Delaware Department of Transportation

HAWK Pedestrian Signal Compliance Review

May 2020

in cooperation with:

RK&K

Executive Summary

Improving pedestrian safety is a primary goal of DelDOT, Delaware's General Assembly, and local community leaders. Since 2010, DelDOT has installed five (5) pedestrian hybrid beacons, also known as High-intensity Activated crossWalK (HAWK) beacons, throughout the state. These HAWK beacons were installed primarily to improve pedestrian safety. This study, and similar prior studies, were conducted to determine the level of compliance motorists and pedestrians exhibit with this relatively new form of traffic control in the State of Delaware. These compliance studies revealed mixed results. In some locations, motorists were found to comply with the red signal indication to a relatively high degree (as high as 92% at the SR 72 at Farm Lane HAWK) and stop appropriately. However, at other locations, notably the SR 1 at Rehoboth Avenue HAWK, more than 41% of motorists were observed disregarding the red signal.

This study focuses on motorist and pedestrian compliance at HAWK signals and compares the number of crashes before and after the installation of the HAWK signals.

The latest findings from all five (5) of Delaware's HAWK signal installations are briefly summarized below:

- **SR 72 at Farm Lane; Newark, DE:** The most recent observations completed in 2017 showed a relatively high level of motorists' compliance (92%) with the HAWK signal. During previous compliance studies at this location, it was relatively uncommon for a pedestrian to be seen crossing at this location due to generally low pedestrian volumes in the area. However, recent field observations indicate that the University of Delaware may have added additional classes that utilize the facilities near the HAWK signal, which may have increased the pedestrian volume at this intersection. However, despite the high level of motorists' compliance, it should be noted that motorists were frequently observed getting out of their vehicles to manually activate the HAWK signal to stop traffic on SR 72, thereby facilitating their left turns from Farm Lane. Crash data showed that while crashes have been reduced by 25% since the installation of the HAWK signal, there were no pedestrian or bicycle crashes at this location before or after the signal was installed, and two crashes since the signal was installed were directly attributable to the new signal.

- **SR 8 at Heatherfield Way, near Dover High School; Dover, DE:** Recent observations showed a relatively high level of motorists' compliance (88%) with the HAWK signal. However, field observations also showed a relatively low pedestrian compliance (39%) at the HAWK signal. It should be noted that, like at SR 72 at Farm Lane, during the field observations, motorists were observed getting out of their vehicle to manually activate the HAWK signal to stop traffic on SR 8, in order to make their left-turn from Heatherfield Way. Crash data showed that there were no pedestrian or bicycle crashes at this location before or after the signal was installed, while total crashes have increased by 75% since the installation of the HAWK signal, with two crashes being directly attributable to the new signal.

- **SR 1 at Rehoboth Avenue; Rehoboth Beach, DE:** Recent observations at the HAWK signal showed a decrease in the level of motorists' compliance, from a high of 87% in 2016 down to 59% in 2019. Recent observations revealed that pedestrians and bicyclists frequently activate the HAWK signal, but cross before the HAWK signal activates. As a result, many of the non-complying vehicles were observed when no pedestrians or bicyclists were present. This may be a factor in the increase of vehicles disregarding the HAWK signal between 2016 and 2019. Crash data showed that total crashes have increased by 27% since the installation of the HAWK signal, which included an increase in pedestrian crashes (0 to 1) and bicycle crashes (0 to 3), though no crashes were directly attributable to the new signal.

- **SR 1 at Holland Glade Road; Rehoboth Beach, DE:** Recent observations at the HAWK signal showed a decrease in the level of motorists' compliance, from a high of 97% in 2016 down to 72% in 2019. Observations revealed that pedestrians and bicyclists frequently activate the HAWK signal, but cross before the HAWK signal activates. As a result, many of the vehicle observations when the HAWK signal was activated were based on motorists' behavior when no pedestrians or bicyclists were present. Perhaps accordingly, recent field observations also showed a large increase in the number of motorists failing to stop for the HAWK signal when it flashed red, if no pedestrians or bicyclists were present. In addition, when the HAWK signal activates and begins to flash yellow, motorists were observed speeding up to "beat the light." Crash data showed an increase in total crashes (29 to 62) and bicycle crashes (1 to 8) since the HAWK signal was installed, with one crash involving a bicyclist being hit by a motor vehicle that disregarded the HAWK signal and three other crashes also being directly attributable to the new signal.

- **SR 273 at Freedom Trail; New Castle, DE:** Recent observations at the HAWK signal showed a relatively high level of motorists' compliance (80%) at the HAWK signal. However, field observations showed a relatively low level of pedestrian compliance (38%) at the HAWK signal. It should be noted that during the field observations, vehicles were observed going around the channelizing island on Freedom Trail to make left-turns onto SR 273. This movement is prohibited with signs and a channelizing island. Crash data showed a 46% decrease in total crashes and a decrease in pedestrian crashes (1 to 0) since the installation of the HAWK signal, as well as one crash directly attributable to the new signal.

Based on the observed motorist behavior at several of the HAWK signals, combined with the generally poor pedestrian compliance at the HAWK signals, especially when compared to similar "traditional" intersections, as well as crash data that showed almost no change in pedestrian/bicycle crashes, **it is recommended that HAWK signals no longer be installed at intersections in Delaware. It is also recommended that DelDOT study the five (5) HAWK signals that are currently located at intersections for potential conversion to a full traffic signal or Rectangular Rapid Flash Beacons (RRFB).** *This recommendation does not apply to HAWK signals installed at mid-block locations, as there are no such examples in Delaware.*

Based on these observations and poor motor vehicle and pedestrian compliance, particularly at the HAWK signals on SR 1 at Holland Glade Road and Rehoboth Avenue, **it is recommended that HAWK signals should not be installed on multilane roadways with more than two (2) lanes in each direction unless the signals are timed to permit a single-stage pedestrian crossing. Similarly, it is recommended that HAWK signals should not be installed at locations with wide medians requiring a two-stage pedestrian crossing.**

Finally, there is experimental research being conducted to use passive detectors (infrared, microwave, pressure sensors) to activate the pedestrian phase at traffic signals. FHWA and the Pedestrian and Bicycle Information Center have listed passive detection as a possible safety countermeasure and improvement option[13,14]. Some of these devices track the pedestrian and can extend the walk interval for slower pedestrians. The devices may also be able to shorten the pedestrian interval or cancel a call if the pedestrian crosses early. Passive detection may improve pedestrian compliance and may also improve motorists' compliance at HAWK signals. **While these devices are still experimental and their reliability is still being reviewed, it is recommended that DelDOT monitor the studies related to the use of passive detectors at HAWK signals and, if they are found to be safe and effective, consider integrating them into any current/future HAWK signals in Delaware.**

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I. Introduction

On August 10, 2005, President George W. Bush enacted the *Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)*, Public Law 109-59, Section 2003 (e), which provided funding for highways, highway safety, and public transportation. SAFETEA-LU established the Highway Safety Improvement Program (HSIP), which provided funding for States to use at their most hazardous locations. Each State was required to develop and implement a strategic highway safety plan, and submit annual reports to the United States Secretary of Transportation[1].

Pedestrian safety has been a high priority of Delaware's Strategic Highway Safety Plan (SHSP), since the first edition of the SHSP was released in 2006[2]. In 2010, the SHSP identified pedestrian-hybrid signals, which included the High-intensity Activated crossWalK (HAWK) beacon, as a possible improvement option to reduce pedestrian's exposure to traffic and increase their visibility when crossing roadways[3]. The 2015 edition of the SHSP revealed that pedestrian safety is still a major issue in Delaware. According to the Delaware's 2015 SHSP, Delaware had the highest pedestrian fatality rate in the United States in 2012 and 2013, based on crashes per capita[4]. The Delaware Department of Transportation (DelDOT), the Delaware Office of Highway Safety, and the Delaware State Police have been working on ways to lower the frequency of pedestrian-related crashes resulting in fatalities or serious injuries. HAWK signals were identified as a countermeasure that may improve pedestrian safety.

Delaware's first HAWK signal was installed in August 2010, at the intersection of SR 72 and Farm Lane, which is located next to the University of Delaware's Animal Management Teaching Facility in New Castle County. This site served as a pilot study for DelDOT to monitor its effectiveness and pedestrian/motorist compliance[5]. DelDOT observed operations at the HAWK signal for several months and completed the first compliance study of this site in February 2011. Following the 2011 compliance study, in 2012, DelDOT made several improvements to the HAWK signal at this location. Following these changes, DelDOT conducted additional compliance studies of the site in 2012, 2013, and 2015. The results from the compliance studies showed mixed results. In addition, observations revealed that motorists on the Farm Lane approaches had learned that they could get out of their vehicles to activate the HAWK signal to stop traffic on SR 72, so that they could turn left onto SR 72 from Farm Lane. This behavior was observed frequently.

In 2013, the City of Dover Safety Advisory and Transportation Committee requested that DelDOT consider installing a HAWK signal at the intersection of SR 8 and Heatherfield Way to provide a safer crossing location for students walking to and from Dover High School. DelDOT installed the HAWK signal in 2014[6,7,8]. DelDOT completed field observations of this HAWK signal immediately after Dover High School opened in 2014, and subsequently, in 2015.

On July 1, 2013, House Resolution 22 passed, establishing the Route 1 Pedestrian Safety Task Force[9]. The task force was created to identify and recommend potential ways to improve safety for pedestrians and bicyclists along SR 1 between Nassau Bridge and the southern limits of Dewey Beach. The Task Force recommended installing HAWK pedestrian crossing beacons at two (2) locations along SR 1. Based on these recommendations, DelDOT installed HAWK signals on SR 1 at Rehoboth Avenue in September 2015, and Holland Glade Road in May 2016.

SR 273 was identified as a corridor with a higher than expected frequency of pedestrian crashes. The SR 273 Pedestrian and Bicycle Road Safety Audit, completed in September 2011, concluded that an enhanced crossing might improve safety along this corridor; Pedestrians frequently crossed SR 273 to travel between the apartments on the north side of the roadway and the bus stop on the south side of the roadway. As a result, DelDOT installed a HAWK signal on SR 273 at Freedom Trail in August 2017.

II. FHWA Research

In 2010, the Federal Highway Administration (FHWA) sponsored a study to evaluate the effectiveness of the HAWK pedestrian signal. The *Safety Effectiveness of the Hawk Pedestrian Crossing Treatment*[10] is a case study of HAWK pedestrian signals in Tucson, Arizona. The City of Tucson developed the HAWK pedestrian crossing in the late 1990's as a way to provide safer pedestrian crossings for a city with a high percentage of senior citizens needing to cross high speed/ multilane roadways. The HAWK signal was developed as a means to provide adequate time for slower pedestrians to cross the street while minimizing the impact to traffic flow by requiring motorists to stop for pedestrians, but allowing them to proceed once the pedestrian has cleared the intersection. The FHWA study cited previous research, which showed that red signal or beacon devices, including HAWK signals, had compliance rates exceeding 95 percent[10].

The study noted that some motorists didn't understand that they were permitted to proceed through the intersection after coming to a complete stop during the flashing red clearance interval. Motorists tended to wait for the HAWK signal to completely deactivate, with the signal heads going completely dark before proceeding. The City of Tucson identified this issue and conducted a campaign to better inform motorists and pedestrians of the proper procedure for compliance.

The FHWA study also included a review of crash rates at 21 unsignalized intersections in Tucson, where HAWK signals had been installed. This included HAWK signals at both three-leg and four-leg intersections. The results indicated that the HAWK signals in Tucson resulted in a 69% reduction in pedestrian crashes, and a 29% reduction in overall crashes[10].

III. Study Methodology

DelDOT and RK&K completed compliance studies at the HAWK signals in Delaware on the following years:

- SR 72 at Farm Lane: 2011, 2012, 2013, 2015, and 2017
- SR 8 at Heatherfield Way: 2014, 2015, 2016, 2017, and 2019
- SR 1 at Rehoboth Avenue: 2016, 2017, and 2019
- SR 1 at Holland Glade Road: 2016, 2017, and 2019
- SR 273 at Freedom Trail: 2019

While the specific data collection methodology differed between all of the different studies between 2011 and 2019, the general concept remained the same: Perform observations of motorists' behavior as they approached a HAWK signal as it was being activated by a waiting pedestrian. Some studies, including the most recent one in 2019, expanded the breadth of the study to also include observations of the pedestrian's behavior, seeing if and how they used the HAWK signal to facilitate crossing the road.

During the initial studies that were performed in 2011 to 2015, to increase the sample size of motorists' compliance observations, DelDOT Staff, typically wearing reflective vests, activated the HAWK signals. That data collection methodology which used "non-typical" and highly visible pedestrians may have influenced the results of these studies.

Therefore, during the 2016, 2017, and 2019 compliance studies, two (2) data collection issues of critical importance were: 1) staff safety and 2) ensuring that field staff worked inconspicuously so as not to bias the results of the study. Therefore, RK&K staff remained in their vehicles, or as far from the HAWK signal as practical, and refrained from manually activating the HAWK signal. RK&K staff simply observed pedestrian arrivals and signal interactions, as well as the actions of approaching motorists. RK&K staff also limited the amount of time at each site to further reduce the likelihood of field staff influencing the results of the study. Hopefully, these actions limited the chances of the data being skewed by motorists realizing that the HAWK signal was being studied.

Traditional Intersections Used as Control Locations:

The 2016 and 2017 motor vehicle compliance studies at the HAWK signals revealed that one specific type of pedestrian behavior may have a negative effect on motor vehicle compliance at the HAWK signals. Specifically, pedestrians activating the HAWK signals and then crossing before the HAWK signal activates. This results in the HAWK signal activating (turning red) when pedestrians are no longer present, which may be causing motorists to believe the signal is malfunctioning. As a result, in 2019, DelDOT requested that RK&K perform compliance studies at a group of "traditional" traffic signals to serve as a control group to compare motor vehicle and pedestrian compliance between a HAWK signal and a "typical" signalized intersection with a pedestrian phase.

The RK&K team identified seven (7) existing "traditional" traffic signals that were potential study locations based on geometry, traffic volumes, and nearby land use.

Group 1: Sites similar to SR 8 at Heatherfield Way

- Chapman Road at Salem Church Road
- SR 8 (Forrest Avenue) at Kenton Road
- Cleveland Avenue at Papermill Road

Group 2: Sites similar to SR 1 at Rehoboth Avenue

- SR 1 at Westway Drive
- SR 1 at Evergreen Road

Group 3: Sites similar to SR 1 at Holland Glade Road

- SR 58 (Churchman's Road) at entrance to Delaware Tech Stanton Campus

Group 4: Sites similar to SR 273 at Freedom Trail

- SR 7 at Skyline Drive/Stoney Batter Road

RK&K staff used video cameras to record 48 hours of video at each of the traffic signal locations to monitor motor vehicle and pedestrian behavior. The video and supplementary field observations were used to answer the following questions:

- Did pedestrians push the button to activate the pedestrian phase?
- If yes, did the pedestrian wait until the WALK phase to cross?
- If yes, how long did the pedestrian wait before the WALK phase activated?
- If no, how long did the pedestrian wait before crossing?
- If no, was there a safe gap in traffic for the pedestrians to cross?
- Did the pedestrian use the marked crosswalk to cross the major roadway?

The results from all of the variables listed above were used to calculate the following:

- Percentage of pedestrians activating the HAWK signal or pedestrian signal
- Percentage of pedestrians complying with the pedestrian signal
- Average wait time for complying pedestrians
- Average wait time for non-complying pedestrians
- Percentage of pedestrians crossing without a safe gap in traffic
- Percentage of pedestrians crossing outside of the marked crosswalk

During the field observations, field staff documented whether the pedestrians crossing the major roadway crossed at the marked crosswalk or outside of it. The field observers also documented gap acceptance. Specifically, it was assumed that the pedestrian used a safe gap if crossing when there was a large gap in traffic on the approaching roadway. It was assumed to be an unsafe crossing if approaching vehicles slowed down, stopped, or pedestrians were seen rushing across the roadway. For the purpose of this study, it is assumed that there was a safe gap in traffic for pedestrians to cross, if they crossed within the pedestrian WALK phase.

IV. Before/After Crash Analysis Methodology

At each location, crash data were obtained for the three (3) full years before HAWK signal installation and the three (3) full years after HAWK signal installation. Crash data from the year of installation were not obtained. Therefore, crashes in the immediate weeks and months after installation were not included. The crash data includes all crashes within 0.10 miles of the intersection and may therefore include crashes at locations other than the HAWK signal.

The before/after crash analysis consisted of:

- Summarizing the number of crashes before and after HAWK signal installation by crash severity
- Reviewing pedestrian/bicyclist crash reports to determine if the HAWK signal was relevant to the crash
- Reviewing vehicle crash reports to find crashes related to HAWK signals

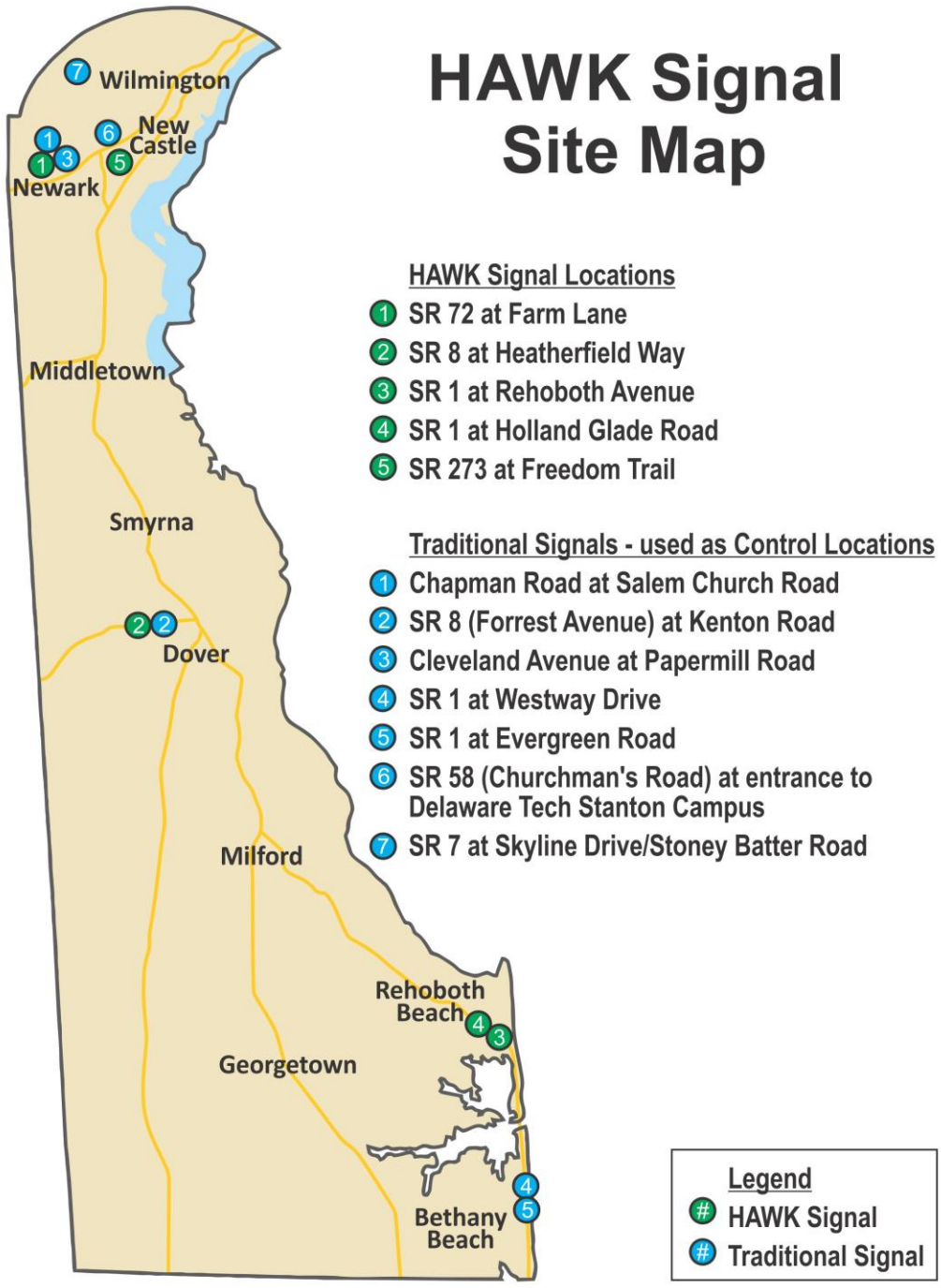

Figure 1: HAWK Signal Site Map

V. SR 72 at Farm Lane

Hybrid Pedestrian Beacons were included in the 2009 edition of the federal MUTCD, and were subsequently included in the 2011 DEMUTCD. Based on the initial results from HAWK installations in Tucson, Arizona, as well as installations in other states, DelDOT decided to pursue a potential HAWK location somewhere in/near the University of Delaware's Campus in Newark, Delaware, in 2010. DelDOT and the University of Delaware chose SR 72 at Farm Lane as the pilot location because of the difficulty students experienced crossing SR 72 to travel between the University's South Campus, west of SR 72, and the University's Animal Management Teaching Facility, east of SR 72. SR 72 has a posted speed limit of 45 MPH and the relatively high volume of traffic (31,250 vehicles per day) made it challenging for pedestrians to cross SR 72. A full traffic signal was not warranted due to the low volume of traffic on Farm Lane, and pedestrian volumes were also too low to meet the DEMUTCD warrant thresholds[11].

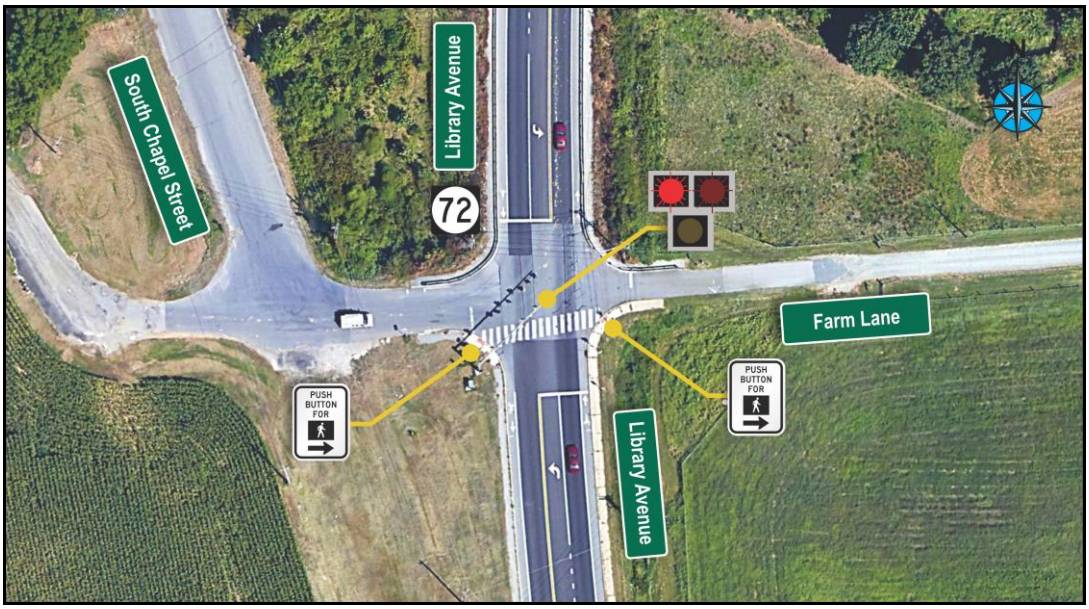

Figure 2: SR 72 and Farm Lane HAWK Signal

A. Motor Vehicle Compliance

DelDOT conducted multiple observations at the HAWK signal, following its installation in August 2010, and through the following February. DelDOT staff manually activated the signal and crossed SR 72, while wearing reflective safety vests. During the first few months after the HAWK signal was installed, there was relatively low motorists' compliance at the signal by motorists. The Newark Police Department observed the new HAWK signal on several occasions and based on their observations, conducted red light enforcement at the signal in December 2010. During this time, field staff handed out pamphlets to motorists about the proper procedures that both motorists and pedestrians should follow at a HAWK signal.

The following year, DelDOT conducted a formal compliance study at this location in February 2011. Only one (1) pedestrian used the HAWK signal on the day of the compliance study. Therefore, DelDOT staff opted to manually activate the signal to collect a sufficient amount of data. Specifically, DelDOT staff wearing reflective safety vests manually activated the HAWK signal and crossed the road when the pedestrian walk indication was activated. However, the notes from the DelDOT staff indicated that motorists seemed to be very aware that the HAWK signal was being activated as part of a study, thereby potentially biasing the results.

After the 2011 compliance study, DelDOT made several improvements at the intersection which were completed in September 2012[12]. Specifically, SR 72 was restriped to provide a left-turn lane, a shared through-right-turn lane, and a five (5) foot bike lane on the northbound and southbound SR 72 approaches to Farm Lane. DelDOT also added supplemental signal heads to the HAWK signal increasing the number from two (2) to five (5) signal heads per direction. Subsequently, DelDOT conducted a compliance study in October 2012 to determine the effects the striping changes and supplemental signal faces had on motorists' compliance[12]. Twenty-five (25) pedestrians were observed using the HAWK signal during the compliance study. The results from the 2012 compliance study, summarized in **Table 1**, showed an increase in motorists' compliance compared to the 2011 study.

DelDOT completed two (2) additional follow-up compliance studies at this HAWK signal on November 6, 2013 and April 23, 2015. On both occasions, the pedestrian volume at this location was sporadic and relatively low. Nineteen (19) pedestrians were observed in 2013 and none were observed in 2015, which required DelDOT staff to manually operate the signal again. Similar to the 2011 and 2012 study, DelDOT staff manually activated the HAWK signal and crossed the road, while wearing reflective vests.

In May 2017, RK&K completed field observations at the SR 72 HAWK signal, during the days when classes were scheduled at the University's Animal Management Teaching Facility. Perhaps for that reason, a much higher number of pedestrians (many of whom were University of Delaware students) utilized the signal during the 2017 study.

Despite the increase in pedestrian activity during the 2017 study compared to the 2015 study, RK&K staff opted to increase the number of observations and manually activated the HAWK signal with a field technician, dressed as a student, who activated the signal and crossed the crosswalk on a two to three-minute interval (when there were no University of Delaware students present). A second field technician observed operations at the HAWK signal, while attempting to remain inconspicuous. RK&K's field staff continued walking towards the campus until all of the stopped cars had cleared the area and they made sure that sufficient time elapsed between HAWK activations, for all of the traffic to clear the area.

Table 1 summarizes the results of all five (5) of the compliance studies conducted at the SR 72/Farm Lane HAWK signal to date. The table shows a significant increase in motor vehicle compliance with the HAWK signal in 2017 compared to the preceding years. The percentage of motorists stopping correctly for the HAWK signal increased (improved) to 92% in 2017 from a low of 55% in 2013. This may be partly attributable to the difference between RK&K's 2017 method of recording observations and the methods used to collect data in previous years. Specifically, RK&K staff tried to remain inconspicuous during the field observations whereas during previous compliance studies motorists were more likely to have been aware that a study was being completed; the field notes from the compliance studies completed prior to 2017 indicated that motorists complained about being stopped for the study on multiple occasions. In addition, during RK&K's field observations typically two (2) or three (3) students crossed SR 72 each time the HAWK signal was activated, whereas during prior studies, only a single pedestrian (either a field technician or a student) crossed the road on most occasions. Larger numbers of pedestrians would be more visible to motorists, potentially increasing the likelihood of motorists stopping correctly.

The observations of vehicles departing from the intersection indicate that motorists may have developed a better understanding of how the HAWK signal works, namely that they may proceed after coming to a complete stop, when pedestrians clear, and the signal turns to flashing red. The highest percentage of motorists correctly proceeding on flashing red after stopping (44%) was observed in 2017, up from a low of 34% in 2012. Similarly, the percentage of motorists appearing confused, e.g., waiting for an extremely long time after the signal deactivates, decreased by 3% per year, to a low of 1% in 2017.

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Table 1:
SR 72 at Farm Lane
Motor Vehicle Compliance

	Vehicle Arrival				Vehicle Departure			
		Vehicle Disregarded signal (During Pedestrian Phase)			Correct Action		Incorrect Action	
Year	Vehicle Stopped for signal	During All-red	During Walk	During Flashing Red	Vehicle Proceeded on Flashing Red	Vehicle Proceeded After Ped Cleared Crosswalk	Vehicle Proceeded During Dark Signal	Motorist Appeared Confused*
2011	81%	14%	**2%**	3%	25%	9%	57%	9%
2012	83%	14%	**1%**	2%	24%	10%	57%	9%
2013	55%	32%	**1%**	12%	28%	8%	58%	6%
2015	68%	23%	**2%**	7%	37%	7%	53%	3%
2017	92%	1%	**0%**	7%	43%	1%	55%	1%

*Instances where the motorist waits an excessive amount of time after the signal goes dark before proceeding

The HAWK signal at SR 72 is uncoordinated and operates free. During the field observations, pedestrians did not have to wait very long between activating the pedestrian push button and the HAWK signal activating. The signal timesheets and signal construction plans are provided in **Appendix F** and **G**.

It should be noted that during the field observations completed by DelDOT and RK&K, motorists from Farm Lane were frequently observed getting out of their car and activating the HAWK signal to stop traffic on SR 72. Once the HAWK signal activated, the motorists used the pedestrian phase to turn left onto SR 72.

B. Pedestrian Compliance/Behavior

The HAWK signal on SR 72 at Farm Lane was not included in the pedestrian compliance study, due to the low pedestrian volume, which would require RK&K staff to manually activate the HAWK signal.

C. Before/After Crash Analysis

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Table 2: SR 72 at Farm Lane Before/After Crash Analysis		
Crash Type	**Crashes Before Installation**	**Crashes After Installation**
Property Damage Only Crashes	4	6
Personal Injury Crashes	8	3
Fatal Crashes	0	0
Total Crashes	**12**	**9**
Total Pedestrian/Bicyclist Crashes	**0**	**0**
Total HAWK-Related Crashes	**-**	**2**

Overall, the total number of crashes within 0.1 mile of the HAWK signal decreased by 25% from the three (3) years before the HAWK signal installation to the three (3) years after its installation. However, there were no pedestrian or bicyclist crashes during either three (3) year period.

There were two (2) rear-end crashes after the HAWK signal installation that were directly attributable to the new signal. In both cases, the following vehicle could not stop in time to avoid striking the leading vehicle that was stopping for the yellow or red signal. Both crashes resulted in personal injury.

VI. SR 8 (Forrest Avenue) at Heatherfield Way

The City of Dover relocated the Dover High School to a new campus on SR 8 (Forrest Avenue) in the fall of 2014. Dover High School has two (2) entrances along SR 8. The main entrance has a full traffic signal and a HAWK signal was installed at the school bus access at Heatherfield Way. The HAWK signal provides a controlled crossing for students and nearby residents to cross SR 8 to travel between the school and residential communities on the north side of SR 8. The High School incorporated a walking path from the main campus to the intersection of SR 8 and Heatherfield Way (see **Figure 3**).

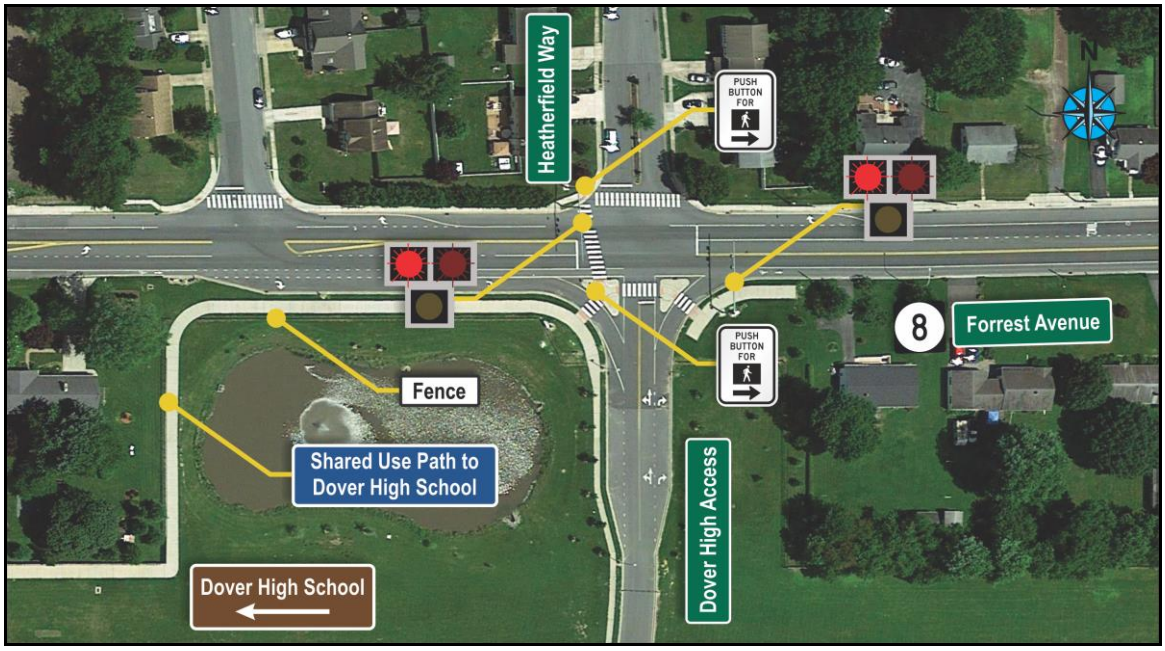

Figure 3: SR 8 and Heatherfield Way HAWK Signal

A. Motor Vehicle Compliance

DelDOT completed field observations at the HAWK signal immediately after Dover High School opened in 2014 and subsequently in 2015. RK&K conducted field observations in October 2016, October 2017, and April 2019 during the school arrival and departure periods. The results from all five (5) studies are summarized in **Table 3**.

