423
Pugh and Waring	1	0	1.00	0.595	0.13	0.929	1.00	0.12	1.12	-0.01	-$929	200	200
Calder Alley and Locust	2	0	2.48	0.373	0.04	0.975	2.18	0.04	2.22	-0.30	-$929	137	434
Allen and Mitchell	0	0	0.71	0.673	0.08	0.957	0.48	0.07	0.55	-0.24	-$968	296	424
Foster and Gill	1	0	1.01	0.593	0.13	0.927	1.01	0.12	1.13	-0.01	-$989	198	207
Southgate and Ashwicken	1	0	1.08	0.577	0.13	0.930	1.05	0.12	1.16	-0.04	-$1,007	194	321
Glenn Alley and Taylor	0	0	0.70	0.677	0.08	0.952	0.47	0.08	0.56	-0.23	-$1,030	295	422
Westerly and Dorum	1	0	1.05	0.583	0.13	0.927	1.03	0.12	1.16	-0.03	-$1,057	196	293
Prospect and "B" Alley	0	0	0.77	0.658	0.08	0.954	0.50	0.08	0.58	-0.27	-$1,097	286	427
Prospect and "C" Alley	0	0	0.77	0.658	0.08	0.954	0.50	0.08	0.58	-0.27	-$1,097	286	427
Pugh and Homan	0	0	0.76	0.659	0.09	0.951	0.50	0.08	0.59	-0.26	-$1,153	285	425
Pugh and Stuart	0	0	0.79	0.651	0.09	0.951	0.51	0.08	0.60	-0.28	-$1,195	282	432
Allen and Bird Alley	1	0	1.11	0.569	0.14	0.924	1.06	0.13	1.19	-0.06	-$1,217	191	342
Allen and Marigold Alley	1	0	1.11	0.569	0.14	0.924	1.06	0.13	1.19	-0.06	-$1,217	191	342
Gill and Prospect	0	0	0.76	0.659	0.10	0.947	0.50	0.09	0.59	-0.27	-$1,236	284	426

Intersection	Obs.[2] PDO	Obs. Injury	Pred.[3] PDO	w PDO	Pred. Injury	w Injury	Exp.[4] PDO	Exp. Injury	Exp. Total	Excess Total	Severity Weighted Excess	Rank by Exp. Total	Rank by Excess Total
Pugh and Bradley	0	0	0.80	0.647	0.10	0.947	0.52	0.09	0.61	-0.29	-$1,300	280	433
Corl and Dorum	0	0	0.61	0.706	0.12	0.932	0.43	0.11	0.55	-0.19	-$1,337	297	408
Sparks and Hill Alley	0	0	0.85	0.634	0.09	0.948	0.54	0.09	0.63	-0.32	-$1,347	278	435
Patterson and Harley	0	0	0.85	0.633	0.09	0.948	0.54	0.09	0.63	-0.32	-$1,359	277	436
Fraser and Foster	1	0	1.37	0.517	0.13	0.928	1.19	0.12	1.32	-0.19	-$1,447	182	409
Allen and South Hills	0	0	0.89	0.623	0.10	0.944	0.55	0.09	0.65	-0.34	-$1,486	274	437
Prospect and Clover Alley	0	0	0.90	0.622	0.10	0.944	0.56	0.09	0.65	-0.34	-$1,496	273	438
Fairmount and Hetzel	0	0	0.90	0.621	0.11	0.937	0.56	0.11	0.67	-0.35	-$1,679	272	439
Garner and Nimitz	1	0	1.16	0.560	0.17	0.911	1.09	0.15	1.24	-0.08	-$1,699	189	365
Hamilton and Apple Alley	0	0	0.95	0.607	0.11	0.940	0.58	0.10	0.68	-0.38	-$1,702	268	441
Hamilton and Berry Alley	0	0	0.95	0.607	0.11	0.940	0.58	0.10	0.68	-0.38	-$1,702	268	441
Pugh and Nimitz	0	0	0.91	0.618	0.12	0.936	0.56	0.11	0.67	-0.35	-$1,717	271	440
Fairmount and Berry Alley	0	0	1.00	0.595	0.12	0.936	0.60	0.11	0.70	-0.41	-$1,867	263	445
Fairmount and Clover Alley	0	0	1.00	0.595	0.12	0.936	0.60	0.11	0.70	-0.41	-$1,867	263	445
Fairmount and Fraternity Row	0	0	1.00	0.595	0.12	0.936	0.60	0.11	0.70	-0.41	-$1,867	263	445
Fairmount and Osage Alley	0	0	1.00	0.595	0.12	0.936	0.60	0.11	0.70	-0.41	-$1,867	263	445
Allen and Crestmont	1	0	1.25	0.540	0.17	0.909	1.14	0.15	1.29	-0.13	-$1,876	185	386
Allen and Adams	1	0	1.22	0.547	0.18	0.906	1.12	0.16	1.28	-0.12	-$1,938	186	380
Waupelani and Oneida	2	0	1.50	0.495	0.22	0.883	1.76	0.20	1.95	0.22	-$1,982	148	124
Sparks and Prospect	0	0	0.97	0.604	0.14	0.925	0.58	0.13	0.71	-0.39	-$2,095	262	444
Fairmount and "B" Alley	0	0	1.06	0.580	0.13	0.931	0.62	0.12	0.74	-0.46	-$2,115	259	450
Atherton and Irvin	2	0	1.61	0.477	0.23	0.881	1.82	0.20	2.02	0.17	-$2,229	146	130
Blue Course and Stratford Court N.	0	0	1.08	0.578	0.14	0.924	0.62	0.13	0.75	-0.47	-$2,322	258	451
Hamilton and Walnut	2	0	1.64	0.473	0.24	0.878	1.83	0.21	2.04	0.16	-$2,383	144	131
Allen and Hutchinson	0	0	1.11	0.569	0.14	0.924	0.63	0.13	0.76	-0.49	-$2,402	255	453
Allen and Iris Alley	0	0	1.11	0.569	0.14	0.924	0.63	0.13	0.76	-0.49	-$2,403	254	454
Waupelani and Aikens	0	0	1.14	0.563	0.14	0.922	0.64	0.13	0.78	-0.51	-$2,520	251	456
Crabapple and Hedgerow	0	0	1.13	0.565	0.17	0.911	0.64	0.15	0.79	-0.51	-$2,859	249	455
Allen and Sunrise Terrace	0	0	1.23	0.545	0.16	0.912	0.67	0.15	0.82	-0.57	-$3,002	243	460
Foster and Hetzel	1	0	1.84	0.444	0.18	0.904	1.37	0.16	1.54	-0.49	-$3,051	170	452
Pugh and Ellen	0	0	1.27	0.536	0.17	0.911	0.68	0.15	0.83	-0.61	-$3,130	242	463
Burrowes and Calder Alley	6	0	6.20	0.192	0.23	0.881	6.04	0.20	6.24	-0.19	-$3,224	90	407

Intersection	Obs.[2] PDO	Obs. Injury	Pred.[3] PDO	w PDO	Pred. Injury	w Injury	Exp.[4] PDO	Exp. Injury	Exp. Total	Excess Total	Severity Weighted Excess	Rank by Exp. Total	Rank by Excess Total
Easterly and Smithfield	1	0	1.50	0.496	0.22	0.885	1.25	0.19	1.44	-0.27	-$3,251	177	431
Prospect and Elk Alley	0	0	1.61	0.478	0.13	0.927	0.77	0.12	0.89	-0.85	-$3,296	234	473
Allen and Whitehall	2	0	1.69	0.465	0.28	0.859	1.86	0.24	2.10	0.13	-$3,514	140	146
Burrowes and Foster	2	0	2.26	0.395	0.25	0.873	2.10	0.22	2.32	-0.19	-$3,625	132	406
Hamilton and "D" Alley	0	0	1.40	0.512	0.18	0.903	0.72	0.16	0.88	-0.70	-$3,680	236	466
Nittany and Hole Alley	0	0	1.73	0.460	0.15	0.920	0.79	0.13	0.93	-0.94	-$3,748	228	477
Atherton and Calder Alley	8	0	5.87	0.201	0.42	0.800	7.57	0.34	7.91	1.62	-$3,879	71	70
Westerly and Sparks	5	0	2.18	0.403	0.43	0.798	3.86	0.34	4.20	1.60	-$4,107	109	73
Westerly and Hamilton	0	0	1.43	0.508	0.22	0.886	0.72	0.19	0.92	-0.73	-$4,456	232	468
Easterly and William	0	0	1.48	0.498	0.22	0.887	0.74	0.19	0.93	-0.77	-$4,547	227	469
Whitehall and Windsor	0	0	1.54	0.489	0.22	0.887	0.75	0.19	0.94	-0.81	-$4,639	225	470
Allen and Fairmount	7	1	4.83	0.233	1.22	0.582	6.49	1.13	7.62	1.57	-$4,717	76	75
Blue Course and Bayberry	1	0	1.65	0.471	0.28	0.860	1.31	0.24	1.55	-0.38	-$4,876	167	443
Westerly and Fairmount	2	0	1.82	0.447	0.32	0.840	1.92	0.27	2.19	0.05	-$4,947	138	188
Garner and Waring	0	0	1.60	0.480	0.23	0.879	0.77	0.21	0.97	-0.86	-$5,170	221	474
Beaver and Thrush Alley	0	0	2.04	0.419	0.19	0.898	0.86	0.17	1.03	-1.20	-$5,236	217	482
Allen and Highland	1	0	1.92	0.434	0.28	0.859	1.40	0.24	1.64	-0.56	-$5,406	162	459
Beaver and Cresson	6	0	7.60	0.162	0.19	0.898	6.26	0.17	6.43	-1.36	-$5,660	85	486
Beaver and Humes	6	0	7.60	0.162	0.19	0.898	6.26	0.17	6.43	-1.36	-$5,660	85	486
Beaver and Sowers	6	0	7.60	0.162	0.19	0.898	6.26	0.17	6.43	-1.36	-$5,660	85	486
Easterly and Centre	0	0	1.20	0.552	0.29	0.853	0.66	0.25	0.91	-0.58	-$5,837	233	462
Garner and Irvin	1	0	1.87	0.441	0.30	0.849	1.38	0.26	1.64	-0.53	-$5,932	163	458
Pugh and McCormick	3	0	2.26	0.395	0.39	0.812	2.71	0.32	3.03	0.38	-$6,279	124	114
Atherton and Clay Alley	3	0	1.58	0.483	0.42	0.800	2.31	0.34	2.65	0.65	-$6,548	129	92
Westerly and Saxton	1	0	1.84	0.445	0.33	0.839	1.37	0.27	1.65	-0.52	-$6,616	161	457
Westerly and South Sparks	0	0	1.69	0.465	0.29	0.856	0.79	0.24	1.03	-0.95	-$6,674	213	478
Prospect and Hetzel	0	0	1.86	0.442	0.30	0.848	0.82	0.26	1.08	-1.09	-$7,568	208	480
Pugh and Irvin	0	0	2.01	0.423	0.33	0.838	0.85	0.27	1.12	-1.21	-$8,572	199	483
Waupelani and Southgate	10	0	3.18	0.317	0.73	0.700	7.84	0.51	8.35	4.45	-$9,229	70	38
Burrowes and Fairmount	1	0	2.80	0.344	0.35	0.829	1.62	0.29	1.91	-1.24	-$9,314	150	484
Westerly and Hedgerow	0	0	1.95	0.431	0.36	0.826	0.84	0.30	1.13	-1.17	-$9,372	197	481
University and Legion	0	1	3.24	0.313	1.09	0.608	1.01	1.06	2.07	-2.26	-$9,903	142	498

Intersection	Obs.[2] PDO	Obs. Injury	Pred.[3] PDO	w PDO	Pred. Injury	w Injury	Exp.[4] PDO	Exp. Injury	Exp. Total	Excess Total	Severity Weighted Excess	Rank by Exp. Total	Rank by Excess Total
Atherton and Science	5	0	1.85	0.442	0.59	0.741	3.61	0.44	4.05	1.60	-$10,754	113	72
Atherton and Daisy	0	0	1.61	0.477	0.44	0.795	0.77	0.35	1.12	-0.93	-$11,400	202	475
Atherton and Storch	0	0	1.61	0.477	0.44	0.795	0.77	0.35	1.12	-0.93	-$11,400	202	475
Pugh and Hamilton	9	0	3.34	0.306	0.74	0.697	7.27	0.51	7.78	3.70	-$11,875	73	46
Atherton and Pugh	15	0	8.50	0.148	0.83	0.672	14.04	0.56	14.60	5.27	-$12,234	37	29
Beaver and Miller	3	0	7.60	0.162	0.19	0.898	3.75	0.17	3.92	-3.87	-$12,582	115	507
Waupelani and Allen	3	0	2.64	0.358	0.55	0.754	2.87	0.42	3.29	0.10	-$13,111	119	171
University and Royal	0	0	1.72	0.462	0.48	0.781	0.79	0.37	1.16	-1.03	-$13,148	195	479
Park and Holmes	1	0	1.83	0.446	0.52	0.767	1.37	0.40	1.76	-0.58	-$13,479	156	461
Beaver and "H" Alley	0	0	3.51	0.295	0.38	0.817	1.04	0.31	1.35	-2.55	-$13,902	180	501
Beaver and Lark Alley	0	0	3.51	0.295	0.38	0.817	1.04	0.31	1.35	-2.55	-$13,902	180	501
Fraser and Calder Alley	0	1	10.52	0.123	0.30	0.850	1.29	0.41	1.70	-9.12	-$14,742	158	513
Waupelani and Stratford	8	0	3.29	0.309	0.77	0.689	6.54	0.53	7.07	3.02	-$15,245	81	58
Westerly and O'Bryan	0	0	2.37	0.383	0.50	0.774	0.91	0.38	1.29	-1.58	-$15,396	184	492
Allen and Irvin	1	0	2.90	0.337	0.54	0.759	1.64	0.41	2.05	-1.39	-$16,618	143	489
University and Ramp D	1	0	2.14	0.408	0.58	0.745	1.46	0.43	1.90	-0.82	-$16,881	151	472
Beaver and Kelly	1	0	7.60	0.162	0.19	0.898	2.07	0.17	2.24	-5.55	-$17,196	133	510
Allen and Logan	1	0	3.01	0.328	0.57	0.748	1.66	0.43	2.09	-1.49	-$18,334	141	490
Atherton and South Hills	1	0	2.05	0.418	0.70	0.709	1.44	0.49	1.93	-0.81	-$22,190	149	471
Atherton and Centre	0	0	6.12	0.194	0.45	0.790	1.19	0.36	1.54	-5.03	-$23,172	168	508
University and Prospect	8	2	4.92	0.230	2.50	0.405	7.29	2.20	9.49	2.07	-$23,383	64	61
Burrowes and New Alley	0	0	8.99	0.141	0.23	0.881	1.26	0.20	1.47	-7.75	-$24,049	175	511
Atherton and Whitehall	7	1	3.89	0.274	1.62	0.512	6.15	1.32	7.46	1.95	-$24,364	77	62
Beaver and Sparks	6	1	8.73	0.144	1.44	0.541	6.39	1.24	7.63	-2.53	-$26,737	75	500
University and Waring	2	0	2.56	0.365	0.88	0.659	2.20	0.58	2.78	-0.65	-$31,254	127	464
Atherton and Hill Alley	0	0	2.78	0.346	0.87	0.661	0.96	0.57	1.54	-2.11	-$34,832	171	497
College and Pugh	47	0	32.22	0.044	1.56	0.520	46.35	0.81	47.17	13.38	-$37,182	8	4
Atherton and Ridge	10	1	4.62	0.241	1.93	0.468	8.70	1.44	10.14	3.58	-$38,986	57	49
Beaver and Gill	3	0	5.94	0.198	0.94	0.643	3.58	0.61	4.19	-2.70	-$40,624	111	503
Beaver and Buckhout	4	0	6.81	0.178	1.10	0.607	4.50	0.67	5.17	-2.75	-$50,114	99	504
University and Irvin	0	0	2.99	0.330	1.13	0.601	0.99	0.68	1.66	-2.45	-$51,055	159	499
Park and Shortlidge	13	1	5.77	0.203	2.23	0.432	11.53	1.53	13.06	5.06	-$55,241	46	31

Intersection	Obs.[2] PDO	Obs. Injury	Pred.[3] PDO	w PDO	Pred. Injury	w Injury	Exp.[4] PDO	Exp. Injury	Exp. Total	Excess Total	Severity Weighted Excess	Rank by Exp. Total	Rank by Excess Total
Atherton and Foster	7	2	19.67	0.070	2.43	0.411	7.88	2.18	10.06	-12.04	-$57,972	58	519
Beaver and Patterson	6	0	7.63	0.162	1.32	0.563	6.26	0.74	7.00	-1.94	-$62,016	84	495
Beaver and High	10	0	22.48	0.061	0.90	0.652	10.77	0.59	11.36	-12.03	-$64,150	54	518
Atherton and Prospect	16	0	4.62	0.241	1.96	0.464	13.25	0.91	14.16	7.58	-$82,931	40	15
Beaver and Pugh	34	3	57.47	0.025	3.35	0.336	34.59	3.12	37.70	-23.11	-$86,468	12	522
University and Foster	5	0	3.96	0.271	1.76	0.491	4.72	0.86	5.58	-0.13	-$88,736	94	387
Allen and Easterly	10	2	10.37	0.124	3.41	0.332	10.05	2.47	12.51	-1.26	-$96,274	50	485
Beaver and Garner	26	4	64.17	0.022	3.99	0.298	26.86	4.00	30.85	-37.31	-$102,366	18	528
University and Hamilton	3	0	4.30	0.255	2.01	0.458	3.33	0.92	4.25	-2.06	-$113,087	108	496
University and McCormick	4	0	4.96	0.229	2.11	0.446	4.22	0.94	5.16	-1.91	-$120,489	100	494
University and Nimitz	3	0	5.54	0.210	2.59	0.396	3.53	1.02	4.56	-3.57	-$163,956	105	506
College and High	13	0	35.07	0.040	2.17	0.438	13.89	0.95	14.84	-22.41	-$182,053	36	521
Beaver and Fraser	18	0	46.09	0.031	2.35	0.419	18.87	0.99	19.85	-28.58	-$213,535	24	523
Beaver and Burrowes	26	1	58.27	0.025	3.42	0.331	26.80	1.80	28.60	-33.09	-$250,944	20	526
Atherton and Allen	25	9	57.78	0.025	11.22	0.131	25.81	9.29	35.11	-33.89	-$283,769	15	527
College and University	27	7	23.32	0.059	10.66	0.137	26.78	7.50	34.28	0.31	-$310,157	16	119
Beaver and Allen	41	1	70.40	0.020	4.63	0.268	41.60	1.97	43.58	-31.45	-$348,870	9	525
Atherton and Beaver	68	6	79.29	0.018	10.34	0.141	68.21	6.61	74.82	-14.81	-$408,604	2	520
University and Curtin	1	0	9.62	0.133	5.37	0.240	2.14	1.29	3.43	-11.56	-$434,688	118	516
Atherton and Westerly	30	6	57.24	0.025	11.06	0.133	30.68	6.67	37.36	-30.94	-$517,593	13	524
Whitehall and Waupelani	6	2	12.78	0.103	8.33	0.169	6.70	3.07	9.77	-11.35	-$550,344	60	515
College and Garner	40	1	87.99	0.016	6.50	0.207	40.79	2.14	42.93	-51.56	-$572,121	10	529
University and Easterly	9	2	14.53	0.092	9.82	0.147	9.51	3.15	12.66	-11.69	-$690,113	49	517
Atherton and Park	57	10	122.85	0.012	20.37	0.077	57.78	10.80	68.58	-74.64	-$1,149,473	3	530

PLANNED INTERSECTION SAFETY IMPROVEMENT PROGRAM FOR THE BOROUGH OF STATE COLLEGE, CENTRE COUNTY

PART II – FINDINGS OF ROADWAY SAFETY AUDIT

FINAL REPORT

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December 9, 2010

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EXECUTIVE SUMMARY

Part II of the *Planned Intersection Safety Improvement Program* for the Borough of State College is the development of recommended safety improvements for the top five intersections by severity-weighted excess crashes. This study considered crashes where at least one motor vehicle was involved. Pedestrian – vehicle crashes are not the focus of this report as they have been analyzed in the *Comprehensive Pedestrian and Bicycle Program* report prepared by *Stahl Sheaffer Engineering, LLC* (2008).