Based on the results presented in **Table 3**, compliance has been improving and motorists appear to have a better understanding of how the HAWK signal works than during the first two (2) years of the signal's operation. The percentage of motorists stopping for the HAWK signal increased (improved) to 88% in 2019, from 82% in 2015, but decreased (worsened) from 93% in 2016 to 88% in 2019.

To determine if pedestrian compliance may be having an impact on motor vehicle compliance, staff documented whether a pedestrian was crossing the roadway when a vehicle disregarded the HAWK signal. In 2019, four (4%) percent of the vehicles disregarded the HAWK signal immediately after it turned red, before the pedestrian WALK phase, when a pedestrian may have started crossing the intersection. In all of the instances where a vehicle disregarded the HAWK signal during the pedestrian clearance interval (flashing red), the pedestrian had already finished crossing the intersection.

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Table 3: SR 8 at Heatherfield Way Motor Vehicle Compliance								
	Vehicle Arrival				**Vehicle Departure**			
Year	Vehicle Stopped for signal	Vehicle Disregarded signal (During Pedestrian Phase)			Correct Action		Incorrect Action	
		During All-red	During Walk	During Flashing Red	Vehicle Proceeded on Flashing Red	Vehicle Proceeded After Ped Cleared Crosswalk	Vehicle Proceeded During Dark Signal	Motorist Appeared Confused*
2014	84%	9%	**1%**	6%	25%	2%	67%	6%
2015	82%	13%	**1%**	4%	21%	5%	71%	3%
2016	93%	5%	**0%**	2%	22%	3%	75%	0%
2017	91%	4%	**0%**	5%	36%	7%	55%	2%
2019	88%	4%	**0%**	8%	57%	0%	41%	2%

*Instances where the motorist waits an excessive amount of time after the signal goes dark before proceeding

With respect to vehicle departures, the results presented in **Table 3** indicate that motorists are becoming more familiar with how HAWK signals operate. During the 2019 observations, 57% of motorists correctly proceeded on flashing red after stopping, compared to 26% in 2015. Additionally, only 2% of motorists appeared confused, compared to 6% in 2014.

It should be noted that field observations revealed that motorists have learned that they can trigger the HAWK signal to turn left from the minor street approaches. Specifically, motorists from Heatherfield Way were observed getting out of their vehicles and activating the HAWK signal to stop traffic on SR 8. Once the HAWK signal activated, the motorists were more easily able to turn left onto SR 8.

B. Pedestrian Compliance/Behavior

During the 2019 field observations at the HAWK signal at SR 8 and Heatherfield Way, RK&K documented pedestrian compliance and behavior in more detail. To determine if pedestrian behavior was having a negative impact on motor vehicle compliance, RK&K observed how pedestrians cross SR 8 at the HAWK signal. RK&K also observed pedestrian behavior at three (3) "typical" signalized intersections to serve as a control group, to determine if pedestrian behavior at the HAWK signal is consistent with their behavior at a "typical" signalized intersection.

All of the selected "typical" signalized intersections have similar characteristics to the HAWK signal at the intersection of SR 8 and Heatherfield Way. SR 8 is a two-lane roadway with a 2018 Annual Average Daily Traffic (AADT) volume of 19,300 vehicles per day (vpd). The "typical" signalized intersection of SR 8 and Kenton Road is located within a half of a mile from the HAWK signal at Heatherfield Way and has an AADT of 19,300 vpd. The "typical" signalized intersection of Chapman Road and Salem Church Road is located next to Christiana High School and

students frequently cross at the intersection to access residential communities along Salem Church Road. Salem Church Road has a 2018 AADT of 21,100 vpd north of Chapman Road and 18,700 vpd south of Chapman Road. The "typical" signalized intersection of Cleveland Avenue and Papermill Road is located near the University of Delaware and college students cross Cleveland Avenue at this intersection to travel between their residences and the University of Delaware. Cleveland Avenue has a 2018 AADT of 21,500 vpd west of Papermill Road and 22,400 vpd east of Papermill Road.

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Table 4:
Control Sites Similar to
HAWK Signal at SR 8 at Heatherfield Way
Pedestrian Compliance

Location	Crossed Correctly		Crossed Incorrectly			
	Activated the Pedestrian Signal and crossed during the pedestrian phase		Activated the Pedestrian Signal but crossed early		Never activated the pedestrian signal and crossed early/late	
	# (%)	Delay (Sec.)	# (%)	Delay (Sec.)	# (%)	Delay (Sec.)
SR 8 at Heatherfield Way	17 (39%)	29	8 (19%)	17	18 (42%)	15
Chapman Rd at Salem Church Rd	21 (75%)	55	2 (7%)	13	5 (18%)	<5
SR 8 at Kenton Rd	27 (79%)	54	2 (6%)	19	5 (15%)	9
Cleveland Ave at Papermill Rd	158 (75%)	53	25 (12%)	28	28 (13%)	23

HAWK Signal Traditional Signal

The results from the field observations at the three (3) typical signalized intersections revealed that over 70% of pedestrians activated the pedestrian signal and crossed during the pedestrian WALK phase. In comparison, field observations at the HAWK signal on SR 8 at Heatherfield Way revealed that only 39% of pedestrians activated the HAWK signal and crossed during the WALK phase.

The results from the three (3) locations with a regular traffic signal revealed that on average, pedestrians waited approximately one minute (53-55 seconds) for the WALK phase. In comparison, the average time pedestrians waited for the HAWK signal to activate at Heatherfield Way was approximately 29 seconds.

Conversely, the results from **Table 4** showed that 61% (19%+42%) of pedestrians crossed SR 8 outside of the WALK phase while only 21-25% of pedestrians at the traditional signals crossed outside of the WALK phase.

During the field observations at the HAWK signal at SR 8 and Heatherfield Way, the majority (73%) of pedestrians that crossed SR 8 outside of the WALK phase, crossed within five (5) feet of the marked crosswalk. The remaining 27% of the pedestrians either cut across the intersection diagonally to continue traveling westbound on SR 8, or crossed SR 8 before they reached the intersection.

HAWK Compliance Study				May 2020
Table 5: Control Sites Similar to HAWK Signal at SR 8 at Heatherfield Way Crosswalk Use and Gap Acceptance				
	Crossed at Marked Crosswalk		**Gap Acceptance**	
Location	Yes	No	Safe Gap	Unsafe Gap
SR 8 at Heatherfield Way	19 (73%)	7 (27%)	18 (69%)	8 (31%)
Chapman Rd at Salem Church Rd	5 (71%)	2 (29%)	4 (57%)	3 (43%)
SR 8 at Kenton Rd	6 (86%)	1 (14%)	6 (86%)	1 (14%)
Cleveland Ave at Papermill Rd	50 (94%)	3 (6%)	41 (77%)	12 (23%)

HAWK Signal Traditional Signal

During the field observations there were frequently large gaps in traffic on SR 8 and the majority (69%) of pedestrians that crossed outside of the WALK phase crossed when there was relatively a large gap in traffic on SR 8. Of the eight (8) pedestrians that crossed with an unsafe gap, there were two (2) extremely unsafe instances where pedestrians crossed very close to an approaching vehicle that had to come to an abrupt stop.

C. Before/After Crash Analysis

HAWK Compliance Study		May 2020
Table 6: SR 8 at Heatherfield Way Before/After Crash Analysis		
Crash Type	**Crashes Before Installation**	**Crashes After Installation**
Property Damage Only Crashes	2	6
Personal Injury Crashes	2	1
Fatal Crashes	0	0
Total Crashes	**4**	**7**
Total Pedestrian/Bicyclist Crashes	**0**	**0**
Total HAWK-Related Crashes	**-**	**2**

Overall, the total number of crashes within 0.1 mile of the HAWK signal increased by 75% from the three (3) years before the HAWK signal installation to the three (3) years after its installation. There were no pedestrian or bicyclist crashes during either three (3) year period.

There were two (2) crashes after the HAWK signal installation that were directly attributable to the new signal. The first was a rear-end property damage only crash where the following driver was distracted and did not notice the leading vehicle stopped for the red light. The second was an angle property damage only crash that occurred at the intersection where a northbound driver on the Dover High Access claimed to have a green light before colliding with an eastbound vehicle on SR 8. This motorist's claim of having a green light at a location without a tri-color signal may indicate driver confusion with HAWK signals at four-way intersections.

VII. SR 1 at Rehoboth Avenue

In September 2015, DelDOT installed the third HAWK signal in the state of Delaware on southbound SR 1 at Rehoboth Avenue in Rehoboth Beach in Sussex County. Prior to the HAWK signal installation, the northbound lanes were, and still are, controlled by a full traffic signal, while the southbound lanes were free flowing. This location is challenging for pedestrians because it requires crossing multiple lanes with high speed (40 MPH) traffic (see **Figure 4**).

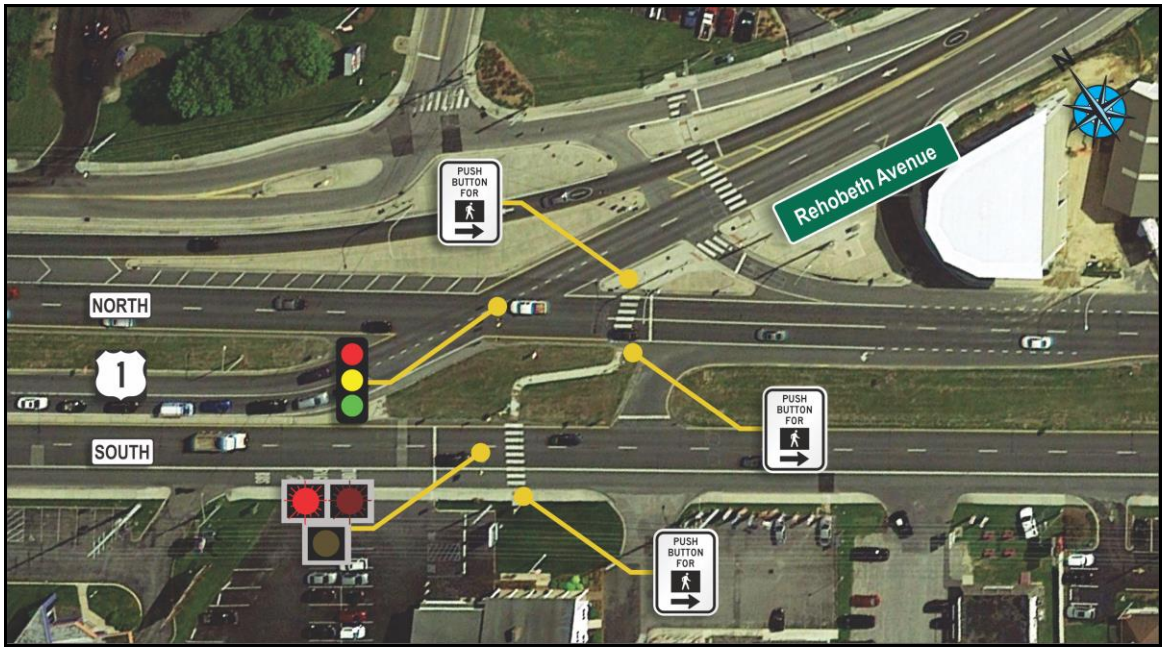

Figure 4: SR 1 and Rehoboth Avenue HAWK Signal

A. Motor Vehicle Compliance

RK&K staff conducted field observations at the HAWK signal in August 2016, July 2017, and August 2019. Field staff sat in their vehicles while they observed the intersection and had no interaction with the HAWK signal, limiting the likelihood of motorists being aware of the study.

Based on the results presented in **Table 7**, the percentage of vehicles stopping correctly for the HAWK signal decreased (worsened) from 87% in 2016 to 59% in 2019. Of those that disregarded the signal, 10% entered the intersection immediately after the signal turned red, 4% entered the intersection during the pedestrian WALK phase when the signal was solid red, and 27% entered the intersection during the pedestrian clearance interval without stopping when the HAWK signal was flashing red.

Following the 2016 HAWK Compliance Study, DelDOT installed new regulatory signs at the HAWK signals at this location, which state “Crosswalk, Stop on Red, Proceed on Flashing Red When Clear” (see **Appendix H**). The results from 2019 showed that the signs may have had a positive effect on motorists’ behavior departing the HAWK signal at this location. The results from the 2019 observations at Rehoboth Avenue showed that approximately 88% of motorists (68% + 20% in **Table 7**) departed from the intersection correctly in 2019, up from only 28% (22% + 6% in **Table 7**) in 2016. This appears to show that motorists have become familiar with the correct procedures to follow at the HAWK signal, which may be attributable to the new signs.

HAWK Compliance Study **May 2020**

Table 7:
Southbound SR 1 at Rehoboth Avenue
Motor Vehicle Compliance

	Vehicle Arrival				Vehicle Departure			
		Vehicle Disregarded signal (During Pedestrian Phase)			Correct Action		Incorrect Action	
Year	Vehicle Stopped for signal	During All-red	During Walk	During Flashing Red	Vehicle Proceeded on Flashing Red	Vehicle Proceeded After Ped Cleared Crosswalk	Vehicle Proceeded During Dark Signal	Motorist Appeared Confused*
2016	87%	9%	**2%**	2%	22%	6%	70%	2%
2017	72%	7%	**1%**	20%	63%	11%	25%	1%
2019	59%	10%	**4%**	27%	68%	20%	12%	0%

*Instances where the motorist waits an excessive amount of time after the signal goes dark before proceeding

B. Pedestrian Compliance

RK&K conducted more detailed field observations at the intersection of SR 1 and Rehoboth Avenue in July and August 2019, to determine if pedestrian behavior is having a negative impact on motor vehicle compliance, and if pedestrian compliance is better or worse than similar signalized crossings in the area. The HAWK signal on SR 1 at Rehoboth Avenue is located at a major crossing for pedestrians to travel between residential communities along the west side of SR 1 and the City of Rehoboth Beach on the east side of SR 1 (see **Figure 4**).

The crossing on SR 1 at Rehoboth Avenue functions as a two (2) stage crossing. The northbound lanes are controlled by a full traffic signal, while the southbound lanes are controlled by a HAWK signal. It requires users to activate a pedestrian signal to cross the first set of lanes to access the median island, and then they need to activate an additional signal in the median island to cross the second set of lanes.

To evaluate pedestrian compliance at the HAWK signal at Rehoboth Beach, RK&K observed pedestrian behavior at two (2) single stage crossings on SR 1 at nearby beach communities with similar roadway geometry: SR 1 at Westway Drive and SR 1 at Evergreen Road. Both locations are along multilane roadways with large median islands.

RK&K observed pedestrian behavior at the HAWK signal at Rehoboth Avenue and the two (2) “typical” signalized intersections in July and August 2019. During the field observations at the two (2) signalized intersections, late-arriving pedestrians would begin to cross SR 1 with only a few seconds of time remaining in the pedestrian clearance interval. This resulted in the pedestrians being within the travel lanes after the pedestrian signal ended or being stuck in the median island as the signal turned green for motorists on SR 1. As a result, the scenario for pedestrians beginning to cross at the end of the clearance interval “Crossed Late” was added as an additional category in **Table 8**.

HAWK Compliance Study **May 2020**

Table 8:
Control Sites Similar to HAWK Signal at SR 1 and Rehoboth Avenue
Pedestrian Compliance

	Crossed Correctly		Crossed Incorrectly					
Location	Crossed Correctly		Crossed Early		Crossed Late		Never Activated	
	# (%)	Delay (Sec.)	# (%)	Delay (Sec.)	# (%)	Delay (Sec.)	# (%)	Delay (Sec.)
Rehoboth Ave (Peds crossing EB)	29 (56%)	57	9 (17%)	34	0	N/A	14 (27%)	6
Rehoboth Ave (Peds crossing WB)	10 (34%)	57	11 (38%)	32	0	N/A	8 (28%)	9
SR 1 at Westway Drive	71 (65%)	44	12 (11%)	30	14 (13%)	0	12 (11%)	5
SR 1 at Evergreen Road	41 (67%)	45	8 (13%)	30	1 (2%)	0	11 (18%)	4

HAWK Signal Traditional Signal

The pedestrian crossing at Rehoboth Avenue functions as a two (2) stage crossing, with pedestrians having to activate a HAWK signal and a regular signal to cross SR 1. Based on the results from **Table 8**, the percentage of pedestrians that activated the HAWK signal on the eastbound and westbound approaches were similar (73% vs. 72%). However, there is a noticeable decrease in compliance (56% vs. 34%) when pedestrians were traveling westbound and had already crossed the "typical" signalized pedestrian crossing for NB SR 1.

HAWK Compliance Study **May 2020**

Table 9:
Control Sites Similar to HAWK Signal at SR 1 and Rehoboth Avenue
Crosswalk Use and Gap Acceptance

	Crosswalk Use		Gap Acceptance	
Location	Yes	No	Safe Gap	Unsafe
Rehoboth Ave (Peds crossing EB)	20 (87%)	3 (13%)	20 (87%)	3 (13%)
Rehoboth Ave (Peds crossing WB)	18 (95%)	1 (5%)	18 (95%)	1 (5%)
SR 1 at Westway Drive	37 (97%)	1 (3%)	36 (95%)	2 (5%)
SR 1 at Evergreen Road	18 (90%)	2 (10%)	15 (75%)	5 (25%)

HAWK Signal Traditional Signal

The majority (87%-95%) of pedestrians that crossed SR 1 at Rehoboth Avenue used the marked crosswalk. This is similar to the percentage of pedestrians using the marked crosswalk at Westway Drive (97%) and Evergreen Road (90%).

Traffic signals near the HAWK signal at Rehoboth Avenue and the signalized crossings at Westway Drive and Evergreen Road create platoons in traffic on northbound and southbound SR 1. This provided large gaps in traffic for pedestrians to cross SR 1 outside of the pedestrian WALK phase. Because of this, the majority (87%-95%) of pedestrians that crossed outside of the WALK phase at the HAWK signal at Rehoboth Avenue crossed when there was a safe gap in traffic.

During the field observations at the "typical" signalized intersection of SR 1 and Westway Drive, pedestrians frequently started to cross the roadway when there were only a few seconds remaining on the countdown timer. This occurred when the pedestrian phase had been called by a pedestrian on the opposite approach, or when a pedestrian activated the pedestrian phase but crossed early. This resulted in the pedestrians having to wait in the median island for the next pedestrian WALK phase or a large gap in traffic. It was also observed that the pedestrians sometimes waited in the median island for an entire cycle length.

C. Before/After Crash Analysis

HAWK Compliance Study **May 2020**

Table 10:
SR 1 at Rehoboth Avenue
Before/After Crash Analysis

Crash Type	Crashes Before Installation	Crashes After Installation
Property Damage Only Crashes	20	28
Personal Injury Crashes	6	5
Fatal Crashes	0	0
Total Crashes	**26**	**33**
Total Pedestrian/Bicyclist Crashes	**0**	**1 P, 3 B**
Total HAWK-Related Crashes	**-**	**0**

Overall, the total number of crashes within 0.1 mile of the HAWK signal increased by 27% from the three (3) years before the HAWK signal installation to the three (3) years after its installation.

There were no reported crashes involving pedestrians or bicyclists in the three years before the HAWK installation. The three (3) reported bicyclist crashes that occurred after the HAWK installation did not occur at the HAWK signal intersection. The pedestrian crash occurred at the HAWK signal intersection, but the pedestrian was struck while walking in the northbound lanes. The pedestrian crash was not a result of the HAWK signal. Similarly, none of the vehicle crashes in the three (3) years after the HAWK signal installation were found to be related to the HAWK signal.

VIII. SR 1 at Holland Glade Road

In May 2016, DelDOT installed two (2) HAWK signals on SR 1 at Holland Glade Road, in front of the Tanger Outlets, near Rehoboth Beach, DE. This location had been difficult for pedestrians to cross because of the relatively high vehicular volumes, high vehicle speeds, and the wide roadway. At this location, there are two (2) HAWK signals that are at the same site but operate independently with separate pushbuttons and which are offset from each other by approximately 30 feet. The northern signal controls the northbound lanes and the southern signal controls the southbound lanes (see **Figure 5**).

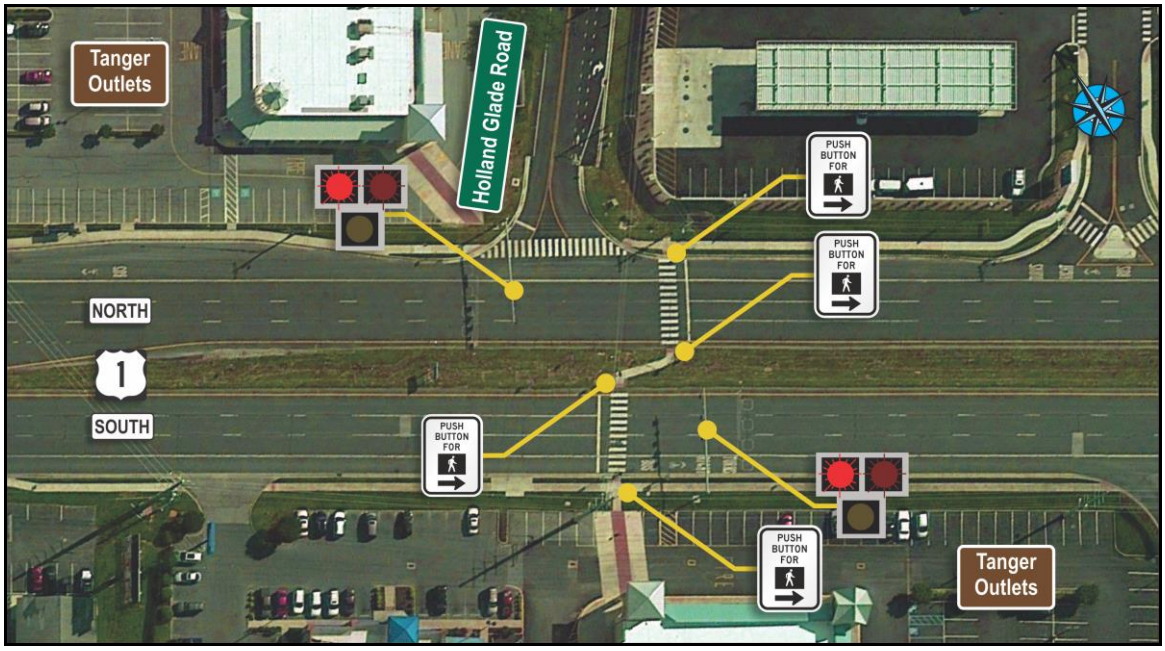

Figure 5: SR 1 and Holland Glade Road HAWK Signal

A. Motor Vehicle Compliance

RK&K conducted observations at the HAWK signal on SR 1 at Holland Glade Road, in July 2016, July 2017, and August 2019, including pedestrian behavior at the crosswalk. Pedestrians appeared to grow frustrated with the delay between pressing the button for the HAWK signal and the signal activating. For pedestrians to cross SR 1, they need to activate the HAWK signals for the northbound and southbound lanes separately. Pedestrians generally waited for the HAWK signal to activate for their first crossing. However, pedestrians frequently failed to wait for the HAWK signal to activate prior to crossing the second set of lanes, or they never even attempted to activate the second HAWK signal. Therefore, many of the vehicle observations in **Table 11**, which summarizes the compliance data for both HAWK signals, are based on motorists' behavior when no pedestrians or bicyclists were present when the HAWK signal was activated.

HAWK Compliance Study **May 2020**

Table 11:
SR 1 at Holland Glade Road
Motor Vehicle Compliance

	Vehicle Arrival				Vehicle Departure			
		Vehicle Disregarded signal (During Pedestrian Phase)			Correct Action		Incorrect Action	
Year	Vehicle Stopped for signal	During All-red	During Walk	During Flashing Red	Vehicle Proceeded on Flashing Red	Vehicle Proceeded After Ped Cleared Crosswalk	Vehicle Proceeded During Dark Signal	Motorist Appeared Confused*
2016	97%	3%	**0%**	0%	27%	17%	56%	0%
2017	78%	6%	**1%**	15%	57%	15%	27%	1%
2019	72%	7%	**2%**	19%	68%	20%	11%	1%

*Instances where the motorist waits an excessive amount of time after the signal goes dark before proceeding

RK&K observed the percentage of motorists complying with the HAWK signal. Based on the results from the observations, the compliance for motorist stopping for the HAWK signal has decreased (worsened) from 97% in 2016 to 72% in 2019. In 2016, only 3% of motorists disregarded the traffic signal (3%+0%+0% in **Table 11**). However, in 2019 approximately 28% of motorists (7%+2%+19% in **Table 11**) disregarded the traffic signal, with the majority of those motorists failing to stop during the clearance interval when the signal is flashing red. As noted previously, several observations were made when pedestrians pressed the pushbutton but crossed the street without waiting for a WALK indication. This resulted in some of the 28% of motorists disregarding the HAWK signal when no pedestrians or bicyclists were present. In addition, when the HAWK signal activates and begins to flash yellow, motorists were observed speeding up to "beat the light."

Following the 2016 HAWK Compliance Study, DelDOT installed new regulatory signs at the HAWK signals at this location, which state "Crosswalk, Stop on Red, Proceed on Flashing Red When Clear" (see **Appendix H**). The results from 2019 showed that the signs may have had a positive effect on motorists' behavior departing the HAWK signal at this location. The results from the 2019 observations at Holland Glade Road showed that approximately 88% of motorists (68%+20% in **Table 11**) departed from the intersection correctly in 2019, up from only 44% (27%+17%) in 2016. This appears to show that motorists have become familiar with the correct procedures to follow at the HAWK signal, which may be attributable to the new signs.

B. Pedestrian Compliance

During the field observations in 2016 and 2017, pedestrians appeared to grow impatient waiting to cross SR 1 at the HAWK signal. The pedestrians frequently failed to wait for the HAWK signal to activate prior to crossing the second set of lanes, or they never even attempted to activate the second HAWK signal. Therefore, many of the vehicle observations in **Table 11**, which summarizes the compliance data for both HAWK signals, are based on motorists' behavior when no pedestrians or bicyclists were present when the HAWK signal was activated. As a result of the issues observed with poor motor vehicle and pedestrian compliance with the HAWK

signals, RK&K completed a more in depth study at the HAWK signal at SR 1 and Holland Glade Road in August 2019.

The HAWK pedestrian signal at Holland Glade Road is a two (2) stage crossing which crosses four (4) lanes in each direction (3 thru-lanes and 1 right-turn/bus lane). There are two (2) HAWK signals that are at the same site, but operate independently with separate pushbuttons. The northern signal controls the northbound lanes and the southern signal controls the southbound lanes. The crossings were offset to decrease the likelihood of pedestrians crossing SR 1 in one (1) stage, thus required a lengthy pedestrian clearance interval. It requires users to activate a pedestrian signal to cross the first set of lanes to access the median island, and then they need to activate an additional signal in the median island to cross the second set of lanes.

To evaluate pedestrian compliance at the HAWK signal at Holland Glade Road, RK&K observed pedestrian behavior at the "typical" traffic signal at SR 58 and the entrance to Deltech's Stanton Campus. The crossing at SR 58 is also a two (2) staged crossing where pedestrians have to activate a pedestrian push button to cross each set of lanes.

The 2019 field observations at the Holland Glade Road HAWK signals also revealed that when the outlets are busy, pedestrians will arrive at both sides of SR 1 at the same time. This resulted in the HAWK signals for the northbound and southbound lanes activating at the same time. When this occurred bicyclists could cross the entire roadway within the WALK phase, but pedestrians frequently started crossing the second leg during the clearance interval. In some cases, the pedestrians were still in the roadway when the HAWK signal deactivated. As a result, the scenario for pedestrians beginning to cross at the end of the clearance interval "Crossed Late" was added as an additional category in **Table 12**.

HAWK Compliance Study **May 2020**

Table 12:
Control Sites Similar to HAWK Signal
at SR 1 and Holland Glade Road
Pedestrian Compliance

Location	Crossed Correctly		Crossed Incorrectly					
	Crossed Correctly		Crossed Early		Crossed Late		Never Activated	
	# (%)	Delay (Sec.)	# (%)	Delay (Sec.)	# (%)	Delay (Sec.)	# (%)	Delay (Sec.)
Holland Glade Rd (Crossing 1)	61 (81%)	86	11 (15%)	46	1 (1%)	0	2 (3%)	0
Holland Glade Rd (Crossing 2)	48 (64%)	65	7 (9%)	25	12 (16%)	0	8 (11%)	2
SR 58 at Deltech (Crossing 1)	27 (61%)	53	8 (18%)	46	0	0	9 (21%)	0
SR 58 at Deltech (Crossing 2)	28 (64%)	59	8 (18%)	16	0	0	8 (18%)	3

HAWK Signal Traditional Signal

Comparing pedestrian compliance at the first crossing with the second crossing, the field observations showed a noticeable decrease in pedestrian compliance for the second crossing at the HAWK signal (64% vs. 81%). The results also showed a spike in pedestrians crossing without activating the HAWK signal for the second crossing (11% vs. 3%) and pedestrians crossing at the end of the pedestrian clearance interval during their second crossing (16% vs 1%). Compared to

the control site with the traditional traffic signal, the pedestrian compliance at the HAWK signals was similar.

HAWK Compliance Study **May 2020**

Table 13:
Control Sites Similar to HAWK Signal at SR 1 and Holland Glade Road
Crosswalk Use and Gap Acceptance

	Crosswalk Use		Gap Acceptance	
Location	Yes	No	Safe Gap	Unsafe
Holland Glade Rd (Crossing 1)	11 (79%)	3 (21%)	10 (71%)	4 (29%)
Holland Glade Rd (Crossing 2)	24 (89%)	3 (11%)	12 (44%)	15 (56%)
SR 58 at Deltech (Crossing 1)	15 (88%)	2 (12%)	14 (82%)	3 (18%)
SR 58 at Deltech (Crossing 2)	14 (88%)	2 (12%)	11 (69%)	5 (31%)

HAWK Signal Traditional Signal

The majority (79% at the first crossing, 89% at the second crossing) of pedestrians that crossed SR 1 at Holland Glade Road used the marked crosswalk. This is similar to the percentage of pedestrians using the marked crosswalk at the traditional traffic signal at SR 58 and the entrance to Deltech (88%).

Notably, when pedestrians did not cross during the WALK indication, they chose safe/large gaps similarly at the first crossing at the HAWK signal and at both crossings (1st and 2nd) at the traditional signal (69% to 82%). However, the pedestrians chose safe/large gaps in traffic only 44% of the time at the second crossing of the HAWK signal. This may indicate a willingness by pedestrians to accept riskier behavior to get out of the median and across the road at the HAWK signal. Specifically, for the second crossing, pedestrians appeared impatient and were willing to take shorter gaps or cross when it wasn't safe. Pedestrians crossed when there were approaching vehicles and they also walked in-between vehicles that were stopped for the nearby traffic signals on SR 1. This appeared to be a potential safety issue, because vehicles in the right-most lane may not see pedestrians if they are still in the travel lane.

The field observations at SR 1 and Holland Glade Road also revealed conflicts between pedestrians and bicyclists. Bicyclists frequently ignore the HAWK signal and do not stop or slow down for pedestrians, which creates a potential conflict. An example of this is shown in **Figures 6** and **7** when a pedestrian in the crosswalk was struck by a bicyclist. During this incident, two (2) pedestrians were crossing the southbound lanes during the clearance interval. Two (2) bicyclists traveling southbound on SR 1 failed to stop or slow down for the HAWK signal or the pedestrians, which resulted in one of the bicyclists striking the pedestrian.

Figure 6: Bicyclists failed to stop for the SR 1 and Holland Glade Road HAWK Signal

Figure 7: The bicyclist struck the pedestrian

Figure 8 shows the importance of checking for oncoming traffic even if the pedestrians have the WALK phase. In this image, the pedestrians have the WALK phase, but the white SUV ran the red light and the bicycles did not slow down or stop for the HAWK signal.

Figure 8: Examples of conflicts at SR 1 and Holland Glade Road HAWK Signal

C. Before/After Crash Analysis

HAWK Compliance Study **May 2020**

Table 14:
SR 1 at Holland Glade Road
Before/After Crash Analysis

Crash Type	Crashes Before Installation	Crashes After Installation
Property Damage Only Crashes	24	49
Personal Injury Crashes	5	13
Fatal Crashes	0	0
Total Crashes	**29**	**62**
Total Pedestrian/Bicyclist Crashes	**1 B**	**8 B**
Total HAWK-Related Crashes	**-**	**4**

Overall, the total number of crashes within 0.1 mile of the HAWK signal increased by 114% from the three (3) years before the HAWK signal installation to the three (3) years after its installation.

The bicyclist crash that occurred before the HAWK signal installation occurred at a business driveway away from the HAWK signal. There were four (4) crashes after the HAWK signal installation that were directly attributable to the new signal. One (1) of the eight (8) bicycle crashes that occurred after the HAWK signal installation involved a bicyclist that was crossing

SR 1. In this crash, the bicyclist activated the HAWK signal and began crossing because vehicle traffic had stopped. However, a vehicle in the farthest travel lane did not stop and struck the bicyclist. There were also three (3) rear-end property damage only crashes where the following vehicle failed to stop in time to avoid striking the leading vehicle stopped at the red HAWK signal. One crash report cited a following driver stating that “because he is from out of town, he is not familiar with the pedestrian lights.”

IX. SR 273 at Freedom Trail

SR 273 was identified by DelDOT and the Office of Highway Safety as a corridor with a higher than expected frequency of pedestrian crashes. DelDOT completed a pedestrian safety audit along SR 273 and determined that an enhanced crossing may improve safety at this intersection. Pedestrians frequently crossed SR 273 to travel between the apartments on the north side of the roadway and the bus stop on the south side of the roadway. As a result, DelDOT installed a HAWK signal at SR 273 and Freedom Trail to provide a safer crossing for pedestrians (see **Figure 9**).

The HAWK signal on SR 273 at Freedom Trail is a single stage crossing. Pedestrians activate the HAWK signal and cross all of the lanes at one time. There is a pedestrian refuge island between the eastbound and westbound lanes on SR 273. However, there are no supplementary pedestrian signal push buttons in the pedestrian refuge island.

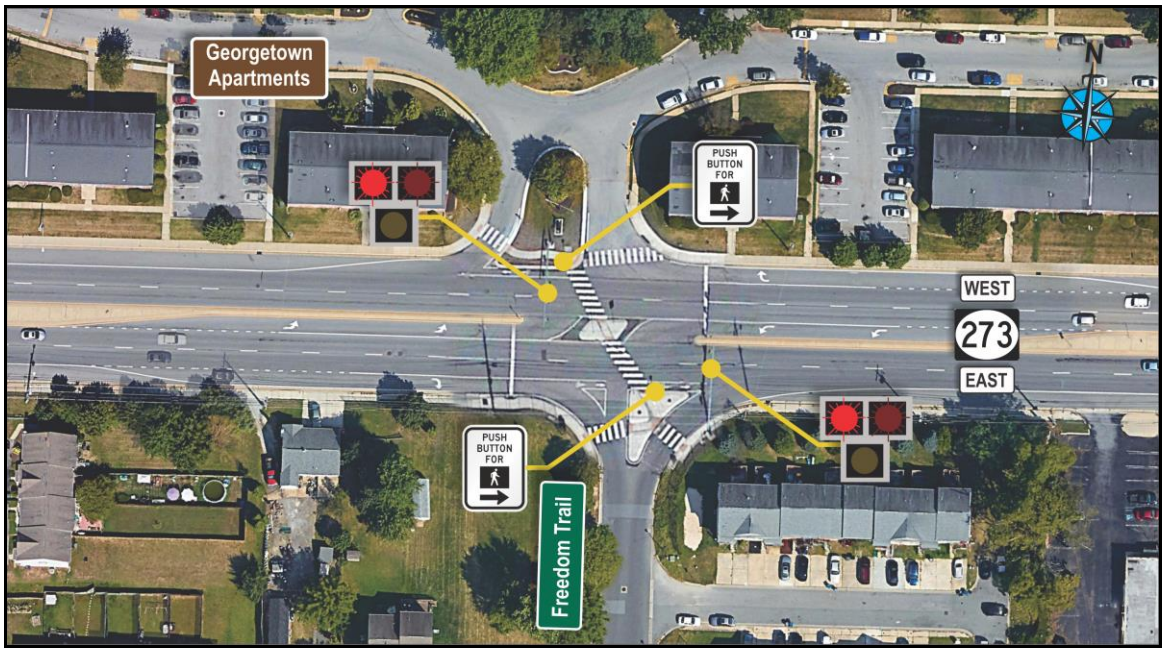

Figure 9: SR 273 and Farm Lane HAWK Signal

A. Motor Vehicle Compliance

RK&K conducted field observations at the HAWK signal at SR 273 and Freedom Trail in November 2018 and May 2019. The results from the field observations are summarized in **Table 15** below.

HAWK Compliance Study **May 2020**

Table 15:
SR 273 at Freedom Trail
Motor Vehicle Compliance

	Vehicle Arrival				Vehicle Departure			
Year	Vehicle Stopped for signal	Vehicle Disregarded signal (During Pedestrian Phase)			Correct Action		Incorrect Action	
		During All-red	During Walk	During Flashing Red	Vehicle Proceeded on Flashing Red	Vehicle Proceeded After Ped Cleared Crosswalk	Vehicle Proceeded During Dark Signal	Motorist Appeared Confused*
2018 & 2019	80%	4%	**0%**	16%	80%	0%	10%	10%

*Instances where the motorist waits an excessive amount of time after the signal goes dark before proceeding

The results presented in **Table 15** shows the majority (80%) of vehicles stopped for the HAWK signal. There were two (2) instances of vehicles failing to stop for the red light. However, the vehicles entered the intersection immediately after the HAWK signal turned red, before the pedestrian WALK phase activated. All of the instances of vehicles failing to stop for the flashing red signal occurred after the pedestrian had already completed crossing the intersection.

With respect to vehicle departures, the results presented in **Table 15** indicate that 80% of motorists correctly proceeded on flashing red after stopping. The remaining 20% of motorists stopped at the intersection and waited an excessive amount of time to enter the intersection or they waited for the HAWK signal to deactivate.

Field observations at this site revealed a safety concern associated with the installation of a HAWK signal at a four (4) leg intersection with channelized movements. Specifically, there are large channelizing islands on the north and south legs to prevent vehicles from turning left onto SR 273 from the minor street approaches. However, during the field observations, vehicles were observed using the gap in traffic created by the HAWK signal to illegally drive around the islands to turn left onto SR 273 (see **Figure 10**). This action by the motorists creates a safety hazard for pedestrians using the crosswalk during the WALK phase.

Figure 10: Vehicle turning left from Freedom Trail

B. Pedestrian Compliance

The HAWK signal at the intersection of SR 273 and Freedom Trail is located at the entrance for an apartment complex (north leg) and a townhome community (south leg). The HAWK signal is intended to provide a safe location for pedestrians to cross SR 273 to access bus stops along both sides of SR 273, shopping centers, and other commercial properties on the south side of SR 273.

To evaluate pedestrian compliance at the HAWK signal at SR 273 and Freedom Trail, RK&K observed pedestrian behavior at the "typical" traffic signal at SR 7 and Skyline Drive/Stoney Batter Road. The "typical" signalized intersection on SR 7 at Skyline Drive has similar characteristics to the HAWK on SR 273 at Freedom Trail. The HAWK signal and the "typical" signalized intersection are on divided highways, with high speeds, multiple lanes to cross, and a large median island. SR 273 has a 2018 AADT of 35,300 vpd, and SR 7 has a 2018 AADT of 28,300 vpd north of Skyline Drive and 34,400 vpd south of Skyline Drive.

HAWK Compliance Study **May 2020**

Table 16:
Control Sites Similar to HAWK Signal
at SR 273 at Freedom Trail
Pedestrian Compliance

	Crossed Correctly		Crossed Incorrectly			
Location	Crossed Correctly		Crossed Early		Never Activated	
	# (%)	Delay (Sec.)	# (%)	Delay (Sec.)	# (%)	Delay (Sec.)
SR 273 at Freedom Trail	8 (38%)	44	3 (14%)	12	10 (48%)	13
SR 7 at Skyline Drive	93 (83%)	43	5 (4%)	19	14 (13%)	4

HAWK Signal Traditional Signal

The results from the observations at the SR 273 and Freedom Trail HAWK pedestrian signal revealed that only 52% (38%+14%) of pedestrians activated the HAWK signal. Significantly, only 38% of the pedestrians waited for the HAWK signal to activate before crossing. In comparison, at the signalized control location, 87% (83%+4%) activated the signal and 83% of them waited for the WALK indication before crossing.

During the field observations, field staff recorded whether the pedestrians crossing the major roadway crossed at the marked crosswalk or outside of it. The field observers also kept track of gap acceptance. Specifically, it was assumed that the pedestrian used a safe gap if the pedestrian crossed when there was a sufficiently large gap in traffic on the approaching roadway that they could easily cross without hurrying. Conversely, it was assumed to be an unsafe crossing if there were nearby approaching vehicles while the pedestrian was crossing, that either caused the vehicle to slow down or stop or caused the pedestrian(s) to rush across the roadway.

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Table 17:
Control Sites Similar to HAWK Signal
at SR 273 at Freedom Trail
Crosswalk Use and Gap Acceptance

	Crossed at Marked Crosswalk		Gap Acceptance	
Location	Yes	No	Safe Gap	Unsafe Gap
SR 273 at Freedom Trail	6 (46%)	7 (54%)	8 (62%)	5 (38%)
SR 7 at Skyline Drive	15 (79%)	4 (21%)	16 (84%)	3 (16%)

HAWK Signal Traditional Signal

The existing traffic signals on SR 273 near the HAWK signal create large platoons on SR 273. During the field observations, the majority (62%) of pedestrians that crossed SR 273 outside of the pedestrian WALK phase, crossed when there was a large gap in traffic. During the field observations, the majority of pedestrians that crossed outside of the WALK phase appeared to carefully check for oncoming traffic before they started crossing the roadway. The pedestrians treated this crossing as a two (2) stage crossing. The pedestrians checked for approaching traffic and then crossed the first set of lanes when there was a large gap in traffic. Subsequently, they waited in the middle island and crossed the second set of lanes when there was a large gap in traffic on that approach.

During the field observations, two (2) pedestrians crossed SR 273 just east of the intersection. Five (5) pedestrians used the marked crosswalk to cross WB SR 273. However, when they crossed EB SR 273, they crossed outside of the marked crosswalk between the median island and the bus stop on the southwest corner of the intersection.

There are existing bus stops with shelters on SR 273. They are located approximately 550 feet west of the HAWK signal, and approximately 680 feet east of the HAWK signal at Freedom Trail. Prior to the installation of the HAWK signal, there were marked crosswalks across SR 273 with 100 feet of both bus stops. After the HAWK signal was installed, the marked crosswalks were removed. Field staff observed pedestrians crossing SR 273 near these former marked crosswalks. DelDOT may want to consider relocating the bus stops closer to the HAWK signal.

C. Before/After Crash Analysis

Because the HAWK signal at this location was installed in 2017, there were only two years of available crash data after the HAWK installation. Therefore, the number of crashes per year is also included in the below table.

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Table 18:
SR 273 at Freedom Trail
Before/After Crash Analysis

Crash Type	Crashes Before Installation (Total / Avg per Yr)	Crashes After Installation (Total / Avg per Yr)
Property Damage Only Crashes	11 / 3.7	4 / 2
Personal Injury Crashes	2 / 0.7	1 / 0.5
Fatal Crashes	1 / 0.3	0 / 0
Total Crashes	**14 / 4.7**	**5 / 2.5**
Total Pedestrian/Bicyclist Crashes	**1 P / 0.3 P**	**0 / 0**
Total HAWK-Related Crashes	**-**	**1 / 0.5**

Overall, the total crash rate (number of crashes/year) within 0.1 mile of the HAWK signal decreased by 46% from the three (3) years before the HAWK signal installation to the two (2) years after its installation. No pedestrian or bicyclist crashes occurred after the installation.

There was one (1) crash that occurred after the HAWK signal installation that was directly attributable to the new signal: It was a rear-end property damage only crash that occurred at the HAWK signal, where the following vehicle did not notice the leading vehicle stopped at the red signal.

It should be noted that the pedestrian crash that occurred before the HAWK signal installation was the result of two (2) pedestrians who crossed SR 273 at night under the influence of alcohol. A vehicle struck the pedestrians and fled the scene.

X. Summary

Since 2010, DelDOT has installed five (5) pedestrian hybrid beacons, also known as High-intensity Activated crossWalK (HAWK) beacons, throughout the state. These HAWK beacons were installed primarily with the intent of improving pedestrian safety. This study, and similar prior studies that have been performed by DelDOT since 2010, were conducted to determine the level of compliance motorists and pedestrians exhibit with this relatively new form of traffic control in the State of Delaware.

The current study examined both pedestrian and motorists' compliance at all five (5) of the HAWK signals in Delaware. Comparisons were made with data and observations made at these signals in prior years, which in some locations included as many as five (5) different previous studies. Additionally, in 2019, observations of pedestrian compliance were also conducted at several "traditional" signalized intersections to serve as a control group for purposes of comparison with the HAWK signals.

The study found a wide range of behavior on the part of both motorists and pedestrians at the HAWK signals. Perhaps the most important statistic in terms of pedestrian safety at a traffic signal is motorists' compliance with the red signal upon arrival at the intersection (which is when pedestrians have the WALK signal and are most likely to be in the intersection). In other words, the percentage of motorists that stop when the signal turns red, and in the case of a HAWK signal, come to a stop before proceeding with caution during the flashing red phase. During the 2019 observations, motorists' compliance with the red HAWK signals ranged from a high of 92% (SR 72 at Farm Lane) to a low of only 59% (SR 1 at Rehoboth Avenue). This means that at SR 1 and Rehoboth Avenue, 41% of the vehicles proceeded through the HAWK signal without stopping during either the all-red phase or the flashing red phase.

Departing the HAWK signals, the study data revealed that many motorists remain unaware that they are able to proceed during the flashing red phase as long as it is safe to do so. Between 12% (SR 1 at Rehoboth Avenue) and 55% (SR 72 at Farm Lane) of the motorists stopped at the HAWK signals waited until the signal went completely dark before proceeding, thereby eliminating one of the intended benefits of the HAWK signal: to reduce delay to motorists.

In terms of pedestrian behavior at the HAWK signals, there was also a wide range of observed compliance. The percentage of pedestrians who activated the pedestrian signal and crossed during the WALK indication ranged from a low of 34% (for those making the second crossing at the SR 1/Rehoboth Ave signal) to a high of 81% (for those making the first crossing at the SR 1/Holland Glade Road signal). As a comparison, at the "traditional" signals, the pedestrian compliance was better, ranging from a low of 61% to a high of 88%.

It is notable that all five (5) of the HAWK signals in Delaware have been constructed at intersections. None have been installed at mid-block locations. Three (3) of them are located at 4-legged intersections and two (2) of them are located at 3-legged intersections with a continuous median passing through the intersection, allowing one direction of travel to remain free flowing without any turning movements. This study revealed both operational and safety issues associated with HAWK signals being installed at intersections. During the observations at the SR 72 at Farm Lane and SR 8 at Heatherfield Way, motorists on the minor street were observed exiting their vehicle to manually activate the HAWK signal (by pressing the pedestrian pushbutton) to stop traffic on the major street, thereby facilitating their left turn. Field observations at the HAWK signal at SR 273 and Freedom Trail revealed that motorists are taking advantage of the gap created during the red phase of the HAWK signal to illegally drive around the channelizing islands at the intersection to make a left-turn onto SR 273. This illegal movement results in the vehicle crossing the crosswalk during the WALK indication.

An analysis of total crashes before and after HAWK signal installation was generally inconclusive. At two of the intersections, the total crashes decreased by 25% and 46% respectively. At the remaining three intersections, the total crashes increased by 27%, 75% and 114% respectively.

An analysis of pedestrian and bicyclist crashes before and after HAWK signal installation did not find a substantial change in crashes that were related to the HAWK signal. Specifically, at four (4) of the five (5) intersections, there were no pedestrian or bicycle crashes reported at the HAWK signal intersection during the three (3) years prior to the installation of the HAWK signal. At one of these locations, there was one (1) reported bicycle crash after the installation of the signal, indicating a net *increase* in pedestrian and bicyclist crashes after the installation of the HAWK signal. At the remaining intersection that had a pedestrian crash prior to the installation of the signal, the pedestrian that was struck was under the influence of alcohol. There have been no further pedestrian crashes at that location since the construction of the HAWK signal.

Narratives from the crash reports suggest there may be motorist confusion regarding the HAWK signals, with one driver stating he was unfamiliar with HAWK signals because he was from out of town and another driver stating she had a green light despite her side-street approach lacking any signal indications.

XI. Recommendations

Based on the observed motorist behavior at several of the HAWK signals, combined with the generally poor pedestrian compliance at the HAWK signals, especially when compared to similar "traditional" intersections, as well as crash data that showed almost no change in pedestrian/bicycle crashes, **it is recommended that HAWK signals no longer be installed at intersections in Delaware. It is also recommended that DelDOT study the five (5) HAWK signals that are currently located at intersections for potential conversion to a full traffic signal or Rectangular Rapid Flash Beacons (RRFB's).** *This recommendation does not apply to HAWK signals installed at mid-block locations, as there are no such examples in Delaware.*

A number of the pedestrian compliance observations in this study are related to the width of the crossings. At two of the locations, the road is so wide that the HAWK signals/traffic signals in each direction operate independently of each other, creating a two-stage pedestrian crossing.

During the field observations at the HAWK signals on SR 1 at Holland Glade Road and Rehoboth Avenue in 2016 and 2017, pedestrians appeared to become impatient after waiting to cross the first set of lanes and appeared to be less likely to activate or wait for the HAWK signal to cross the second set of lanes. The field observations completed in 2019 appeared to confirm this. The field observations showed a noticeable decrease in compliance from the first stage to the second stage crossing at the HAWK pedestrian signal at Holland Glade Road (81% to 64%, respectively). The field observations at the HAWK signal at SR 1 and Rehoboth Avenue showed a similar decrease in pedestrian compliance between the eastbound direction (56%) and the westbound direction (34%) when pedestrians had already waited for the WALK phase to cross NB SR 1.

The results from the compliance study at the HAWK signal at SR 1 and Holland Glade Road also revealed several conflicts between pedestrians, bicycles, and motor vehicles. When the Tanger Outlets were busy, the HAWK signal for both sets of lanes were activated at the same time. When this occurred, pedestrians attempted to cross both crossings at the same time, despite the fact that neither signal is timed to provide sufficient time to cross both crossings simultaneously. This resulted in the pedestrian starting to cross the second set of lanes during the clearance interval. In some cases, pedestrians were still in the travel lane when the HAWK signal deactivated. This is a potential safety issue, because vehicles in the rightmost lane may not see the pedestrians crossing.

Based on these observations, crash history, and poor motor vehicle and pedestrian compliance, particularly at the HAWK signals on SR 1 at Holland Glade Road and Rehoboth Avenue, **it is recommended that HAWK signals should not be installed on multilane roadways with more than two (2) lanes in each direction unless the signals are timed to permit a single stage pedestrian crossing. Similarly, it is recommended that HAWK signals should not be installed at locations with wide medians requiring a two-stage pedestrian crossing.**

Finally, there is experimental research being conducted to use passive detectors (infrared, microwave, pressure sensors) to activate the pedestrian phase at traffic signals. FHWA and the Pedestrian and Bicycle Information Center have listed passive detection as a possible safety countermeasure and improvement option[13,14]. Some of these devices track the pedestrian and can extend the walk interval for slower pedestrians. The devices may also be able to shorten the pedestrian interval or cancel a call if the pedestrian crosses early. Passive detection may improve pedestrian compliance and may also improve motorists' compliance at HAWK signals. **While these devices are still experimental and their reliability is still being reviewed, it is recommended that DelDOT monitor the studies related to the use of passive detectors at HAWK signals and, if they are found to be safe and effective, consider integrating them into any current/future HAWK signals in Delaware.**

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APPENDIX A

HAWK Compliance Studies
SR 72 at Farm Lane

HAWK Field Observations

Tuesday, August 10, 2010

- Rear-end accident NB at 8:40 am. Andy pushed the ped button on the SE corner of the intersection and stood on the sidewalk until cars came to a stop in both directions. The SB drivers stopped fine. The first NB driver came to a full stop at an acceptable speed. The following NB driver (driver 2) was at a good stopping distance from the first car, but didn't realize it was a red light and hit his brakes way too late, hitting driver 1.
- Some angry drivers yelling at us in the PM. They seem to have been stopped by our "test" multiple times.
- Nearly all drivers do not know how to use the dark phase

Friday, August 13, 2010

- Pavement striping crews showed up in mid AM peak to begin striping new crosswalk and temporary markings and the count was postponed

Tuesday, August 17, 2010

- Spoke with Newark Concrete manager and handed out HAWK pamphlets for the concrete truck drivers to educate themselves on how the signal works
- Many people yelling at our technician because they seem to be getting caught in our "study" too often
- A few vehicles coming from the side street turning right into the crosswalk during the ped walk phase
- Some drivers appearing confused when vehicles are turning from the side street, thinking that they have a light and wondering what to do

Thursday, August 19, 2010

- University of Delaware Police performed red light running enforcement during the mid-day peak period. Observed one driver northbound being pulled over and none in the southbound direction (cop car too visible)

Friday, August 20, 2010

- The Lieutenant of the Newark Police, along with various other police stopped to speak with us at various points of the day to talk about the new signal. The lieutenant expressed his negative views of the signal and repeatedly mentioned that this should be converted to a full signal for safety reasons. He also mentioned that the signs were too small for the 45 mph speed limit

Thursday, August 26, 2010

- During the AM peak, a northbound vehicle stopped in the middle of the intersection after realizing that he/she had run the solid red and backed up to the stop bar while our pedestrian was in the crosswalk
- At 11:10 AM, a rear-end accident occurred in the southbound direction. Our technician pushed the button on the south west corner of the intersection, the first vehicle in each direction came to a full stop at the solid red, the 2nd vehicle in the southbound direction also came to a complete stop, the 3rd vehicle in the southbound direction swerved around the 2nd car and into the shoulder to avoid hitting the 2nd vehicle and came to a complete stop, and finally the 4th vehicle collided with the 3rd vehicle and both vehicles pulled into the shoulder to wait for the police to arrive
- A few quotes from the AM peak period –
    1. "If I get caught in your stupid f#@*ing test one more f#@*ing time, I'm going to kick your f#@*ing a$$"
    2. "I think you test this thing enough"
    3. "Are you serious?"
- During the PM peak period, a DART bus traveling in the southbound direction ran the solid red light approximately 4 seconds into the phase
- In the PM peak period a southbound driver pulled over after passing through the signal and stopped in front of my vehicle and proceeded to take a picture with his camera of the camera setup and my license plate
- During the PM peak period, a northbound vehicle was waiting to turn left onto Farm Lane and the light turned to solid red. Vehicles stopped in the southbound direction, and the vehicle turned left well into the ped phase
- An agricultural student/worker who had been observed driving tractors and other vehicles back and forth to the Agricultural building stopped and spoke with us for a bit. He said "this should be a signal. The ped part doesn't make sense. When students return to school, it would be a good idea to change this to a full signal so that everyone benefits because they'll have a green light and they'll know what to do"

Wednesday, September 8, 2010

- During the entire AM peak period, there was intermittent rain that paused our study from time to time
- In the AM peak, a disgruntled Verizon driver was honking and cursing while passing me and our technician
- During the mid-day peak period, a vehicle coming from the Agricultural building approached during the flashing red phase of Route 72 and blew the stop sign to ensure that he/she would make it before vehicles started again. While he/she was in the middle of the road, the signal went dark, but vehicles waited for the vehicle to clear before starting
- There has been a lot of confusion observed with vehicles approaching from Farm Lane. This is true for the entire study period and has yet to improve. Drivers approach the stop sign while Route 72 traffic is steady and they wait for a gap to

turn. When the signal is activated and Route 72 traffic comes to a stop, the side street traffic does not go and waits for the main traffic to begin and they continue to wait for a gap

- Vehicles approaching from the side streets do not have any indication that the signal is activated and many times these vehicles will turn on the ped phase simply because traffic on Route 72 comes to a stop and they have a gap, regardless of a pedestrian in the crosswalk or not
- During the mid-day peak period, an Agricultural student gets dropped off on the south west corner of the intersection by a vehicle and proceeds to run up the path to class
- During the PM peak period, an Agricultural student leaving class on bicycle used the ped button on the south west corner and waited for vehicles to come to a complete stop. Vehicles in the northbound direction immediately stopped and vehicles in the southbound direction were approaching from a distance and the student continued to wait for a complete stop in that direction. When it was apparent that southbound vehicles were stopping, the student proceeded on bicycle. When the student was in the middle of the road, the signal turned dark, but vehicles waited for the student to clear before starting
- At 4:15 PM, an elementary or middle school bus stop stopped at the HAWK signal in the northbound direction, turned on it's lights and mechanical stop sign to stop traffic in both directions and let 2 children off at the south west corner. The children crossed and walked up Farm Lane
- Many disgruntled drivers were yelling and gesturing to us. Some examples:
    1. "You're testing this e-f#@*ing-nough"
    2. F#@* you... why are you doing this?!

Friday, September 10, 2010

- During the AM peak, the ped signal was activated and the first 2 southbound vehicles came to a complete stop. The 3rd vehicle pulled around the first 2 in the shoulder and came to a complete stop. When the flashing red phase began, the vehicle in the shoulder drove through
- During the mid-day peak, there was a near accident. The ped signal was activated and the first vehicle in both directions came to a complete stop. The second vehicle in the northbound direction approached at full speed (approx. 50 mph) and had to swerve around the first car to avoid a collision at the last second. At this point, the pedestrian (our technician) had the walk symbol, but luckily saw the vehicle approaching wildly and did not step from the curb

Wednesday, September 15, 2010

- During the AM peak, a school bus approaching from Farm Lane stopped at the stop sign and waited for a gap. The ped phase was activated and the school bus driver did not notice our technician waiting to cross in front of him/her, but when traffic stopped, the bus turned right across the crosswalk and cut off our technician who was trying to cross to the east side

- In the PM peak period, a pedestrian leaving the Agricultural building pushed the ped button and waited for cars to stop, but in the meantime, hit the button again, thinking it wasn't activated. The ped crossed (on bicycle) and about 5-6 seconds after the ped cycle ended, the ped cycle started again without any peds

Friday, October 22, 2010

- The VMS signs have not been removed, but larger signs have been installed on the mast arms for vehicles to stop on red ball.
- No pedestrians crossed at the signal, besides our technician.
- Police were not present at any point during the study.
- Many angry drivers were witnessed yelling at our technician, saying the usual things. This was most prevalent during the PM peak period.
- Many forms of police, mass transit and municipal drivers still do not appear to know how the light works and what to do during flashing Red.

Friday, December 17, 2010

- The AM peak period was skipped for this study due to the weather conditions (icy roads, below freezing temperatures, poor driving conditions).
- At 11:00 AM, an unmarked Newark Police officer stopped and introduced himself. He asked what times we would be studying the signal and how the signal worked, etc. He then stated that he would enforce red light running for a short while during the mid-day, but would have someone enforce for the majority of the PM peak period.
- The unmarked police officer was present from 11:00 AM to 11:40 AM during the mid-day peak period. During this time, he pulled 2 violators over in the shoulder after running the red light. One northbound, one southbound.
- The unmarked police officer was also present during the PM peak period, from 2:00 PM to 3:35 PM. From 2:00 PM to 3:00 PM, this officer pulled 2 violators over in the shoulder after running the red light. Again, one northbound and one southbound.
- From 3:00 PM to 3:35 PM, an additional Newark police officer showed up, this time a marked police vehicle. After conversing with the unmarked police officer for a short while, he then pulled into the northbound shoulder and parked, which effectively blocked anyone trying to pass any left turning vehicles. He stayed parked there until 3:35 PM, just observing traffic. During this time, the unmarked police officer pulled one southbound violator over after running the red light.
- At 3:35 PM both police officers pulled off of the roadway, conversed for about 5 minutes and left, heading down Farm Lane.
- At 3:50 PM, a school bus stopped at the SW corner of the intersection and activated it's stop sign, stopping traffic in both directions. A child then exited the bus, crossed SR 72 and walked down Farm Lane.
- Adam Weiser stopped by to observe the signal at 4:02 PM. He introduced himself and stayed for a few minutes while his DelDOT maintenance truck was parked and flashing in the southbound shoulder.

- The camera batteries were completely exhausted as of 4:10 PM.
- This was the last day of Fall classes for The University of Delaware
- New backplates were present on all signal heads.
- There was no change in signing or pavement markings.
- No VMS signs or cones were present.

Friday, February 24, 2011

- Signing recommendations implemented.
- No police present
- Only one student used the push button all day
- Many DART and police personnel observed blowing the red light
- The usual angry drivers yelling at our technician as they drive by
- A few times, drivers on the eastbound approach stopped, got out of their vehicle and hit the button to either go straight across or turn onto Route 72

Friday, April 29, 2011

- On two separate occasions, a DART bus blew through the solid red light well after it had turned red going Southbound. One was a short transit bus, and the other was a full-sized bus.
- On a few occasions, Newark municipal truck drivers approaching from Farm Lane would stop at the stop sign, get out of their vehicle and hit the push button to pull onto Route 72.
- At 11:45 AM, our intern activated the pedestrian push button on the east side of Route 72. The northbound vehicles stopped fine for the solid red light. The first southbound vehicle stopped at the solid red light without stopping too hard (no tire skidding). The second southbound vehicle, which had been following the first vehicle very closely at the time did not break and slammed into the rear of the first vehicle. The third vehicle seemed to stop without striking the second vehicle. Both vehicles remained in the travel lane and the driver and passenger of the second vehicle immediately got out of the car and went to the side of the road to use their cell phones. The driver of the first vehicle remained in the car and seemed to be hurt. There was no visible damage to the first vehicle, but the second vehicle had severe damage and was not drivable. Airbags were deployed in the second vehicle. Police, EMS and a tow truck arrived at the scene within 5-6 minutes and all 3 individuals were taken by ambulance. A police officer spoke with us about the incident and documented names, addresses, drivers licenses and our employer information.
- The police officer did not know anything about the signal. He was under the impression that it was malfunctioning and did not understand the functionality of the signal. After traffic patterns returned to normal and the police were out of driver sight (but parked nearby talking), a very similar situation occurred in the southbound direction after a municipal truck driver had activated the signal. A southbound box truck slammed on it's breaks to avoid rear-ending vehicles that had stopped at the solid red light. The police officer was startled when he heard

the squeeling tires and immediately asked us why the signal was activated. After explaining to him that it was activated by the truck driver, he stated "Put that in your report. Something needs to change. This is not working".
- On 3 separate occasions, vehicles in the northbound direction would swerve into the shoulder around vehicles that stop at the red light, and thus run the red light at high speeds.

Wednesday, September 14, 2011

- During all peak periods there were many near-collisions but no actual contact. All were nearly rear-end collisions.
- Many angry drivers yelling randomly from their vehicles.
- Driver reactions seem consistent with previous studies.
- No new intersection improvements.

Friday, September 30, 2011

- AM rain caused a delay in the study. Start time was 12:30pm.
- At approximately 12:10pm, there was a rear-end collision in the NB direction after the ped button had been pushed and our technician was standing on the SE corner waiting to cross. Police arrived within minutes and a statement was given by Urban staff.
- A second collision was witnessed at approximately 3:40pm in the SB direction after the ped button was pushed and our technician was standing on the SE corner of the intersection waiting to cross. No injuries were observed, but there was significant damage to one vehicle. Both parties exchanged information and drove away without calling police.
- No new intersection improvements.

HAWK Observations
2-24-11

		Southbound Arrivals				Southbound Departures				Northbound Arrivals				Northbound Departures				SB Running Red During Walk	NB Running Red During Walk	
Start Time	Button Pushed	Stopped Properly On Y/R	Ran Red	Stop On Flashing Red	Ran Flashing Red	Used FR Correctly	Wait For Dark	Go on Dark Correctly	Go Dark Confused	Stopped Properly On Y/R	Ran Red	Stop On Flashing Red	Ran Flashing Red	Used FR Correctly	Wait For Dark	Go on Dark Correctly	Go Dark Confused			
7:15 AM	9	8	5	3	0	4	8	0	0	12	1	2	0	4	9	0	0	0	0	
7:30 AM	10	8	2	2	0	2	7	2	0	12	4	4	0	7	8	1	0	0	0	
7:45 AM	4	3	0	2	2	3	1	2	0	3	1	3	2	4	1	0	1	0	0	
8:00 AM	6	4	0	3	2	2	2	1	2	5	2	3	1	3	3	1	1	0	0	
8:15 AM	4	2	1	3	0	0	4	1	0	5	2	2	0	2	5	1	0	0	0	
8:30 AM	7	5	1	4	0	3	4	2	1	7	2	4	0	5	4	1	2	0	0	
8:45 AM	7	5	0	2	0	0	5	0	2	8	1	2	0	2	5	0	3	0	0	
AM	47	35	9	19	4	14	31	8	5	52	13	20	3	27	35	4	7	0	0	
		80%	20%	83%	17%	31%	69%	0		80%	20%	87%	13%	44%	56%			0%	0%	*
10:00 AM	7	6	3	3	0	2	6	0	1	5	5	0	0	0	4	0	1	0	0	
10:15 AM	10	5	0	8	0	4	6	3	3	7	1	2	0	0	5	0	4	0	0	
10:30 AM	10	11	0	6	2	8	8	2	2	7	6	10	1	6	9	3	1	2	2	
10:45 AM	11	10	2	3	1	4	7	1	2	7	2	8	0	5	7	4	2	0	1	
11:00 AM	11	9	2	4	1	3	8	0	1	8	4	3	1	2	9	0	0	0	2	
11:15 AM	8	8	0	0	0	0	10	0	0	5	1	3	0	0	9	1	0	0	0	
12:15 PM	11	7	0	3	0	1	9	0	1	6	0	5	0	2	8	1	1	0	0	
12:30 PM	8	5	2	5	0	1	7	1	3	6	4	3	1	3	6	1	2	0	1	
12:45 PM	8	8	0	2	0	4	6	2	1	6	2	5	0	2	6	1	2	0	0	
1:00 PM	8	5	3	9	0	7	6	3	0	6	0	3	0	3	5	1	1	0	0	
1:15 PM	7	7	2	2	3	3	5	1	1	5	3	2	2	1	5	1	1	0	0	
1:30 PM	7	8	3	2	0	3	6	0	0	2	0	3	0	0	4	2	1	0	0	
MID	57	49	7	24	4	21	45	6	9	39	19	26	2	13	43	8	8	2	5	
		88%	13%	86%	14%	32%	68%			67%	33%	93%	7%	23%	77%			4%	9%	*
2:45 PM	10	9	0	0	0	0	9	0	0	11	4	2	0	1	11	0	0	0	0	
3:00 PM	4	5	0	0	0	0	4	0	1	3	1	1	0	0	4	0	1	0	0	
3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3:30 PM	9	9	2	0	0	1	6	1	1	9	4	1	0	1	6	1	1	0	0	
3:45 PM	6	6	4	2	0	3	5	1	1	5	2	3	0	1	8	0	0	0	0	
4:00 PM	5	2	1	6	0	5	3	3	0	4	2	3	1	4	3	3	0	0	0	
PM	34	31	7	8	0	9	27	5	3	32	13	10	1	7	32	4	2	0	0	
		82%	18%	100%	0%	25%	75%			71%	29%	91%	9%	18%	82%			0%	0%	*
TOTALS	138	115	23	51	8	44	103	19	17	123	45	56	6	47	110	16	17	2	5	
		83%	17%	86%	14%	30%	70%			73%	27%	90%	10%	30%	70%			1%	4%	*

	Steady Red		Flashing Red	
SB Compliance	115	23	44	103
NB Compliance	123	45	47	110
Overall Compliance	238	68	91	213
	78%	22%	30%	70%

* Percentage of Severe Red Light Running per Ped Phase Activation

URBAN ENGINEERS, INC.
Colwick Business Center
2 Penns Way, Suite 309
New Castle, DE 19720
Telephone: (302) 689 0260
Facsimile : (302) 689 0261

MEMORANDUM

TO: Mark Luszcz

FROM: Órla H. Pease

DATE: 11/8/2012

RE: Route 72 / Farm Lane HAWK Observations – POST implementation of changes to intersection

CC: Erik Schmidt; Scott Diehl; Jay Etzel; Lisa Delyaur

The purpose of this study was to evaluate driver compliance after physical changes were implemented at the intersection of Route 72 and Farm Lane. On Friday, October 10, 2012, Urban observed driver reactions to the HAWK signal at the intersection of Route 72 and Farm Lane while classes were in session for the fall semester at the University of Delaware. Observations were made from 7:00 AM to 9:00 AM, 10:00 AM to 2:00 PM and 2:45 PM to 4:30 PM. Driver reaction to the signal was documented for arrival and departure, along with severity of red light running.