Part I of the *Planned Intersection Safety Improvement Program* prioritized intersections for safety improvements by analyzing crash data, roadway characteristics, and traffic volume data. Based upon the analysis in Part I and meetings with State College Borough Transportation Commission and Borough Staff, the top five intersections for safety improvements are:

1. Atherton Street (SR 3014) & University Drive (SR 3018)
2. Atherton Street (SR 3014) & College Avenue (SR 0026)
3. Atherton Street (SR 3014) & Hillcrest Avenue
4. Atherton Street (SR 3014) & White Course Drive
5. Easterly Parkway & Pugh Street

Intersection safety audits were performed for each of the five intersections identified for safety improvements. After the review of the existing data and intersection conditions, recommended safety improvements were then formulated for each of the study intersections.

The recommended safety improvements should be implemented for each of the study intersections. A follow up analysis of the crash data should be performed after implementation of the improvements to measure the effectiveness of the improvements and to monitor any additional patters that may not have been mitigated by the safety improvements.

This document should serve as a guide for not only the study intersections, but any other intersections throughout State College Borough that have a history of crashes, or receive complaints from the motoring public regarding safety issues. Many of the safety improvements recommended in this document are cost-effective and can even be considered basic maintenance issues (pavement markings, signage, etc). By monitoring maintenance and safety issues at intersections with extensive crash histories, intersection safety can easily be improved.

INTRODUCTION

Part II of the *Planned Intersection Safety Improvement Program* for the Borough of State College is the development of recommended safety improvements for the top five intersections by severity-weighted excess crashes. This study considered crashes where at least one motor vehicle was involved. Pedestrian – vehicle crashes are not the focus of this report as they have been analyzed in the *Comprehensive Pedestrian and Bicycle Program* report prepared by *Stahl Sheaffer Engineering, LLC* (2008).

Part I of the *Planned Intersection Safety Improvement Program* prioritized intersections for safety improvements by analyzing crash data, roadway characteristics, and traffic volume data. Based upon the analysis in Part I and meetings with the State College Borough Transportation Commission and Borough Staff, the top five intersections for safety improvements are:

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5. Easterly Parkway & Pugh Street

The following report outlines the data analysis, observed safety issues, and recommended safety improvements to the above-mentioned study intersections.

INTERSECTION SAFETY AUDITS

Intersection safety audits were performed for each of the five intersections identified for safety improvements. The intersection safety audits consisted of a review of existing information, such as:

- Crash data
- Roadway ‘as built’ plans
- Signal plans and timings

After reviewing the aforementioned information, a field view of existing intersection conditions and operations was then conducted by SSE on Monday, November 1, 2010. As part of the field view, the following conditions were observed and noted:

- Posted speed limits
- Roadway geometry
- Lighting/visibility
- Sight distances
- Signing and pavement markings
- Signal timing and operations
- Human factors

After the review of the existing data and intersection conditions, recommended safety improvements were then formulated for each of the study intersections.

Atherton Street (SR 3014) & University Drive (SR 3018)

Based the crash data received and analyzed by SSE, 69 total vehicular crashes occurred at the intersection of Atherton Street & University Drive from 2005 to 2009. Of these 69 crashes:

- 57% were turning/angle crashes
- 36% were rear-end crashes
- 5% were sideswipe crashes
- 1% were head-on crashes

Figure 1 presents a crash diagram depicting the type and location of the crashes at this intersection.

Table 1
Intersection Safety Audit Summary - Atherton Street and University Drive

	MAJOR-Atherton Street	MINOR-University Drive
Functional Classification	Major Arterial	Collector
Typical Section	4-12’ Travel Lanes 1-10’ Turn Lane	2-10’ to 12’ Travel Lane 1-10’ Turning Lane
Average Daily Traffic (Year)	29,536 (2010)	11,428 (2010)
Posted Speed Limit	35 MPH	45 MPH NB/35 MPH SB
Roadway Geometry	Sufficient	Sufficient
Lighting/Visibility	Sufficient	Sufficient
Sight Distances	Insufficient for Left Turns	May be Insufficient SB Insufficient for NB Rights
Signing and Pavement Markings	Insufficient/Worn	Insufficient/Worn
Signal Timing and Operations	Protected/Permitted Left Turns	NB Right Turns Yield Controlled
Human Factors	Running Red Light Proceeding without Clearance	Running Red Light Proceeding without Clearance

In addition to these crashes, the following safety issues were observed during the field view:

- Atherton Street – Eastbound approach
  - Sight distance is limited for left turns seeing oncoming through traffic
  - Turn lane pavement marking legends are barely visible
- Atherton Street – Westbound approach
  - Turn lane pavement marking legends are barely visible

- University Drive – Northbound approach
  - Sight distance is limited for right turns looking left
  - No lane use control signs
- University Drive – Southbound approach
  - Sight distance due to road curvature is limited
  - Lane use control signs are old & too close to intersection
  - Inconsistent pavement markings for left/center turn lane
  - Private driveways are close to intersection
- Overall intersection safety issues:
  - Brightness of signal lenses are inconsistent
  - Stop bars are skewed
  - Inconsistent traffic medians (three different types)
  - Lanes & medians not delineated with pavement markers

Figure 2 presents the existing intersection condition diagram for this location, while Figure 3 presents the proposed intersection condition.

Atherton Street (SR 3014) & College Avenue (SR 0026)

Based the crash data received and analyzed by SSE, 114 total vehicular crashes occurred at the intersection of Atherton Street & College Avenue from 2005 to 2009. Of these 114 crashes:

- 58% were rear-end crashes
- 26% were angle crashes
- 13% were sideswipe crashes
- 1% were head-on crashes
- 1% were fixed-object crashes
- 1% were out-of-control crashes

Figure 4 presents a crash diagram depicting the type and location of the crashes at this intersection.

Table 2
Intersection Safety Audit Summary - Atherton Street and College Avenue

	MAJOR-Atherton Street	MINOR-College Avenue
Functional Classification	Major Arterial	Major Arterial
Typical Section	4-11’ Travel Lanes	2-12’ Travel Lanes 1-12’ Turning Lane
Average Daily Traffic (Year)	20,043 (2010)	11,226 (2010)
Posted Speed Limit	35 MPH	25 MPH
Roadway Geometry	Substandard	Sufficient
Lighting/Visibility	Insufficient	Insufficient

Sight Distances	May be Insufficient for NB Lefts	May be Insufficient for WB Rights
Signing and Pavement Markings	Insufficient/Worn	Insufficient/Worn
Signal Timing and Operations	NB Advance Movement	NB Right Turns Yield Controlled
Human Factors	Proceeding Without Clearance	Pedestrian Crossing (WB Right Turns)

In addition to these crashes, the following safety issues were observed during the field view:

- Atherton Street – Northbound approach
  - Sight distance is limited for left-turning vehicles
  - Lane use control signs are too close to intersection
  - Mid-block pedestrian crossings are occurring
- Atherton Street – Southbound approach
  - No lane use control signs
  - Access to gas station is not controlled
  - Directional signage for Penn State facilities is difficult to read
- College Avenue – Westbound approach
  - Route designation signs are confusing
  - Lane use control signs are too close to intersection
  - Bus stop is located within travel lane
  - Right turn slip ramp is yield-controlled and conflicts with pedestrians
  - Turn lane pavement marking legends are worn
- Overall intersection safety issues:
  - Roadway geometry along Atherton Street is substandard
  - Intersection lighting is insufficient

Figure 5 presents the existing intersection condition diagram for this location.

Atherton Street (SR 3014) & Hillcrest Avenue

Based the crash data received and analyzed by SSE, 59 total vehicular crashes occurred at the intersection of Atherton Street & Hillcrest Avenue from 2005 to 2009. Of these 59 crashes:

- 47% were rear-end crashes
- 36% were angle crashes
- 10% were fixed-object crashes
- 5% were sideswipe crashes
- 2% were animal crashes

Figure 6 presents a crash diagram depicting the type and location of the crashes at this intersection.

Table 3
Intersection Safety Audit Summary - Atherton Street and Hillcrest Avenue

	MAJOR-Atherton Street	MINOR-Hillcrest Avenue
Functional Classification	Major Arterial	Local
Typical Section	4-10' Travel Lanes 1-10' Turning Lane	2-12' Travel Lanes
Average Daily Traffic (Year)	27,573 (2010)	653 (2010)
Posted Speed Limit	35 MPH	25 MPH
Roadway Geometry	Sufficient	Sufficient
Lighting/Visibility	Insufficient-Signal Heads	Sufficient
Sight Distances	Sufficient	Sufficient
Signing and Pavement Markings	Insufficient	Sufficient
Signal Timing and Operations	WB Advance Movement Left Turns Permitted	Sufficient
Human Factors	Speeding/Tailgating	N/A

In addition to these crashes, the following safety issues were observed during the field view:

- Atherton Street – Northbound approach
  - No lane use control signs
- Atherton Street – Southbound approach
  - No lane use control signs

Figure 7 presents the existing intersection condition diagram for this location.

Atherton Street (SR 3014) & White Course Drive

Based the crash data received and analyzed by SSE, 36 total vehicular crashes occurred at the intersection of Atherton Street & White Course Drive from 2005 to 2009. Of these 36 crashes:

- 51% rear-end crashes
- 26% angle crashes
- 13% fixed-object crashes
- 10% sideswipe crashes

Figure 8 presents a crash diagram depicting the type and location of the crashes at this intersection.

Table 4
Intersection Safety Audit Summary - Atherton Street and White Course Drive

	MAJOR-Atherton Street	MINOR-White Course Drive
Functional Classification	Major Arterial	Local
Typical Section	4-10' Travel Lanes 1-10' Turning Lane	3-12' Travel Lanes
Average Daily Traffic (Year)	21,479 (2010)	410 (2009)
Posted Speed Limit	35 MPH	25 MPH
Roadway Geometry	Narrow Left Turn Lane	Sufficient
Lighting/Visibility	Sufficient	Sufficient
Sight Distances	May be Insufficient for Vehicles in SB Curb Lane	May be Insufficient for Right Turns on Red
Signing and Pavement Markings	Insufficient/Worn	Sufficient
Signal Timing and Operations	WB Advance Movement Left Turns Permitted	Sufficient
Human Factors	Speeding	Proceeding Without Clearance

In addition to these crashes, the following safety issues were observed during the field view:

- Atherton Street – Eastbound approach
  - Sight distance is limited for eastbound vehicles approaching stopped vehicles
  - No lane use control signs
  - Pedestrians crossing approach occurring although prohibited
- Atherton Street – Westbound approach
  - Left turn lane is narrow
- White Course Drive – Northbound approach
  - Sight distance is limited for right turns looking left
  - Tracer line between dual left turns is missing

Figure 9 presents the existing intersection condition diagram for this location.

Easterly Parkway & Pugh Street

Based the crash data received and analyzed by SSE, 23 total vehicular crashes occurred at the intersection of Easterly Parkway & Pugh Street from 2005 to 2009. Of these 23 crashes:

- 72% were angle crashes
- 28% were rear-end crashes

Figure 10 presents a crash diagram depicting the type and location of the crashes at this intersection.

Table 5
Intersection Safety Audit Summary - Easterly Parkway and Pugh Street

	MAJOR-Easterly Parkway	MINOR-Pugh Street
Functional Classification	Collector	Local
Typical Section	2-12+' Travel Lanes 1-10' WB Turning Lane	2-12+' Travel Lanes
Average Daily Traffic (Year)	8,126 (2003)	2,477 (2008)
Posted Speed Limit	25 MPH	25 MPH
Roadway Geometry	Roadway Deflection Within Intersection	Curb Lines Do Not Line Up on Opposite Sides of Int.
Lighting/Visibility	Sufficient	Insufficient-Stop Signs
Sight Distances	Sufficient	Insufficient
Signing and Pavement Markings	Insufficient	Insufficient
Signal Timing and Operations	N/A	Stop-Controlled
Human Factors	None	Stop Sign Running

In addition to these crashes, the following safety issues were observed during the field view:

- Easterly Parkway – Eastbound approach
  - Roadway geometry – horizontal deflection occurs within the intersection
- Easterly Parkway – Westbound approach
  - Center turn lane sign is located before left turn lane terminates
- Pugh Street – Northbound and Southbound approaches
  - Sidewalk placement and limited sight distance requires vehicles to stop within crosswalks
  - Stop signs are located far from edge of pavement due to wide planting strips adjacent to roadway
  - Adjacent intersections do not require drivers to stop, therefore drivers may not be anticipating stop signs
- Overall intersection issues:
  - Lane designations along Easterly are inconsistent
  - Stop bars are missing
  - Street name signs are needed

Figure 11 presents the existing intersection condition diagram for this location.

RECOMMENDATIONS

Based on the crash data and observed safety issues, the following safety improvements are recommended:

Atherton Street (SR 3014) & University Drive (SR 3018)

- Atherton Street – Eastbound approach
  - Verify sight distance for left turns seeing oncoming through traffic
    - Consider different signal phasing if sight distance is deficient
  - Repaint turn lane pavement marking legends
- Atherton Street – Westbound approach
  - Repaint turn lane pavement marking legends
- University Drive – Northbound approach
  - Signalize right turns if adequate sight distance is not available and cannot be provided by re-grading adjacent hillside

It should be noted that roadway and traffic signal upgrades have been proposed for this intersection. However, signal plans were still in the preliminary phase at the time of this report.

Atherton Street (SR 3014) & College Avenue (SR 0026)

- Atherton Street – Northbound approach
  - Reduce speed limit from 35 MPH to 25 MPH
  - Move lane use control signs farther away from intersection to allow for more decision time
  - Install fence to discourage midblock pedestrian crossings
- Atherton Street – Southbound approach
  - Reduce speed limit from 35 MPH to 25 MPH
  - Install lane use control signs
  - Minimize control points/movements from gas station (access control)
  - Increase legibility of directional signage for Penn State facilities
- College Avenue – Westbound approach
  - Combine route designation signs and lane use control signs (reduce visual clutter)
  - Move bus stop off-street to reduce conflicts and weaving
  - Add ‘Yield Here for Pedestrians’ sign and pavement markings for right turn slip ramp prior to crosswalk
  - Investigate signalizing right turns and adding dual right turn lanes
  - Repaint turn lane pavement marking legends
- Overall intersection safety improvements:
  - Install additional intersection lighting
  - Install ADA-compliant pedestrian features

Atherton Street (SR 3014) & Hillcrest Avenue

- Atherton Street – Northbound approach
  - Add lane use control signs
  - Install 'Signal Ahead' advance warning signs
  - Investigate controlling left turns with protected/prohibited signal phasing
- Atherton Street – Southbound approach
  - Add lane use control signs
  - Install 'Signal Ahead' advance warning signs
  - Investigate controlling left turns with protected/prohibited signal phasing
- Overall intersection safety improvements:
  - Add backplates to all traffic signals

Atherton Street (SR 3014) & White Course Drive

- Atherton Street – Eastbound approach
  - Verify sight distance and remove vegetation that may limit sight for eastbound traffic approaching stopped vehicles
    - Reduce speed limit from 35 MPH to 25 MPH if sight distance is not available through elimination of landscaping
  - Install lane control signs
  - Extend fences and landscaping to help deter pedestrians from crossing approach
- Atherton Street – Westbound approach
  - Investigate widening left turn lane
- White Course Drive – Northbound approach
  - Prohibit right turns on red with 'No Turn On Red' signage due to sight distance limitations
  - Paint tracer line between dual left turn lanes

Easterly Parkway & Pugh Street

- Easterly Parkway – Eastbound approach
  - Add delineation to guide drivers through horizontal deflection within the intersection
  - Add left turn lane to mirror westbound left turn lane and provide a consistent cross section
- Easterly Parkway – Westbound approach
  - Relocate center turn lane sign after left turn lane terminates
- Pugh Street – Northbound and Southbound approaches
  - Verify sight distances and remove trees/obstructions from sight triangle
  - Investigate moving sidewalk closer to curb line in order to move crosswalks closer to the intersection
  - Construct bulb-outs to move stop signs closer to travel lane
  - Add 'Stop Ahead' signs
  - Add red retroreflective vertical strips to stop sign posts

  - Add stop bars
- Overall intersection safety improvements:
  - Lane designations along Easterly Parkway are inconsistent
  - Install street name signs

The recommended safety improvements are rated based on their Crash Reduction Factor (CRF), which are presented in Table 6. The CRF's were taken from the *Crash Modification Factors Clearinghouse (http://www.cmfclearinghouse.org).* Each safety improvement, also known as a countermeasure, is presented with the CRF in percent. Only CRF's with sufficient quality or confidence (three or more stars) were included in the table.