The changes that were made at the intersection in September 2012 include restriping, adding additional HAWK signal faces and changing the flashing yellow phase timing. The previous lane configuration on both northbound and southbound approaches included one shared left-thru-right lane with a wide shoulder. The new striping for these approaches consist of a left turn lane, a shared thru-right lane and a 5-foot bicycle lane with no shoulder. The bicycle lanes in both directions extend beyond the intersection and continue along the corridor. Previously, two HAWK signal faces were fixed to the mast arm in each direction, with no supplemental signal faces. There are now a total of five (5) HAWK signal faces for each approach, with three (3) fixed to the mast arm, one (1) fixed to the mast arm pole and one (1) supplemental signal head and pole installed on the opposite side of the road. The new stop bar striping extends to the curb in both directions, which previously did not include the shoulder.

The signal phases were updated to the following timing sequence:

1. Flashing Yellow for 6 seconds (previously 8.5 seconds)
2. Solid Yellow for 5.5 seconds (same)
3. Steady Red for 5 seconds (same)
4. Steady Red plus pedestrian Walk for 7 seconds (same)
5. Flashing Red plus pedestrian Flashing Don't Walk for 17 seconds (same)
6. Dark (off)

Compliance with the steady red signal is 78% and compliance with the flashing red signal is 30%. These values are improved from previous observations, which averaged 64% compliance with the steady red signal and 28% with the flashing red signal. Figure 2 shows the red light compliance over time. As can been seen, the data and trend line indicate that compliance is steadily improving, although the latest results showed a clear improvement in the trend line. The results of the severity of red light running indicate 4% of the southbound vehicles and 11%

of the northbound vehicles that run the steady red light do so after the pedestrian gets the flashing walk symbol. It should be noted that this occurred *only* between 10:30 AM and 12:30 PM. Previously this type of behavior was observed during all time periods. Detailed results are provided in the attached table.

Key observations that were noted on the date of the study include:

- Increased student usage (25 students compared to 15 students, previously).
- Much fewer instances of verbal frustration from passing motorists.
- No accidents were observed.
- Much fewer instances of hard stopping for the steady red signal.
- Heavy trucks turning pose much less of a safety concern.
- No DART buses or City of Newark municipal trucks were observed running red, as observed during previous studies.

Some observations that were noted that were consistent with previous days include:

- Drivers on the unsignalized approaches sometimes get out of their vehicles to hit the button and make vehicles stop on Route 72.
- The majority of drivers do not know what to do on flashing red.

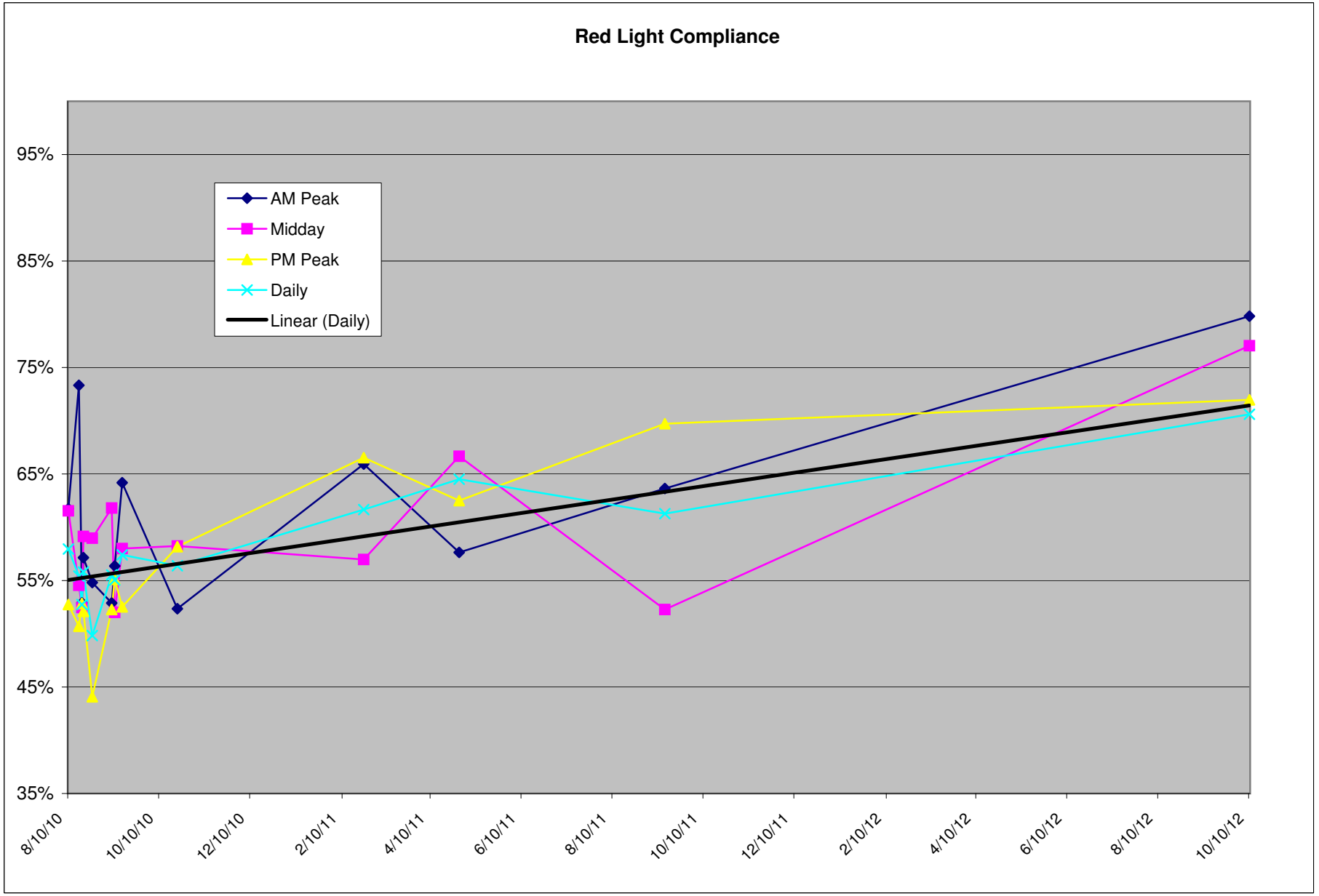
In conclusion, the recent changes to the intersection have addressed many of the safety concerns from previous studies. The addition of turn lanes and bike lanes have reduced the safety concerns for vehicles passing turning vehicles and using the shoulder as a thru lane. The addition of supplemental signal heads seems to have increased awareness of the signal as well as driver compliance, as shown in the graphs. Although compliance has improved, it is recommended to continue with public outreach and police enforcement to increase compliance.

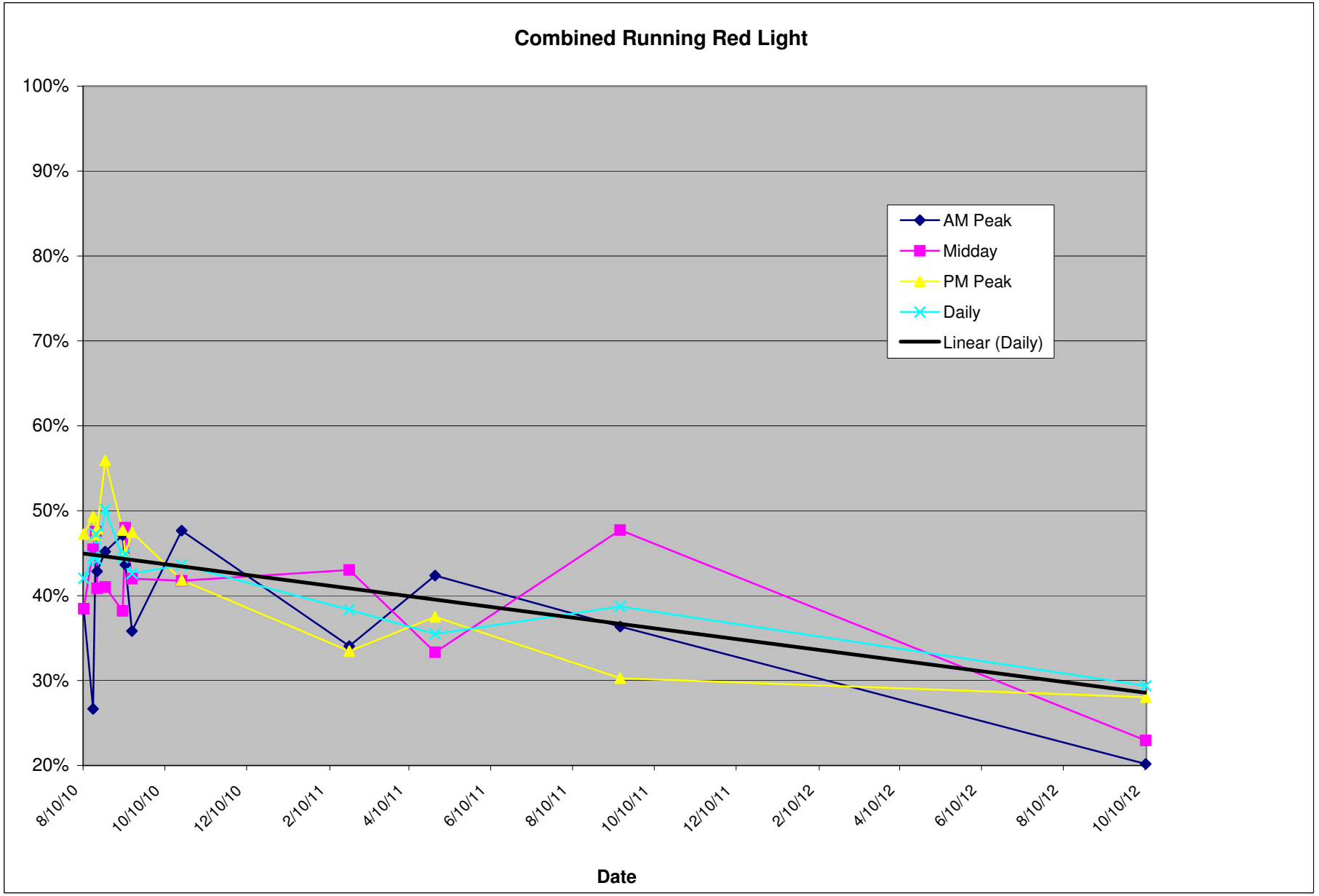
10-10-12

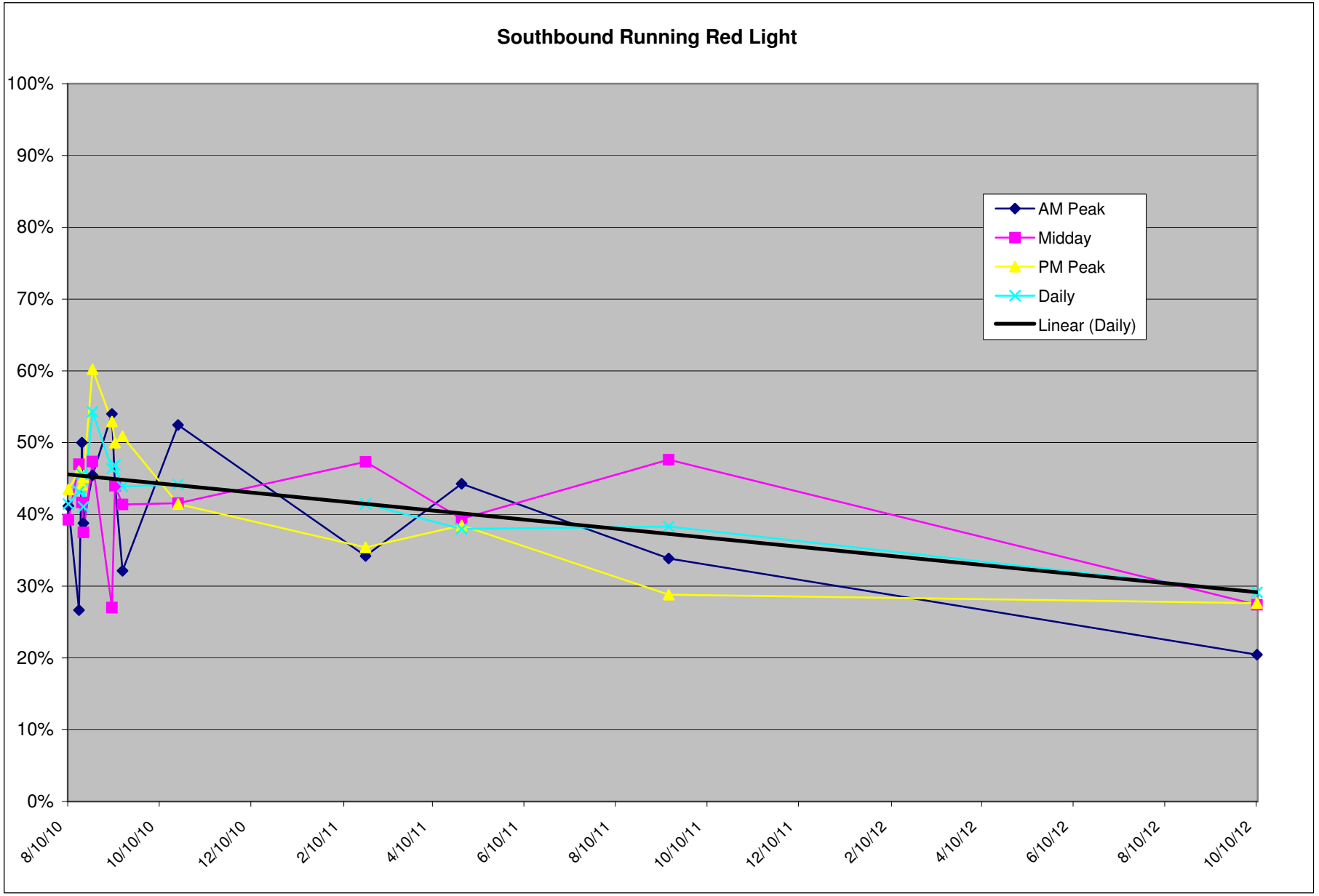
		Southbound Arrivals				Southbound Departures				Northbound Arrivals				Northbound Departures				SB Running Red During Walk	NB Running Red During Walk	
Start Time	Button Pushed	Stopped Properly On Y/R	Ran Red	Stop On Flashing Red	Ran Flashing Red	Used FR Correctly	Wait For Dark	Go on Dark Correctly	Go Dark Confused	Stopped Properly On Y/R	Ran Red	Stop On Flashing Red	Ran Flashing Red	Used FR Correctly	Wait For Dark	Go on Dark Correctly	Go Dark Confused			
7:15 AM	9	8	5	3	0	4	8	0	0	12	1	2	0	4	9	0	0	0	0	
7:30 AM	10	8	2	2	0	2	7	2	0	12	4	4	0	7	8	1	0	0	0	
7:45 AM	4	3	0	2	2	3	1	2	0	3	1	3	2	4	1	0	1	0	0	
8:00 AM	6	4	0	3	2	2	2	1	2	5	2	3	1	3	3	1	1	0	0	
8:15 AM	4	2	1	3	0	0	4	1	0	5	2	2	0	2	5	1	0	0	0	
8:30 AM	7	5	1	4	0	3	4	2	1	7	2	4	0	5	4	1	2	0	0	
8:45 AM	7	5	0	2	0	0	5	0	2	8	1	2	0	2	5	0	3	0	0	
AM	**47**	**35**	**9**	**19**	**4**	**14**	**31**	**8**	**5**	**52**	**13**	**20**	**3**	**27**	**35**	**4**	**7**	**0**	**0**	
		80%	**20%**	**83%**	**17%**	**31%**	**69%**	**62%**	**38%**	**80%**	**20%**	**87%**	**13%**	**44%**	**56%**	**36%**	**64%**	**0%**	**0%**	*
10:00 AM	7	6	3	3	0	2	6	0	1	5	5	0	0	0	4	0	1	0	0	
10:15 AM	10	5	0	8	0	4	6	3	3	7	1	2	0	0	5	0	4	0	0	
10:30 AM	10	11	0	6	2	8	8	2	2	7	6	10	1	6	9	3	1	2	2	
10:45 AM	11	10	2	3	1	4	7	1	2	7	2	8	0	5	7	4	2	0	1	
11:00 AM	11	9	2	4	1	3	8	0	1	8	4	3	1	2	9	0	0	0	2	
11:15 AM	8	8	0	0	0	0	10	0	0	5	1	3	0	0	9	1	0	0	0	
12:15 PM	11	7	0	3	0	1	9	0	1	6	0	5	0	2	8	1	1	0	0	
12:30 PM	8	5	2	5	0	1	7	1	3	6	4	3	1	3	6	1	2	0	1	
12:45 PM	8	8	0	2	0	4	6	2	1	6	2	5	0	2	6	1	2	0	0	
1:00 PM	8	5	3	9	0	7	6	3	0	6	0	3	0	3	5	1	1	0	0	
1:15 PM	7	7	2	2	3	3	5	1	1	5	3	2	2	1	5	1	1	0	0	
1:30 PM	7	8	3	2	0	3	6	0	0	2	0	3	0	0	4	2	1	0	0	
MID	**57**	**89**	**17**	**47**	**7**	**40**	**84**	**13**	**15**	**70**	**28**	**47**	**5**	**24**	**77**	**15**	**16**	**2**	**6**	
		84%	**16%**	**87%**	**13%**	**32%**	**68%**	**46%**	**54%**	**71%**	**29%**	**90%**	**10%**	**24%**	**76%**	**48%**	**52%**	**4%**	**11%**	*
2:45 PM	10	9	0	0	0	0	9	0	0	11	4	2	0	1	11	0	0	0	0	
3:00 PM	4	5	0	0	0	0	4	0	1	3	1	1	0	0	4	0	1	0	0	
3:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3:30 PM	9	9	2	0	0	1	6	1	1	9	4	1	0	1	6	1	1	0	0	
3:45 PM	6	6	4	2	0	3	5	1	1	5	2	3	0	1	8	0	0	0	0	
4:00 PM	5	2	1	6	0	5	3	3	0	4	2	3	1	4	3	3	0	0	0	
PM	**34**	**31**	**7**	**8**	**0**	**9**	**27**	**5**	**3**	**32**	**13**	**10**	**1**	**7**	**32**	**4**	**2**	**0**	**0**	
		82%	**18%**	**100%**	**0%**	**25%**	**75%**	**63%**	**38%**	**71%**	**29%**	**91%**	**9%**	**18%**	**82%**	**67%**	**33%**	**0%**	**0%**	*
TOTALS	**138**	**155**	**33**	**74**	**11**	**63**	**142**	**26**	**23**	**154**	**54**	**77**	**9**	**58**	**144**	**23**	**25**	**2**	**6**	
		82%	**18%**	**87%**	**13%**	**31%**	**69%**	**53%**	**47%**	**74%**	**26%**	**90%**	**10%**	**29%**	**71%**	**48%**	**52%**	**1%**	**4%**	*

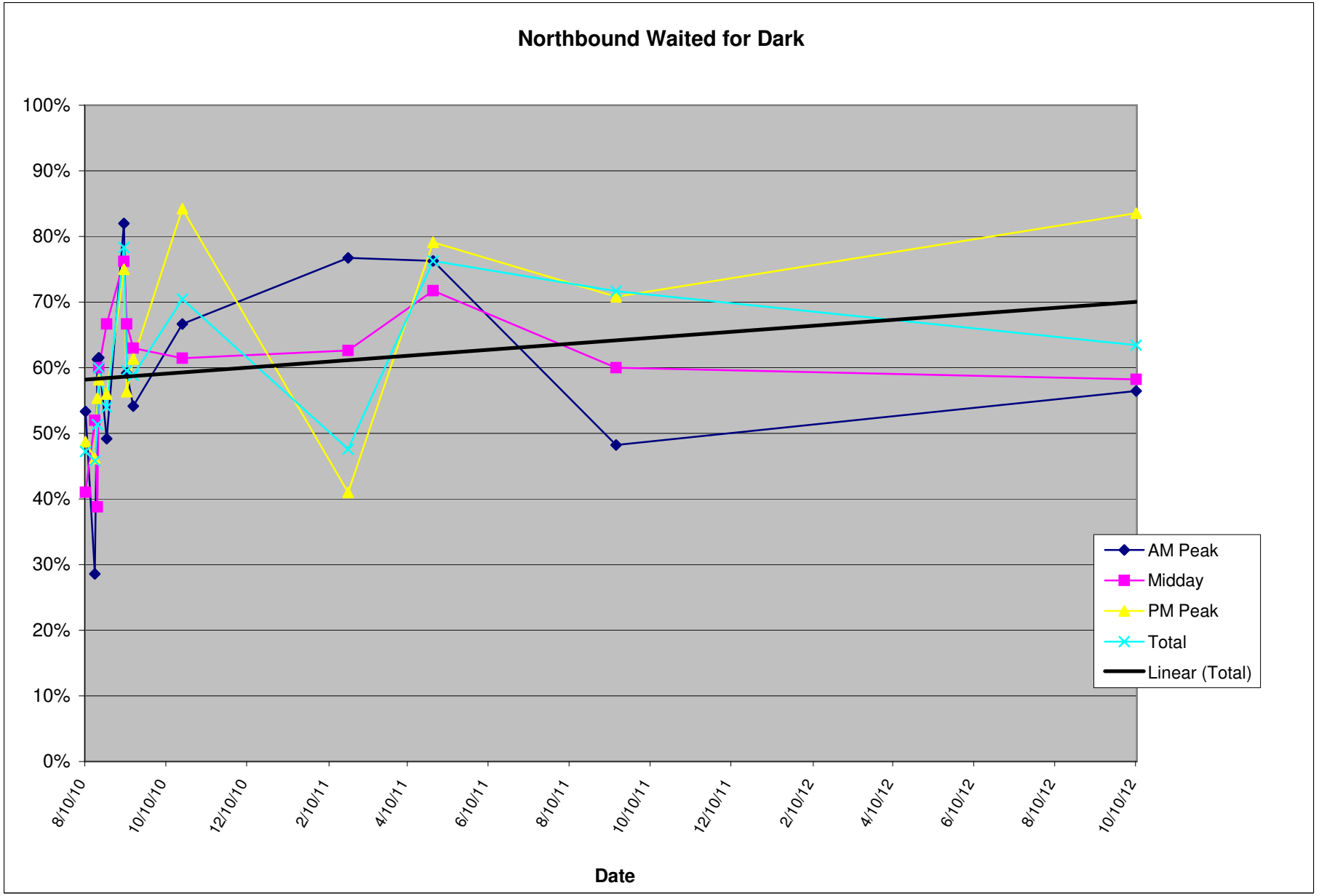
	Steady Red		**Flashing Red**	
SB Compliance	155	33	63	142
NB Compliance	154	54	58	144
Overall Compliance	309	87	121	286
	78%	**22%**	**30%**	**70%**

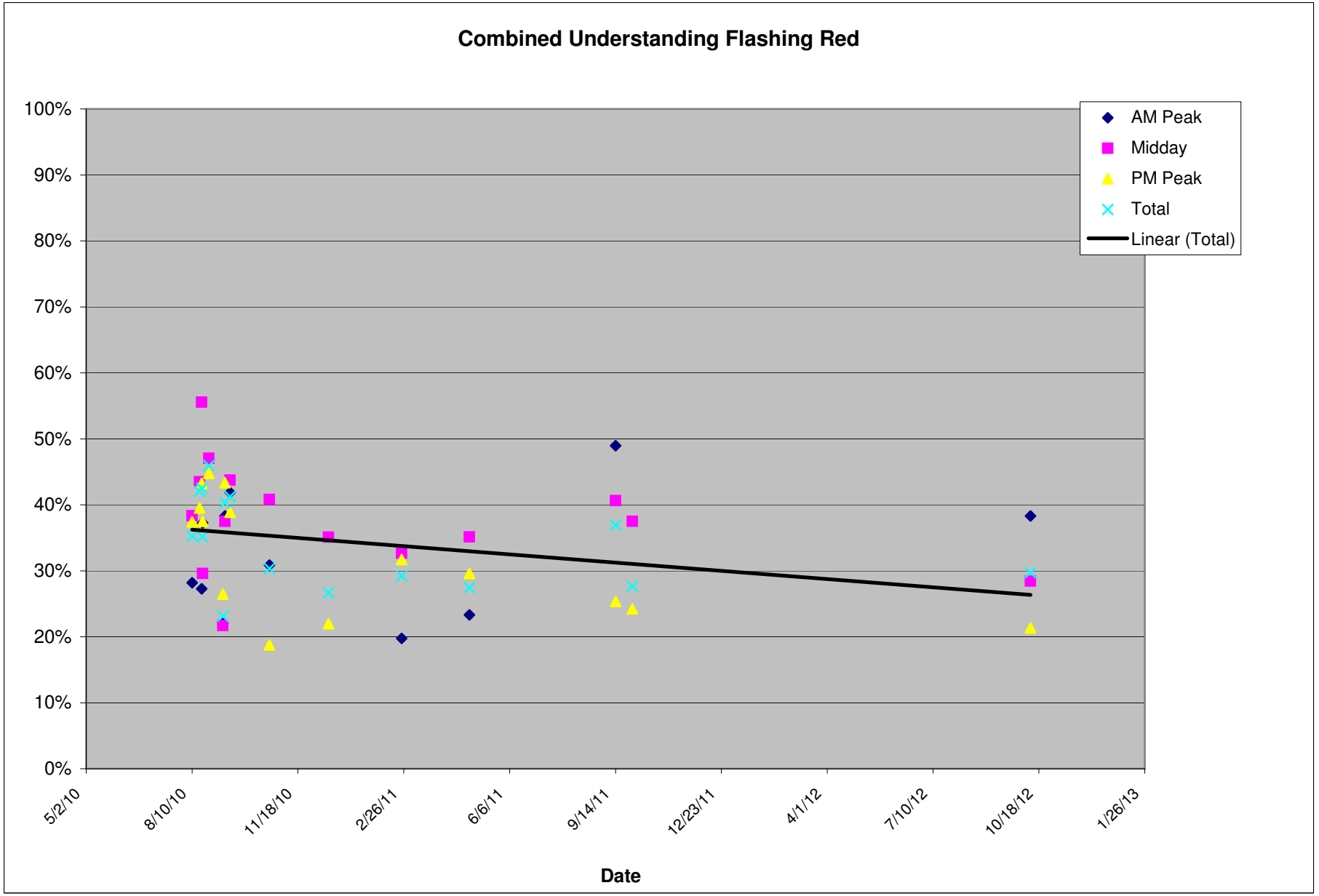
* Percentage of Severe Red Light Running per Ped Phase Activation

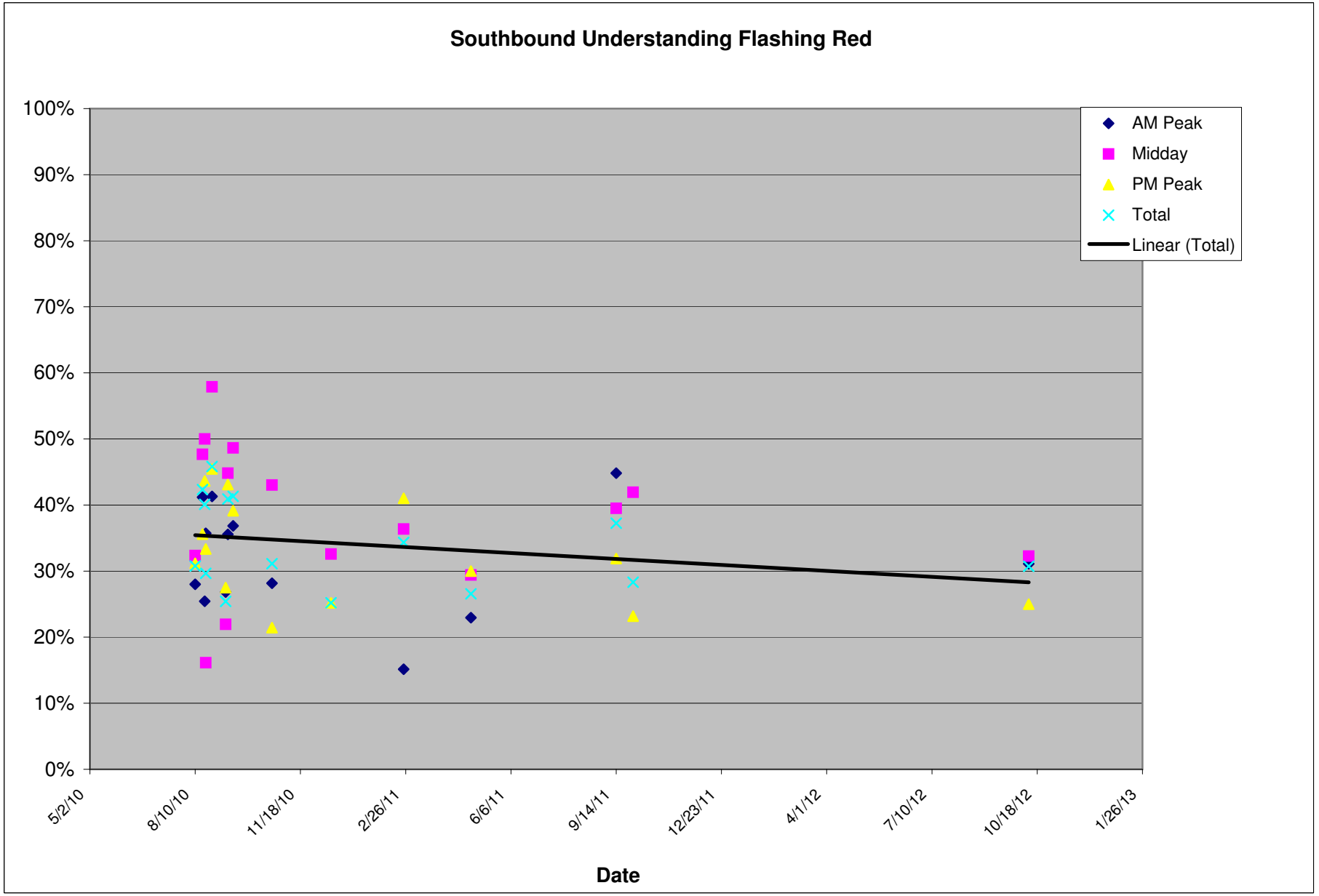

Red Light Compliance
95%
85%
75%
65%
55%
45%
35%
AM Peak
Midday
PM Peak
Daily
Linear (Daily)
8/10/10
10/10/10
12/10/10
2/10/11
4/10/11
6/10/11
8/10/11
10/10/11
12/10/11
2/10/12
4/10/12
6/10/12
8/10/12
10/10/12