Table 6
Countermeasure Crash Reduction Factor Summary

Countermeasure	Crash Reduction Factor (CRF), Percent	Reference
Sight Distance – Increase Sight Triangle Distance	11% to 56%	Elvik, R. and Vaa, T., "Handbook of Road Safety Measures." Oxford, United Kingdom, Elsevier, (2004) Rodegerdts, L. A., Nevers, B., and Robinson, B., "Signalized Intersections: Informational Guide." FHWA-HRT-04-091, (2004)
Sight Distance – Zero or Positive Left Turn Lane Offset	20% to 26%	Wang, X. and Abdel-Aty, M., Right-Angle Crash Ocurrence at Signalized Intersections, Transportation Research Record 2019, (2007), pp. 156-168.
Lower Posted Speed	4% to -17%	Parker, M. R. Jr., "Effects of Raising and Lowering Speed Limits on Selected Roadway Sections." FHWA-RD-92-084, (1997)
Install Delineators	-4% to -5%	Elvik, R. and Vaa, T., "Handbook of Road Safety Measures." Oxford, United Kingdom, Elsevier, (2004)
Introduce 'Stop Ahead' Pavement Markings	-4% to 60%	Gross, F., Jagannathan, R., Lyon, C., and Eccles, K., "Safety Effectiveness of STOP AHEAD Pavement Markings", Presented at the 87th Annual Meeting of the Transportation Research Board, 2008
Change Signalized Left Turns From Permitted or Permitted-Protected to Protected	-2% to 100%	Harkey, D., et al., Accident Modification Factors for Traffic Engineering and ITS Improvements, NCHRP Report 617, TRB, 2008 Davis, G.A. and Aul, N., "Safety Effects of Left-Turn Phasing Schemes at High-Speed Intersections", Minnesota Department of Transportation, Report No. MN/RC-2007-03, (2007) Srinivasan, R., F. Council, C. Lyon, F. Gross, N. Lefler, and B. Persaud. "Evaluation of the Safety Effectiveness of Selected Treatments at Urban Signalized Intersections." TRB 87th Annual Meeting Compendium of Papers CD-ROM. Washington, D.C., 2008.
Change From Yield Signal Control to Signalized Control	-3% to 54%	Jensen, S. U. "Safety Effects of Intersection Signalization: a Before-After Study." TRB 89th Annual Meeting Compendium of Papers CD-ROM. Washington, D.C. 2010.
Add Backplates to Signal Heads	3% to 9%	Sayed, T., El Esawey, M., and Pump, J., "Evaluating the Safety Impacts of Improving Signal Visibility at Urban Signalized Intersections." 2007 TRB 86th Annual Meeting: Compendium of Papers CD-ROM, Vol. TRB#07-135, Washington, D.C., (2007)

Install left Turn Lane	9% to 55%	Harwood, D. W., Bauer, K. M., Potts, I. B., Torbic, D. J., Richard, K. R., Rabbani, E. R., Hauer, E., Elefteriadou, L., and Griffith, M. S., "Safety Effectiveness of Intersection Left- and Right-Turn Lanes." Washington, D.C., 82nd Transportation Research Board Annual Meeting, (2003)
Improve Intersection Lighting	-4.9% to 82%	Donnell, E.D., R.J. Porter, and V.N. Shankar. "A Framework for Estimating the Safety Effects of Roadway Lighting at Intersections." TRB 89th Annual Meeting Compendium of Papers CD-ROM. Washington, D.C., 2010. Elvik, R. and Vaa, T., "Handbook of Road Safety Measures." Oxford, United Kingdom, Elsevier, (2004)

Atherton Street (SR 3014) from Hillcrest Avenue to Easterly Parkway Excessive Speed Crashes

SSE conducted a preliminary analysis of crashes related to excessive speed along Atherton Street between Hillcrest Avenue and Easterly Parkway. As outlined in PennDOT Publication 212, *Official Traffic Control Devices*, crashes for a five-year period from 2005-2009 between the above-mentioned intersections were summarized to obtain a crash rate, which was then compared to the homogeneous crash rate for similar roadway facilities. Based upon preliminary calculations, a speed reduction could be warranted for Atherton Street between Hillcrest Avenue to Easterly Parkway based upon the crash rate for this section of roadway.

CONCLUSIONS

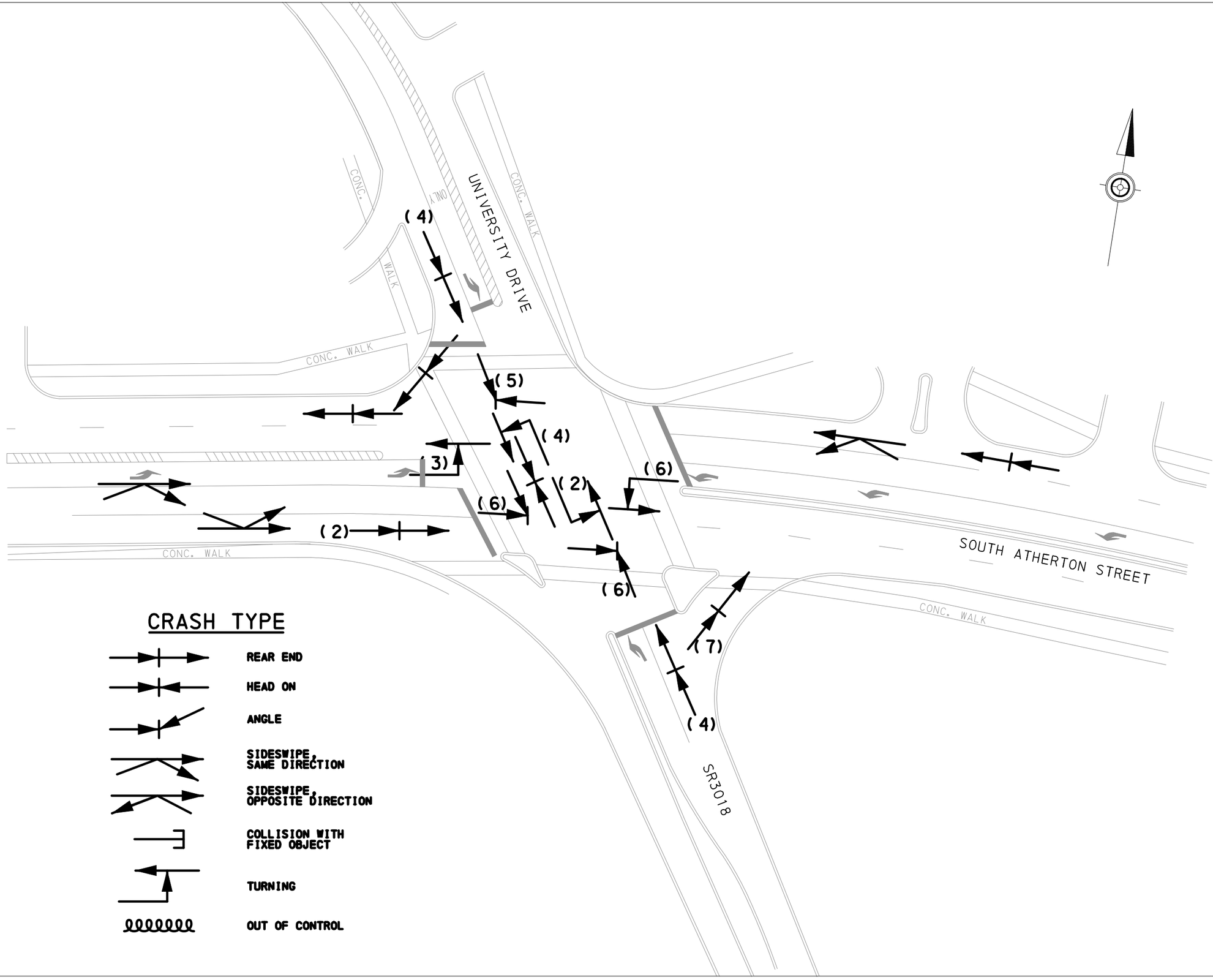
The recommended safety improvements should be implemented for each of the study intersections. A follow up analysis of the crash data should be performed after implementation of the improvements to measure the effectiveness of the improvements and to monitor any additional patters that may not have been mitigated by the safety improvements.

This document should serve as a guide for not only the study intersections, but any other intersections throughout State College Borough that have a history of crashes, or receive complaints from the motoring public regarding safety issues. Many of the safety improvements recommended in this document are cost-effective and can even be considered basic maintenance issues (pavement markings, signage, etc). By monitoring maintenance and safety issues at intersections with extensive crash histories, intersection safety can easily be improved.

PLOTTED: 12/9/2010

FILE NAME: S. ATHERTON ST. (SR3014), SR3018 & UNIVERSITY DR.

FILE NAME: Atherton & University.dgn



CRASH TYPE

- REAR END
- HEAD ON
- ANGLE
- SIDESWIPE, SAME DIRECTION
- SIDESWIPE, OPPOSITE DIRECTION
- COLLISION WITH FIXED OBJECT
- TURNING
- OUT OF CONTROL

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SEAL:

SURVEYOR

CADD

DESIGNER

PROJ. MANAGER

FILE:

DATE DESCRIPTION

REVISIONS

PROJECT NAME

PLANNED INTERSECTION SAFETY IMPROVEMENT PROGRAM PART II

SHEET NAME

ATHERTON STREET & UNIVERSITY DRIVE YEARS 2005-2009 VEHICULAR CRASHES

PROJECT NO.	
10-047	
DATE	
DECEMBER 9, 2010	
SCALE	SHEET NO.
NTS	1 OF 11

DISTRICT	COUNTY	ROUTE	SECTION	SHEET
2 - 0	CENTRE			OF

PERMIT NO. 21-50 SHEET 2 OF 3

DATE ISSUED 4/9/91 DATE REVISED 2/19/03

GENERAL NOTES

INSTALL, OPERATE AND MAINTAIN THIS TRAFFIC SIGNAL IN ACCORDANCE WITH PENNSYLVANIA DEPARTMENT OF TRANSPORTATION REGULATIONS ON OFFICIAL TRAFFIC CONTROL DEVICES,

NO MODIFICATION OF THIS INSTALLATION IS PERMITTED UNLESS PRIOR APPROVAL IS GRANTED, IN WRITING, BY THE DEPARTMENT.

ALL MAINTENANCE NECESSARY FOR PROPER VISIBILITY OF THE SIGNALS, INCLUDING TRIMMING TREES, IS THE RESPONSIBILITY OF THE PERMITTEE,

THE PERMITTEE INSTALLS AND MAINTAINS ALL SIGNS AND PAVEMENT MARKINGS INDICATED ON THIS DRAWING WHICH ARE CONSIDERED AS PART OF THE PERMIT, UNLESS OTHERWISE INDICATED. THE DEPARTMENT MAINTAINS THE LONGITUDINAL PAVEMENT MARKINGS ON STATE HIGHWAYS.

INSTALL POST MOUNTED SIGNALS WITH THE SIGNAL HEADS A MINIMUM OF 2 FEET BEHIND THE FACE OF THE CURB OR EDGE OF THE SHOULDER. ALSO, INSTALL SUPPORT POLES FOR OVERHEAD SIGNALS WITH A MINIMUM HORIZONTAL CLEARANCE OF 2 FEET.

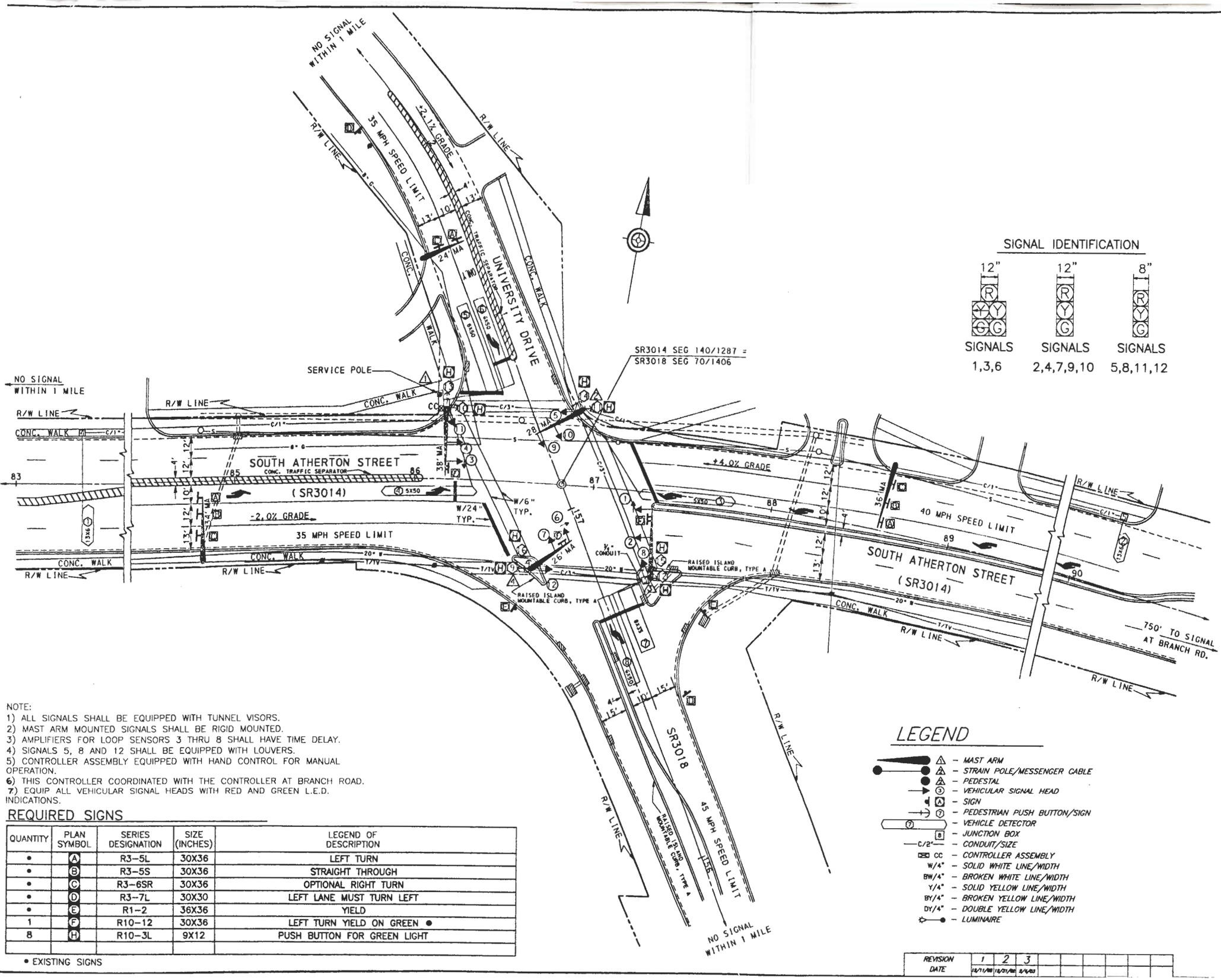
INSTALL SIGNAL HEADS AND SIGNS ERECTED OVER THE ROADWAY WITH THE BOTTOMS NOT LESS THAN 15 NOR MORE THAN 19 FEET ABOVE THE ROADWAY.

INSTALL POST MOUNTED SIGNAL HEADS WITH BOTTOMS NOT LESS THAN 8 FEET NOR MORE THAN 15 FEET ABOVE THE SIDEWALK OR PAVEMENT GRADE.

INSTALL SIGNALS WITH A MINIMUM HORIZONTAL DISTANCE OF 8 FEET BETWEEN THE HEADS AS MEASURED AT RIGHT ANGLES TO THE APPROACH.

THIS DRAWING CANNOT BE USED AS A CONSTRUCTION DRAWING UNLESS THE PERMITTEE COMPLIES WITH THE PROVISIONS OF PA. ACT 287 OF 1994 AS AMENDED BY ACT 187 OF 1996, PREVENTION OF DAMAGE TO UNDERGROUND UTILITIES. PRIOR TO CONSTRUCTION CONSULT WITH UTILITY COMPANIES TO RESOLVE ANY PROBLEMS WHICH MAY BE CREATED DUE TO THE LOCATION OF UTILITIES.

PLACE PAVEMENT MARKINGS IN ACCORDANCE WITH TC-7600 PAVEMENT MARKING STANDARDS.



NOTE:
1) ALL SIGNALS SHALL BE EQUIPPED WITH TUNNEL VISORS.
2) MAST ARM MOUNTED SIGNALS SHALL BE RIGID MOUNTED.
3) AMPLIFIERS FOR LOOP SENSORS 3 THRU 8 SHALL HAVE TIME DELAY.
4) SIGNALS 5, 8 AND 12 SHALL BE EQUIPPED WITH LOUVERS.
5) CONTROLLER ASSEMBLY EQUIPPED WITH HAND CONTROL FOR MANUAL OPERATION.
6) THIS CONTROLLER COORDINATED WITH THE CONTROLLER AT BRANCH ROAD.
7) EQUIP ALL VEHICULAR SIGNAL HEADS WITH RED AND GREEN L.E.D. INDICATIONS.

REQUIRED SIGNS

QUANTITY	PLAN SYMBOL	SERIES DESIGNATION	SIZE (INCHES)	LEGEND OF DESCRIPTION
•	A	R3-5L	30X36	LEFT TURN
•	B	R3-5S	30X36	STRAIGHT THROUGH
•	C	R3-6SR	30X36	OPTIONAL RIGHT TURN
•	D	R3-7L	30X30	LEFT LANE MUST TURN LEFT
•	E	R1-2	36X36	YIELD
1	F	R10-12	30X36	LEFT TURN YIELD ON GREEN •
8	H	R10-3L	9X12	PUSH BUTTON FOR GREEN LIGHT

• EXISTING SIGNS

SIGNAL IDENTIFICATION

12"	12"	8"
SIGNALS 1,3,6	SIGNALS 2,4,7,9,10	SIGNALS 5,8,11,12

LEGEND

- MAST ARM
- STRAIN POLE/MESSENGER CABLE
- PEDESTAL
- VEHICULAR SIGNAL HEAD
- SIGN
- PEDESTRIAN PUSH BUTTON/SIGN
- VEHICLE DETECTOR
- JUNCTION BOX
- C/2" — CONDUIT/SIZE
- CC — CONTROLLER ASSEMBLY
- W/4" — SOLID WHITE LINE/WIDTH
- BW/4" — BROKEN WHITE LINE/WIDTH
- Y/4" — SOLID YELLOW LINE/WIDTH
- BY/4" — BROKEN YELLOW LINE/WIDTH
- DY/4" — DOUBLE YELLOW LINE/WIDTH
- LUMINAIRE

REVISION	1	2	3						
DATE	12/1/00	12/31/02	2/4/03						

COMMONWEALTH OF PENNSYLVANIA REGISTERED PROFESSIONAL CHARLES A. WOOSTER ENGINEER PE-038828-E PENNSYLVANIA

FIGURE 2 OF 11

COUNTY : CENTRE

MUNICIPALITY : BOROUGH OF STATE COLLEGE

INTERSECTION : SOUTH ATHERTON STREET (SR3014), SR3018 AND UNIVERSITY DRIVE.

REVIEWED : Amy L. Story, P.E. 2/12/03
MUNICIPAL OFFICIAL DATE

RECOMMENDED : Jerome Bunk 2-18-03
DISTRICT TRAFFIC ENGINEER DATE

SCALE : 0 25 50 75

DISTRICT	COUNTY	ROUTE	SECTION	SHEET
2-0	CENTRE	3018	N10	17 OF 24
STATE COLLEGE BOROUGH				
REVISION NUMBER	REVISION		DATE	BY

TRAFFIC SIGNAL PLAN

PHASING DIAGRAM

SIGNALS	PHASE 1+5				PHASE 1+6				PHASE 2+5				PHASE 2+6				PHASE 3+8				PHASE 4+8				FLASHING
	INTERVALS				INTERVALS				INTERVALS				INTERVALS				INTERVALS				INTERVALS				
1	R-G-	R-Y③	R③		G-G-	G-G-	Y⑤	R⑥	R	R	R	R	G	G	Y	R	R	R	R	R	R	R	R	R	Y
2	R	R	R		G	G	Y⑥	R⑥	R	R	R	R	G	G	Y	R	R	R	R	R	R	R	R	R	Y
3	R-G-	R-Y④	R④		R	R	R	R	G-G-	G-G-	Y-Y⑤	R⑥	G	G	Y	R	R	R	R	R	R	R	R	R	Y
4	R	R	R		R	R	R	R	G	G	Y⑥	R⑥	G	G	Y	R	R	R	R	R	R	R	R	R	Y
5	R	R	R		R	R	R	R	R	R	R	R	R	R	R	R	G-G-	G-G-	Y-Y⑦	R⑧	G	G	Y	R	R
6	R	R	R		R	R	R	R	R	R	R	R	R	R	R	R	G	G	Y⑧	R⑧	G	G	Y	R	R
7-8	R	R	R		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	G	G	Y	R	R
9-10	DW	DW	DW		W*	FD*	DW	DW	DW	DW	DW	DW	W*	FD*	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	OFF
11-12	DW	DW	DW		DW	DW	DW	DW	W*	FD*	DW	DW	W*	FD*	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	OFF
13-14	DW	DW	DW		DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	W*	FD*	DW	DW	W*	FD*	DW	DW	OFF
15-16	DW	DW	DW		DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	W*	FD*	DW	DW	OFF
FIXED		4.0	1.0			4.0	1.0			4.0	1.0			4.0	2.5			4.0	2.5			4.0	2.5		
MINIMUM	1.0				1.0				1.0				15.0				2.0				3.0				
PASSAGE	2.0				2.0				2.0				6.7				2.0				2.0				
SEC./ACT.													2.0												
MAX. INITIAL													25.0												
BEFORE RED.													25.0												
TO REDUCE													10.0												
MIN. GAP													3.0												
MAX I	9				9				15				35				9				25				
CYCLE I	▲ 12				▲ 12				▲ 31				▲ 33				▲ 14				▲ 32				
CYCLE II	▲ 12				▲ 12				▲ 26				▲ 33				▲ 22				▲ 29				
PEDESTRIANS*					②				②				7 17				①				4 18				
MEMORY	NON LOCKING				NON LOCKING				NON LOCKING				MIN RECALL				NON LOCKING				NON LOCKING				

CONTROLLER NOTES

① TIMING WILL BE AS SHOWN IN PHASE 4+8. IT MAY TIME OUT IN THIS PHASE OR BE COMPLETED IN PHASE 4+8

② TIMING WILL BE AS SHOWN IN PHASE 2+6. IT MAY TIME OUT IN THIS PHASE OR BE COMPLETED IN PHASE 2+6

③ R/-G- IF FOLLOWED BY PHASE 1+6

④ R/-G- IF FOLLOWED BY PHASE 2+5

⑤ G/-Y- IF FOLLOWED BY PHASE 2+6

⑥ G IF FOLLOWED BY PHASE 2+6

⑦ G/-Y- IF FOLLOWED BY PHASE 4+8

⑧ G IF FOLLOWED BY PHASE 4+8

* UPON PEDESTRIAN ACTUATION, OTHERWISE "DON'T WALK" AT ALL TIMES.
** UPON PEDESTRIAN ACTUATION, SIGNALS 9 THROUGH 16 SHALL DISPLAY THE NUMBER OF SECONDS REMAINING IN INTERVAL 2 OF THE ACTIVE PHASE. THE COUNTDOWN TIMER SHALL REMAIN DARK DURING ALL OTHER INTERVALS.
▲ TOTAL LENGTH OF PHASE IN SECONDS

INTERCONNECT NOTE:

CONTROLLER TO BE TIME BASED COORDINATED WITH ADJACENT SIGNAL CONTROLLER ALONG *LEGAL RIGHT OF WAY LINE* S.R.3014 (SOUTH ATHERTON ST) TO PROVIDE A PROGRESSIVE MOVEMENT OF TRAFFIC.
INTERSECTIONS INCLUDED IN INTERCONNECT ARE AS FOLLOWS:
- UNIVERSITY DRIVE
- BRANCH ROAD

SIGNS

PLAN SYMBOL	SERIES DESIGNATION	SIZE W x H	DESCRIPTION	QTY.
A	R10-3E-L	9"x14"	EDUCATIONAL PUSH BUTTON FOR WALK SIGNAL WITH COUNTDOWN TIMER ←	4
B	R10-3E-R	9"x14"	EDUCATIONAL PUSH BUTTON FOR WALK SIGNAL WITH COUNTDOWN TIMER →	4
C	R10-12	30"x36"	LEFT TURN YIELD ON GREEN ●	3
D	D3-4 *	78"x16"	Atherton St	2
E	D3-4 *	84"x16"	University Dr	2
F	R3-5L	30"x36"	LEFT TURN SIGN	4
G	R3-6SR	30"x36"	OPTIONAL RIGHT TURN SIGN	3
H	R3-5S	30"x36"	STRAIGHT THROUGH SIGN	3
I	R3-5R	30"x36"	RIGHT TURN SIGN	1
J	R3-8A(L-S-R)	48"x30"	LANE USE CONTROL SIGN	1
K	R3-8B(L-S-SR)	48"x30"	LANE USE CONTROL SIGN	2
L	R1-2	36"x36"	YIELD	1
M	R3-8A(L-SR)	30"x30"	LANE USE CONTROL SIGN	1
N	R1-5L	18"x18"	YIELD HERE TO PEDESTRIAN	1

* SIGNS D AND E SHALL HAVE WHITE LEGEND AND BORDER ON A BLUE BACKGROUND.

+ NOTE: FOUNDATION TO BE FLUSH WITH SIDEWALK TO ALLOW FOR 10" ADA COMPATIBLE REACH

DETAIL 1+ N.T.S. — CONTROLLER ASSEMBLY TYPE I MOUNTING ELECTRICAL SERVICE, TYPE B

DETAIL 2+ N.T.S. — 12' BREAKAWAY PEDESTAL

DETAIL 3+ N.T.S. — 12' BREAKAWAY PEDESTAL

DETAIL 4+ N.T.S. — 12' BREAKAWAY PEDESTAL

DETAIL 5+ N.T.S. — 12' BREAKAWAY PEDESTAL

DETAIL 6+ N.T.S. — 12' BREAKAWAY PEDESTAL

DETAIL 7+ N.T.S. — 12' BREAKAWAY PEDESTAL

LEGEND

- ① - SIGNAL SUPPORT AND MAST ARM
- *EXISTING SUPPORT AND MAST ARM*
- ① - PEDESTAL
- ① - VEHICULAR SIGNAL HEAD
- ① - PEDESTRIAN SIGNAL HEAD
- (A) - SIGN
- 1a - VEHICLE DETECTION ZONE
- 4 - PEDESTRIAN PUSH BUTTON WITH SIGN
- 4 - JUNCTION BOX
- *4 - EXISTING JUNCTION BOX*
- C/2" - CONDUIT/SIZE
- CL/2" - LIGHTING CONDUIT/SIZE
- CP/2" - CONTROLLER POWER CONDUIT/SIZE
- CONTROLLER ASSEMBLY
- W/4" - SOLID WHITE LINE/WIDTH
- DY/4" - DOUBLE SOLID YELLOW LINE/WIDTH
- BY/4" - BROKEN YELLOW LINE/WIDTH
- *DYL - EXISTING DOUBLE YELLOW LINE*
- *BWL - EXISTING BROKEN WHITE LINE*
- *SWL - EXISTING SINGLE WHITE LINE*
- *EXISTING PAVEMENT MARKING LEGEND*
- ① - VIDEO CAMERA DETECTOR
- ① - RADAR DETECTOR
- ④ - PREEMPTION CONFIRMATION LIGHT
- ① - PREEMPTION DETECTOR
- ① - LUMINAIRE

COMMONWEALTH OF PENNSYLVANIA — REGISTERED PROFESSIONAL — MARK C. SZEWCOW — ENGINEER — 050343-E

FIGURE 3 OF 11

COUNTY : CENTRE
MUNICIPALITY : STATE COLLEGE BOROUGH
INTERSECTION : S. ATHERTON ST. (SR 3014), UNIVERSITY DR. EXT. (SR 3018) AND UNIVERSITY DR.

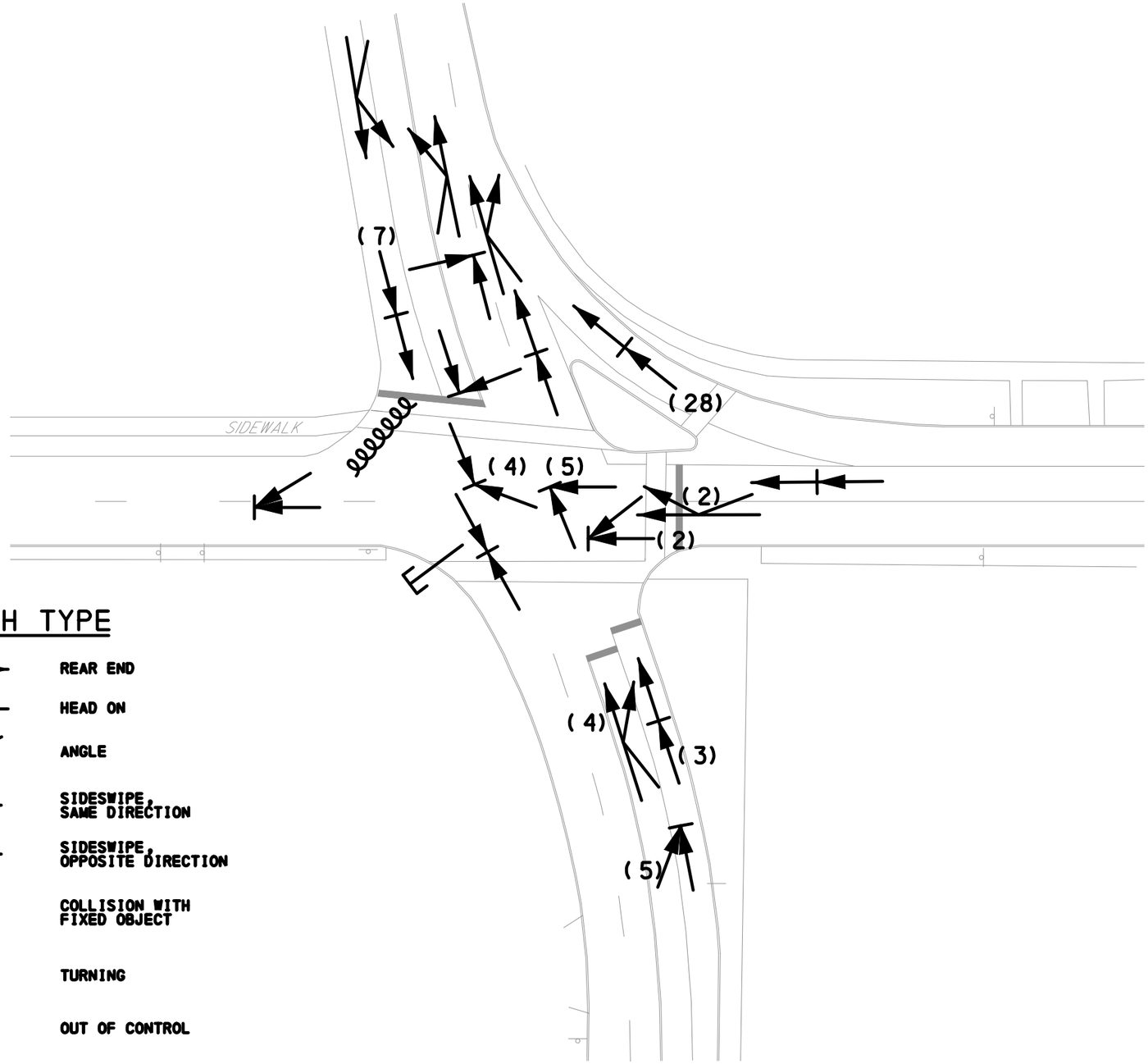
APPROVED BY:
MUNICIPAL OFFICIAL DATE
RECOMMENDED :
DISTRICT TRAFFIC ENGINEER DATE

SCALE : 0' 25' 50' 75'

PLOTTED: 12/7/2010

FILE NAME: P:\Eadsg00\08130\Working\05 South Atherton Street Signal\Construction Plan.dgn

PLOTTED: 12/9/2010



CRASH TYPE

- REAR END
- HEAD ON
- ANGLE
- SIDESWIPE, SAME DIRECTION
- SIDESWIPE, OPPOSITE DIRECTION
- COLLISION WITH FIXED OBJECT
- TURNING
- OUT OF CONTROL

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SEAL:

SURVEYOR
CADD
DESIGNER
PROJ. MANAGER
FILE:

DATE DESCRIPTION
REVISIONS

PROJECT NAME

PLANNED INTERSECTION SAFETY IMPROVEMENT PROGRAM PART II

SHEET NAME

ATHERTON STREET & COLLEGE AVENUE YEARS 2005-2009 VEHICULAR CRASHES

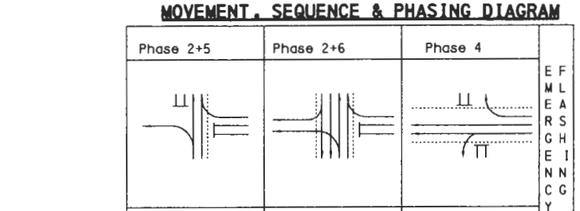
PROJECT NO.
10-047

DATE
DECEMBER 9, 2010

SCALE	SHEET NO.
N TS	4 OF 11

FILE NAME: Atherton & College.dgn

MOVEMENT, SEQUENCE & PHASING DIAGRAM



	INTERVALS				INTERVALS				INTERVALS				EMERGENCY FLASHING
SIGNALS	1	2			1	2	3	4	1	2	3	4	
1,2	R	R			G	G	Y	R	R	R	R	R	Y
3	G -G-	G -Y-			G	G	Y	R	R	R	R	R	Y
4	G	G			G	G	Y	R	R	R	R	R	Y
5,6	R	R			R	R	R	R	G	G	Y	R	R
8,9	W	W			W	FDW	DW	DW	DW	DW	DW	DW	OFF
10,11	DW	DW			W	FDW	DW	DW	DW	DW	DW	DW	OFF
12,13,14,15	DW	DW			DW	DW	DW	DW	W	FDW	DW	DW	OFF
FIXED		3					4.1	1.6			3	2.6	
MINIMUM					■								
PASSAGE									3				
MAXIMUM	■								■				
PEDESTRIAN						6			10	14			
MEMORY	Max. Recall				Max. Recall				Ped. Recall				
■ CYCLE 1	10				55				35				
■ CYCLE 2	10				37				38				
■ CYCLE 3	10				46				44				

■ TOTAL LENGTH OF PHASE

OPERATION NOTES:

1. REST IN PHASE 2+6 INTERVAL 1.
2. UNUSED GREEN TIME FROM PHASE 4 WILL BE PROVIDED TO PHASE 2+6.
3. RUN CYCLE 2 IN CASE OF SYSTEM FAILURE.

EMERGENCY VEHICLE PREEMPTION NOTES

EMERGENCY VEHICLE PREEMPTION MAY OCCUR DURING ANY INTERVAL OF THE NORMAL CONTROLLER OPERATION. PROVIDE EMERGENCY VEHICLE PREEMPTION EQUIPMENT IN THE CONTROLLER CABINET CAPABLE OF DISPLAYING APPROACH CONTROL OPERATION. DEPENDING ON THE DIRECTION OF TRAVEL OF THE EMERGENCY VEHICLE, ONE OF THE FOLLOWING PHASES SHALL BE DISPLAYED: PHASE 2+5, PHASE 6 OR PHASE 4. PROVIDE THE FOLLOWING SEQUENCE UPON ACTIVATION BY AN EMERGENCY VEHICLE.

IF THE CONTROLLER OPERATION IS IN INTERVAL 1 (GREEN/GREEN ARROW) OF A NON-PREEMPTIVE PHASE, THE CONTROLLER SHALL IMMEDIATELY TERMINATE THE CONFLICTING GREEN INDICATION AND PROCEED THROUGH THE YELLOW AND ALL-RED CLEARANCE INTERVALS BEFORE PROCEEDING TO THE PREEMPTION PHASE GREEN.

IF THE CONTROLLER OPERATION IS IN INTERVAL 1 (GREEN/GREEN ARROW/WALK) OF A NON-PREEMPTIVE PHASE, THE CONTROLLER SHALL IMMEDIATELY TERMINATE THE CONFLICTING WALK INDICATION AND PROCEED THROUGH THE FLASHING DON'T WALK INTERVAL, THE YELLOW AND ALL-RED INTERVALS BEFORE PROCEEDING TO THE PREEMPTION PHASE GREEN. THE GREEN INDICATION SHALL REMAIN GREEN THROUGH THE FLASHING DON'T WALK INTERVAL.

IF THE CONTROLLER IS IN INTERVAL 2 (GREEN/FLASHING DON'T WALK) OF A NON-PREEMPTIVE PHASE, THE CONTROLLER SHALL TIME OUT THE INTERVAL BEFORE PROCEEDING THROUGH THE YELLOW AND ALL-RED CLEARANCE INTERVALS. THE GREEN INDICATION SHALL REMAIN GREEN THROUGH THE FLASHING DON'T WALK INTERVAL.

IF THE CONTROLLER OPERATION IS IN INTERVAL 1 (GREEN/GREEN ARROW) OF A PREEMPTION PHASE, THE CONTROLLER SHALL REMAIN IN THE GREEN INTERVAL OF THE PREEMPTION PHASE WHILE THE CONFLICTING GREEN INDICATIONS ARE IMMEDIATELY TERMINATED AND PROCEED THROUGH THE YELLOW AND ALL-RED INTERVALS.