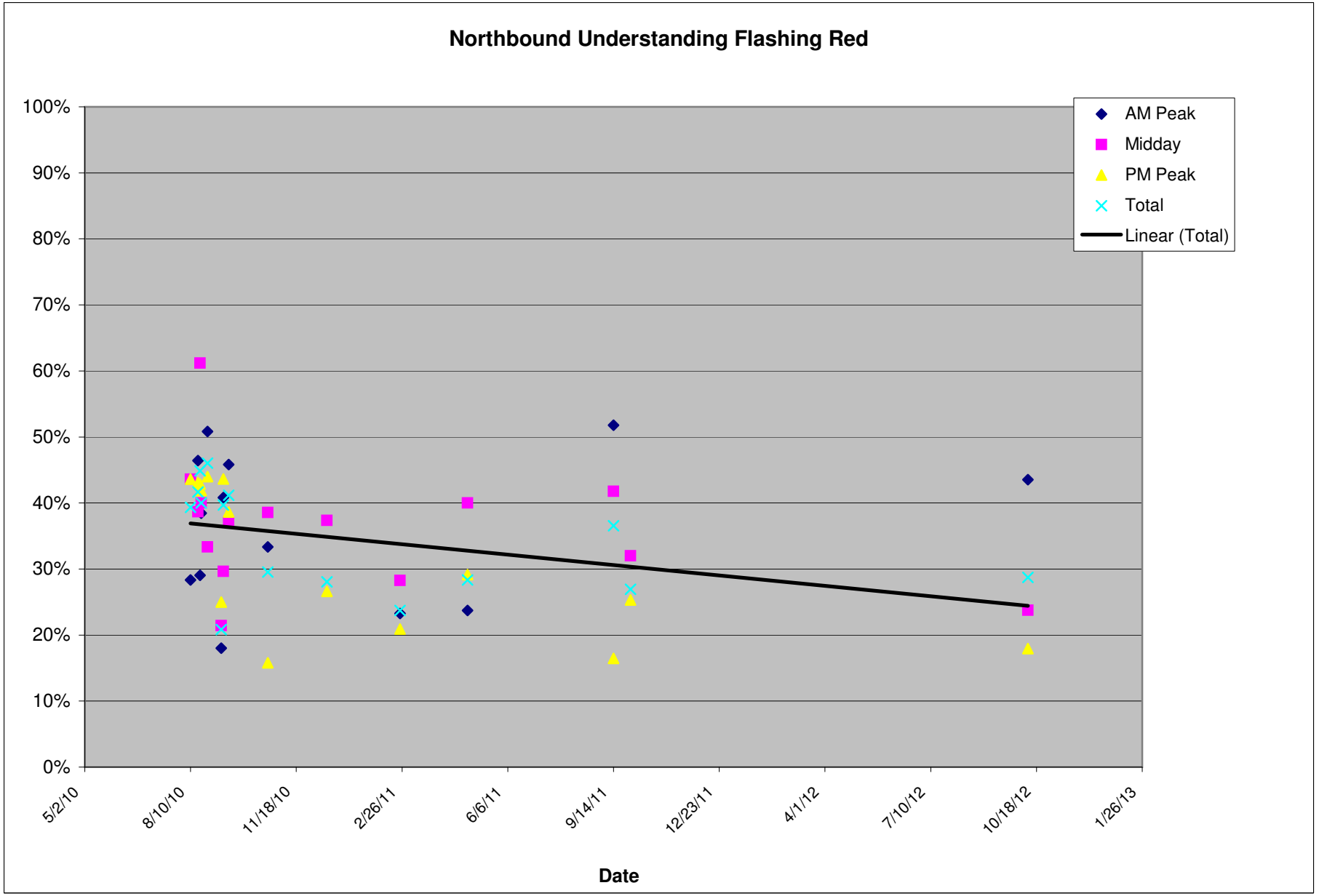

Combined Running Red Light
100%
90%
80%
70%
60%
50%
40%
30%
20%
AM Peak
Midday
PM Peak
Daily
Linear (Daily)
8/10/10
10/10/10
12/10/10
2/10/11
4/10/11
6/10/11
8/10/11
10/10/11
12/10/11
2/10/12
4/10/12
6/10/12
8/10/12
10/10/12
Date

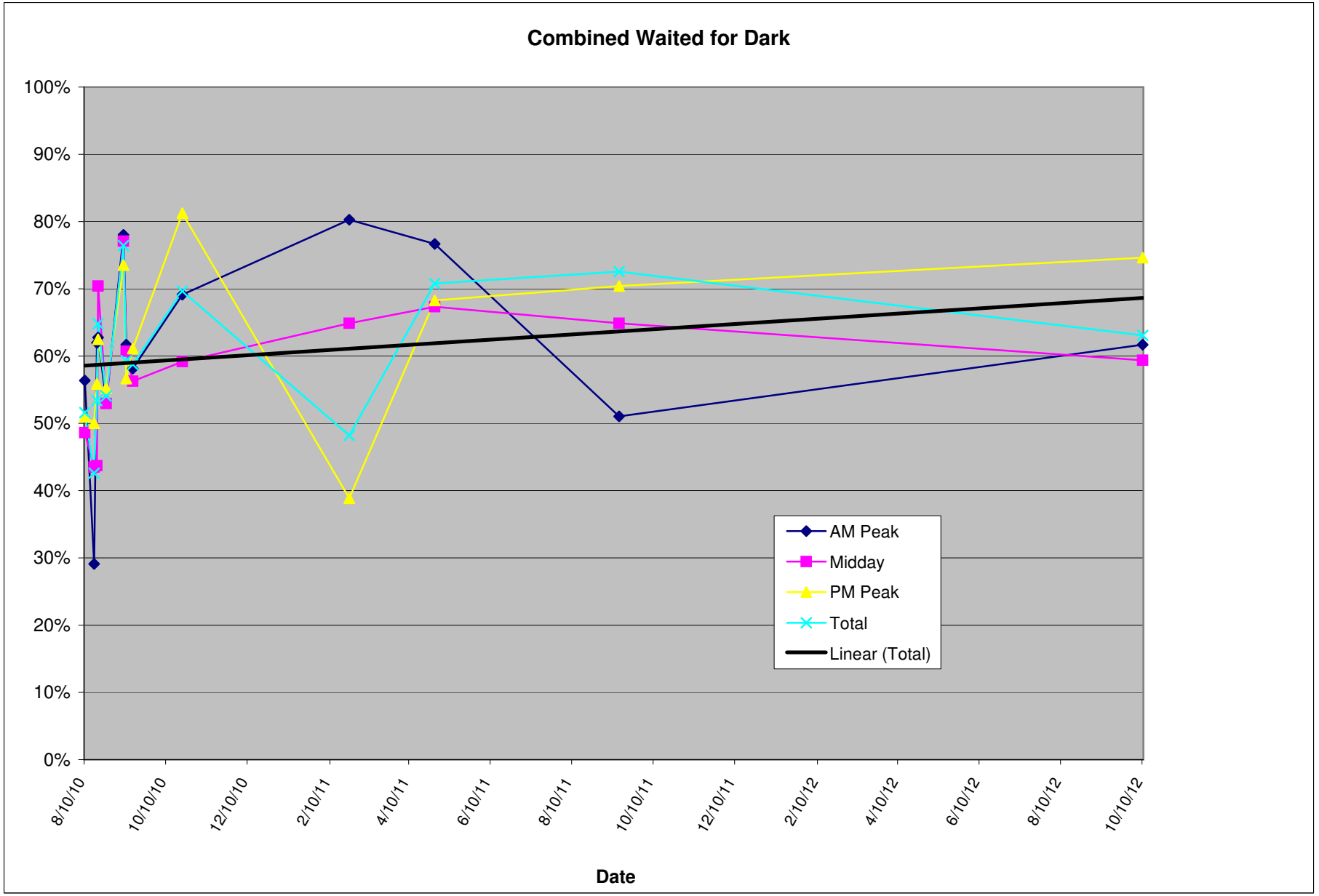

Southbound Running Red Light
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
8/10/10
10/10/10
12/10/10
2/10/11
4/10/11
6/10/11
8/10/11
10/10/11
12/10/11
2/10/12
4/10/12
6/10/12
8/10/12
10/10/12
AM Peak
Midday
PM Peak
Daily
Linear (Daily)

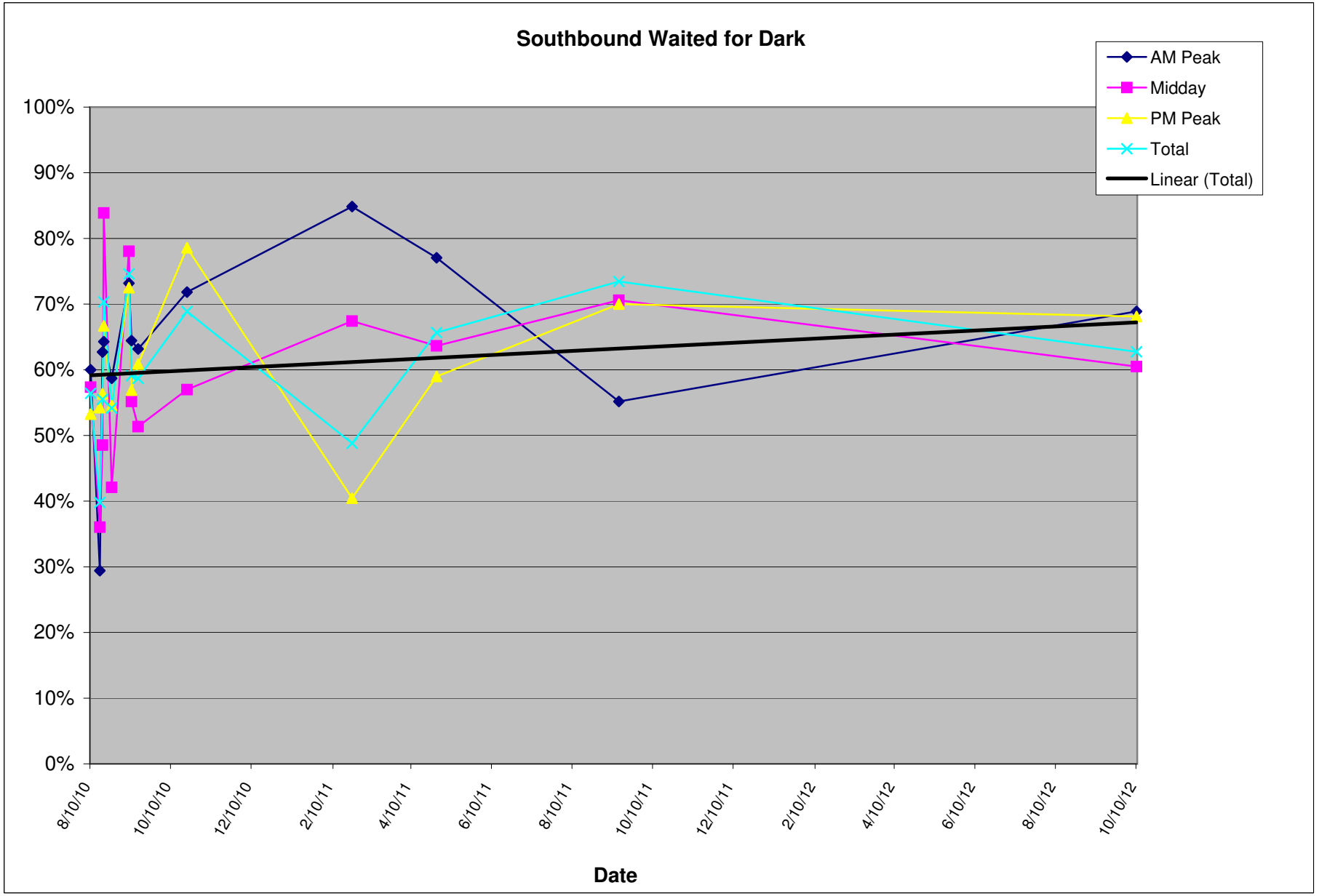

Northbound Waited for Dark
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
8/10/10
10/10/10
12/10/10
2/10/11
4/10/11
6/10/11
8/10/11
10/10/11
12/10/11
2/10/12
4/10/12
6/10/12
8/10/12
10/10/12
Date
AM Peak
Midday
PM Peak
Total
Linear (Total)


Combined Understanding Flashing Red
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
5/2/10
8/10/10
11/18/10
2/26/11
6/6/11
9/14/11
12/23/11
4/1/12
7/10/12
10/18/12
1/26/13
Date
AM Peak
Midday
PM Peak
Total
Linear (Total)


Southbound Understanding Flashing Red
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
5/2/10
8/10/10
11/18/10
2/26/11
6/6/11
9/14/11
12/23/11
4/1/12
7/10/12
10/18/12
1/26/13
Date
AM Peak
Midday
PM Peak
Total
Linear (Total)


Northbound Understanding Flashing Red
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
5/2/10
8/10/10
11/18/10
2/26/11
6/6/11
9/14/11
12/23/11
4/1/12
7/10/12
10/18/12
1/26/13
Date
AM Peak
Midday
PM Peak
Total
Linear (Total)


Combined Waited for Dark
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
8/10/10
10/10/10
12/10/10
2/10/11
4/10/11
6/10/11
8/10/11
10/10/11
12/10/11
2/10/12
4/10/12
6/10/12
8/10/12
10/10/12
Date
AM Peak
Midday
PM Peak
Total
Linear (Total)


Southbound Waited for Dark
AM Peak
Midday
PM Peak
Total
Linear (Total)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
8/10/10
10/10/10
12/10/10
2/10/11
4/10/11
6/10/11
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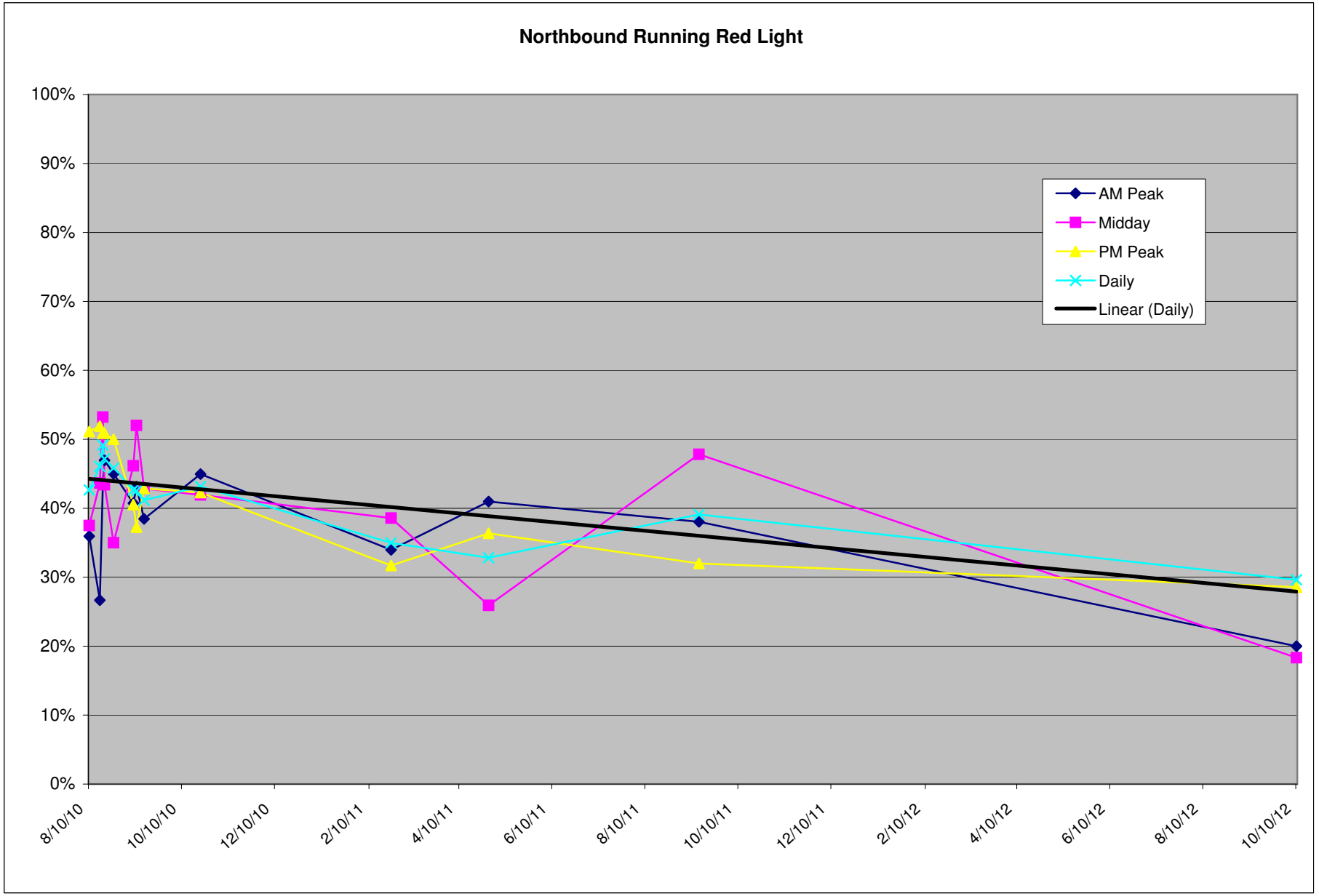
2/10/12
4/10/12
6/10/12
8/10/12
10/10/12
Date


Northbound Running Red Light
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
8/10/10
10/10/10
12/10/10
2/10/11
4/10/11
6/10/11
8/10/11
10/10/11
12/10/11
2/10/12
4/10/12
6/10/12
8/10/12
10/10/12
AM Peak
Midday
PM Peak
Daily
Linear (Daily)

HAWK Signal Observation – DE Route 72

Date Completed: 11/6/13

Weather: Daylight / Clear / Dry

Time: 12:30pm – 4:00pm

(The time of the observation was determined by the Aggregate Building classes that were in session. The data was collected starting a half an hour before the start of class to a half an hour after class let out.)

Conducted By: Shawn Kemp / Chris McNelis

Field Notes:

- **Pedestrians –** There were **21** pedestrians that were noted crossing DE Route 72. Of the 21 counted, **2** pedestrians did not wait for the HAWK signal before crossing.

- **Vehicles –** There were **11** total vehicles accessing the Aggregate Building during the observation.

- **Traffic Conflicts –** Traffic operation was observed, including any near misses or accidents. There were 2 instances where rear end accidents nearly occurred. Both times were with a vehicle stopped for the red light, and a second vehicle approaching the HAWK signal, with the driver slamming on their brakes and stopping just before contact.

- **Confusion –** During the observation, it did appear that the Safety Vest worn by the tech pushing the button did cause some confusion with the drivers stopped at the signal. On a few occasions, the drivers waited after the signal went completely dark, looking at the tech as if to wait for them to be told what to do.

Hawk Observations
11/6/13

		Southbound Arrivals				Southbound Departures				Northbound Arrivals				Northbound Departures				SB Running Red During Walk	NB Running Red During Walk	
Start Time	Button Pushed	Stopped Properly On Y/R	Ran Red	Stop On Flashing Red	Ran Flashing Red	Used FR Correclty	Wait For Dark	Go On Dark Correctly	Go Dark Confused	Stopped Properly On Y/R	Ran Red	Stop On Flashing Red	Ran Flashing Red	Used FR Correctly	Wait For Dark	Go On Dark Correctly	Go Dark Confused			
01:00 PM	9	8	4	0	0	1	7	0	2	9	2	0	0	1	7	0	1	0	0	
01:15 PM	9	4	7	3	8	4	4	0	0	5	4	3	3	5	4	2	0	0	0	
01:30 PM	7	6	5	0	0	3	7	0	2	5	5	2	1	1	7	0	1	0	0	
01:45 PM	7	7	5	0	0	3	5	2	0	6	9	0	0	2	6	0	0	0	0	
02:00 PM	7	6	6	1	2	7	3	2	0	7	4	1	2	6	3	2	0	0	0	
02:15 PM	7	7	7	1	2	3	3	2	1	7	6	0	4	4	3	2	1	0	0	
02:30 PM	7	7	3	0	5	4	4	1	0	6	5	1	3	4	4	0	0	1	1	
02:45 PM	6	5	1	0	1	0	6	0	0	5	3	0	0	0	6	0	0	0	0	
03:00 PM	7	6	4	0	0	1	6	0	1	6	5	1	0	2	6	0	1	0	0	
03:15 PM	7	5	1	0	0	0	6	0	1	4	2	1	0	1	6	0	0	1	0	
03:30 PM	6	6	2	0	1	1	5	1	1	4	2	3	1	5	3	1	0	0	0	
03:45 PM	7	7	1	0	0	1	6	0	0	4	2	1	1	1	5	1	0	0	0	
PM	86	74	48	5	19	28	62	8	8	68	49	13	15	32	60	8	4	2	1	
		61%	39%	21%	79%	31%	69%	50%	50%	58%	42%	46%	54%	35%	65%	67%	33%	2%	1%	*
TOTALS	86	74	48	5	19	28	62	8	8	68	49	13	15	32	60	8	4	2	1	
		61%	39%	21%	79%	31%	69%	50%	50%	58%	42%	46%	54%	35%	65%	67%	33%	2%	1%	*

	Steady Red		Flashing Red	
SB Compliance	74	48	28	62
NB Compliance	68	49	32	60
Overall Compliance	142	97	60	122
	59%	41%	33%	67%

* Percentage of Severe Red Light Running per Ped Phase Activation

HAWK Signal Observation – DE Route 72

Date Completed: 4/23/15

Weather: Daylight / Clear / Dry

Time: 7:30am – 11:30am

(The time of the observation was determined by the Agricultural Building classes that were in session. Also, we were told by a U of D representative that during the fall semester, intro classes are conducted at the Agricultural Building. There are three labs a week for eight week.)

Conducted By: Shawn Kemp / Chris McNelis

Field Notes:

- **Pedestrians** – There were no pedestrians that used the signal during the scheduled hours for the class.

- **Vehicles -**

    - **Agricultural Building**
        - **Entering – 24** *(3 of the vehicles that came from Farm Lane used the HAWK signal to stop traffic)*
        - **Exiting – 19**
            - **Total – 43**

- **Traffic Conflicts** – On at least two occasions, while the first vehicle was "waiting for dark", the second vehicle in line would attempt to pass the first vehicle.

Hawk Observation: Farms Lane
04/23/15

		Southbound Arrivals				Southbound Departures				Northbound Arrivals				Northbound Departures				SB Running Red During Walk	NB Running Red During Walk	
Start Time	Button Pushed	Stopped Properly On Y/R	Ran Red	Stop On Flashing Red	Ran Flashing Red	Used FR Correctly	Wait For Dark	Go On Dark Correctly	Go Dark Confused	Stopped Properly On Y/R	Ran Red	Stop On Flashing Red	Ran Flashing Red	Used FR Correctly	Wait For Dark	Go On Dark Correctly	Go Dark Confused			
07:00 AM	8	5	3	3	1	4	4	0	0	6	3	6	6	7	4	0	0	0	2	
07:15 AM	7	6	5	0	3	4	3	0	1	4	3	2	3	5	4	0	0	1	1	
07:30 AM	9	8	6	2	0	4	5	0	0	8	6	2	2	4	5	0	1	0	0	
07:45 AM	7	4	2	3	0	4	3	0	0	7	5	2	5	5	4	0	0	0	1	
08:00 AM	7	4	3	3	0	1	6	0	1	7	4	0	1	1	5	0	2	0	0	
08:15 AM	8	6	4	3	0	5	5	0	0	6	0	7	1	9	2	1	0	0	0	
08:30 AM	6	7	5	1	0	1	4	2	1	7	1	2	0	1	4	2	1	0	0	
08:45 AM	7	2	3	3	0	1	3	2	0	7	2	2	0	5	3	2	0	0	0	
09:00 AM	4	4	1	2	0	2	4	0	0	5	1	1	0	1	4	1	0	0	0	
09:15 AM	6	6	2	1	0	1	6	0	0	6	4	0	0	1	5	0	0	0	0	
09:30 AM	6	7	3	0	0	0	7	0	0	5	7	1	0	2	5	0	0	0	0	
09:45 AM	6	4	1	1	1	3	3	0	0	3	0	1	0	2	2	0	0	1	0	
10:00 AM	7	5	0	4	2	4	3	2	0	5	1	4	2	5	2	2	0	0	1	
10:15 AM	8	6	1	3	0	2	6	1	0	4	0	2	0	1	6	0	0	0	0	
10:30 AM	6	7	5	5	0	7	4	1	0	5	2	5	0	5	3	2	0	0	0	
10:45 AM	7	6	4	2	0	0	8	0	0	5	2	2	0	0	7	0	0	0	0	
PM	109	87	48	36	7	43	74	8	3	90	41	39	20	54	65	10	4	2	5	
		64%	36%			37%	63%			69%	31%			45%	55%			1%	4%	*
TOTALS		87	48	36	7	43	74	8	3	90	41	39	20	54	65	10	4	2	5	
		64%	36%			37%	63%			69%	31%			45%	55%			1%	4%	*

	Steady Red		Flashing Red	
SB Compliance	87	48	43	74
NB Compliance	90	41	54	65
Overall Compliance	177	89	97	139
	67%	33%	41%	59%

* Percentage of Severe Red Light Running per Ped Phase Activation

Traffic Section
(302) 659-4097

To: Chris McNelis
Heather Lindale
Shawn Kemp
Transportation Technicians

From: Naa-Atswei Tetteh
Traffic Studies Engineer

Date: April 20, 2015

RE: **Chapel Street/Library Street, SR 72 (N356) and Farm Lane**
Newark, NCC

Hi Chris, Heather, and Shawn:

As discussed, please perform a HAWK compliance study at the SR 72 and Farm Lane intersection between 7-11 AM to capture some of the pedestrians for the class that is occurring at 8-9:15 AM on Thursday, April 23, 2015.

If you have any questions, please let me know, call me at 302-659-4097.

Thanks for your help,

Naa-Atswei Tetteh

Observations of motorist behavior at the HAWK signals on SR 72 at Farm Lane were conducted on Wednesday, May 3, 2017. Field staff recorded whether motorists stopped for the HAWK signal when it was solid red and when it was flashing red. They also recorded if motorists were confused about when they were allowed to proceed on flashing red or when the signal had deactivated.

HAWK Compliance Study SR 72 at Farm Lane								
Pedestrian Actuation Count	Vehicle Arrival				Vehicle Departure			
	Stop Solid Red OK	Stop Flashing Red OK	Blow Solid Red	Blow Flashing Red	Go Flash OK	Go Dark OK	Wait for Dark	Confused
67	**86**	**138**	**2**	**18**	**60**	**2**	**77**	**1**

Terms

Pedestrian Actuation Count – HAWK signal actuation by Pedestrian / Bicyclist.

Stop Solid Red OK – A vehicle stopped when the HAWK signal turned solid red (WALK Phase).

Stop Flashing Red OK – A vehicle stopped when the HAWK signal was flashing red (Pedestrian Clearance Interval).

Blow Solid Red – A vehicle disregarded the HAWK signal when it was red (i.e. WALK Phase) and traveled through the pedestrian crosswalk without stopping.

Blow Flashing Red – A vehicle disregarded the HAWK signal when it was flashing red (i.e. Pedestrian Clearance Phase) and traveled through the pedestrian crosswalk without stopping.

Go Flash OK –The vehicle stopped for the HAWK signal and proceeded while the HAWK signal was flashing red.

Go Dark OK – The vehicle stopped for the HAWK signal and proceeded after the cycle for the HAWK signal was dark.

Wait for Dark – The cycle for the HAWK signal was complete, but the vehicle continued to wait because there were pedestrians still in the crosswalk.

Confused – The vehicle waited several seconds after the HAWK signal turned dark.

APPENDIX B

HAWK Compliance Studies
SR 8 at Heatherfield Way

NOTES: During the HAWK signal compliance observation, additional notes were taken that are not reflected on the PETRA data. This would include the pedestrian count for the peak periods that were observed. The selected times for the HAWK observation coincided with the start and end of the school day. The times selected were 6:30 to 8:30am (an hour before and after the start of school), and 2:00 to 6:00pm to not only get traffic from the school peak time but also to collect normal traffic pm peak data.

2:30 to 8:30:

Total Number of Pedestrians: There were **20** pedestrians counted during the AM peak.

- **Additional Notes:** On two occasions, a passenger from a vehicle waiting on the side street would leave the vehicle to activate the HAWK signal so that traffic would stop on DE Route 8. School bus stops were noted and were as follows: 7:05, 7:08, and 7:56. After school began, around 7:30, the HAWK signal seemed to have a response delay. Before school started, the signal was activated immediately once the button was pushed. Regardless of whether or not the HAWK signal is on a response delay, a red LED light is still shown upon pressing the button. This light stays on until the GO signal.

2:00 to 6:00:

Total Number of Pedestrians: There were **33** pedestrians counted during the PM peak.

- **Additional Notes:** During the PM peak, there were 4 instances of "RAN RED" during a solid red with the WALK signal being displayed. This would be shown on the PETRA data as "RAN RED" but were extreme occurrences. School bus stops were noted and were as follows: 2:34, 2:39, 3:29, 3:41, 4:08, and 4:10. Around 3:00pm, the HAWK signal went back to the delayed response. This continued for the rest of the PM peak. A turning movement count was completed at this intersection the next day, and it was observed that pedestrians would not wait for the signal to change during the delayed response. At 2:47 traffic backed up through the intersection in the eastbound direction. Some drivers appeared to be confused when there were vehicles waiting on the side road, perhaps thinking this is a full traffic signal.

Hawk Observations: Dover High School
10/06/14

		Eastbound Arrivals				Eastbound Departures				Westbound Arrivals				Westbound Departures				EB Running Red During Walk	WB Running Red During Walk	
Start Time	Button Pushed	Stopped Properly On Y/R	Ran Red	Stop On Flashing Red	Ran Flashing Red	Used FR Correcty	Wait For Dark	Go On Dark Correctly	Go Dark Confused	Stopped Properly On Y/R	Ran Red	Stop On Flashing Red	Ran Flashing Red	Used FR Correctly	Wait For Dark	Go On Dark Correctly	Go Dark Confused			
6:30 AM	5	3	1	2	0	1	4	0	0	2	0	0	0	0	4	0	0	0	0	
6:45 AM	7	6	0	0	0	4	6	0	1	4	0	4	0	2	5	0	1	0	0	
7:00 AM	8	6	1	0	0	3	6	0	0	7	1	1	0	0	6	1	0	0	0	
7:15 AM	6	7	0	0	0	3	6	2	1	6	3	2	0	1	6	0	1	0	1	
7:30 AM	6	6	1	2	0	7	4	2	0	4	2	3	0	3	4	0	0	0	0	
7:45 AM	6	4	1	2	1	3	6	2	0	1	0	4	0	0	5	0	0	0	0	
8:00 AM	6	3	0	4	1	4	4	1	0	2	0	1	0	0	2	0	1	0	0	
8:15 AM	6	3	1	6	1	0	3	0	1	3	0	3	1	0	4	0	1	0	0	
AM	50	38	5	16	3	26	39	7	3	29	6	18	1	6	36	1	4	0	1	
		88%	12%	84%	16%	39%	61%	70%	30%	83%	17%	95%	5%	14%	86%	20%	80%	0%	3%	*
2:00 PM	7	8	2	0	1	1	7	0	0	5	2	2	1	0	7	0	0	0	0	
2:15 PM	9	4	3	5	1	5	5	0	0	6	2	3	1	3	6	0	1	0	0	
2:30 PM	9	10	6	2	0	4	7	0	0	6	0	3	0	2	5	0	0	0	0	
2:45 PM	6	6	0	0	0	0	6	0	0	6	1	1	2	2	5	0	0	0	0	
3:00 PM	5	4	0	2	1	3	2	0	1	4	0	2	4	2	3	0	1	0	0	
3:15 PM	8	2	0	5	0	1	5	0	0	3	0	6	0	2	6	0	0	0	0	
3:30 PM	7	5	1	1	0	0	6	0	0	7	0	1	1	1	6	0	1	0	0	
3:45 PM	6	4	1	2	0	2	2	0	3	3	0	6	0	5	4	0	1	1	0	
4:00 PM	5	3	0	3	0	1	5	0	0	5	1	0	0	0	5	0	0	0	0	
4:15 PM	7	1	0	7	0	3	5	0	0	5	0	3	0	2	6	0	0	0	0	
4:30 PM	6	2	0	3	0	1	4	0	0	6	2	0	0	0	5	0	0	0	0	
4:45 PM	5	2	0	3	0	0	4	0	1	3	2	2	0	0	5	0	1	0	1	
5:00 PM	7	3	0	5	1	2	6	0	1	4	3	2	0	0	6	0	1	0	1	
5:15 PM	9	7	0	0	0	2	6	0	1	6	1	4	0	2	8	0	0	0	0	
5:30 PM	8	5	1	5	1	5	5	0	0	5	1	3	5	3	4	0	0	0	0	
5:45 PM	7	7	0	1	1	2	6	0	0	6	2	1	0	3	6	0	0	0	0	
PM	111	73	14	44	6	32	81	0	7	80	17	39	14	27	87	0	6	1	2	
		84%	16%	88%	12%	28%	72%	0%	100%	82%	18%	74%	26%	24%	76%	0%	100%	1%	2%	*
TOTALS	161	111	19	60	9	57	120	7	10	109	23	57	15	33	123	1	10	1	3	
		85%	15%	87%	13%	32%	68%	41%	59%	83%	17%	79%	21%	21%	79%	9%	91%	1%	2%	*

	Steady Red		Flashing Red	
EB Compliance	111	19	57	120
WB Compliance	109	23	33	123
Overall Compliance	220	42	90	243
	84%	16%	27%	73%

* Percentage of Severe Red Light Running per Ped Phase Activation

NOTES: During the HAWK signal compliance observation, additional notes were taken that are not reflected on the PETRA data. The selected times for the HAWK observation coincided with the start and end of the school classes. The times selected were 6:30 to 8:30am (an hour before and after the start of school), and 2:00 to 6:00pm to not only get traffic from the school peak time but also to collect normal traffic pm peak data.