IF THE CONTROLLER OPERATION IS IN INTERVAL 1 (GREEN/GREEN ARROW/WALK) OF A PREEMPTION PHASE, THE CONTROLLER SHALL REMAIN IN THE GREEN INTERVAL OF THE PREEMPTION PHASE AND IMMEDIATELY TERMINATE THE WALK INDICATION AND PROCEED TO TIME THE FLASHING DON'T WALK INTERVAL TIME. UPON CONCLUSION OF THE FLASHING DON'T WALK TIME ANY CONFLICTING GREEN INDICATION WILL BE IMMEDIATELY TERMINATED AND PROCEED THROUGH THE YELLOW AND ALL-RED INTERVALS.

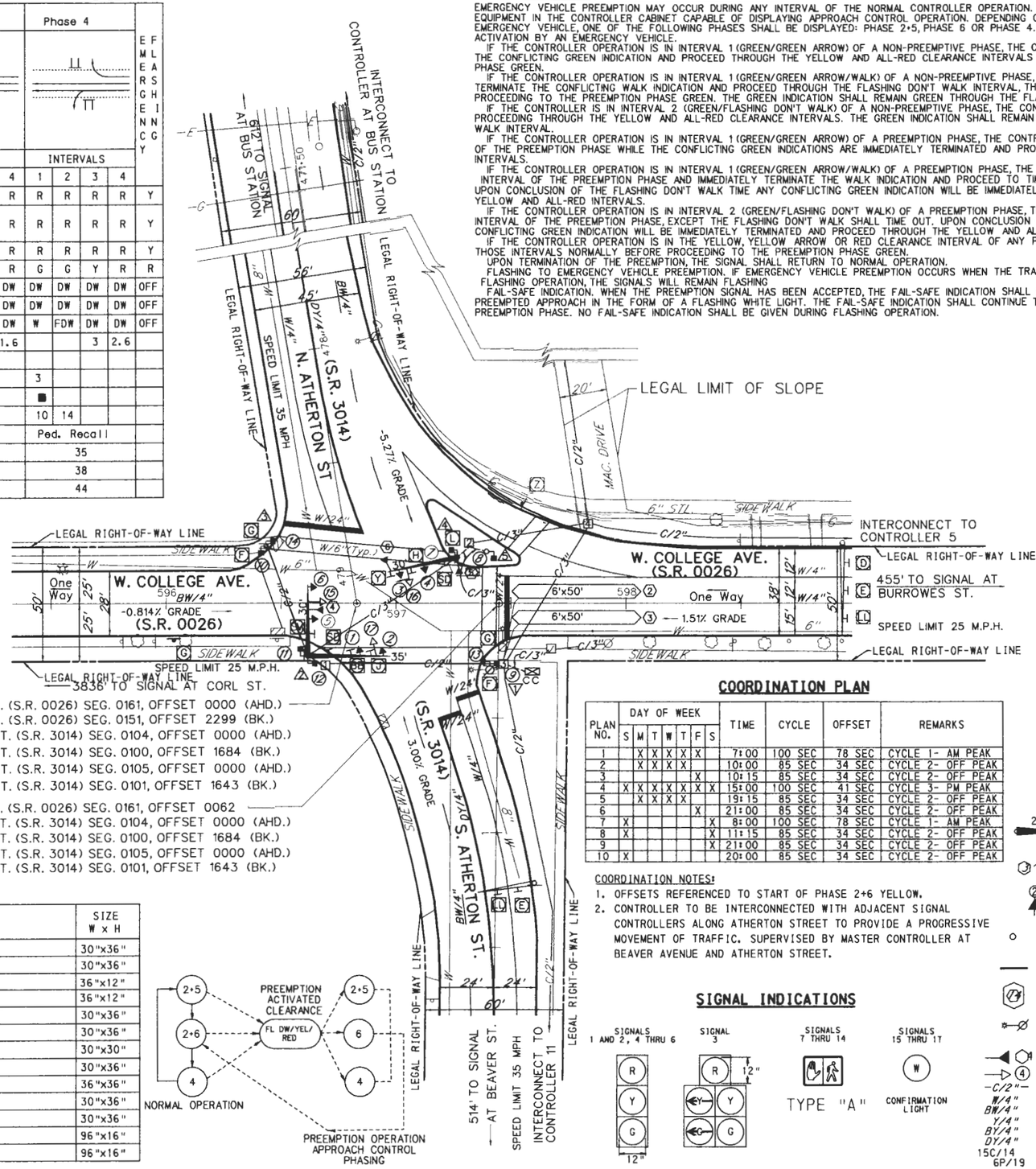
IF THE CONTROLLER OPERATION IS IN INTERVAL 2 (GREEN/FLASHING DON'T WALK) OF A PREEMPTION PHASE, THE CONTROLLER SHALL REMAIN IN THE GREEN INTERVAL OF THE PREEMPTION PHASE, EXCEPT THE FLASHING DON'T WALK SHALL TIME OUT. UPON CONCLUSION OF THE FLASHING DON'T WALK TIME ANY CONFLICTING GREEN INDICATION WILL BE IMMEDIATELY TERMINATED AND PROCEED THROUGH THE YELLOW AND ALL-RED INTERVALS.

IF THE CONTROLLER OPERATION IS IN THE YELLOW, YELLOW ARROW OR RED CLEARANCE INTERVAL OF ANY PHASE, THE CONTROLLER SHALL TIME OUT THOSE INTERVALS NORMALLY BEFORE PROCEEDING TO THE PREEMPTION PHASE GREEN.

UPON TERMINATION OF THE PREEMPTION, THE SIGNAL SHALL RETURN TO NORMAL OPERATION.

FLASHING TO EMERGENCY VEHICLE PREEMPTION. IF EMERGENCY VEHICLE PREEMPTION OCCURS WHEN THE TRAFFIC SIGNALS ARE IN CONFLICTING FLASHING OPERATION, THE SIGNALS WILL REMAIN FLASHING

FAIL-SAFE INDICATION. WHEN THE PREEMPTION SIGNAL HAS BEEN ACCEPTED, THE FAIL-SAFE INDICATION SHALL BE DISPLAYED IMMEDIATELY ON THE PREEMPTED APPROACH IN THE FORM OF A FLASHING WHITE LIGHT. THE FAIL-SAFE INDICATION SHALL CONTINUE TO FLASH FOR THE DURATION OF THE PREEMPTION PHASE. NO FAIL-SAFE INDICATION SHALL BE GIVEN DURING FLASHING OPERATION.



WEST COLLEGE AVE. (S.R. 0026) SEG. 0161, OFFSET 0000 (AHD.)
WEST COLLEGE AVE. (S.R. 0026) SEG. 0151, OFFSET 2299 (BK.)
SOUTH ATHERTON ST. (S.R. 3014) SEG. 0104, OFFSET 0000 (AHD.)
NORTH ATHERTON ST. (S.R. 3014) SEG. 0100, OFFSET 1684 (BK.)
SOUTH ATHERTON ST. (S.R. 3014) SEG. 0105, OFFSET 0000 (AHD.)
NORTH ATHERTON ST. (S.R. 3014) SEG. 0101, OFFSET 1643 (BK.)

WEST COLLEGE AVE. (S.R. 0026) SEG. 0161, OFFSET 0062
SOUTH ATHERTON ST. (S.R. 3014) SEG. 0104, OFFSET 0000 (AHD.)
NORTH ATHERTON ST. (S.R. 3014) SEG. 0100, OFFSET 1684 (BK.)
SOUTH ATHERTON ST. (S.R. 3014) SEG. 0105, OFFSET 0000 (AHD.)
NORTH ATHERTON ST. (S.R. 3014) SEG. 0101, OFFSET 1643 (BK.)

SIGNS

PLAN SYMBOL	DESCRIPTION		SIZE W x H
D	R3-5R,	RIGHT TURN	30"x36"
E	R3-5S,	STRAIGHT-THROUGH	30"x36"
F	R6-1L,	HORIZONTAL LEFT ONE-WAY	36"x12"
G	R6-1R,	HORIZONTAL RIGHT ONE-WAY	36"x12"
H	R6-2L,	VERTICAL LEFT ONE-WAY	30"x36"
J	R6-2R,	VERTICAL RIGHT ONE-WAY	30"x36"
Q	R5-1,	DO NOT ENTER	30"x30"
Y	R10-12,	LEFT TURN YIELD ON GREEN	30"x36"
Z	R1-2,	YIELD	36"x36"
BB	R10-11,	NO TURN ON RED	30"x36"
LT	R3-6LS,	OPTIONAL LEFT TURN	30"x36"
SD	D3-4	W COLLEGE AVE	96"x16"
SM	D3-4	ATHERTON ST	96"x16"

COORDINATION PLAN

PLAN NO.	DAY OF WEEK S	M	T	W	T	F	S	TIME	CYCLE	OFFSET	REMARKS
1		X	X	X	X	X		7:00	100 SEC	78 SEC	CYCLE 1- AM PEAK
2		X	X	X	X			10:00	85 SEC	34 SEC	CYCLE 2- OFF PEAK
3						X		10:15	85 SEC	34 SEC	CYCLE 2- OFF PEAK
4	X	X	X	X	X	X	X	15:00	100 SEC	41 SEC	CYCLE 3- PM PEAK
5		X	X	X	X			19:15	85 SEC	34 SEC	CYCLE 2- OFF PEAK
6						X		21:00	85 SEC	34 SEC	CYCLE 2- OFF PEAK
7	X						X	8:00	100 SEC	78 SEC	CYCLE 1- AM PEAK
8	X						X	11:15	85 SEC	34 SEC	CYCLE 2- OFF PEAK
9							X	21:00	85 SEC	34 SEC	CYCLE 2- OFF PEAK
10	X							20:00	85 SEC	34 SEC	CYCLE 2- OFF PEAK

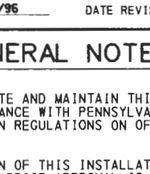
COORDINATION NOTES:

1. OFFSETS REFERENCED TO START OF PHASE 2+6 YELLOW.
2. CONTROLLER TO BE INTERCONNECTED WITH ADJACENT SIGNAL CONTROLLERS ALONG ATHERTON STREET TO PROVIDE A PROGRESSIVE MOVEMENT OF TRAFFIC. SUPERVISED BY MASTER CONTROLLER AT BEAVER AVENUE AND ATHERTON STREET.

SIGNAL INDICATIONS

LEGEND

- 25' MAST ARM
- PEDESTRIAN PUSH BUTTON
- PEDESTRIAN SIGNAL HEAD
- VEHICULAR SIGNAL HEAD
- SIGN
- STRAIN POLE/PEDESTAL
- TRAFFIC SIGNAL SUPPORT
- DEPRESSED CURB
- STREET LIGHT POLE USED AS TRAFFIC SIGNAL SUPPORT
- VEHICLE DETECTOR
- JUNCTION BOX
- UTILITY POLE W/ STREET LIGHT CC
- CONTROLLER ASSEMBLY
- PREEMPTION DETECTOR
- PREEMPTION CONFIRMATION LIGHT
- C/2" Existing Conduit/Size
- W/4" Solid White Line/Width
- BW/4" Broken White Line/Width
- Y/4" Solid Yellow Line/Width
- BY/4" Broken Yellow Line/Width
- DY/4" Double Solid Yellow Line/Width
- 15C/14 # Conductors/AWG Wire Size
- 6P/19 # Pairs/AWG Wire Size
- FIRE HYDRANT
- TREES
- MANHOLE



INTERSECTION 12
FIGURE 5 OF 11

County: CENTRE COUNTY
Municipality: STATE COLLEGE BOROUGH
Intersection: ATHERTON ST. (S.R. 3014) AND WEST COLLEGE AVE. (S.R. 0026)

Reviewed: Amy J. Stout, P.E. — Municipal Official — 10-27-06 Date
Recommended: Michael A. Kuhns, P.E. — District Traffic Engineer — 7/6/06 Date
Scale 0' 25' 50' 75'

PERMIT NO. 21-61 SHEET 2 OF 2
DATE ISSUED 3/8/96 DATE REVISED 7/6/06

PLOTTED: 6/19/2006

FILE NAME: Z:\State00\03163\Final\21-61.dgn

GENERAL NOTES

INSTALL, OPERATE AND MAINTAIN THIS TRAFFIC SIGNAL IN ACCORDANCE WITH PENNSYLVANIA DEPARTMENT OF TRANSPORTATION REGULATIONS ON OFFICIAL TRAFFIC CONTROL DEVICES.

NO MODIFICATION OF THIS INSTALLATION IS PERMITTED UNLESS PRIOR APPROVAL IS GRANTED, IN WRITING, BY THE DEPARTMENT.

ALL MAINTENANCE NECESSARY FOR PROPER VISIBILITY OF THE SIGNALS, INCLUDING TRIMMING TREES, IS THE RESPONSIBILITY OF THE PERMITTEE.

THE PERMITTEE INSTALLS AND MAINTAINS ALL SIGNS AND PAVEMENT MARKINGS INDICATED ON THIS DRAWING WHICH ARE CONSIDERED AS PART OF THE PERMIT, UNLESS OTHERWISE INDICATED. THE DEPARTMENT MAINTAINS THE LONGITUDINAL PAVEMENT MARKINGS ON STATE HIGHWAYS.

INSTALL POST MOUNTED SIGNALS WITH THE SIGNAL HEADS A MINIMUM OF 2 FEET BEHIND THE FACE OF THE CURB OR EDGE OF THE SHOULDER. ALSO, INSTALL SUPPORT POLES FOR OVERHEAD SIGNALS WITH A MINIMUM HORIZONTAL CLEARANCE OF 2 FEET.

INSTALL SIGNAL HEADS AND SIGNS ERECTED OVER THE ROADWAY WITH THE BOTTOMS NOT LESS THAN 15 FEET NOR MORE THAN 19 FEET ABOVE THE ROADWAY.

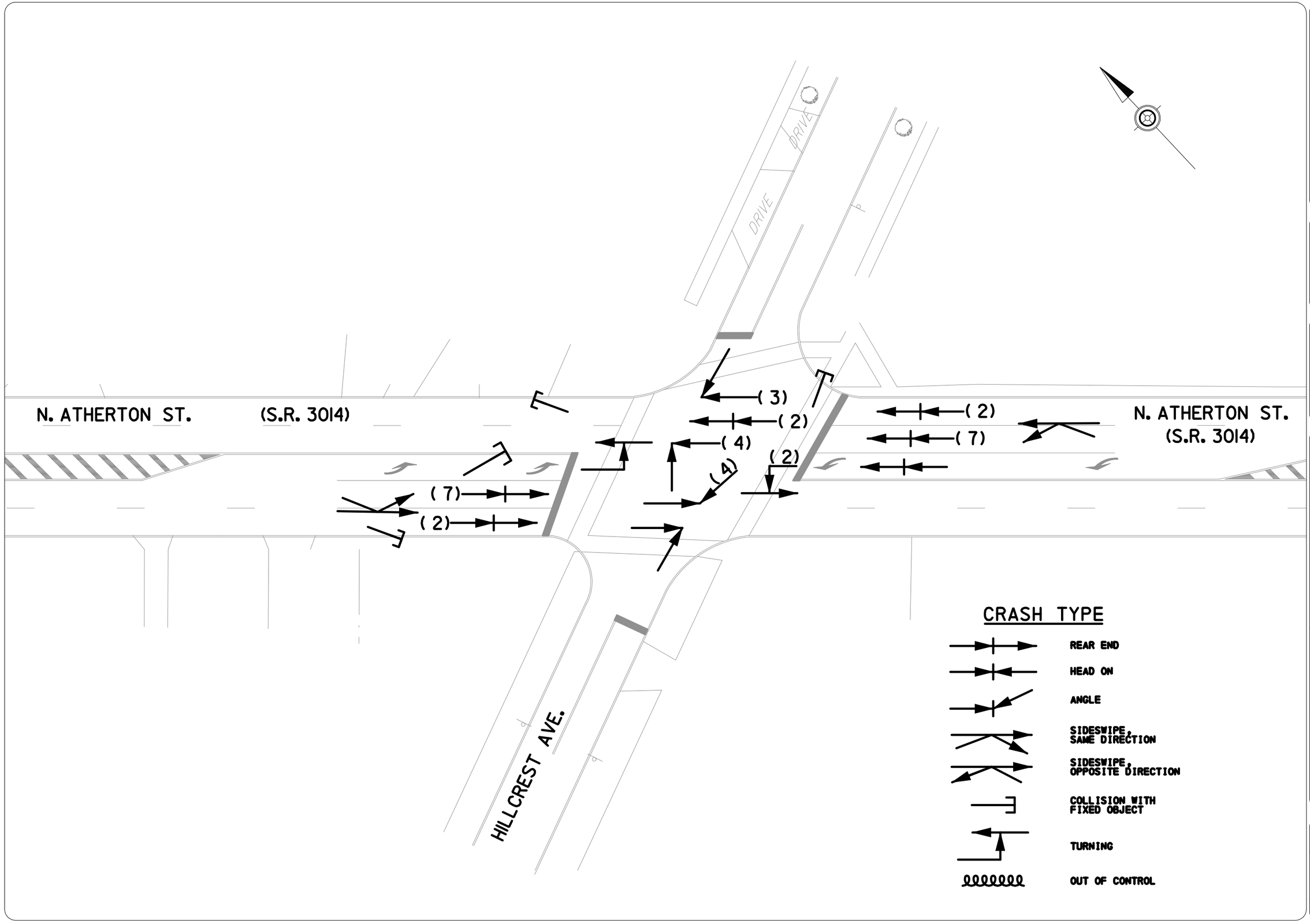
INSTALL POST MOUNTED SIGNAL HEADS WITH BOTTOMS NOT LESS THAN 8 FEET NOR MORE THAN 15 FEET ABOVE THE SIDEWALK OR PAVEMENT GRADE.

INSTALL SIGNALS WITH A MINIMUM HORIZONTAL DISTANCE OF 8 FEET BETWEEN THE HEADS AS MEASURED AT RIGHT ANGLES TO THE APPROACH.

THIS DRAWING CAN NOT BE USED AS A CONSTRUCTION DRAWING UNLESS THE PERMITTEE COMPLIES WITH THE PROVISIONS OF PA. ACT 287 OF 1994 AS AMENDED BY ACT 187 OF 1996, PREVENTION OF DAMAGE TO UNDERGROUND UTILITIES. PRIOR TO CONSTRUCTION CONSULT WITH UTILITY COMPANIES TO RESOLVE ANY PROBLEMS WHICH MAY BE CREATED DUE TO THE LOCATION OF UTILITIES.

PLACE PAVEMENT MARKINGS IN ACCORDANCE WITH TC-8600 PAVEMENT MARKING STANDARDS.

PLOTTED: 12/9/2010



STAHL SHEAFFER ENGINEERING, LLC
3941 S. ATHERTON STREET, SUITE A
STATE COLLEGE, PA 16801
PH: 814-689-1562
FAX: 814-689-1885
WWW.SSE-LLC.COM

SEAL:

SURVEYOR
CADD
DESIGNER
PROJ. MANAGER
FILE:

DATE DESCRIPTION
REVISIONS

PROJECT NAME

PLANNED INTERSECTION SAFETY IMPROVEMENT PROGRAM PART II

SHEET NAME

ATHERTON STREET & HILLCREST AVENUE YEARS 2005-2009 VEHICULAR CRASHES

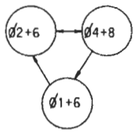
PROJECT NO.
10-047

DATE
DECEMBER 9, 2010

SCALE	SHEET NO.
NTS	6 OF 11

FILE NAME: Atherton & Hillcrest.dgn

MOVEMENT, SEQUENCE & PHASING DIAGRAM



	Phase 2+6				Phase 4+8				Phase 1+6				FLASHING
	INTERVALS				INTERVALS				INTERVALS				
SIGNALS	1	2	3	4	1	2	3	4	1	2			
1	G	G	Y	R	R	R	R	R	G	G			Y
2	G	G	Y	R	R	R	R	R	G	G			Y
3,4	G	G	Y	R	R	R	R	R	R	R			Y
5,6,7,8	R	R	R	R	G	G	Y	R	DW	DW			R
9,10,11,12	W	FDW	DW	DW	DW	DW	DW	DW	DW	DW			OFF
13,14,15,16	DW	DW	DW	DW	DW ①	DW ②	DW	DW	DW	DW			OFF
FIXED			4	1.4			3	2.9		3			
MINIMUM	15				2				2				
SEC./ACT.	2												
MAX. INIT.	22												
PASSAGE	5.3				2				2				
TO REDUCE	10												
BEFORE RED.	22												
MIN. GAP	3												
MAXIMUM	■				■				■				
PEDESTRIAN	9*	6			7*	11*							
MEMORY	PED. RECALL				Non-locking				Non-locking				
■ CYCLE 1	65				25				10				
■ CYCLE 2	49				25				11				
■ CYCLE 3	63				24				13				

■ Total Length of Phase.

COORDINATION PLAN

PLAN NO.	DAY OF WEEK S	M	T	W	T	F	S	TIME	CYCLE	OFFSET	REMARKS
1		X	X	X	X	X		7:00	100 SEC	92 SEC	CYCLE 1- AM PEAK
2		X	X	X	X			10:00	85 SEC	73 SEC	CYCLE 2- OFF PEAK
3						X		10:15	85 SEC	73 SEC	CYCLE 2- OFF PEAK
4	X	X	X	X	X	X	X	15:00	100 SEC	52 SEC	CYCLE 3- PM PEAK
5		X	X	X	X			19:15	85 SEC	73 SEC	CYCLE 2- OFF PEAK
6						X		21:00	85 SEC	73 SEC	CYCLE 2- OFF PEAK
7	X						X	8:00	100 SEC	92 SEC	CYCLE 1- AM PEAK
8	X						X	11:15	85 SEC	73 SEC	CYCLE 2- OFF PEAK
9							X	21:00	85 SEC	73 SEC	CYCLE 2- OFF PEAK
10	X							20:00	85 SEC	73 SEC	CYCLE 2- OFF PEAK
11	X	X	X	X	X	X	X	1:00	——	——	FLASH

COORDINATION NOTES:

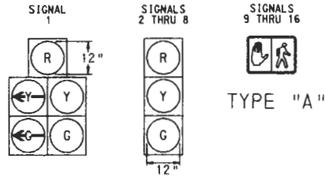
1. OFFSETS REFERENCED TO START OF PHASE 2+6 YELLOW.
2. CONTROLLER TO BE INTERCONNECTED WITH ADJACENT SIGNAL CONTROLLERS ALONG ATHERTON STREET TO PROVIDE A PROGRESSIVE MOVEMENT OF TRAFFIC. SUPERVISED BY MASTER CONTROLLER AT BEAVER AVENUE AND ATHERTON STREET.

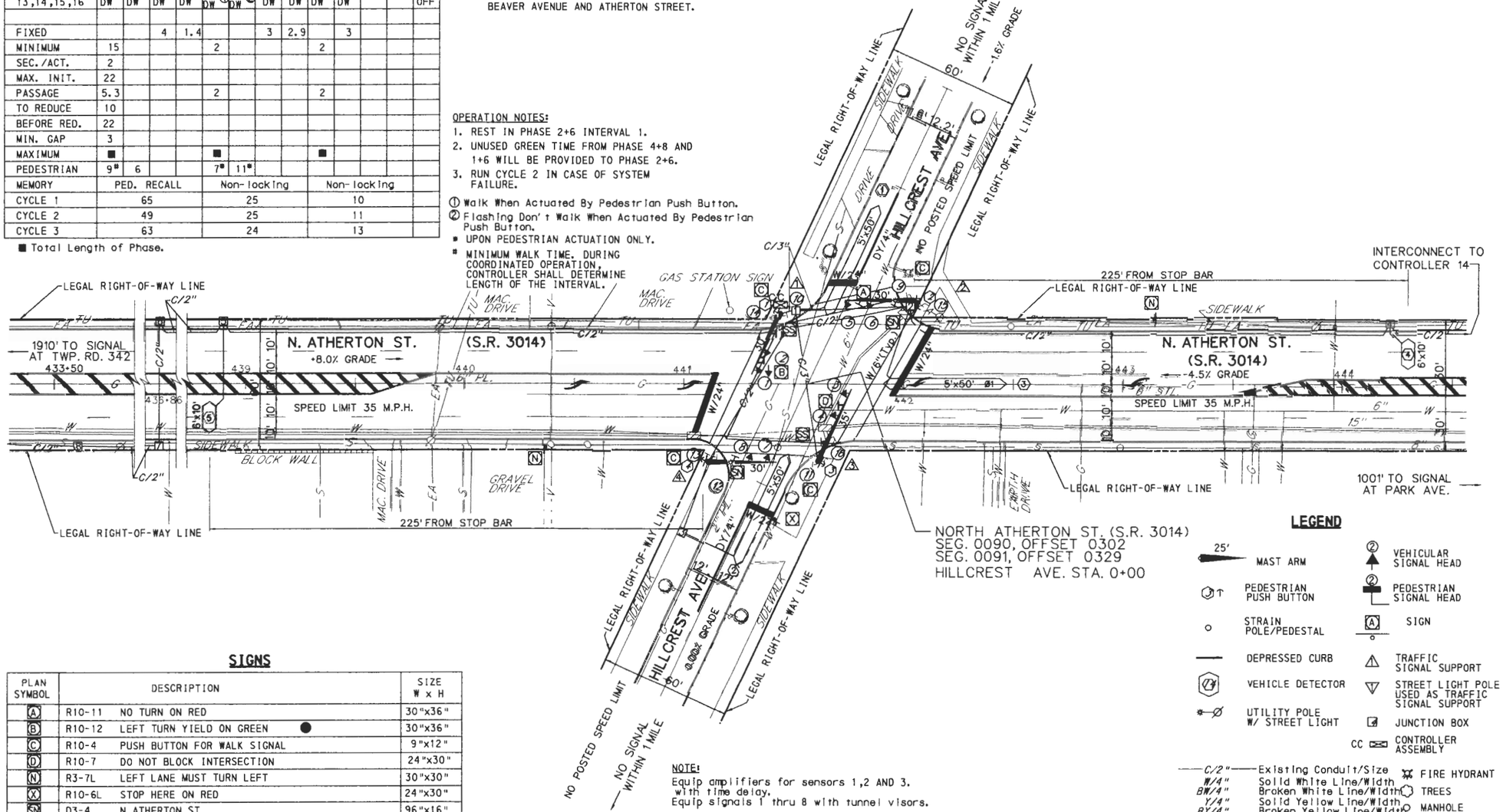
OPERATION NOTES:

1. REST IN PHASE 2+6 INTERVAL 1.
2. UNUSED GREEN TIME FROM PHASE 4+8 AND 1+6 WILL BE PROVIDED TO PHASE 2+6.
3. RUN CYCLE 2 IN CASE OF SYSTEM FAILURE.

① Walk When Actuated By Pedestrian Push Button.
② Flashing Don't Walk When Actuated By Pedestrian Push Button.
* UPON PEDESTRIAN ACTUATION ONLY.
* MINIMUM WALK TIME, DURING COORDINATED OPERATION, CONTROLLER SHALL DETERMINE LENGTH OF THE INTERVAL.

SIGNAL INDICATIONS





NOTE:
Equip amplifiers for sensors 1,2 AND 3. with time delay.
Equip signals 1 thru 8 with tunnel visors.

SIGNS

PLAN SYMBOL		DESCRIPTION	SIZE W x H
A	R10-11	NO TURN ON RED	30"x36"
B	R10-12	LEFT TURN YIELD ON GREEN ●	30"x36"
C	R10-4	PUSH BUTTON FOR WALK SIGNAL	9"x12"
D	R10-7	DO NOT BLOCK INTERSECTION	24"x30"
N	R3-7L	LEFT LANE MUST TURN LEFT	30"x30"
X	R10-6L	STOP HERE ON RED	24"x30"
SN	D3-4	N ATHERTON ST	96"x16"
SS	D3-4	HILLCREST AVE	96"x16"

LEGEND

- 25' MAST ARM
- PEDESTRIAN PUSH BUTTON
- STRAIN POLE/PEDESTAL
- DEPRESSED CURB
- VEHICLE DETECTOR
- UTILITY POLE W/ STREET LIGHT
- VEHICULAR SIGNAL HEAD
- PEDESTRIAN SIGNAL HEAD
- SIGN
- TRAFFIC SIGNAL SUPPORT
- STREET LIGHT POLE USED AS TRAFFIC SIGNAL SUPPORT
- JUNCTION BOX
- CC CONTROLLER ASSEMBLY
- C/2" Existing Conduit/Size
- W/4" Solid White Line/Width
- BW/4" Broken White Line/Width
- Y/4" Solid Yellow Line/Width
- BY/4" Broken Yellow Line/Width
- DY/4" Double Solid Yellow Line/Width
- 15C/14 * Conductors/AWG Wire Size
- 6P/19 * Pairs/AWG Wire Size
- FIRE HYDRANT
- TREES
- MANHOLE

PERMIT NO. 21-13 SHEET 2 OF 2
DATE ISSUED 9/1/82 DATE REVISED 7/6/06

PLOTTED: 6/19/2006

GENERAL NOTES

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INSTALL POST MOUNTED SIGNALS WITH THE SIGNAL HEADS A MINIMUM OF 2 FEET BEHIND THE FACE OF THE CURB OR EDGE OF THE SHOULDER. ALSO, INSTALL SUPPORT POLES FOR OVERHEAD SIGNALS WITH A MINIMUM HORIZONTAL CLEARANCE OF 2 FEET.

INSTALL SIGNAL HEADS AND SIGNS ERECTED OVER THE ROADWAY WITH THE BOTTOMS NOT LESS THAN 15 FEET NOR MORE THAN 19 FEET ABOVE THE ROADWAY.

INSTALL POST MOUNTED SIGNAL HEADS WITH BOTTOMS NOT LESS THAN 8 FEET NOR MORE THAN 15 FEET ABOVE THE SIDEWALK OR PAVEMENT GRADE.

INSTALL SIGNALS WITH A MINIMUM HORIZONTAL DISTANCE OF 8 FEET BETWEEN THE HEADS AS MEASURED AT RIGHT ANGLES TO THE APPROACH.

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PLACE PAVEMENT MARKINGS IN ACCORDANCE WITH TC-8600 PAVEMENT MARKING STANDARDS.

INTERSECTION 15
FIGURE 7 OF 11

County: CENTRE COUNTY
Municipality: STATE COLLEGE BOROUGH
Intersection: NORTH ATHERTON ST. (S.R. 3014) AND HILLCREST AVE.

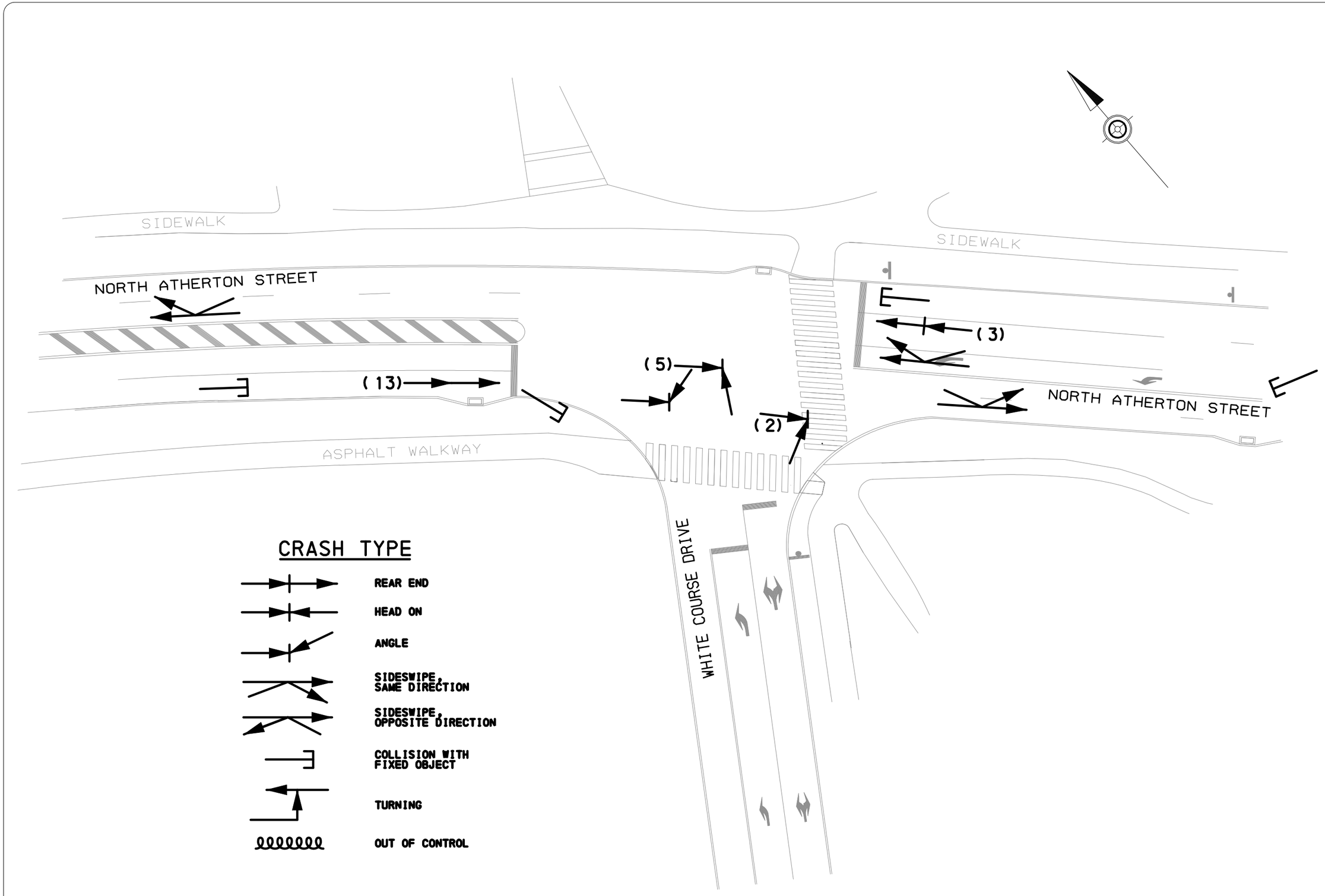
Reviewed: Amy J. Stay, P.E. 6-27-06
Municipal Official Date

Recommended: Michael A. Ambler, P.E. 7/6/06
District Traffic Engineer Date

Scale 0' 25' 50' 75'

FILE NAME: Z:\State00\03163\Final\21-13.dgn

PLOTTED: 12/9/2010



CRASH TYPE

- REAR END
- HEAD ON
- ANGLE
- SIDESWIPE, SAME DIRECTION
- SIDESWIPE, OPPOSITE DIRECTION
- COLLISION WITH FIXED OBJECT
- TURNING
- OUT OF CONTROL

STAHL SHEAFFER ENGINEERING, LLC
3941 S. ATHERTON STREET, SUITE A
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SEAL:

SURVEYOR
CADD
DESIGNER
PROJ. MANAGER
FILE:

DATE DESCRIPTION
REVISIONS

PROJECT NAME

PLANNED INTERSECTION SAFETY IMPROVEMENT PROGRAM PART II

SHEET NAME

ATHERTON STREET & WHITE COURE DRIVE YEARS 2005-2009 VEHICULAR CRASHES

PROJECT NO.
10-047

DATE
DECEMBER 9, 2010

SCALE	SHEET NO.
NTS	8 OF 11

FILE NAME: Atherton & White Course.dgn

PERMIT NO.	21-105	SHEET	2	OF	2
DATE ISSUED	8/24/01	DATE REVISED	11/3/06		

PHASING DIAGRAM

SIGNALS	PHASE 2+5 INTERVALS 1	2	PHASE 2+6 INTERVALS 1	2	3	4	PHASE 4 INTERVALS 1	2	3	4	FLASHING
1	G	G	G	G	Y	R	R	R	R	R	Y
2	G	G	G	G	Y	R	R	R	R	R	Y
3,4	R	R	G	G	Y	R	R	R	R	R	Y
5	R	R	R	R	R	R	G	G	Y	R	R
6	R	R	R	R	R	R	G	G	Y	R	R
7,8 *	DW	DW	W	FDW	DW	DW	DW	DW	DW	DW	OFF
9,10 *	DW	DW	DW	DW	DW	DW	W	FDW	DW	DW	OFF
FIXED		3			4.1	1.8			3	3.5	
MINIMUM	2		■				10				
PASSAGE	2						2				
MAXIMUM	■						■				
PEDESTRIAN *			7	6			7	13			
MEMORY	NON-LOCKING		MAX RECALL				NON-LOCKING				
■ CYCLE I	21		52				27				
■ CYCLE II	14		41				30				
■ CYCLE III	16		49				35				

■ TOTAL LENGTH OF PHASE

UPON PEDESTRIAN ACTUATION ONLY, OTHERWISE HARD SYMBOL AT ALL TIMES.