2:30 to 8:30:

- **Additional Notes:** School bus stops were noted at the intersection and are as follows: 7:05, 7:08 x 2, and 7:56. At 6:43, the HAWK signal went from a delay to an instant response. After school began, at approximately 7:35, the HAWK signal went back to a response delay. Pedestrians were noted crossing prior to the crosswalk when the HAWK signal was initialized.

2:00 to 6:00:

- **Additional Notes:** School bus stops: 2:37, 2:48, 3:27, 3:37, 4:11, and 5:34. At approximately 2:00pm, the HAWK signal went to an instant response when the button was pressed. At 3:00pm, the HAWK signal went back to the delayed response. This continued for the rest of the PM peak. Some pedestrians were noted crossing before the "WALK" signal was displayed. Pedestrians were noted crossing prior to the crosswalk when the HAWK signal was initialized.

- **During the times there was a delayed response, some of the data collected from arriving traffic was affected. Vehicles would arrive during the "Flashing Red" phase. With having no data through the "Solid Red" phase, "Ran Red" data would not be able to be collected.**

Hawk Observations: Dover High School
05/06/15

		Eastbound Arrivals				Eastbound Departures				Westbound Arrivals				Westbound Departures				EB Running Red During Walk	WB Running Red During Walk	
Start Time	Button Pushed	Stopped Properly On Y/R	Ran Red	Stop On Flashing Red	Ran Flashing Red	Used FR Correctly	Wait For Dark	Go On Dark Correctly	Go Dark Confused	Stopped Properly On Y/R	Ran Red	Stop On Flashing Red	Ran Flashing Red	Used FR Correctly	Wait For Dark	Go On Dark Correctly	Go Dark Confused			
6:30 AM	7	5	0	1	0	1	5	0	0	2	0	0	0	1	1	0	0	0	0	
6:45 AM	8	8	2	2	0	2	8	0	0	6	2	2	0	1	7	0	0	0	0	
7:00 AM	8	7	1	2	0	3	6	0	0	8	3	1	0	3	6	0	0	0	0	
7:15 AM	7	7	3	0	0	0	7	0	0	5	2	2	0	0	7	0	0	0	0	
7:30 AM	8	6	1	1	0	0	6	1	0	4	1	1	0	0	4	1	0	0	0	
7:45 AM	7	5	1	3	0	2	6	0	0	0	1	4	1	2	3	0	0	0	0	
8:00 AM	8	4	2	3	1	0	6	0	1	2	1	8	1	3	4	1	2	1	0	
8:15 AM	10	5	2	4	1	0	9	0	0	1	0	9	0	1	8	1	0	0	0	
AM	63	47	12	16	2	8	53	1	1	28	10	27	2	11	40	3	2	1	0	
		80%	20%	89%	11%	13%	87%	50%	50%	74%	26%	93%	7%	22%	78%	60%	40%	2%	0%	*
2:00 PM	10	5	0	5	2	3	6	1	0	5	2	4	1	3	5	1	2	0	0	
2:15 PM	9	7	3	2	0	1	8	0	1	7	5	6	0	2	9	0	2	0	0	
2:30 PM	10	9	1	4	0	3	7	2	0	6	3	3	0	1	8	0	0	0	1	
2:45 PM	7	8	5	3	3	7	4	1	0	6	3	5	0	4	4	1	0	0	0	
3:00 PM	6	5	3	7	0	7	3	2	0	6	1	3	0	3	5	1	0	0	0	
3:15 PM	10	5	0	5	0	1	9	1	0	2	1	11	0	3	9	2	0	0	0	
3:30 PM	8	9	1	3	1	3	7	0	0	4	2	2	0	0	6	0	0	0	0	
3:45 PM	7	5	1	2	0	0	6	0	1	2	3	5	0	0	7	0	1	0	0	
4:00 PM	6	4	0	2	0	0	6	0	0	4	0	3	0	2	5	0	0	0	0	
4:15 PM	7	5	0	3	1	1	7	0	0	3	0	5	0	0	7	0	0	0	0	
4:30 PM	7	4	2	4	0	1	5	0	1	5	2	2	1	1	5	0	0	0	0	
4:45 PM	7	5	0	0	2	2	4	0	0	6	1	2	3	3	5	0	0	0	0	
5:00 PM	6	3	0	3	0	1	2	1	2	3	0	5	1	3	5	0	0	0	0	
5:15 PM	6	4	1	2	0	0	6	0	0	6	0	1	0	0	7	0	0	0	0	
5:30 PM	6	5	1	2	2	3	4	1	0	6	3	7	0	7	4	0	0	0	0	
5:45 PM	7	7	2	3	0	1	9	0	0	4	2	4	0	1	8	0	0	0	0	
PM	119	90	20	50	11	34	93	9	5	75	28	68	6	33	99	5	5	0	1	
		82%	18%	82%	18%	27%	73%	64%	36%	73%	27%	92%	8%	25%	75%	50%	50%	0%	1%	*
TOTALS	182	137	32	66	13	42	146	10	6	103	38	95	8	44	139	8	7	1	1	
		81%	19%	84%	16%	22%	78%	63%	38%	73%	27%	92%	8%	24%	76%	53%	47%	1%	1%	*

	Steady Red		Flashing Red	
EB Compliance	137	32	42	146
WB Compliance	103	38	44	139
Overall Compliance	240	70	86	285
	77%	23%	23%	77%

* Percentage of Severe Red Light Running per Ped Phase Activation

Observations of motorist behavior at the HAWK signals on Forrest Avenue were conducted on the following dates: 9/15/2016, 9/22/2016, 9/28/2016, 10/6/2016. Field staff recorded whether motorists stopped for the HAWK signal when it was solid red and when it was flashing red. They also recorded if motorists were confused about when they were allowed to proceed on flashing red or when the signal had deactivated.

HAWK Compliance Study Dover High School								
Pedestrian Actuation Count	Vehicle Arrival				Vehicle Departure			
	Stop Solid Red OK	Stop Flashing Red OK	Blow Solid Red	Blow Flashing Red	Go Flash OK	Go Dark OK	Wait for Dark	Confused
41	**72**	**64**	**7**	**3**	**20**	**3**	**69**	**0**

Terms

Pedestrian Actuation Count – HAWK signal actuation by Pedestrian / Bicyclist.

Stop Solid Red OK – A vehicle stopped when the HAWK signal turned solid red (WALK Phase).

Stop Flashing Red OK – A vehicle stopped when the HAWK signal was flashing red (Pedestrian Clearance Interval).

Blow Solid Red – A vehicle disregarded the HAWK signal when it was red (i.e. WALK Phase) and traveled through the pedestrian crosswalk without stopping.

Blow Flashing Red – A vehicle disregarded the HAWK signal when it was flashing red (i.e. Pedestrian Clearance Phase) and traveled through the pedestrian crosswalk without stopping.

Go Flash OK –The vehicle stopped for the HAWK signal and proceeded while the HAWK signal was flashing red.

Go Dark OK – The vehicle stopped for the HAWK signal and proceeded after the cycle for the HAWK signal was dark.

Wait for Dark – The cycle for the HAWK signal was complete, but the vehicle continued to wait because there were pedestrians still in the crosswalk.

Confused – The vehicle waited several seconds after the HAWK signal turned dark.

Observations of motorist behavior at the HAWK signals on SR 8, at Heatherfield Way, were conducted on the following dates: Thursday, October 5, 2017 and Tuesday, October 10, 2017. Field staff recorded whether motorists stopped for the HAWK signal when it was solid red and when it was flashing red. They also recorded if motorists were confused about when they were allowed to proceed on flashing red or when the signal had deactivated.

HAWK Compliance Study SR 8 at Heatherfield Way								
Pedestrian Actuation Count	Vehicle Arrival				Vehicle Departure			
	Stop Solid Red OK	Stop Flashing Red OK	Blow Solid Red	Blow Flashing Red	Go Flash OK	Go Dark OK	Wait for Dark	Confused
28	**42**	**52**	**4**	**5**	**20**	**4**	**30**	**1**

Terms

Pedestrian Actuation Count – HAWK signal actuation by Pedestrian / Bicyclist.

Stop Solid Red OK – A vehicle stopped when the HAWK signal turned solid red (WALK Phase).

Stop Flashing Red OK – A vehicle stopped when the HAWK signal was flashing red (Pedestrian Clearance Interval).

Blow Solid Red – A vehicle disregarded the HAWK signal when it was red (i.e. WALK Phase) and traveled through the pedestrian crosswalk without stopping.

Blow Flashing Red – A vehicle disregarded the HAWK signal when it was flashing red (i.e. Pedestrian Clearance Phase) and traveled through the pedestrian crosswalk without stopping.

Go Flash OK –The vehicle stopped for the HAWK signal and proceeded while the HAWK signal was flashing red.

Go Dark OK – The vehicle stopped for the HAWK signal and proceeded after the cycle for the HAWK signal was dark.

Wait for Dark – The cycle for the HAWK signal was complete, but the vehicle continued to wait because there were pedestrians still in the crosswalk.

Confused – The vehicle waited several seconds after the HAWK signal turned dark.

SR 8 at Heatherfield Way Vehicle Observations (April 2019)									
	Vehicle Arrival					Vehicle Departure			
Total	Vehicle Stopped for signal	Vehicle Disregarded signal (During Pedestrian Phase)				Total Departures	Correct Action		Incorrect Action	
		During All-red	During Walk	During Flashing Red			Vehicle Proceeded on Flashing Red	Vehicle Proceeded After Ped Cleared Crosswalk	Vehicle Proceeded During Dark Signal	Motorist Appeared Confused*
52	46	2	0	4		46	26	0	19	1
	88%	4%	0%	8%			57%	0%	41%	2%

SR 8 at Heatherfield Way
Pedestrian Observations
(April 2019)

	Breakdown		Wait	Was there a safe gap in traffic				Did pedestrians use the crosswalk?			
Group	#	%	Time	Yes	% Yes	No	% No	Yes	% Yes	No	% No
Crossed Correctly (Group 1)	17	39.5%	29	0	-	0	-	17	100.0%	0	0.0%
Crossed Early (Group 2)	8	18.6%	17	6	75.0%	2	25.0%	6	75.0%	2	25.0%
Never Activated (Group 3)	18	41.9%	15	12	66.7%	6	33.3%	13	72.2%	5	27.8%
Total	43										

Group 2 & 3 combined	26	60.5%		18	69.2%	8	30.8%	19	73.1%	7	26.9%

Chapman Road at Salem Church Road Pedestrian Observations (May 2019)											
	Breakdown		Wait Time	Was there a safe gap in traffic				Did pedestrians use the crosswalk?			
Group	#	%		Yes	% Yes	No	% No	Yes	% Yes	No	% No
Crossed Correctly (Group 1)	21	75.0%	55	0	#DIV/0!	0	#DIV/0!	21	100.0%	0	0.0%
Crossed Early (Group 2)	2	7.1%	13	1	50.0%	1	50.0%	2	100.0%	0	0.0%
Never Activated (Group 3)	5	17.9%	3	3	60.0%	2	40.0%	3	60.0%	2	40.0%
Total	28										

Group 2 & 3 combines	7	25.0%		4	57.1%	3	42.9%	5	71.4%	2	28.6%

SR 8 at Kenton Road
Pedestrian Observations
(April 2019)

	Breakdown		Wait	Was there a safe gap in traffic				Did pedestrians use the crosswalk?			
Group	#	%	Time	Yes	% Yes	No	% No	Yes	% Yes	No	% No
Crossed Correctly (Group 1)	27	79.4%	54	0	#DIV/0!	0	#DIV/0!	27	100.0%	0	0.0%
Crossed Early (Group 2)	2	5.9%	19	2	100.0%	0	0.0%	2	100.0%	0	0.0%
Never Activated (Group 3)	5	14.7%	9	4	80.0%	1	20.0%	4	80.0%	1	20.0%
Total	34										

Group 2 & 3 combines	7	20.6%		6	85.7%	1	14.3%	6	85.7%	1	14.3%

Cleveland Avenue at Papermill Road
Pedestrian Observations
(April 2019)

	Breakdown		Wait	Was there a safe gap in traffic				Did pedestrians use the crosswalk?			
Group	#	%	Time	Yes	% Yes	No	% No	Yes	% Yes	No	% No
Crossed Correctly (Group 1)	158	74.9%	53	0	#DIV/0!	0	#DIV/0!	152	96.2%	6	3.8%
Crossed Early (Group 2)	25	11.8%	28	19	76.0%	6	24.0%	23	92.0%	2	8.0%
Never Activated (Group 3)	28	13.3%	23	22	78.6%	6	21.4%	27	96.4%	1	3.6%
Total	211										

Group 2 & 3 combines	53	25.1%		41	77.4%	12	22.6%	50	94.3%	3	5.7%

APPENDIX C

HAWK Compliance Studies
SR 1 at Rehoboth Avenue

Observations of motorist behavior at the HAWK signal on DE Route 1 at its intersection with Rehoboth Avenue were conducted on Friday, August 12, 2016 and Friday, August 19, 2016. Field staff recorded whether motorists stopped for the HAWK signal when it was solid red and when it was flashing red. They also recorded if motorists were confused about when they were allowed to proceed on flashing red or when the signal had deactivated.

HAWK Compliance Study DE Route 1 (Coastal Highway) at Rehoboth Avenue								
Pedestrian Actuation Count	Vehicle Arrival				Vehicle Departure			
	Stop Solid Red OK	Stop Flashing Red OK	Blow Solid Red	Blow Flashing Red	Go Flash OK	Go Dark OK	Wait for Dark	Confused
68	**96**	**127**	**27**	**6**	**28**	**8**	**91**	**2**

Note: Three (3) vehicles ran the red light during pedestrian walk phase.

Terms

Pedestrian Actuation Count – HAWK signal actuation by Pedestrian / Bicyclist.

Stop Solid Red OK – A vehicle stopped when the HAWK signal turned solid red (WALK Phase).

Stop Flashing Red OK – A vehicle stopped when the HAWK signal was flashing red (Pedestrian Clearance Interval).

Blow Solid Red – A vehicle disregarded the HAWK signal when it was red (i.e. WALK Phase) and traveled through the pedestrian crosswalk without stopping.

Blow Flashing Red – A vehicle disregarded the HAWK signal when it was flashing red (i.e. Pedestrian Clearance Phase) and traveled through the pedestrian crosswalk without stopping.

Go Flash OK –The vehicle stopped for the HAWK signal and proceeded while the HAWK signal was flashing red.

Go Dark OK – The vehicle stopped for the HAWK signal and proceeded after the cycle for the HAWK signal was dark.

Wait for Dark – The cycle for the HAWK signal was complete, but the vehicle continued to wait because there were pedestrians still in the crosswalk.

Confused – The vehicle waited several seconds after the HAWK signal turned dark.

Observations of motorist behavior at the HAWK signals on SR 1 at its intersection with Rehoboth Avenue were conducted on Tuesday, July 11, 2017 and Wednesday, July 19, 2017. Field staff recorded whether motorists stopped for the HAWK signal when it was solid red and when it was flashing red. They also recorded if motorists were confused about when they were allowed to proceed on flashing red or when the signal had deactivated.

HAWK Compliance Study SR 1 (Coastal Highway) at Rehoboth Avenue								
Pedestrian Actuation Count	Vehicle Arrival				Vehicle Departure			
	Stop Solid Red OK	Stop Flashing Red OK	Blow Solid Red	Blow Flashing Red	Go Flash OK	Go Dark OK	Wait for Dark	Confused
100	**82**	**131**	**24**	**58**	**86**	**15**	**34**	**1**

Note: One (1) vehicle ran the red light during pedestrian walk phase.

Terms

Pedestrian Actuation Count – HAWK signal actuation by Pedestrian / Bicyclist.

Stop Solid Red OK – A vehicle stopped when the HAWK signal turned solid red (WALK Phase).

Stop Flashing Red OK – A vehicle stopped when the HAWK signal was flashing red (Pedestrian Clearance Interval).

Blow Solid Red – A vehicle disregarded the HAWK signal when it was red (i.e. WALK Phase) and traveled through the pedestrian crosswalk without stopping.

Blow Flashing Red – A vehicle disregarded the HAWK signal when it was flashing red (i.e. Pedestrian Clearance Phase) and traveled through the pedestrian crosswalk without stopping.

Go Flash OK –The vehicle stopped for the HAWK signal and proceeded while the HAWK signal was flashing red.

Go Dark OK – The vehicle stopped for the HAWK signal and proceeded after the cycle for the HAWK signal was dark.

Wait for Dark – The cycle for the HAWK signal was complete, but the vehicle continued to wait because there were pedestrians still in the crosswalk.

Confused – The vehicle waited several seconds after the HAWK signal turned dark.

SR1 at Rehoboth Avenue Vehicle Observations (August 2019)										
	Vehicle Arrival					Vehicle Departure				
Total	Vehicle Stopped for signal	Vehicle Disregarded signal (During Pedestrian Phase)				Total Departures	Correct Action		Incorrect Action	
		During All-red	During Walk	During Flashing Red			Vehicle Proceeded on Flashing Red	Vehicle Proceeded After Ped Cleared Crosswalk	Vehicle Proceeded During Dark Signal	Motorist Appeared Confused*
152	90	15	6	41		95	65	19	11	0
	59%	10%	4%	27%			68%	20%	12%	0%

SR 1 at Rehoboth Avenue Pedestrian Observations - EB Direction (August 2019)											
	Breakdown		Wait	Was there a safe gap in traffic				Did pedestrians use the crosswalk?			
Group	#	%	Time	Yes	% Yes	No	% No	Yes	% Yes	No	% No
Crossed Correctly (Group 1)	29	55.8%	57	0	#DIV/0!	0	#DIV/0!	29	100.0%	0	0.0%
Crossed Early (Group 2)	9	17.3%	34	9	100.0%	0	0.0%	9	100.0%	0	0.0%
Crossed Late (Group 3)	0	0.0%	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!
Never Activated (Group 4)	14	26.9%	6	11	78.6%	3	21.4%	11	78.6%	3	21.4%
Total	52	100.0%		20	87.0%	3	13.0%	49	94.2%	3	5.8%

Group 2 & 4 combined	23			20		3		20		3	

SR 1 at Rehoboth Avenue Pedestrian Observations - WB Direction (August 2019)											
	Breakdown		Wait	Was there a safe gap in traffic				Did pedestrians use the crosswalk?			
Group	#	%	Time	Yes	% Yes	No	% No	Yes	% Yes	No	% No
Crossed Correctly (Group 1)	10	34.5%	57	0	#DIV/0!	0	#DIV/0!	10	100.0%	0	0.0%
Crossed Early (Group 2)	11	37.9%	32	11	100.0%	0	0.0%	11	100.0%	0	0.0%
Crossed Late (Group 3)	0	0.0%	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!
Never Activated (Group 4)	8	27.6%	9	7	87.5%	1	12.5%	7	87.5%	1	12.5%
Total	29	100.0%		18	#DIV/0!	1	5.3%	28	96.6%	1	3.4%

Group 2 & 4 combined	19			18		1		18		1	

SR 1 at Westway Avenue
Pedestrian Observations
(August 2019)

	Breakdown		Wait	Was there a safe gap in traffic				Did pedestrians use the crosswalk?			
Group	#	%	Time	Yes	% Yes	No	% No	Yes	% Yes	No	% No
Crossed Correctly (Group 1)	71	65.1%	44	0	#DIV/0!	0	#DIV/0!	71	100.0%	0	0.0%
Crossed Early (Group 2)	12	11.0%	30	11	91.7%	1	8.3%	12	100.0%	0	0.0%
Crossed Late (Group 3)	14	12.8%	0	14	100.0%	0	0.0%	14	100.0%	0	0.0%
Never Activated (Group 4)	12	11.0%	5	11	91.7%	1	8.3%	11	91.7%	1	8.3%
Total	109			36		2		108		1	

Group 2, 3, 4 combined	38			36	94.7%	2	5.3%	37	97.4%	1	2.6%

SR 1 at Evergreen Road Pedestrian Observations (August 2019)											
	Breakdown		Wait	Was there a safe gap in traffic				Did pedestrians use the crosswalk?			
Group	#	%	Time	Yes	% Yes	No	% No	Yes	% Yes	No	% No
Crossed Correctly (Group 1)	41	67.2%	45	0	#DIV/0!	0	#DIV/0!	41	100.0%	0	0.0%
Crossed Early (Group 2)	8	13.1%	30	7	87.5%	1	12.5%	8	100.0%	0	0.0%
Crossed Late (Group 3)	1	1.6%	0	1	100.0%	0	0.0%	1	100.0%	0	0.0%
Never Activated (Group 4)	11	18.0%	4	7	63.6%	4	36.4%	9	81.8%	2	18.2%
Total	61			15		5		59		2	
Group 2, 3, 4 combined	20			15	75.0%	5	25.0%	18	90.0%	2	10.0%

APPENDIX D

HAWK Compliance Study
SR 1 at Holland Glade Road

Observations of motorist behavior at the HAWK signals on DE Route 1 at the Tanger Outlets were conducted on Tuesday, July 26, 2016. Field staff recorded whether motorists stopped for the HAWK signal when it was solid red and when it was flashing red. They also recorded if motorists were confused about when they were allowed to proceed on flashing red or when the signal had deactivated.

HAWK Compliance Study DE Route 1 (Coastal Highway) at Tanger Outlets								
Pedestrian Actuation Count	Vehicle Arrival				Vehicle Departure			
	Stop Solid Red OK	Stop Flashing Red OK	Blow Solid Red	Blow Flashing Red	Go Flash OK	Go Dark OK	Wait for Dark	Confused
71	**140**	**81**	**7**	**0**	**33**	**20**	**68**	**0**

Terms

Pedestrian Actuation Count – HAWK signal actuation by Pedestrian / Bicyclist.

Stop Solid Red OK – A vehicle stopped when the HAWK signal turned solid red (WALK Phase).

Stop Flashing Red OK – A vehicle stopped when the HAWK signal was flashing red (Pedestrian Clearance Interval).

Blow Solid Red – A vehicle disregarded the HAWK signal when it was red (i.e. WALK Phase) and traveled through the pedestrian crosswalk without stopping.

Blow Flashing Red – A vehicle disregarded the HAWK signal when it was flashing red (i.e. Pedestrian Clearance Phase) and traveled through the pedestrian crosswalk without stopping.

Go Flash OK –The vehicle stopped for the HAWK signal and proceeded while the HAWK signal was flashing red.

Go Dark OK – The vehicle stopped for the HAWK signal and proceeded after the cycle for the HAWK signal was dark.

Wait for Dark – The cycle for the HAWK signal was complete, but the vehicle continued to wait because there were pedestrians still in the crosswalk.

Confused – The vehicle waited several seconds after the HAWK signal turned dark.

Observations of motorist behavior at the HAWK signals on SR 1 at Holland Glade Drive were conducted on Wednesday, July 26, 2017 and Thursday, July 27, 2017. Field staff recorded whether motorists stopped for the HAWK signal when it was solid red and when it was flashing red. They also recorded if motorists were confused about when they were allowed to proceed on flashing red or when the signal had deactivated.

HAWK Compliance Study SR 1 (Coastal Highway) at Holland Glade Drive								
Pedestrian Actuation Count	Vehicle Arrival				Vehicle Departure			
	Stop Solid Red OK	Stop Flashing Red OK	Blow Solid Red	Blow Flashing Red	Go Flash OK	Go Dark OK	Wait for Dark	Confused
87	**126**	**175**	**30**	**56**	**100**	**26**	**48**	**1**

Note: Five (5) vehicles ran the red light during pedestrian walk phase.

Terms

Pedestrian Actuation Count – HAWK signal actuation by Pedestrian / Bicyclist.

Stop Solid Red OK – A vehicle stopped when the HAWK signal turned solid red (WALK Phase).

Stop Flashing Red OK – A vehicle stopped when the HAWK signal was flashing red (Pedestrian Clearance Interval).

Blow Solid Red – A vehicle disregarded the HAWK signal when it was red (i.e. WALK Phase) and traveled through the pedestrian crosswalk without stopping.

Blow Flashing Red – A vehicle disregarded the HAWK signal when it was flashing red (i.e. Pedestrian Clearance Phase) and traveled through the pedestrian crosswalk without stopping.

Go Flash OK –The vehicle stopped for the HAWK signal and proceeded while the HAWK signal was flashing red.

Go Dark OK – The vehicle stopped for the HAWK signal and proceeded after the cycle for the HAWK signal was dark.

Wait for Dark – The cycle for the HAWK signal was complete, but the vehicle continued to wait because there were pedestrians still in the crosswalk.

Confused – The vehicle waited several seconds after the HAWK signal turned dark.

SR 1 at Holland Glade Road Vehicle Observations (August 2019)										
	Vehicle Arrival					Vehicle Departure				
Total	Vehicle Stopped for signal	Vehicle Disregarded signal (During Pedestrian Phase)				Total Departures	Correct Action		Incorrect Action	
		During All-red	During Walk	During Flashing Red			Vehicle Proceeded on Flashing Red	Vehicle Proceeded After Ped Cleared Crosswalk	Vehicle Proceeded During Dark Signal	Motorist Appeared Confused*
355	255	26	7	67		253	172	51	28	2
	72%	7%	2%	19%			68%	20%	11%	1%

SR 1 at Holland Glade Road - Pedestrian Observation
Summary of results for EB Crossing 1 and WB Crossing 1
(August 2019)

	Breakdown		Wait Time(Seconds)		Was there a safe gap in traffic				Did pedestrians use the crosswalk?			
Group	#	%	Total	Average	Yes	% Yes	No	% No	Yes	% Yes	No	% No
EB Crossing 1												
Crossed Correctly (Group 1)	30	78.9%	2,468	82	0	#DIV/0!	0	#DIV/0!	28	93.3%	2	6.7%
Crossed Early (Group 2)	7	18.4%	160	23	5	71.4%	2	28.6%	7	100.0%	0	0.0%
Crossed Late (Group 3)	1	12.5%	0	0	0	0.0%	1	100.0%	1	100.0%	0	0.0%
Never Activated (Group 4)	0	0.0%	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!
WB Crossing 1												
Crossed Correctly (Group 1)	31	83.8%	2,755	89	0	#DIV/0!	0	#DIV/0!	29	93.5%	2	6.5%
Crossed Early (Group 2)	4	10.8%	86	21	4	100.0%	0	0.0%	3	75.0%	1	25.0%
Crossed Late (Group 3)	0	0.0%	0	0	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!
Never Activated (Group 4)	2	5.4%	0	0	1	50.0%	1	50.0%	0	0.0%	2	100.0%
Combined												
Crossed Correctly (Group 1)	61	81.3%	5,223	86	0	#DIV/0!	0	#DIV/0!	57	93.4%	4	6.6%
Crossed Early (Group 2)	11	14.7%	246	22	9	81.8%	2	18.2%	10	90.9%	1	9.1%
Crossed Late (Group 3)	1	1.1%	0	0	0	0.0%	1	100.0%	1	100.0%	0	0.0%
Never Activated (Group 4)	2	2.7%	0	0	1	50.0%	1	50.0%	0	0.0%	2	100.0%
Total	75	84.3%	5,469	73	10	71.4%	4	28.6%	68	90.7%	7	9.3%

Group 2, 3, 4 combined	14				10	71.4%	4	28.6%	11	78.6%	3	21.4%

SR 1 at Holland Glade Road - Pedestrian Observations
Summary of results for EB Crossing 2 and WB Crossing 2
(August 2019)

	Breakdown		Wait Time(Seconds)		Was there a safe gap in traffic				Did pedestrians use the crosswalk?			
Group	#	%	Total	Average	Yes	% Yes	No	% No	Yes	% Yes	No	% No
EB Crossing 2												
Crossed Correctly (Group 1)	24	63.2%	1,440	60	0	#DIV/0!	0	#DIV/0!	23	95.8%	1	4.2%
Crossed Early (Group 2)	3	7.9%	67	22	2	66.7%	1	33.3%	2	66.7%	1	33.3%
Crossed Late (Group 3)	8	21.1%	0	0	0	0.0%	8	100.0%	8	100.0%	0	0.0%
Never Activated (Group 4)	3	7.9%	8	3	2	66.7%	1	33.3%	1	33.3%	2	66.7%
WB Crossing 2												
Crossed Correctly (Group 1)	24	64.9%	1,682	70	0	#DIV/0!	0	#DIV/0!	19	79.2%	5	20.8%
Crossed Early (Group 2)	4	10.8%	106	27	3	75.0%	1	25.0%	4	100.0%	0	0.0%
Crossed Late (Group 3)	4	10.8%	0	0	0	0.0%	4	100.0%	4	100.0%	0	0.0%
Never Activated (Group 4)	5	13.5%	5	1	5	100.0%	0	0.0%	5	100.0%	0	0.0%
Combined												
Crossed Correctly (Group 1)	48	64.0%	3,122	65	0	#DIV/0!	0	#DIV/0!	42	87.5%	6	12.5%
Crossed Early (Group 2)	7	9.3%	173	25	5	71.4%	2	28.6%	6	85.7%	1	14.3%
Crossed Late (Group 3)	12	16.0%	0	0	0	0.0%	12	100.0%	12	100.0%	0	0.0%
Never Activated (Group 4)	8	10.7%	13	2	7	87.5%	1	12.5%	6	75.0%	2	25.0%
Total	75		3,308	44	12	44.4%	15	55.6%	66	88.0%	9	12.0%

Group 2, 3, 4 combined	27				12	44.4%	15	55.6%	24	88.9%	3	11.1%

SR 58 at Deltech
Summary of results for NB Crossing 1 and SB Crossing 1
(May 2019)

	Breakdown		Wait Time(Seconds)		Was there a safe gap in traffic				Did pedestrians use the crosswalk?			
Group	#	%	Total	Average	Yes	% Yes	No	% No	Yes	% Yes	No	% No
NB Crossing 1												
Crossed Correctly (Group 1)	14	63.6%	656	47	0		0		14		0	
Crossed Early (Group 2)	2	9.1%	121	61	2	100.0%	0	0.0%	2	100.0%	0	0.0%
Never Activated (Group 3)	6	27.3%	3	1	4	66.7%	2	33.3%	4	66.7%	2	33.3%
SB Crossing 1												
Crossed Correctly (Group 1)	13	59.1%	776	60	0		0		13		0	
Crossed Early (Group 2)	6	27.3%	244	41	6	100.0%	0	0.0%	6	100.0%	0	0.0%
Never Activated (Group 3)	3	13.6%	0	0	2	66.7%	1	33.3%	3	100.0%	0	0.0%
Combined												
Crossed Correctly (Group 1)	27	61.4%	1,432	53	0		0		27		0	
Crossed Early (Group 2)	8	18.2%	365	46	8	100.0%	0	0.0%	8	100.0%	0	0.0%
Never Activated (Group 3)	9	20.5%	3	0	6	66.7%	3	33.3%	7	77.8%	2	22.2%
Total	22											

Group 2 & 3 combines	17				14	82.4%	3	17.6%	15	88.2%	2	11.8%

SR 58 at Deltech
Summary of results for NB Crossing 2 and SB Crossing 2
(May 2019)

	Breakdown		Wait Time(Seconds)		Was there a safe gap in traffic				Did pedestrians use the crosswalk?			
Group	#	%	Total	Average	Yes	% Yes	No	% No	Yes	% Yes	No	% No
NB Crossing 2												
Crossed Correctly (Group 1)	16	72.7%	705	44	0		0		15		1	
Crossed Early (Group 2)	5	22.7%	98	20	4	80.0%	1	20.0%	5	100.0%	0	0.0%
Never Activated (Group 3)	1	4.5%	0	0	1	100.0%	0	0.0%	1	100.0%	0	0.0%
SB Crossing 2												
Crossed Correctly (Group 1)	12	54.5%	955	80	0		0		12		0	
Crossed Early (Group 2)	3	13.6%	31	10	2	66.7%	1	33.3%	2	66.7%	1	33.3%
Never Activated (Group 3)	7	31.8%	20	3	4	57.1%	3	42.9%	6	85.7%	1	14.3%
Combined												
Crossed Correctly (Group 1)	28	63.6%	1,660	59	0		0		27		1	
Crossed Early (Group 2)	8	18.2%	129	16	6	75.0%	2	25.0%	7	87.5%	1	12.5%
Never Activated (Group 3)	8	18.2%	20	3	5	62.5%	3	37.5%	7	87.5%	1	12.5%
Total	22											

Group 2 & 3 combines	16				11	68.8%	5	31.3%	14	87.50%	2	12.5%

APPENDIX E

HAWK Compliance Study
SR 273 at Freedom Trail

SR 273 at Freedom Trail Vehicle Observations (2018 and 2019)									
	Vehicle Arrival					**Vehicle Departure**			
Total	Vehicle Stopped for signal	Vehicle Disregarded signal (During Pedestrian Phase)				Total Departures	Correct Action		Incorrect Action	
		During All-red	During Walk	During Flashing Red			Vehicle Proceeded on Flashing Red	Vehicle Proceeded After Ped Cleared Crosswalk	Vehicle Proceeded During Dark Signal	Motorist Appeared Confused*
49	39	2	0	8		39	31	0	4	4
	80%	4%	0%	16%			79%	0%	10%	10%

SR 273 at Freedom Trail Pedestrian Observations (2018 and 2019)											
	Breakdown		Wait Time	Was there a safe gap in traffic				Did pedestrians use the crosswalk?			
Group	#	%	(Seconds)	Yes	% Yes	No	% No	Yes	% Yes	No	% No
Crossed Correctly (Group 1)	8	38.1%	44	0		0		7	87.5%	1	12.5%
Crossed Early (Group 2)	3	14.3%	12	2	66.7%	1	33.3%	2	66.7%	1	33.3%
Never Activated (Group 3)	10	47.6%	13	6	60.0%	4	40.0%	4	40.0%	6	60.0%
Total	21										