COORDINATION PLAN

PLAN NO.	DAY OF WEEK S	M	T	W	T	F	S	TIME	CYCLE	OFFSET	REMARKS
1		X	X	X	X	X		7:00	100 SEC	36 SEC	CYCLE 1- AM PEAK
2		X	X	X	X			10:00	85 SEC	24 SEC	CYCLE 2- OFF PEAK
3						X		10:15	85 SEC	24 SEC	CYCLE 2- OFF PEAK
4	X	X	X	X	X	X	X	15:00	100 SEC	17 SEC	CYCLE 3- PM PEAK
5		X	X	X	X			19:15	85 SEC	24 SEC	CYCLE 2- OFF PEAK
6						X		21:00	85 SEC	24 SEC	CYCLE 2- OFF PEAK
7	X						X	8:00	100 SEC	36 SEC	CYCLE 1- AM PEAK
8	X						X	11:15	85 SEC	24 SEC	CYCLE 2- OFF PEAK
9							X	21:00	85 SEC	24 SEC	CYCLE 2- OFF PEAK
10	X							20:00	85 SEC	24 SEC	CYCLE 2- OFF PEAK
11	X	X	X	X	X	X	X	1:00	———	———	FLASH
12	X	X	X	X	X	X	X	6:00	85 SEC	24 SEC	CYCLE 2- OFF PEAK

COORDINATION NOTES:

1. OFFSETS REFERENCED TO START OF PHASE 2+6 YELLOW.
2. SIGNAL TO BE INTERCONNECTED WITH ADJACENT SIGNAL CONTROLLERS ALONG ATHERTON STREET TO PROVIDE A PROGRESSIVE MOVEMENT OF TRAFFIC. SUPERVISED BY MASTER CONTROLLER AT BEAVER AVENUE AND ATHERTON STREET.

OPERATION NOTES:

1. REST IN PHASE 2+6 INTERVAL 1.
2. UNUSED GREEN TIME FROM PHASES 2+5 AND 4 WILL BE PROVIDED TO PHASE 2+6.
3. RUN CYCLE 2 IN CASE OF SYSTEM FAILURE.
4. PHASE 2+5 WILL ONLY FOLLOW PHASE 4.

EMERGENCY VEHICLE PRE-EMPTION NOTES

EMERGENCY VEHICLE PREEMPTION MAY OCCUR DURING ANY INTERVAL OF THE NORMAL CONTROLLER OPERATION.
PROVIDE EMERGENCY VEHICLE PREEMPTION EQUIPMENT IN THE CONTROLLER CABINET CAPABLE OF DISPLAYING APPROACH CONTROL OPERATION.
DEPENDING ON THE DIRECTION OF TRAVEL OF THE EMERGENCY VEHICLE, ONE OF THE FOLLOWING PHASES SHALL BE DISPLAYED: PHASE 2+5, PHASE 4, OR PHASE 6. PROVIDE THE FOLLOWING SEQUENCE UPON ACTIVATION BY AN EMERGENCY VEHICLE.
IF THE CONTROLLER OPERATION IS IN INTERVAL 1 (GREEN/GREEN ARROW) OF A NON-PREEMPTIVE PHASE, THE CONTROLLER SHALL IMMEDIATELY TERMINATE THE CONFLICTING GREEN INDICATION AND PROCEED THROUGH THE YELLOW AND ALL-RED CLEARANCE INTERVALS BEFORE PROCEEDING TO THE PREEMPTION PHASE GREEN.
IF THE CONTROLLER OPERATION IS IN INTERVAL 1 (GREEN/GREEN ARROW/WALK) OF A NON-PREEMPTIVE PHASE, THE CONTROLLER SHALL IMMEDIATELY TERMINATE THE CONFLICTING WALK INDICATION AND PROCEED THROUGH THE FLASHING DON'T WALK INTERVAL, THE YELLOW AND ALL-RED INTERVALS BEFORE PROCEEDING TO THE PREEMPTION PHASE GREEN. THE GREEN INDICATION SHALL REMAIN GREEN THROUGH THE FLASHING DON'T WALK INTERVAL.
IF THE CONTROLLER IS IN INTERVAL 2 (GREEN/FLASHING DON'T WALK) OF A NON-PREEMPTIVE PHASE, THE CONTROLLER SHALL TIME OUT THE INTERVAL BEFORE PROCEEDING THROUGH THE YELLOW AND ALL-RED CLEARANCE INTERVALS. THE GREEN INDICATION SHALL REMAIN GREEN THROUGH THE FLASHING DON'T WALK INTERVAL.
IF THE CONTROLLER OPERATION IS IN INTERVAL 1 (GREEN) OF A PREEMPTION PHASE, THE CONTROLLER SHALL REMAIN IN THE GREEN INTERVAL OF THE PREEMPTION PHASE WHILE THE CONFLICTING GREEN INDICATIONS ARE IMMEDIATELY TERMINATED AND PROCEED THROUGH THE YELLOW AND ALL RED INTERVALS.
IF THE CONTROLLER OPERATION IS IN INTERVAL 1 (GREEN/WALK) OF A PREEMPTION PHASE, THE CONTROLLER SHALL REMAIN IN THE GREEN INTERVAL OF THE PREEMPTION PHASE AND IMMEDIATELY TERMINATE THE WALK INDICATION AND PROCEED TO TIME THE FLASHING DON'T WALK INTERVAL TIME. UPON CONCLUSION OF THE FLASHING DON'T WALK TIME ANY CONFLICTING GREEN INDICATION WILL BE IMMEDIATELY TERMINATED AND PROCEED THROUGH THE YELLOW AND ALL-RED INTERVALS.
IF THE CONTROLLER OPERATION IS IN INTERVAL 2 (GREEN/FLASHING DON'T WALK) OF A PREEMPTION PHASE, THE CONTROLLER SHALL REMAIN IN THE GREEN INTERVAL OF THE PREEMPTION PHASE, EXCEPT THE FLASHING DON'T WALK SHALL TIME OUT. UPON CONCLUSION OF THE FLASHING DON'T WALK TIME ANY CONFLICTING GREEN INDICATION WILL BE IMMEDIATELY TERMINATED AND PROCEED THROUGH THE YELLOW AND ALL-RED INTERVALS.
IF THE CONTROLLER OPERATION IS IN THE YELLOW, YELLOW ARROW OR RED CLEARANCE INTERVAL OF ANY PHASE, THE CONTROLLER SHALL TIME OUT THOSE INTERVALS NORMALLY BEFORE PROCEEDING TO THE PREEMPTION PHASE GREEN.
UPON TERMINATION OF THE PREEMPTION, THE SIGNAL SHALL RETURN TO NORMAL OPERATION.
FLASHING TO EMERGENCY VEHICLE PREEMPTION, IF EMERGENCY VEHICLE PREEMPTION OCCURS WHEN THE TRAFFIC SIGNALS ARE IN CONFLICTING/TIME CLOCK FLASHING OPERATION, THE NORMAL FLASHING OPERATION SEQUENCE, AS SHOWN IN THE PHASING DIAGRAM, SHALL CONTINUE.
FAIL-SAFE INDICATION, WHEN THE PREEMPTION SIGNAL HAS BEEN ACCEPTED, THE FAIL-SAFE INDICATION SHALL BE DISPLAYED IMMEDIATELY ON THE PREEMPTED APPROACH IN THE FORM OF A FLASHING WHITE LIGHT. THE FAIL-SAFE INDICATION SHALL CONTINUE TO FLASH FOR THE DURATION OF THE PREEMPTION PHASE. NO FAIL-SAFE INDICATION SHALL BE GIVEN DURING FLASHING OPERATION.

GENERAL NOTES

INSTALL, OPERATE AND MAINTAIN THIS TRAFFIC SIGNAL IN ACCORDANCE WITH PENNSYLVANIA DEPARTMENT OF TRANSPORTATION REGULATIONS ON OFFICIAL TRAFFIC CONTROL DEVICES.

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INSTALL POST MOUNTED SIGNALS WITH THE SIGNAL HEADS A MINIMUM OF 2 FEET BEHIND THE FACE OF THE CURB OR EDGE OF THE SHOULDER. ALSO, INSTALL SUPPORT POLES FOR OVERHEAD SIGNALS WITH A MINIMUM HORIZONTAL CLEARANCE OF 2 FEET.

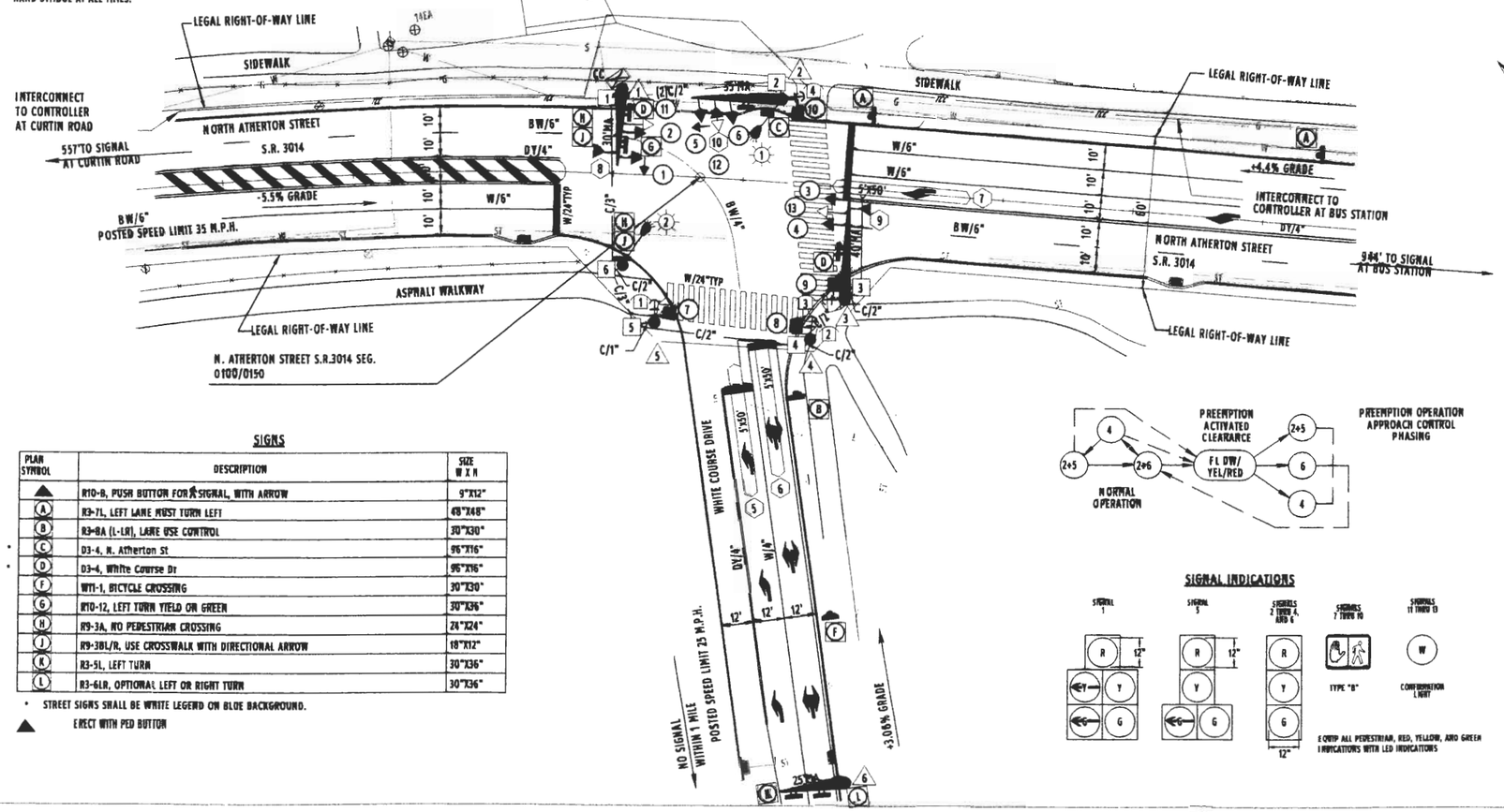
INSTALL SIGNAL HEADS AND SIGNS ERECTED OVER THE ROADWAY WITH THE BOTTOMS NOT LESS THAN 15 FEET NOR MORE THAN 19 FEET ABOVE THE ROADWAY.

INSTALL POST MOUNTED SIGNAL HEADS WITH BOTTOMS NOT LESS THAN 8 FEET NOR MORE THAN 15 FEET ABOVE THE SIDEWALK OR PAVEMENT GRADE.

INSTALL SIGNALS WITH A MINIMUM HORIZONTAL DISTANCE OF 8 FEET BETWEEN THE HEADS AS MEASURED AT RIGHT ANGLES TO THE APPROACH.

THIS DRAWING CAN NOT BE USED AS A CONSTRUCTION DRAWING UNLESS THE PERMITTEE COMPLIES WITH THE PROVISIONS OF PA. ACT 287 OF 1994 AS AMENDED BY ACT 187 OF 1996, PREVENTION OF DAMAGE TO UNDERGROUND UTILITIES. PRIOR TO CONSTRUCTION CONSULT WITH UTILITY COMPANIES TO RESOLVE ANY PROBLEMS WHICH MAY BE CREATED DUE TO THE LOCATION OF UTILITIES.

PLACE PAVEMENT MARKINGS IN ACCORDANCE WITH TC-8600 PAVEMENT MARKING STANDARDS.



SIGNS

PLAN SYMBOL	DESCRIPTION	SIZE W X H
▲	R10-B, PUSH BUTTON FOR ▲ SIGNAL, WITH ARROW	9"X12"
(A)	R3-7L, LEFT LANE MUST TURN LEFT	48"X48"
(B)	R3-8A (L-LR), LANE USE CONTROL	30"X30"
(C)	D3-4, N. Atherton St	96"X16"
(D)	D3-4, White Course Dr	96"X16"
(F)	W11-1, BICYCLE CROSSING	30"X30"
(G)	R10-12, LEFT TURN YIELD OR GREEN	30"X36"
(H)	R9-3A, NO PEDESTRIAN CROSSING	24"X24"
(J)	R9-3BL/R, USE CROSSWALK WITH DIRECTIONAL ARROW	18"X12"
(K)	R3-5L, LEFT TURN	30"X36"
(L)	R3-6LR, OPTIONAL LEFT OR RIGHT TURN	30"X36"

* STREET SIGNS SHALL BE WHITE LEGEND ON BLUE BACKGROUND.
▲ ERECT WITH PED BUTTON

SIGNAL INDICATIONS

LEGEND

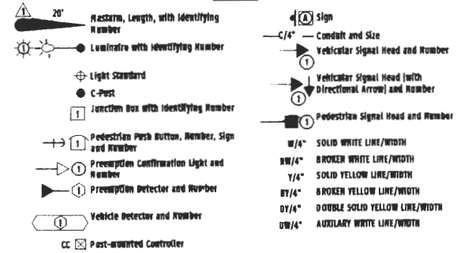


FIGURE 9 OF 11

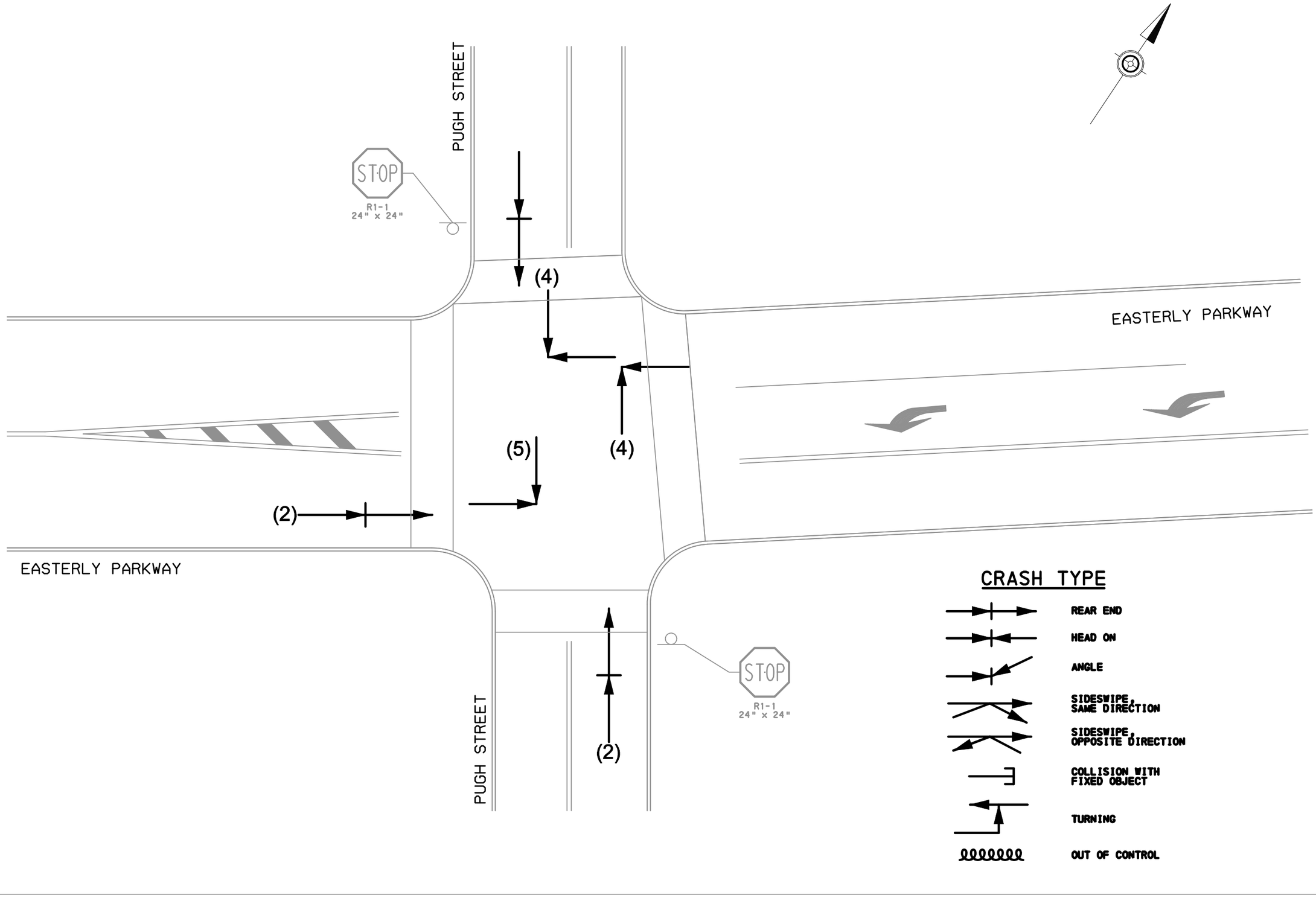
County: CENTRE
Municipality: STATE COLLEGE BOROUGH
Intersection: NORTH ATHERTON ST. (SR 3014) AND WHITE COURSE DR.

Reviewed: Municipal Official — 12/14/2006 Date

Recommended: District Traffic Engineer — 12/20/06 Date

Scale: 25 0 25 50

PLOTTED: 12/9/2010



STAHL SHEAFFER ENGINEERING, LLC
3941 S. ATHERTON STREET, SUITE A
STATE COLLEGE, PA 16801
PH: 814-689-1562
FAX: 814-689-1885
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SEAL:

SURVEYOR
CADD
DESIGNER
PROJ. MANAGER
FILE:

DATE DESCRIPTION
REVISIONS

PROJECT NAME

PLANNED INTERSECTION SAFETY IMPROVEMENT PROGRAM PART II

SHEET NAME

EASTERLY PARKWAY & PUGH STREET YEARS 2005-2009 VEHICULAR CRASHES

PROJECT NO.
10-047

DATE
DECEMBER 9, 2010

SCALE	SHEET NO.
NTS	10 OF 11

FILE NAME: Parkway & Pugh.dgn

PLOTTED: 12/9/2010

FILE NAME: Parkway & Pugh.dgn

STAHL SHEAFFER ENGINEERING, LLC
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SEAL:

SURVEYOR
CADD
DESIGNER
PROJ. MANAGER
FILE:

DATE DESCRIPTION
REVISIONS

PROJECT NAME

PLANNED INTERSECTION SAFETY IMPROVEMENT PROGRAM PART II

SHEET NAME

EASTERLY PARKWAY & PUGH STREET INTERSECTION CONDITION DIAGRAM

PROJECT NO.
10-047

DATE
DECEMBER 9, 2010

SCALE	SHEET NO.
NTS	11 OF 11

APPENDIX A

STAHL SHEAFFER ENGINEERING, LLC

3941 Atherton Street, Suite A
State College, PA 16801
Phone: (814) 689-1562
Fax: (814) 689-1885

Project: SC Road Safety Audit
Subject: Crash Rate Summary
Page: 1 of 1 Date: 12/9/2010
By: CKR Chk'd:

Crash Rate Calculation
As presented in Publication 212

R = (C * 1,000,000) / (T * V * L)

R = Crash rate per million vehicle miles traveled
C = Number of crashes at the study location; within a 5 year time period
T = Time period when crashes are occurring (days)
V = Average Daily Traffic (ADT)
L = Length of road segment (miles)

From crash data - Hillcrest Avenue to Easterly Parkway:

C = 384
T = 1825
V = 20000
L = 1.57

R = 6.70

From homogenous crash data for similar facilities, provided by PennDOT:
(see attached sheets)

C (no clearance) = 1384
C (speeding) = 389
C (speeding related) = 2422
T * V * L = 10239

R = 0.41

Crash rate of Atherton Street between Hillcrest Avenue and Easterly Parkway exceeds state average for similar facillities.

Pennsylvania Department of Transportation
Center for Highway Safety
Homogenous Report for State Road Crashes in Years 2005 to 2009

EXPECTED CRASH EXPERIENCE FOR HOMOGENOUS ROADWAY ATTRIBUTES

NO CLEARANCE

					MILLION VEHICLE	LENGTH	----------ACCIDENT COUNTS BY SEVERITY----------							ACC	ACCIDENT	
			TOTAL WIDTH	ADT RANGE	MILES/5 YRS	(MILES)	FATAL	MAJOR	MODRT	MINOR	-----UNKNOWN----- SEVERITY	IF INJ	PDO	TOTAL	RATE	INTENSITY
RURAL	FAC	DIV	0 - 99 FT	0 - 20,000	41,912	2,153	4	0	8	17	3	0	23	55	0.00	0.03
RURAL	FAC	DIV	0 - 99 FT	20,001 - 99,999	8,123	183	0	0	0	2	2	0	0	4	0.00	0.02
RURAL	FAC	UNDIV	0 - 99 FT	0 - 99,999	313	137	0	1	7	10	0	0	12	30	0.10	0.22
RURAL	NFAC	DIV	0 - 40 FT	0 - 99,999	7,471	694	21	19	84	147	41	4	178	494	0.07	0.71
RURAL	NFAC	DIV	41 - 99 FT	0 - 99,999	111	9	0	0	2	2	2	0	2	8	0.07	0.85
RURAL	NFAC	UNDIV	0 - 19 FT	0 - 999	3,466	7,163	0	4	25	51	15	1	78	174	0.05	0.02
RURAL	NFAC	UNDIV	20 - 99 FT	0 - 999	7,267	8,314	10	16	67	193	29	2	226	543	0.07	0.07
RURAL	NFAC	UNDIV	0 - 19 FT	1,000 - 9,999	1,388	377	0	1	6	17	5	0	23	52	0.04	0.14
RURAL	NFAC	UNDIV	20 - 26 FT	1,000 - 9,999	58,276	10,645	64	159	479	1,232	322	35	1,620	3,911	0.07	0.37
RURAL	NFAC	UNDIV	27 - 40 FT	1,000 - 9,999	4,873	560	3	10	57	125	41	4	173	413	0.08	0.74
RURAL	NFAC	UNDIV	41 - 99 FT	1,000 - 9,999	428	44	0	5	11	20	9	1	32	78	0.18	1.78
RURAL	NFAC	UNDIV	0 - 21 FT	10,000 - 99,999	358	16	0	2	5	13	1	1	17	39	0.11	2.40
RURAL	NFAC	UNDIV	22 - 26 FT	10,000 - 99,999	6,079	266	9	14	48	121	32	2	181	407	0.07	1.53
RURAL	NFAC	UNDIV	27 - 35 FT	10,000 - 99,999	2,345	91	4	10	24	48	9	2	71	168	0.07	1.86
RURAL	NFAC	UNDIV	36 - 40 FT	10,000 - 99,999	1,142	46	1	3	6	15	6	3	32	66	0.06	1.44
RURAL	NFAC	UNDIV	41 - 99 FT	10,000 - 99,999	155	7	0	0	2	6	2	0	7	17	0.11	2.56
URBAN	FAC	DIV	0 - 99 FT	0 - 99,999	87,774	2,090	1	2	17	105	39	5	144	313	0.00	0.15
URBAN	FAC	UNDIV	0 - 99 FT	0 - 99,999	346	109	0	0	2	13	8	1	13	37	0.11	0.34
URBAN	NFAC	DIV	0 - 99 FT	0 - 99,999	53,757	2,869	42	124	397	1,544	867	74	1,964	5,012	0.09	1.75
URBAN	NFAC	UNDIV	0 - 19 FT	0 - 999	216	448	0	2	11	26	10	1	60	110	0.51	0.25
URBAN	NFAC	UNDIV	20 - 99 FT	0 - 999	577	588	0	2	18	31	16	0	57	124	0.21	0.21
URBAN	NFAC	UNDIV	0 - 19 FT	1,000 - 9,999	994	169	0	1	11	36	15	2	66	131	0.13	0.78
URBAN	NFAC	UNDIV	20 - 26 FT	1,000 - 9,999	36,942	4,468	42	108	510	1,556	572	91	2,443	5,322	0.14	1.19
URBAN	NFAC	UNDIV	27 - 40 FT	1,000 - 9,999	9,416	837	8	23	153	546	285	44	934	1,993	0.21	2.38
URBAN	NFAC	UNDIV	41 - 99 FT	1,000 - 9,999	1,108	90	2	3	14	78	64	2	108	271	0.24	3.02
URBAN	NFAC	UNDIV	0 - 26 FT	10,000 - 99,999	26,648	1,043	20	40	249	836	360	45	1,217	2,767	0.10	2.65
URBAN	NFAC	UNDIV	27 - 35 FT	10,000 - 99,999	12,372	466	3	23	101	429	171	27	590	1,344	0.11	2.89
URBAN	NFAC	UNDIV	36 - 40 FT	10,000 - 99,999	10,239	377	4	19	103	404	194	28	596	1,348	0.13	3.58
URBAN	NFAC	UNDIV	41 - 99 FT	10,000 - 99,999	5,268	190	3	12	37	214	120	18	257	661	0.13	3.48

Pennsylvania Department of Transportation
Center for Highway Safety
Homogenous Report for State Road Crashes in Years 2005 to 2009

EXPECTED CRASH EXPERIENCE FOR HOMOGENOUS ROADWAY ATTRIBUTES

SPEEDING

					MILLION VEHICLE	LENGTH	----------ACCIDENT COUNTS BY SEVERITY----------							ACC	ACCIDENT	
			TOTAL WIDTH	ADT RANGE	MILES/5 YRS	(MILES)	FATAL	MAJOR	MODRT	MINOR	-----UNKNOWN----- SEVERITY	IF INJ	PDO	TOTAL	RATE	INTENSITY
RURAL	FAC	DIV	0 - 99 FT	0 - 20,000	41,912	2,153	29	21	51	121	22	3	161	408	0.01	0.19
RURAL	FAC	DIV	0 - 99 FT	20,001 - 99,999	8,123	183	9	2	11	17	3	1	33	76	0.01	0.42
RURAL	FAC	UNDIV	0 - 99 FT	0 - 99,999	313	137	4	1	2	6	0	0	4	17	0.05	0.12
RURAL	NFAC	DIV	0 - 40 FT	0 - 99,999	7,471	694	18	24	32	62	16	6	72	230	0.03	0.33
RURAL	NFAC	DIV	41 - 99 FT	0 - 99,999	111	9	0	0	0	0	1	0	0	1	0.01	0.11
RURAL	NFAC	UNDIV	0 - 19 FT	0 - 999	3,466	7,163	27	30	56	88	18	12	118	349	0.10	0.05
RURAL	NFAC	UNDIV	20 - 99 FT	0 - 999	7,267	8,314	52	72	125	201	66	19	242	777	0.11	0.09
RURAL	NFAC	UNDIV	0 - 19 FT	1,000 - 9,999	1,388	377	2	3	12	21	3	3	23	67	0.05	0.18
RURAL	NFAC	UNDIV	20 - 26 FT	1,000 - 9,999	58,276	10,645	284	293	508	738	225	59	1,017	3,124	0.05	0.29
RURAL	NFAC	UNDIV	27 - 40 FT	1,000 - 9,999	4,873	560	22	12	38	50	9	3	71	205	0.04	0.37
RURAL	NFAC	UNDIV	41 - 99 FT	1,000 - 9,999	428	44	0	1	2	4	3	1	6	17	0.04	0.39
RURAL	NFAC	UNDIV	0 - 21 FT	10,000 - 99,999	358	16	2	0	1	3	1	0	4	11	0.03	0.68
RURAL	NFAC	UNDIV	22 - 26 FT	10,000 - 99,999	6,079	266	16	11	21	32	10	2	43	135	0.02	0.51
RURAL	NFAC	UNDIV	27 - 35 FT	10,000 - 99,999	2,345	91	3	5	6	9	3	2	18	46	0.02	0.51
RURAL	NFAC	UNDIV	36 - 40 FT	10,000 - 99,999	1,142	46	1	1	2	6	1	0	2	13	0.01	0.28
RURAL	NFAC	UNDIV	41 - 99 FT	10,000 - 99,999	155	7	1	0	0	1	0	0	5	7	0.05	1.05
URBAN	FAC	DIV	0 - 99 FT	0 - 99,999	87,774	2,090	103	105	266	480	172	51	675	1,852	0.02	0.89
URBAN	FAC	UNDIV	0 - 99 FT	0 - 99,999	346	109	2	1	5	14	4	3	18	47	0.14	0.43
URBAN	NFAC	DIV	0 - 99 FT	0 - 99,999	53,757	2,869	166	167	352	629	391	74	731	2,510	0.05	0.88
URBAN	NFAC	UNDIV	0 - 19 FT	0 - 999	216	448	5	4	12	35	14	5	39	114	0.53	0.26
URBAN	NFAC	UNDIV	20 - 99 FT	0 - 999	577	588	10	6	18	33	14	6	71	158	0.27	0.27
URBAN	NFAC	UNDIV	0 - 19 FT	1,000 - 9,999	994	169	1	5	4	19	7	5	18	59	0.06	0.35
URBAN	NFAC	UNDIV	20 - 26 FT	1,000 - 9,999	36,942	4,468	169	176	304	544	247	87	856	2,383	0.06	0.53
URBAN	NFAC	UNDIV	27 - 40 FT	1,000 - 9,999	9,416	837	36	35	100	129	85	38	190	613	0.07	0.73
URBAN	NFAC	UNDIV	41 - 99 FT	1,000 - 9,999	1,108	90	6	7	17	23	14	2	31	100	0.09	1.12
URBAN	NFAC	UNDIV	0 - 26 FT	10,000 - 99,999	26,648	1,043	42	58	104	176	108	26	266	780	0.03	0.75
URBAN	NFAC	UNDIV	27 - 35 FT	10,000 - 99,999	12,372	466	22	31	49	92	52	10	140	396	0.03	0.85
URBAN	NFAC	UNDIV	36 - 40 FT	10,000 - 99,999	10,239	377	25	30	51	82	63	14	124	389	0.04	1.03
URBAN	NFAC	UNDIV	41 - 99 FT	10,000 - 99,999	5,268	190	9	24	34	56	42	11	66	242	0.05	1.27

Pennsylvania Department of Transportation
Center for Highway Safety
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EXPECTED CRASH EXPERIENCE FOR HOMOGENOUS ROADWAY ATTRIBUTES

SPEEDING RELATED

					MILLION VEHICLE	LENGTH	----------ACCIDENT COUNTS BY SEVERITY----------							ACC	ACCIDENT	
			TOTAL WIDTH	ADT RANGE	MILES/5 YRS	(MILES)	FATAL	MAJOR	MODRT	MINOR	-----UNKNOWN----- SEVERITY	IF INJ	PDO	TOTAL	RATE	INTENSITY
RURAL	FAC	DIV	0 - 99 FT	0 - 20,000	41,912	2,153	128	162	538	1,695	295	43	3,411	6,272	0.15	2.91
RURAL	FAC	DIV	0 - 99 FT	20,001 - 99,999	8,123	183	18	14	64	149	47	9	423	724	0.09	3.96
RURAL	FAC	UNDIV	0 - 99 FT	0 - 99,999	313	137	7	6	14	52	9	2	95	185	0.59	1.35
RURAL	NFAC	DIV	0 - 40 FT	0 - 99,999	7,471	694	59	65	176	470	89	19	787	1,665	0.22	2.40
RURAL	NFAC	DIV	41 - 99 FT	0 - 99,999	111	9	0	2	6	3	2	1	13	27	0.24	2.87
RURAL	NFAC	UNDIV	0 - 19 FT	0 - 999	3,466	7,163	79	166	421	836	142	68	1,395	3,107	0.90	0.43
RURAL	NFAC	UNDIV	20 - 99 FT	0 - 999	7,267	8,314	192	277	815	1,779	341	114	2,838	6,356	0.87	0.77
RURAL	NFAC	UNDIV	0 - 19 FT	1,000 - 9,999	1,388	377	14	21	84	171	37	12	305	644	0.46	1.71
RURAL	NFAC	UNDIV	20 - 26 FT	1,000 - 9,999	58,276	10,645	801	1,166	3,171	7,516	1,463	374	12,579	27,070	0.46	2.54
RURAL	NFAC	UNDIV	27 - 40 FT	1,000 - 9,999	4,873	560	58	51	181	441	83	14	719	1,547	0.32	2.76
RURAL	NFAC	UNDIV	41 - 99 FT	1,000 - 9,999	428	44	1	3	15	34	12	2	53	120	0.28	2.74
RURAL	NFAC	UNDIV	0 - 21 FT	10,000 - 99,999	358	16	3	1	17	28	8	4	51	112	0.31	6.89
RURAL	NFAC	UNDIV	22 - 26 FT	10,000 - 99,999	6,079	266	50	52	152	450	103	15	667	1,489	0.24	5.60
RURAL	NFAC	UNDIV	27 - 35 FT	10,000 - 99,999	2,345	91	7	14	52	134	28	10	221	466	0.20	5.15
RURAL	NFAC	UNDIV	36 - 40 FT	10,000 - 99,999	1,142	46	2	3	14	62	10	1	75	167	0.15	3.63
RURAL	NFAC	UNDIV	41 - 99 FT	10,000 - 99,999	155	7	2	0	9	16	3	2	37	69	0.45	10.39
URBAN	FAC	DIV	0 - 99 FT	0 - 99,999	87,774	2,090	188	332	1,347	4,117	1,317	300	8,314	15,915	0.18	7.62
URBAN	FAC	UNDIV	0 - 99 FT	0 - 99,999	346	109	7	8	27	61	20	7	130	260	0.75	2.39
URBAN	NFAC	DIV	0 - 99 FT	0 - 99,999	53,757	2,869	253	360	1,179	3,780	1,975	263	5,653	13,463	0.25	4.69
URBAN	NFAC	UNDIV	0 - 19 FT	0 - 999	216	448	9	18	51	161	53	14	335	641	2.97	1.43
URBAN	NFAC	UNDIV	20 - 99 FT	0 - 999	577	588	20	29	92	210	66	30	444	891	1.54	1.52
URBAN	NFAC	UNDIV	0 - 19 FT	1,000 - 9,999	994	169	5	11	27	124	27	13	176	383	0.39	2.27
URBAN	NFAC	UNDIV	20 - 26 FT	1,000 - 9,999	36,942	4,468	297	520	1,483	3,821	1,322	357	7,451	15,251	0.41	3.41
URBAN	NFAC	UNDIV	27 - 40 FT	1,000 - 9,999	9,416	837	60	74	256	654	317	97	1,162	2,620	0.28	3.13
URBAN	NFAC	UNDIV	41 - 99 FT	1,000 - 9,999	1,108	90	8	13	31	99	48	13	174	386	0.35	4.31
URBAN	NFAC	UNDIV	0 - 26 FT	10,000 - 99,999	26,648	1,043	90	168	568	1,865	809	133	3,281	6,914	0.26	6.63
URBAN	NFAC	UNDIV	27 - 35 FT	10,000 - 99,999	12,372	466	37	65	191	758	326	60	1,196	2,633	0.21	5.65
URBAN	NFAC	UNDIV	36 - 40 FT	10,000 - 99,999	10,239	377	40	61	193	673	336	52	1,067	2,422	0.24	6.43
URBAN	NFAC	UNDIV	41 - 99 FT	10,000 - 99,999	5,268	190	16	35	103	309	186	35	497	1,181	0.22	6.21

APPENDIX B

Atherton Street & University Drive

University Drive northbound approach – Sight distance looking left

University Drive southbound approach – Sight distance approaching intersection

Atherton Street & College Avenue

Atherton Street northbound approach – signing and sight distance

College Street westbound approach – right turn slip ramp

Atherton Street & Hillcrest Avenue

Atherton Street northbound signal visibility

Atherton Street & White Course Drive

White Course Drive right turn - sight distance looking left

Atherton Street eastbound approach - sight distance looking west

Easterly Parkway & Pugh Street

Pugh Street northbound – sight distance looking left

Pugh Street southbound – stop sign visibility