Group 2 & 3 combines	13	61.9%		8	61.5%	5	38.5%	6	46.2%	7	53.8%

SR 7 at Skyline Drive
Pedestrian Observations
(April 2019)

	Breakdown		Wait Time	Was there a safe gap in traffic				Did pedestrians use the crosswalk?			
Group	#	%	(Seconds)	Yes	% Yes	No	% No	Yes	% Yes	No	% No
Crossed Correctly (Group 1)	93	83.0%	43	0		0		92	98.9%	1	1.1%
Crossed Early (Group 2)	5	4.5%	19	5	100.0%	0	0.0%	5	100.0%	0	0.0%
Never Activated (Group 3)	14	12.5%	4	11	78.6%	3	21.4%	10	71.4%	4	28.6%
Total	112	100.0%									

Group 2 & 3 combined	19	17.0%		16	84.2%	3	15.8%	15	78.9%	4	21.1%

APPENDIX F

Signal Time Data

INTERSECTION TIMESHETT PACKET
NOTICE TO PROCEED

Signal Permit Number: N768
Date of Timesheet: 1/10/12
Controller Type: EPAC-PED HAWK
Coordination Type: ACTRA-SYSTEM FREE

Location: DE 72 & FARM LANE
Revision Number: B.1
Monitor Type: NEMA
Coordination Address: 166, 245, 117, 240
Baud Rate: 9600

Phase Data

PHASE #	1	2	3	4	5	6	7	8
PHASE LOCATION	NB DE72	PED WEST			SB DE72	PED EAST		
MIN GRN	5	5			5	5		
PASS/10								
MAX I	40	30			40	30		
MAX II	40	30			40	30		
YEL/10	60	30			60	30		
RED/10	50	20			50	20		
AINI/10								
MAX INI								
CAR BEF								
REDUCE								
MGAP/10								
WALK	32	7			32	7		
PED CLR	6	17			6	17		
EXT PCL	0	2			0	2		
INITIAL	4	1			4	1		
NA RESP								
V. RECALL	2				2			
P. RECALL	2				2			
NL MEM								
2 ENTRY SPCL SEQ OMIT Ø								
OCAL Ø								

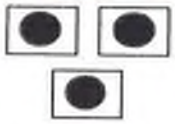
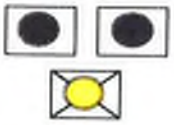
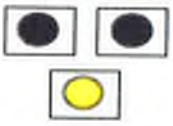
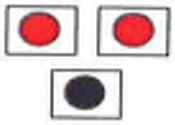
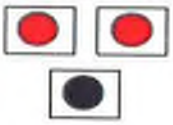
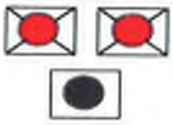
OVERLAP DATA

	A	B	C	D
OVERLAP LOCATION				
OVERLAP PHASES				

DO NOT USE TIMESHEET
UNDER CONSTRUCTION
1/13/12
____ OK TO USE TIMESHEET

Signal Permit Number N768

Delaware HAWK Signal - Sequence of Operation (rev B.1)

Signal Display	Ped Display	Summary of sequence
	DW	Main Street display is dark, and is controlled by phase 1 & 5 Walk interval Signal Display rests in phase 1 walk for one direction (no signal display) Signal Display rests in phase 5 walk for one direction (no signal display) Pedestrian Signal phase 2 rests in Don't Walk (associated to phase 1) Pedestrian Signal phase 6 rests in Don't Walk (associated to phase 5)
	DW	Flashing yellow is activated by ped call (phase 2 & 6 calls are placed a the same time) the flashing yellow interval is set by phase 1 & 5 pedestrian clearance interval and must equal the yellow clearance for the through movement (phase 1 & 5 yellow clearance) Phase 1 & 5 are programmed to minimum vehicle recall and pedestrian recall
	DW	Solid yellow is controlled by phase 1 & 5 yellow clearance value. This value is calculated using standard engineering practices. Phase 1 & 5 ped clearance shall not clear through the yellow / red intervals.
	DW	The Left head Red is activated by phase 1 red and the Right head Red is activated by phase 2 red (one combination of displays for one direction) The Left head Red is activated by phase 5 red and the Right head Red is activated by phase 6 red (one combination of displays for one direction)
	W	Phase 2 walk activates pedestrian display Phase 6 walk activates pedestrian display
	PdCl	Phase 2 & 6 pedestrian clearance interval begins The solid red displays begin to flash in wig/wag operation The wig/wag flash is accomplished through the EPAC controller. Load switches for phase 1, 2, 5 & 6 are programmed to alternately flash red output The wig/wag flash continues through the yellow & red intervals for phase 2 & 6
	DW	Return to beginning sequence

Main Street dark indication is controlled by phase 1 & 5 Walk interval
Signal will cycle upon power restoration
Signal Monitor Unit will monitor all indications
Signal will flash yellow in fault mode (ped displays will be dark)

INTERSECTION TIMESHETT PACKET
NOTICE TO PROCEED

Signal Permit Number: K312
Date of Timesheet: 4/14/14
Controller Type: EPAC - PED HAWK
Coordination Type: TACTICS

Location: DEB @ HEATHERFIELD WAY
Revision Number: A1
Monitor Type: NEMA1
Coordination Address:
Baud Rate:

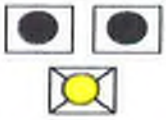
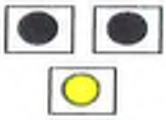
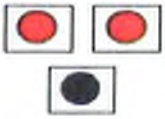
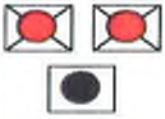
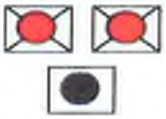
Phase Data

PHASE #	1	2	3	4	5	6	7	8
PHASE	EB	PED			WB	PED		
LOCATION	DEB	NORTH			DEB	SOUTH		
MIN GRN	5	5			5	5		
PASS/10								
MAX I	40	30			40	30		
MAX II	40	30			40	30		
YEL/10	50	30			50	30		
RED/10	50	20			50	20		
WALK	30	7			30	7		
PED CLR	5	16			5	16		
EXT PCL	0	2			0	2		
WOFF/10								
WMODE								
ARIW	1				1			
INITIAL	4	1			4	1		
NA RESP								
V. RECALL	2				2			
P. RECALL	2				2			
NL MEM								
2 ENTRY								
SPC SEQ OMIT Ø								
OCAL Ø								

OVERLAP DATA

	A	B	C	D
OVERLAP LOCATION	NORTH PED		SOUTH PED	
OVERLAP PHASES				

Delaware HAWK Signal - Sequence of Operation (rev C.1)

Signal Display	Ped Display	Summary of sequence
	DW	Main Street display is dark, and is controlled by phase 1 & 5 Walk interval Signal Display rests in phase 1 walk for one direction (no signal display) Signal Display rests in phase 5 walk for one direction (no signal display) Pedestrian Signal phase 2 rests in Don't Walk (associated to phase 1) Pedestrian Signal phase 6 rests in Don't Walk (associated to phase 5)
	DW	Flashing yellow is activated by ped call (phase 2 & 6 calls are placed a the same time) the flashing yellow interval is set by phase 1 & 5 pedestrian clearance interval and must equal the yellow clearance for the through movement (phase 1 & 5 yellow clearance) Phase 1 & 5 are programmed to minimum vehicle recall and pedestrian recall
	DW	Solid yellow is controlled by phase 1 & 5 yellow clearance value. This value is calculated using standard engineering practices. Phase 1 & 5 ped clearance shall not clear through the yellow / red intervals.
	DW	The Left head Red is activated by phase 1 red and the Right head Red is activated by phase 2 red (one combination of displays for one direction) The Left head Red is activated by phase 5 red and the Right head Red is activated by phase 6 red (one combination of displays for one direction)
	W	Phase 2 walk activates pedestrian display Phase 6 walk activates pedestrian display
	PdCl	Phase 2 & 6 pedestrian clearance interval begins The solid red displays begin to flash in wig/wag operation The wig/wag flash is accomplished through the EPAC controller. Load switches for phase 1, 2, 5 & 6 are programmed to alternately flash red output The wig/wag flash continues through the yellow interval for phase 2 & 6
	DW	The wig/wag flash continues through the red intervals for phase 2 & 6 The pedestrian display is solid red - don't walk display
	DW	Return to beginning sequence

Main Street dark indication is controlled by phase 1 & 5 Walk interval
Signal will cycle upon power restoration
Signal Monitor Unit will monitor all indications
Signal will flash yellow in fault mode (ped displays will be dark)

TOD by Zone

11/7/2016

ZONE/GROUP: K004 DE8 DOVER HS > HEATHERFIELD WAY

Everyday — Time of Day Changes for K004 DE8 DOVER HS > HEATHERFIELD WAY

00:01	Pattern Change to 1/4/1 75 BAL for K004 DE8 DOVER HS > HEATHERFIELD WAY

Sunday — Time of Day Changes for K004 DE8 DOVER HS > HEATHERFIELD WAY

06:50	Mode Change to Free for K004 DE8 DOVER HS > HEATHERFIELD WAY
12:10	Pattern Change to 1/4/1 75 BAL for K004 DE8 DOVER HS > HEATHERFIELD WAY

Friday — Time of Day Changes for K004 DE8 DOVER HS > HEATHERFIELD WAY

18:05	Mode Change to Free for K004 DE8 DOVER HS > HEATHERFIELD WAY
22:00	Pattern Change to 1/4/1 75 BAL for K004 DE8 DOVER HS > HEATHERFIELD WAY

Weekdays — Time of Day Changes for K004 DE8 DOVER HS > HEATHERFIELD WAY

06:45	Mode Change to Free for K004 DE8 DOVER HS > HEATHERFIELD WAY
07:35	Pattern Change to 1/1/1 - 90 AM SCHOOL for K004 DE8 DOVER HS > HEATHERFIELD WAY
10:00	Pattern Change to 1/2/1 - 90 BAL for K004 DE8 DOVER HS > HEATHERFIELD WAY
14:00	Mode Change to Free for K004 DE8 DOVER HS > HEATHERFIELD WAY
15:00	Pattern Change to 1/3/1 90 PM SCHOOL for K004 DE8 DOVER HS > HEATHERFIELD WAY
18:00	Pattern Change to 1/4/1 75 BAL for K004 DE8 DOVER HS > HEATHERFIELD WAY
21:00	Pattern Change to 1/1/1 - 90 AM SCHOOL for K004 DE8 DOVER HS > HEATHERFIELD WAY

Dial 1/Split 1

Cycle Length	90

Phase	1	2	3	4	5	6	7	8
Time	50	40	0	0	50	40	0	0
Mode	1 - CP	0 - AP	0 - AP	0 - AP	1 - CP	0 - AP	0 - AP	0 - AP
Min Veh Time	Bnk1=16 Bnk2=11 Bnk3=11 Bnk4=11	Bnk1=11 Bnk2=11 Bnk3=11 Bnk4=11			Bnk1=16 Bnk2=11 Bnk3=11 Bnk4=11	Bnk1=11 Bnk2=11 Bnk3=11 Bnk4=11		
Min Ped Time	Bnk1=35 Bnk2=0 Bnk3=0 Bnk4=0	Bnk1=20 Bnk2=0 Bnk3=0 Bnk4=0			Bnk1=35 Bnk2=0 Bnk3=0 Bnk4=0	Bnk1=20 Bnk2=0 Bnk3=0 Bnk4=0		
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Phase	9	10	11	12	13	14	15	16
Time	0	0	0	0	0	0	0	0
Mode	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP
Min Veh Time								
Min Ped Time								
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Dial 1/Split 2

Cycle Length	90

Phase	1	2	3	4	5	6	7	8
Time	50	40	0	0	50	40	0	0
Mode	1 - CP	0 - AP	0 - AP	0 - AP	1 - CP	0 - AP	0 - AP	0 - AP
Min Veh Time	Bnk1=16 Bnk2=11 Bnk3=11 Bnk4=11	Bnk1=11 Bnk2=11 Bnk3=11 Bnk4=11			Bnk1=16 Bnk2=11 Bnk3=11 Bnk4=11	Bnk1=11 Bnk2=11 Bnk3=11 Bnk4=11		
Min Ped Time	Bnk1=35 Bnk2=0 Bnk3=0 Bnk4=0	Bnk1=20 Bnk2=0 Bnk3=0 Bnk4=0			Bnk1=35 Bnk2=0 Bnk3=0 Bnk4=0	Bnk1=20 Bnk2=0 Bnk3=0 Bnk4=0		
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Phase	9	10	11	12	13	14	15	16
Time	0	0	0	0	0	0	0	0
Mode	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP
Min Veh Time								
Min Ped Time								
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Offset	1	2	3
Time	0	0	0
Mode	0 - Normal	0 - Normal	0 - Normal
Alt Sequence	0	0	0
Correction	0 - Normal	0 - Normal	0 - Normal
Special Function	0	0	0
Maximum Mode	0 - None	0 - None	0 - None
Ring 2 Lag Time	0	0	0
Ring 3 Lag Time	0	0	0
Ring 4 Lag Time	0	0	0

Dial 1/Split 3

Cycle Length	90

Phase	1	2	3	4	5	6	7	8
Time	50	40	0	0	50	40	0	0
Mode	1 - CP	0 - AP	0 - AP	0 - AP	1 - CP	0 - AP	0 - AP	0 - AP
Min Veh Time	Bnk1=16 Bnk2=11 Bnk3=11 Bnk4=11	Bnk1=11 Bnk2=11 Bnk3=11 Bnk4=11			Bnk1=16 Bnk2=11 Bnk3=11 Bnk4=11	Bnk1=11 Bnk2=11 Bnk3=11 Bnk4=11		
Min Ped Time	Bnk1=35 Bnk2=0 Bnk3=0 Bnk4=0	Bnk1=20 Bnk2=0 Bnk3=0 Bnk4=0			Bnk1=35 Bnk2=0 Bnk3=0 Bnk4=0	Bnk1=20 Bnk2=0 Bnk3=0 Bnk4=0		
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Phase	9	10	11	12	13	14	15	16
Time	0	0	0	0	0	0	0	0
Mode	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP
Min Veh Time								
Min Ped Time								
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Offset	1	2	3
Time	0	0	0
Mode	0 - Normal	0 - Normal	0 - Normal
Alt Sequence	0	0	0
Correction	0 - Normal	0 - Normal	0 - Normal
Special Function	0	0	0
Maximum Mode	0 - None	0 - None	0 - None
Ring 2 Lag Time	0	0	0
Ring 3 Lag Time	0	0	0
Ring 4 Lag Time	0	0	0

Dial 1/Split 4

Cycle Length	75

Phase	1	2	3	4	5	6	7	8
Time	46	29	0	0	46	29	0	0
Mode	1 - CP	0 - AP	0 - AP	0 - AP	1 - CP	0 - AP	0 - AP	0 - AP
Min Veh Time	Bnk1=16 Bnk2=11 Bnk3=11 Bnk4=11	Bnk1=11 Bnk2=11 Bnk3=11 Bnk4=11			Bnk1=16 Bnk2=11 Bnk3=11 Bnk4=11	Bnk1=11 Bnk2=11 Bnk3=11 Bnk4=11		
Min Ped Time	Bnk1=35 Bnk2=0 Bnk3=0 Bnk4=0	Bnk1=20 Bnk2=0 Bnk3=0 Bnk4=0			Bnk1=35 Bnk2=0 Bnk3=0 Bnk4=0	Bnk1=20 Bnk2=0 Bnk3=0 Bnk4=0		
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Phase	9	10	11	12	13	14	15	16
Time	0	0	0	0	0	0	0	0
Mode	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP
Min Veh Time								
Min Ped Time								
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Offset	1	2	3
Time	0	0	0
Mode	0 - Normal	0 - Normal	0 - Normal
Alt Sequence	0	0	0
Correction	0 - Normal	0 - Normal	0 - Normal
Special Function	0	0	0
Maximum Mode	0 - None	0 - None	0 - None
Ring 2 Lag Time	0	0	0
Ring 3 Lag Time	0	0	0
Ring 4 Lag Time	0	0	0

INTERSECTION TIMESHEET PACKET
NOTICE TO PROCEED

Signal Permit Number: S 346
Date of Timesheet: 5/2012
Controller Type: EPAC (MARK IED)
Coordination Type: TACTICS

Location: DE 1 @ DE 19 (MAIN)
Revision Number: A.1
Monitor Type: none
Coordination Address: 1
Baud Rate: 9600

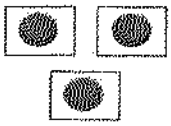
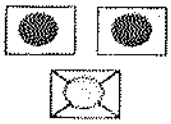
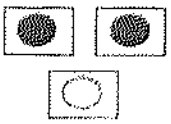
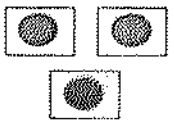
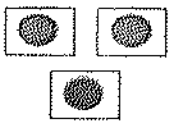
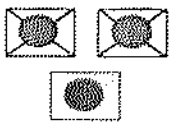
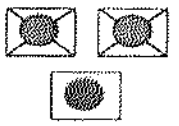
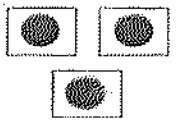
Phase Data

PHASE #	1	2	3	4	5	6	7	8
PHASE	5	PED Phase						
LOCATION	DE1	DE19						
MIN GRN	5	5						
PASS/10								
MAX I	40	30						
MAX II	40	30						
YEL/10	50	50						
RED/10	30	20						
WALK	30	7						
PED CLR	5	9						
EXT PCL	0	2						
WOFF/10								
WMODE								
ARIW	1							
INITIAL	4	1						
NA RESP								
V RECALL	2							
P. RECALL	2							
NL MEM								
2 ENTRY SPC SEQ								
OMIT Ø								
OCAL Ø								

OVERLAP DATA

	A	B	C	D
OVERLAP LOCATION	E/W PED RIDE			
OVERLAP PHASES	DE1 5% (PHASE 2)			

Delaware HAWK Signal - Sequence of Operation (rev C.1)

Signal Display	Ped Display	Summary of sequence
	DW	Main Street display is dark, and is controlled by phase 1 & 5 Walk interval Signal Display rests in phase 1 walk for one direction (no signal display) Signal Display rests in phase 5 walk for one direction (no signal display) Pedestrian Signal phase 2 rests in Don't Walk (associated to phase 1) Pedestrian Signal phase 6 rests in Don't Walk (associated to phase 5)
	DW	Flashing yellow is activated by ped call (phase 2 & 6 calls are placed a the same time) the flashing yellow interval is set by phase 1 & 5 pedestrian clearance interval and must equal the yellow clearance for the through movement (phase 1 & 5 yellow clearance) Phase 1 & 5 are programmed to minimum vehicle recall and pedestrian recall
	DW	Solid yellow is controlled by phase 1 & 5 yellow clearance value. This value is calculated using standard engineering practices. Phase 1 & 5 ped clearance shall not clear through the yellow / red intervals
	DW	The Left head Red is activated by phase 1 red and the Right head Red is activated by phase 2 red (one combination of displays for one direction) The Left head Red is activated by phase 5 red and the Right head Red is activated by phase 6 red (one combination of displays for one direction)
	W	Phase 2 walk activates pedestrian display Phase 6 walk activates pedestrian display
	PdCl	Phase 2 & 6 pedestrian clearance interval begins The solid red displays begin to flash in wig/wag operation The wig/wag flash is accomplished through the EPAC controller. Load switches for phase 1, 2, 5 & 6 are programmed to alternately flash red output The wig/wag flash continues through the yellow interval for phase 2 & 6
	DW	The wig/wag flash continues through the red intervals for phase 2 & 6 The pedestrian display is solid red - don't walk display
	DW	Return to beginning sequence

Main Street dark indication is controlled by phase 1 & 5 Walk interval
Signal will cycle upon power restoration
Signal Monitor Unit will monitor all indications
Signal will flash yellow in fault mode (ped displays will be dark)

Level Pattern Select

Restart TR for changes to take effect

Level	Free	Pattern	Level	Free	Pattern
AAA	☐	111 - 90 BAL	ABA	☐	111 - 90 BAL
AAB	☐	111 - 90 BAL	ABB	☐	111 - 90 BAL
AAC	☐	111 - 90 BAL	ABC	☐	111 - 90 BAL
BAA	☐	121 - 120 BAL	BBA	☐	121 - 120 BAL
BAB	☐	121 - 120 BAL	BBB	☐	121 - 120 BAL
BAC	☐	121 - 120 BAL	BBC	☐	121 - 120 BAL
CAA	☐	231 - 150 NB	CBA	☐	231 - 150 NB
CAB	☐	221 - 150 BAL	CBB	☐	221 - 150 BAL
CAC	☐	211 - 150 SB	CBC	☐	211 - 150 SB
DAA	☐	331 - 165 NB	DBA	☐	331 - 165 NB
DAB	☐	321 - 165 BAL	DBB	☐	321 - 165 BAL
DAC	☐	311 - 165 SB	DBC	☐	311 - 165 SB

Dial 1/Split 1

Cycle Length	90

Phase	1	2	3	4	5	6	7	8
Time	50	40	0	0	50	40	0	0
Mode	1 - CP	0 - AP	0 - AP	0 - AP	1 - CP	0 - AP	0 - AP	0 - AP
Min Veh Time	Bnk1=14 Bnk2=11 Bnk3=11 Bnk4=11	Bnk1=11 Bnk2=11 Bnk3=11 Bnk4=11						
Min Ped Time	Bnk1=35 Bnk2=0 Bnk3=0 Bnk4=0	Bnk1=13 Bnk2=0 Bnk3=0 Bnk4=0						
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Phase	9	10	11	12	13	14	15	16
Time	0	0	0	0	0	0	0	0
Mode	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP
Min Veh Time								
Min Ped Time								
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Dial 1/Split 2

Cycle Length	120

Phase	1	2	3	4	5	6	7	8
Time	80	40	0	0	50	40	0	0
Mode	1 - CP	0 - AP	0 - AP	0 - AP	1 - CP	0 - AP	0 - AP	0 - AP
Min Veh Time	Bnk1=14 Bnk2=11 Bnk3=11 Bnk4=11	Bnk1=11 Bnk2=11 Bnk3=11 Bnk4=11						
Min Ped Time	Bnk1=35 Bnk2=0 Bnk3=0 Bnk4=0	Bnk1=13 Bnk2=0 Bnk3=0 Bnk4=0						
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Phase	9	10	11	12	13	14	15	16
Time	0	0	0	0	0	0	0	0
Mode	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP
Min Veh Time								
Min Ped Time								
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Offset	1	2	3
Time	0	0	0
Mode	0 - Normal	0 - Normal	0 - Normal
Alt Sequence	0	0	0
Correction	0 - Normal	0 - Normal	0 - Normal
Special Function	0	0	0
Maximum Mode	0 - None	0 - None	0 - None
Ring 2 Lag Time	0	0	0
Ring 3 Lag Time	0	0	0
Ring 4 Lag Time	0	0	0

Dial 2/Split 1

Cycle Length	150

Phase	1	2	3	4	5	6	7	8
Time	110	40	0	0	80	40	0	0
Mode	1 - CP	0 - AP	0 - AP	0 - AP	1 - CP	0 - AP	0 - AP	0 - AP
Min Veh Time	Bnk1=14 Bnk2=11 Bnk3=11 Bnk4=11	Bnk1=11 Bnk2=11 Bnk3=11 Bnk4=11						
Min Ped Time	Bnk1=35 Bnk2=0 Bnk3=0 Bnk4=0	Bnk1=13 Bnk2=0 Bnk3=0 Bnk4=0						
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Phase	9	10	11	12	13	14	15	16
Time	0	0	0	0	0	0	0	0
Mode	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP
Min Veh Time								
Min Ped Time								
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Offset	1	2	3
Time	0	0	0
Mode	0 - Normal	0 - Normal	0 - Normal
Alt Sequence	0	0	0
Correction	0 - Normal	0 - Normal	0 - Normal
Special Function	0	0	0
Maximum Mode	0 - None	0 - None	0 - None
Ring 2 Lag Time	0	0	0
Ring 3 Lag Time	0	0	0
Ring 4 Lag Time	0	0	0

Dial 2/Split 2

Cycle Length	150

Phase	1	2	3	4	5	6	7	8
Time	110	40	0	0	80	40	0	0
Mode	1 - CP	0 - AP	0 - AP	0 - AP	1 - CP	0 - AP	0 - AP	0 - AP
Min Veh Time	Bnk1=14 Bnk2=11 Bnk3=11 Bnk4=11	Bnk1=11 Bnk2=11 Bnk3=11 Bnk4=11						
Min Ped Time	Bnk1=35 Bnk2=0 Bnk3=0 Bnk4=0	Bnk1=13 Bnk2=0 Bnk3=0 Bnk4=0						
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Phase	9	10	11	12	13	14	15	16
Time	0	0	0	0	0	0	0	0
Mode	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP
Min Veh Time								
Min Ped Time								
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Offset	1	2	3
Time	0	0	0
Mode	0 - Normal	0 - Normal	0 - Normal
Alt Sequence	0	0	0
Correction	0 - Normal	0 - Normal	0 - Normal
Special Function	0	0	0
Maximum Mode	0 - None	0 - None	0 - None
Ring 2 Lag Time	0	0	0
Ring 3 Lag Time	0	0	0
Ring 4 Lag Time	0	0	0

Dial 2/Split 3

Cycle Length	150

Phase	1	2	3	4	5	6	7	8
Time	110	40	0	0	80	40	0	0
Mode	1 - CP	0 - AP	0 - AP	0 - AP	1 - CP	0 - AP	0 - AP	0 - AP
Min Veh Time	Bnk1=14 Bnk2=11 Bnk3=11 Bnk4=11	Bnk1=11 Bnk2=11 Bnk3=11 Bnk4=11						
Min Ped Time	Bnk1=35 Bnk2=0 Bnk3=0 Bnk4=0	Bnk1=13 Bnk2=0 Bnk3=0 Bnk4=0						
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Phase	9	10	11	12	13	14	15	16
Time	0	0	0	0	0	0	0	0
Mode	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP
Min Veh Time								
Min Ped Time								
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Offset	1	2	3
Time	0	0	0
Mode	0 - Normal	0 - Normal	0 - Normal
Alt Sequence	0	0	0
Correction	0 - Normal	0 - Normal	0 - Normal
Special Function	0	0	0
Maximum Mode	0 - None	0 - None	0 - None
Ring 2 Lag Time	0	0	0
Ring 3 Lag Time	0	0	0
Ring 4 Lag Time	0	0	0

Dial 3/Split 1

Cycle Length	165

Phase	1	2	3	4	5	6	7	8
Time	125	40	0	0	110	40	0	0
Mode	1 - CP	0 - AP	0 - AP	0 - AP	1 - CP	0 - AP	0 - AP	0 - AP
Min Veh Time	Bnk1=14 Bnk2=11 Bnk3=11 Bnk4=11	Bnk1=11 Bnk2=11 Bnk3=11 Bnk4=11						
Min Ped Time	Bnk1=35 Bnk2=0 Bnk3=0 Bnk4=0	Bnk1=13 Bnk2=0 Bnk3=0 Bnk4=0						
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Phase	9	10	11	12	13	14	15	16
Time	0	0	0	0	0	0	0	0
Mode	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP
Min Veh Time								
Min Ped Time								
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Offset	1	2	3
Time	121	0	0
Mode	0 - Normal	0 - Normal	0 - Normal
Alt Sequence	0	0	0
Correction	0 - Normal	0 - Normal	0 - Normal
Special Function	0	0	0
Maximum Mode	0 - None	0 - None	0 - None
Ring 2 Lag Time	0	0	0
Ring 3 Lag Time	0	0	0
Ring 4 Lag Time	0	0	0

Dial 3/Split 2

Cycle Length	165

Phase	1	2	3	4	5	6	7	8
Time	125	40	0	0	110	40	0	0
Mode	1 - CP	0 - AP	0 - AP	0 - AP	1 - CP	0 - AP	0 - AP	0 - AP
Min Veh Time	Bnk1=14 Bnk2=11 Bnk3=11 Bnk4=11	Bnk1=11 Bnk2=11 Bnk3=11 Bnk4=11						
Min Ped Time	Bnk1=35 Bnk2=0 Bnk3=0 Bnk4=0	Bnk1=13 Bnk2=0 Bnk3=0 Bnk4=0						
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Phase	9	10	11	12	13	14	15	16
Time	0	0	0	0	0	0	0	0
Mode	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP
Min Veh Time								
Min Ped Time								
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Offset	1	2	3
Time	111	0	0
Mode	0 - Normal	0 - Normal	0 - Normal
Alt Sequence	0	0	0
Correction	0 - Normal	0 - Normal	0 - Normal
Special Function	0	0	0
Maximum Mode	0 - None	0 - None	0 - None
Ring 2 Lag Time	0	0	0
Ring 3 Lag Time	0	0	0
Ring 4 Lag Time	0	0	0

Dial 3/Split 3

Cycle Length	165

Phase	1	2	3	4	5	6	7	8
Time	125	40	0	0	110	40	0	0
Mode	1 - CP	0 - AP	0 - AP	0 - AP	1 - CP	0 - AP	0 - AP	0 - AP
Min Veh Time	Bnk1=14 Bnk2=11 Bnk3=11 Bnk4=11	Bnk1=11 Bnk2=11 Bnk3=11 Bnk4=11						
Min Ped Time	Bnk1=35 Bnk2=0 Bnk3=0 Bnk4=0	Bnk1=13 Bnk2=0 Bnk3=0 Bnk4=0						
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Phase	9	10	11	12	13	14	15	16
Time	0	0	0	0	0	0	0	0
Mode	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP
Min Veh Time								
Min Ped Time								
Phase Reduction	0	0	0	0	0	0	0	0
Phase Extension	0	0	0	0	0	0	0	0

Offset	1	2	3
Time	40	0	0
Mode	0 - Normal	0 - Normal	0 - Normal
Alt Sequence	0	0	0
Correction	0 - Normal	0 - Normal	0 - Normal
Special Function	0	0	0
Maximum Mode	0 - None	0 - None	0 - None
Ring 2 Lag Time	0	0	0
Ring 3 Lag Time	0	0	0
Ring 4 Lag Time	0	0	0

INTERSECTION TIMESHETT PACKET
NOTICE TO PROCEED

Signal Permit Number: S347
Date of Timesheet: 2/5/15
Controller Type: EPAC-PED IMAK
Coordination Type: TRAFICS

Location: DEL/Cr HOLLAND GLADE RD
Revision Number: A.1
Monitor Type: NEMA+
Coordination Address: 1
Baud Rate: 9600

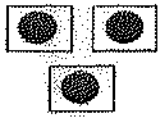
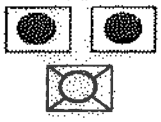
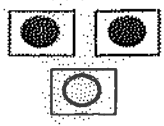
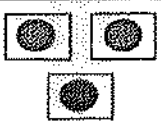
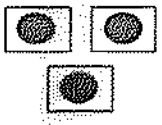
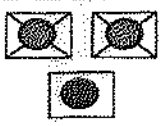
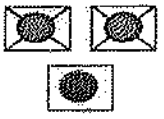
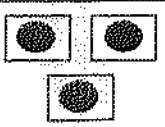
Phase Data

PHASE #	1	2	3	4	5	6	7	8
PHASE	SB	PED NBSB			NB	PED NBSB		
LOCATION	DEL	SB DEL			DEL	NB DEL		
MIN GRN	5	5			5	5		
PASS/10								
MAX I	40	30			40	30		
MAX II	40	30			40	30		
YEL/10	50	30			50	30		
RED/10	30	20			30	20		
WALK	30	7			30	7		
PED CLR	5	15			5	15		
EXT PCL	0	2			0	2		
WOFF/10								
WMODE								
ARIW	1				1			
INITIAL	4	1			4	1		
NA RESP								
V. RECALL	2				2			
P. RECALL	2				2			
NL MEM								
2 ENTRY	0				0			
SPC SEQ								
OMIT Ø								
OCAL Ø								

OVERLAP DATA

	A	B	C	D
OVERLAP LOCATION	PHASE 2 PED		PHASE 6 PED	
OVERLAP PHASES				

Delaware HAWK Signal - Sequence of Operation (rev C.1)

Signal Display	Ped Display	Summary of sequence
	DW	Main Street display is dark, and is controlled by phase 1 & 5 Walk interval Signal Display rests in phase 1 walk for one direction (no signal display) Signal Display rests in phase 5 walk for one direction (no signal display) Pedestrian Signal phase 2 rests in Don't Walk (associated to phase 1) Pedestrian Signal phase 6 rests in Don't Walk (associated to phase 5)
	DW	Flashing yellow is activated by ped call (phase 2 & 6 calls are placed a the same time) the flashing yellow interval is set by phase 1 & 5 pedestrian clearance interval and must equal the yellow clearance for the through movement (phase 1 & 5 yellow clearance) Phase 1 & 5 are programmed to minimum vehicle recall and pedestrian recall
	DW	Solid yellow is controlled by phase 1 & 5 yellow clearance value. This value is calculated using standard engineering practices. Phase 1 & 5 ped clearance shall not clear through the yellow / red intervals.
	DW	The Left head Red is activated by phase 1 red and the Right head Red is activated by phase 2 red (one combination of displays for one direction) The Left head Red is activated by phase 5 red and the Right head Red Is activated by phase 6 red (one combination of displays for one direction)
	W	Phase 2 walk activates pedestrian display Phase 6 walk activates pedestrian display
	PdCl	Phase 2 & 6 pedestrian clearance interval begins The solid red displays begin to flash in wig/wag operation The wig/wag flash is accomplished through the EPAC controller. Load switches for phase 1, 2, 5 & 6 are programmed to alternately flash red output The wig/wag flash continues through the yellow interval for phase 2 & 6
	DW	The wig/wag flash continues through the red intervals for phase 2 & 6 The pedestrian display is solid red - don't walk display
	DW	Return to beginning sequence

Main Street dark indication is controlled by phase 1 & 5 Walk Interval
Signal will cycle upon power restoration
Signal Monitor Unit will monitor all indications
Signal will flash yellow in fault mode (ped displays will be dark)

Level Pattern Select

Restart TR for changes to take effect

Level	Free	Pattern	Level	Free	Pattern
AAA	☐	111 - 90 BAL	ABA	☐	111 - 90 BAL
AAB	☐	111 - 90 BAL	ABB	☐	111 - 90 BAL
AAC	☐	111 - 90 BAL	ABC	☐	111 - 90 BAL
BAA	☐	121 - 120 BAL	BBA	☐	121 - 120 BAL
BAB	☐	121 - 120 BAL	BBB	☐	121 - 120 BAL
BAC	☐	121 - 120 BAL	BBC	☐	121 - 120 BAL
CAA	☐	231 - 150 NB	CBA	☐	231 - 150 NB
CAB	☐	221 - 150 BAL	CBB	☐	221 - 150 BAL
CAC	☐	211 - 150 SB	CBC	☐	211 - 150 SB
DAA	☐	331 - 165 NB	DBA	☐	331 - 165 NB
DAB	☐	321 - 165 BAL	DBB	☐	321 - 165 BAL
DAC	☐	311 - 165 SB	DBC	☐	311 - 165 SB

Dial 1/Split 1

Cycle Length	90

Phase	1	2	3	4	5	6	7	8
Time	65	25	0	0	65	25	0	0
Mode	1 - CP	0 - AP	0 - AP	0 - AP	1 - CP	0 - AP	0 - AP	0 - AP
Min Veh Time	14	11			14	11		
Min Ped Time	35	19			35	19		

Phase	9	10	11	12	13	14	15	16
Time	0	0	0	0	0	0	0	0
Mode	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP
Min Veh Time								
Min Ped Time								

Dial 1/Split 2

Cycle Length	120

Phase	1	2	3	4	5	6	7	8
Time	95	25	0	0	95	25	0	0
Mode	1 - CP	0 - AP	0 - AP	0 - AP	1 - CP	0 - AP	0 - AP	0 - AP
Min Veh Time	14	11			14	11		
Min Ped Time	35	19			35	19		

Phase	9	10	11	12	13	14	15	16
Time	0	0	0	0	0	0	0	0
Mode	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP
Min Veh Time								
Min Ped Time								

Offset	1	2	3
Time	47	0	0
Mode	0 - Normal	0 - Normal	0 - Normal
Alt Sequence	0	0	0
Ring 2 Lag Time	0	0	0
Ring 3 Lag Time	0	0	0
Ring 4 Lag Time	0	0	0

Dial 2/Split 1

Cycle Length	150

Phase	1	2	3	4	5	6	7	8
Time	125	25	0	0	125	25	0	0
Mode	1 - CP	0 - AP	0 - AP	0 - AP	1 - CP	0 - AP	0 - AP	0 - AP
Min Veh Time	14	11			14	11		
Min Ped Time	35	19			35	19		

Phase	9	10	11	12	13	14	15	16
Time	0	0	0	0	0	0	0	0
Mode	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP
Min Veh Time								
Min Ped Time								

Offset	1	2	3
Time	104	0	0
Mode	0 - Normal	0 - Normal	0 - Normal
Alt Sequence	0	0	0
Ring 2 Lag Time	0	0	0
Ring 3 Lag Time	0	0	0
Ring 4 Lag Time	0	0	0

Dial 2/Split 2

Cycle Length	150

Phase	1	2	3	4	5	6	7	8
Time	125	25	0	0	125	25	0	0
Mode	1 - CP	0 - AP	0 - AP	0 - AP	1 - CP	0 - AP	0 - AP	0 - AP
Min Veh Time	14	11			14	11		
Min Ped Time	35	19			35	19		

Phase	9	10	11	12	13	14	15	16
Time	0	0	0	0	0	0	0	0
Mode	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP
Min Veh Time								
Min Ped Time								

Offset	1	2	3
Time	76	0	0
Mode	0 - Normal	0 - Normal	0 - Normal
Alt Sequence	0	0	0
Ring 2 Lag Time	0	0	0
Ring 3 Lag Time	0	0	0
Ring 4 Lag Time	0	0	0

Dial 2/Split 3

Cycle Length	150

Phase	1	2	3	4	5	6	7	8
Time	125	25	0	0	125	25	0	0
Mode	1 - CP	0 - AP	0 - AP	0 - AP	1 - CP	0 - AP	0 - AP	0 - AP
Min Veh Time	14	11			14	11		
Min Ped Time	35	19			35	19		

Phase	9	10	11	12	13	14	15	16
Time	0	0	0	0	0	0	0	0
Mode	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP
Min Veh Time								
Min Ped Time								

Offset	1	2	3
Time	78	0	0
Mode	0 - Normal	0 - Normal	0 - Normal
Alt Sequence	0	0	0
Ring 2 Lag Time	0	0	0
Ring 3 Lag Time	0	0	0
Ring 4 Lag Time	0	0	0

Dial 3/Split 1

Cycle Length	165

Phase	1	2	3	4	5	6	7	8
Time	140	25	0	0	140	25	0	0
Mode	1 - CP	0 - AP	0 - AP	0 - AP	1 - CP	0 - AP	0 - AP	0 - AP
Min Veh Time	14	11			14	11		
Min Ped Time	35	19			35	19		

Phase	9	10	11	12	13	14	15	16
Time	0	0	0	0	0	0	0	0
Mode	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP
Min Veh Time								
Min Ped Time								

Offset	1	2	3
Time	48	0	0
Mode	0 - Normal	0 - Normal	0 - Normal
Alt Sequence	0	0	0
Ring 2 Lag Time	0	0	0
Ring 3 Lag Time	0	0	0
Ring 4 Lag Time	0	0	0

Dial 3/Split 2

Cycle Length	165

Phase	1	2	3	4	5	6	7	8
Time	140	25	0	0	140	25	0	0
Mode	1 - CP	0 - AP	0 - AP	0 - AP	1 - CP	0 - AP	0 - AP	0 - AP
Min Veh Time	14	11			14	11		
Min Ped Time	35	19			35	19		

Phase	9	10	11	12	13	14	15	16
Time	0	0	0	0	0	0	0	0
Mode	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP
Min Veh Time								
Min Ped Time								

Offset	1	2	3
Time	48	0	0
Mode	0 - Normal	0 - Normal	0 - Normal
Alt Sequence	0	0	0
Ring 2 Lag Time	0	0	0
Ring 3 Lag Time	0	0	0
Ring 4 Lag Time	0	0	0

Dial 3/Split 3

Cycle Length	165

Phase	1	2	3	4	5	6	7	8
Time	140	25	0	0	140	25	0	0
Mode	1 - CP	0 - AP	0 - AP	0 - AP	1 - CP	0 - AP	0 - AP	0 - AP
Min Veh Time	14	11			14	11		
Min Ped Time	35	19			35	19		

Phase	9	10	11	12	13	14	15	16
Time	0	0	0	0	0	0	0	0
Mode	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP	0 - AP
Min Veh Time								
Min Ped Time								

Offset	1	2	3
Time	75	0	0
Mode	0 - Normal	0 - Normal	0 - Normal
Alt Sequence	0	0	0
Ring 2 Lag Time	0	0	0
Ring 3 Lag Time	0	0	0
Ring 4 Lag Time	0	0	0

APPENDIX G

Signal Construction Plans

CONDUIT RUN SCHEDULE

CR#	# OF CONDUITS	SIZE	LENGTH	AMOUNT AND TYPE OF CABLE/ WIRE
*1	1	2.0"	59'	(1)2/#8 U.F.W/ GROUND
*1A	1	2.0"	11'	(1)2/#8 U.F.W/ GROUND
*2	3	2.5"	7'	(4)9/#14 (NEW (4)9/#14)
*3	1	2.5"	10'	(1)9/#14 (NEW (1)9/#14)
*4	1	2.5"	15'	(1)9/#14
*5	1	2.5"	78'	(1)9/#14 (NEW (1)9/#14)
*6	1	2.5"	7'	(1)9/#14 (NEW (1)9/#14)
7	1	2.5"	10'	(1)9/#14

* DENOTES EXISTING

MAST ARM SCHEDULE

MA#	HEIGHT OF POLE	LENGTH OF ARM	* OF HEADS	S.F. OF SIGNING
1	21'	60'	6	33

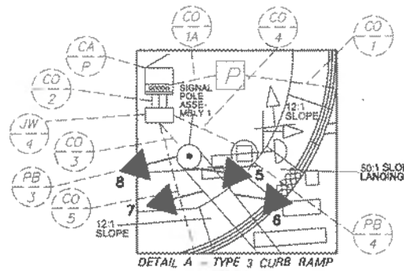
OVERHEAD SIGN DETAIL

S-1

R10-23
30" X 36"

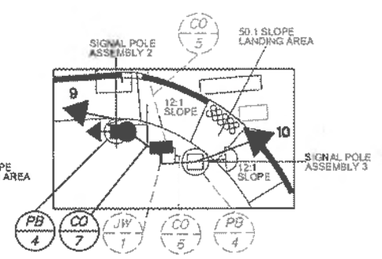
S-2

W11-2
36" X 36"
FLUORESCENT YELLOW



DETAIL A – TYPE 3 CURB RAMP

SCALE
0 10
FEET



DETAIL B – TYPE 3 CURB RAMP

SCALE
0 10
FEET

SIGNAL NOTES CON'T

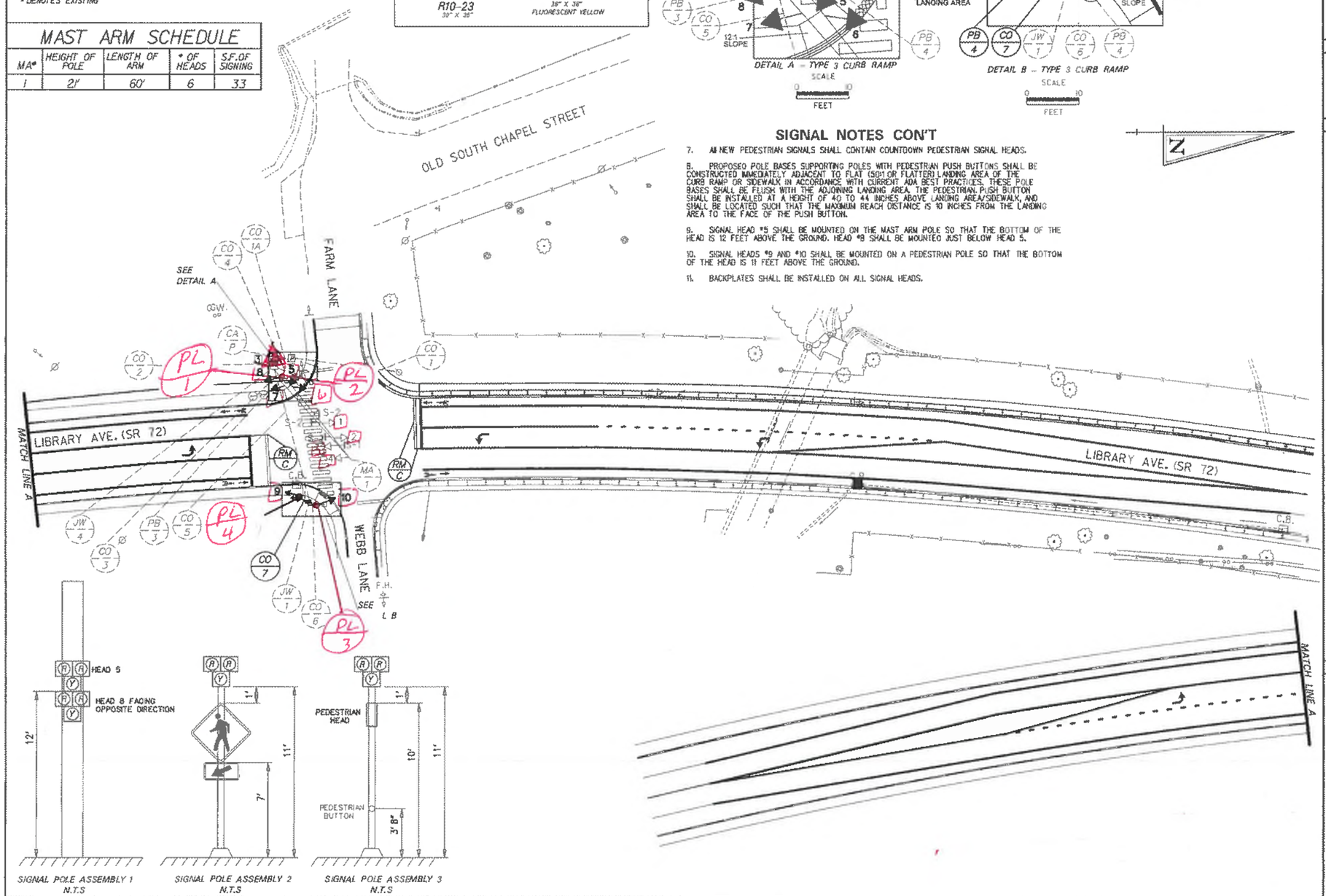
7. ALL NEW PEDESTRIAN SIGNALS SHALL CONTAIN COUNTDOWN PEDESTRIAN SIGNAL HEADS.

8. PROPOSED POLE BASES SUPPORTING POLES WITH PEDESTRIAN PUSH BUTTONS SHALL BE CONSTRUCTED IMMEDIATELY ADJACENT TO FLAT (SO:1 OR FLATTER) LANDING AREA OF THE CURB RAMP OR SIDEWALK IN ACCORDANCE WITH CURRENT ADA BEST PRACTICES. THESE POLE BASES SHALL BE FLUSH WITH THE ADJOINING LANDING AREA. THE PEDESTRIAN PUSH BUTTON SHALL BE INSTALLED AT A HEIGHT OF 40 TO 44 INCHES ABOVE LANDING AREA/SIDEWALK, AND SHALL BE LOCATED SUCH THAT THE MAXIMUM REACH DISTANCE IS 10 INCHES FROM THE LANDING AREA TO THE FACE OF THE PUSH BUTTON.

9. SIGNAL HEAD #5 SHALL BE MOUNTED ON THE MAST ARM POLE SO THAT THE BOTTOM OF THE HEAD IS 12 FEET ABOVE THE GROUND. HEAD #8 SHALL BE MOUNTED JUST BELOW HEAD 5.

10. SIGNAL HEADS #9 AND #10 SHALL BE MOUNTED ON A PEDESTRIAN POLE SO THAT THE BOTTOM OF THE HEAD IS 11 FEET ABOVE THE GROUND.

11. BACKPLATES SHALL BE INSTALLED ON ALL SIGNAL HEADS.



SIGNAL POLE ASSEMBLY 1 N.T.S

SIGNAL POLE ASSEMBLY 2 N.T.S

SIGNAL POLE ASSEMBLY 3 N.T.S

SIGNAL PHASING

1. THE PEDESTRIAN HYBRID BEACON REMAINS DARK IN BETWEEN PEDESTRIAN ACTUATIONS CONCURRENT WITH PEDESTRIAN DON'T WALK INDICATION.
2. UPON PEDESTRIAN ACTUATION, THE BEACON DISPLAYS A FLASHING YELLOW INDICATION CONCURRENT WITH THE PEDESTRIAN DON'T WALK INDICATION.
3. THE BEACON CHANGES TO A STEADY YELLOW INDICATION CONCURRENT WITH THE PEDESTRIAN DON'T WALK INDICATION.
4. THE BEACON CHANGES TO A STEADY RED INDICATION CONCURRENT WITH THE PEDESTRIAN WALK INTERVAL.
5. THE BEACON CHANGES TO AN ALTERNATING FLASHING RED INDICATION CONCURRENT WITH THE PEDESTRIAN COUNTDOWN INDICATION AND PEDESTRIAN CLEARANCE INTERVAL.
6. THE BEACON REVERTS BACK TO THE DARK CONDITION AFTER THE PEDESTRIAN CLEARANCE INTERVAL ENDS.

SIGNAL HEAD DIAGRAM

LEGEND

- PROPOSED SIGNAL CABINET
- EXISTING SIGNAL CABINET
- PROPOSED SIGNAL POLE BASE
- EXISTING SIGNAL POLE BASE
- PROPOSED PEDESTRIAN POLE BASE
- EXISTING PEDESTRIAN POLE BASE
- PROPOSED WOOD POLE
- EXISTING UTILITY POLE
- PROPOSED JUNCTION WELL
- EXISTING JUNCTION WELL
- PROPOSED SIGNAL HEAD
- EXISTING SIGNAL HEAD
- PROPOSED PEDESTRIAN SIGNAL HEAD
- EXISTING PEDESTRIAN SIGNAL HEAD
- PROPOSED PEDESTRIAN PUSHBUTTON
- EXISTING PEDESTRIAN PUSHBUTTON
- PROPOSED VIDEO DETECTION
- EXISTING VIDEO DETECTION
- PROPOSED MICROWAVE DETECTION
- EXISTING MICROWAVE DETECTION
- OVERHEAD SIGNING
- PROPOSED OPTICOM RECEIVER
- EXISTING OPTICOM RECEIVER
- PROPOSED MAST ARM
- EXISTING MAST ARM
- PROPOSED LUMINAIRE
- EXISTING LUMINAIRE
- PROPOSED LOOP DETECTOR (TYPE I OR 2)
- EXISTING LOOP DETECTOR (TYPE I OR 2)
- REMOVE BY CONTRACTOR
- REMOVE BY OTHERS
- ABANDON
- PROPOSED POLE BASE IDENTIFIER (TYPE OF POLE BASE)
- EXISTING POLE BASE IDENTIFIER (TYPE OF POLE BASE)
- PROPOSED JUNCTION WELL IDENTIFIER (TYPE OF JUNCTION WELL)
- EXISTING JUNCTION WELL IDENTIFIER (TYPE OF JUNCTION WELL)
- PROPOSED CONDUIT RUN IDENTIFIER (# OF CONDUIT RUNS)
- EXISTING CONDUIT RUN IDENTIFIER (# OF CONDUIT RUNS)
- PROPOSED OVERHEAD RUN IDENTIFIER (# OF OVERHEAD RUNS)
- EXISTING OVERHEAD RUN IDENTIFIER (# OF OVERHEAD RUNS)
- PROPOSED MAST ARM IDENTIFIER (LENGTH OF ARM)
- EXISTING MAST ARM IDENTIFIER (LENGTH OF ARM)
- PROPOSED CABINET IDENTIFIER (TYPE OF CABINET)
- EXISTING CABINET IDENTIFIER (TYPE OF CABINET)
- PROPOSED SPAN WIRE
- EXISTING SPAN WIRE
- RIGHT-OF-WAY OR PROPERTY LINE
- PROPOSED SPAN INSULATOR
- EXISTING SPAN INSULATOR
- SERVICE PEDESTAL

GENERAL SIGNAL NOTES

1. ALL MAST ARM POLES WILL BE 21 FEET, EXCEPT WHERE SHOWN.
2. ALL SIGNAL EQUIPMENT REMOVED FROM A PROJECT IS TO BE RETURNED TO DELDOT TRAFFIC -DOVER, DELAWARE.
3. POLE BASES, CABINET BASE AND CONDUIT JUNCTION WELLS TO BE REMOVED IN ACCORDANCE WITH SECTION 201 AND 202 OF THE STANDARD SPECIFICATIONS OR AS DIRECTED BY ENGINEER. EXISTING CONDUIT IS TO BE ABANDONED.
4. ALL GALVANIZED CONDUIT (GRC) SHALL BE REAMED AND THREADED. ALL GRC SHALL BE THREADED TOGETHER WITH APPROVED COUPLINGS. SET SCREW, BOLTED, AND COMPRESSION FITTING ARE NOT ACCEPTABLE.
5. ALL UNDERGROUND AND OVERHEAD UTILITIES SHOWN ON THESE PLANS ARE SCHEMATIC ONLY AND MAY NOT BE COMPLETE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING MISS UTILITY, AND/OR THE APPROPRIATE UTILITY PRIOR TO THE BEGINNING OF CONSTRUCTION FOR THE UTILITY MARKOUTS. IF THE CONTRACTOR PERCEIVES THAT A CONFLICT BETWEEN UTILITIES AND THE TRAFFIC SIGNAL WILL OCCUR, THE CONTRACTOR SHALL NOTIFY DELDOT TRAFFIC IMMEDIATELY BEFORE CONSTRUCTION.

RECOMMENDED _____ DATE: _____

RECOMMENDED _____ DATE: 7/2/12

RECOMMENDED _____ DATE: 7/2/12

APPROVED TRAFFIC ENGINEER _____ DATE: 7/2/12

APPROVED FOR INSTALLATION
CHIEF TRAFFIC ENGINEER _____ DATE: 7/3/12

DELAWARE
DEPARTMENT OF TRANSPORTATION

ADDENDUM / REVISIONS
(3) ADDED LEFT TURN BAYS AND SUPPLEMENTAL HEADS. GG - 2/10/12

SCALE
0 30 60 90
FEET

SR 72 & FARM LANE
PEDESTRIAN HYBRID BEACON INSTALLATION

CONTRACT	PERMIT NO.	N768
31-041-03	DESIGNED BY: GG	
COUNTY: NEW CASTLE	CHECKED BY:	

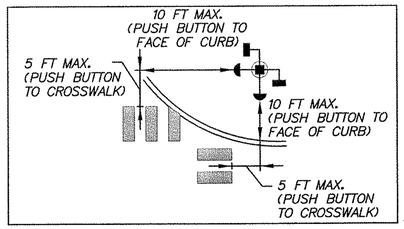
PEDESTRIAN HYBRID BEACON SIGNAL PLAN
SR 72 @ FARM LANE

SHEET NO. 1
TOTAL SHTS. 2

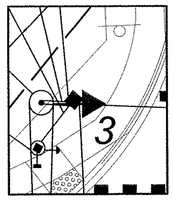
As Built Rev 9-3-13 SR

ADDITIONAL NOTES

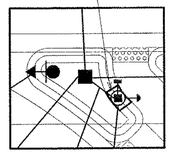
7. ALL PEDESTRIAN SIGNALS SHALL CONTAIN PEDESTRIAN COUNTDOWN MODULES.
8. INSTALL CDMA FOR COMMUNICATION WITH TMC.
9. PROGRAM SIGNAL CONTROLLER TO KEEP A STEADY DON'T WALK FOR PEDS WHEN EMERGENCY PREEMPTION IS ACTIVATED.
10. AS PER CORRESPONDENCE WITH GARY LAWSON & STEVE ENSS OF CITY OF DOVER ELECTRIC DEPARTMENT, SERVICE PEDESTAL FOR 120 / 240 VOLTS SERVICE FROM BURIED UTILITY HAS ALREADY BEEN PROVIDED FOR THE HAWK SIGNAL.
11. STATUS OF RIGHT-OF-WAY ACQUISITION FOR NW AND NE CORNERS TO BE VERIFIED PRIOR TO STARTING SIGNAL CONSTRUCTION WORK.



PUSH BUTTON DETAIL (TYPICAL)
(NOT TO SCALE)

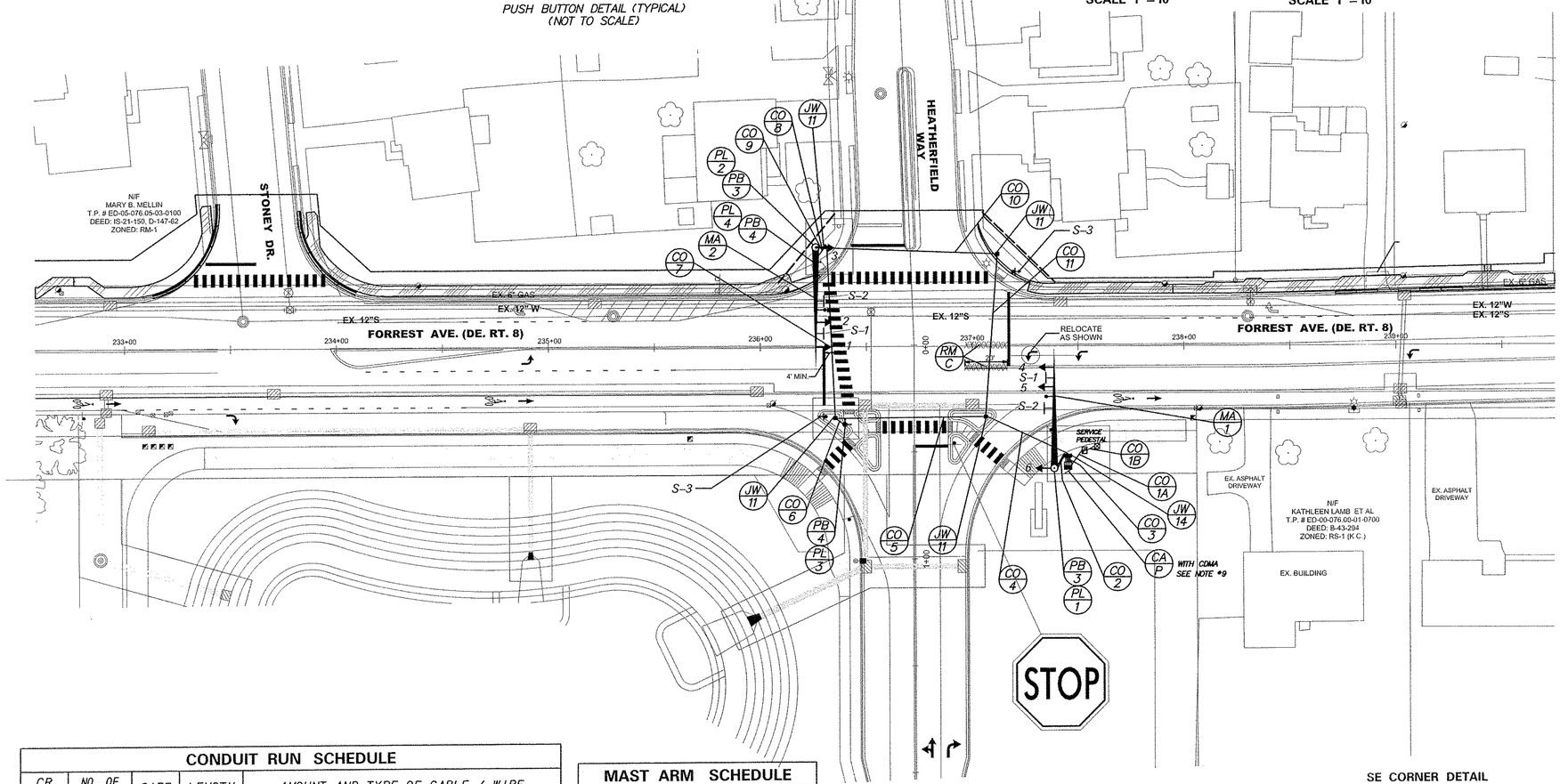


NW CORNER DETAIL
SCALE 1" = 10'



TYPE 2 CURB AREA SHOWN AROUND PED POLE FLUSH WITH RAMP PAVEMENT

SW ISLAND DETAIL
SCALE 1" = 10'



CONDUIT RUN SCHEDULE

CR NO.	NO. OF CONDUITS	SIZE	LENGTH	AMOUNT AND TYPE OF CABLE / WIRE
1A	1	2"	90'	(1) 2/#8 U.F. w/GROUND
1B	1	2"	10'	(1) 2/#8 U.F. w/GROUND
2	2	3"	5'	(1) 9/#14 (1) 4/#18 (1) #6
3	4	4"	5'	(2) 9/#14 (2) 4/#18 (3) 5/#14 (5)#6
4	1	4"	40'	(1) 9/#14 (1) 4/#18 (2) 5/#14 (3)#6
5	1	4"	70'	(1) 9/#14 (1) 4/#18 (2) 5/#14 (3)#6
6	1	2.5"	10'	(1) 5/#14 (1) #6
7	1	4"	80'	(1) 9/#14 (1) 4/#18 (1) #6
8	2	3"	5'	(1) 9/#14 (1) 4/#18 (1) #6
9	1	2.5"	10'	(1) 5/#14 (1) #6
10	1	4"	80'	(1) 5/#14 (1) #6
11	1	4"	80'	(1) 5/#14 (1) #6
12	1	2.5"	25'	(1) 5/#14 (1) #6

* DENOTES EXISTING

MAST ARM SCHEDULE

MA NO.	LENGTH OF ARM	NO. OF HEADS	S.F. OF SIGNING
1	55'	2	16.5
2	55'	2	16.5

SIGNAL POLE SCHEDULE

POLE*	POLE TYPE	HEIGHT	MATERIAL
1	STRAIN	21'	STEEL
2	STRAIN	21'	STEEL
3	PEDESTAL	10'	ALUMINUM
4	PEDESTAL	10'	ALUMINUM

* DENOTES EXISTING

OVERHEAD SIGNS

S-1

R10-23
30" X 36"

S-2

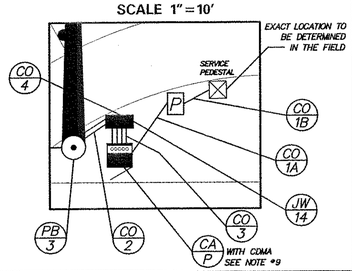
S1-1 (FYG)
36" X 36"

GROUND SIGN

S-3

R10-6
24" X 36"

SE CORNER DETAIL
SCALE 1" = 10'



SIGNAL PHASING

1. THE PEDESTRIAN HYBRID BEACON REMAINS DARK (NOT ILLUMINATED) DURING PERIOD BETWEEN ACTUATIONS CONCURRENT WITH PEDESTRIAN DON'T WALK INDICATION.
2. UPON PEDESTRIAN ACTUATION, THE BEACON DISPLAYS A FLASHING YELLOW INDICATION CONCURRENT WITH THE PEDESTRIAN DON'T WALK INDICATION.
3. THE BEACON CHANGES TO A STEADY YELLOW INDICATION CONCURRENT WITH THE PEDESTRIAN DON'T WALK INDICATION.
4. THE BEACON CHANGES TO A STEADY RED INDICATION CONCURRENT WITH THE PEDESTRIAN WALK INTERVAL.
5. THE BEACON CHANGES TO AN ALTERNATING FLASHING RED INDICATION CONCURRENT WITH THE PEDESTRIAN COUNTDOWN INDICATION AND PEDESTRIAN CLEARANCE INTERVAL.
6. THE BEACON REVERTS BACK TO THE DARK CONDITION AFTER THE PEDESTRIAN CLEARANCE INTERVAL ENDS.

SIGNAL HEAD DIAGRAM

1 – 6

LEGEND

AB	ABANDON	OH-•	EXISTING OVERHEAD RUN IDENTIFIER (• OF OVERHEAD RUN)
CA-X	EXISTING CABINET IDENTIFIER (TYPE OF CABINET)	OH-•	PROPOSED OVERHEAD RUN IDENTIFIER (• OF OVERHEAD RUN)
CA-X	PROPOSED CABINET IDENTIFIER (TYPE OF CABINET)	PB-X	EXISTING POLE BASE IDENTIFIER (TYPE OF POLE BASE)
CO-•	EXISTING CONDUIT RUN IDENTIFIER (• OF CONDUIT RUN)	PB-X	PROPOSED POLE BASE IDENTIFIER (TYPE OF POLE BASE)
CO-•	PROPOSED CONDUIT RUN IDENTIFIER (• OF CONDUIT RUN)	PL-X	EXISTING POLE IDENTIFIER (• OF POLE)
JW-X	EXISTING JUNCTION WELL IDENTIFIER (TYPE OF JUNCTION WELL)	PL-X	PROPOSED POLE IDENTIFIER (• OF POLE)
JW-X	PROPOSED JUNCTION WELL IDENTIFIER (TYPE OF JUNCTION WELL)	RM-C	REMOVE BY CONTRACTOR
MA-XX	EXISTING MAST ARM IDENTIFIER (LENGTH OF ARM)	RM-O	REMOVE BY OTHERS
MA-XX	PROPOSED MAST ARM IDENTIFIER (LENGTH OF ARM)	RM-TC	REMOVE BY TRAFFIC CONTRACTOR

	EXISTING SYMBOL	PROPOSED SYMBOL
JUNCTION WELL	J.W.	■
LOOP DETECTOR, TYPE 1		
LOOP DETECTOR, TYPE 2		
LUMINAIRE		
MAST ARM		
MICROWAVE DETECTION		
OPTICOM RECEIVER		
OVERHEAD SIGNING		
PEDESTRIAN POLE/BASE		
PEDESTRIAN PUSHBUTTON		
PEDESTRIAN SIGNAL HEAD		
RIGHT-OF-WAY		R/W
SERVICE PEDESTAL		P
SIGNAL CABINET		
SIGNAL HEAD		
SIGNAL POLE/BASE		
SPAN INSULATOR		
SPAN WIRE	XX	
UTILITY POLE		
VIDEO DETECTION		

GENERAL SIGNAL NOTES

1. ALL MAST ARM SIGNAL POLES WILL BE 21 FEET, EXCEPT WHERE SHOWN.
2. ALL SIGNAL EQUIPMENT REMOVED FROM A PROJECT IS TO BE RETURNED TO DELDOT TRAFFIC - DOVER, DELAWARE.
3. POLE BASES, CABINET BASE AND CONDUIT JUNCTION WELLS TO BE REMOVED IN ACCORDANCE WITH SECTION 201 AND 202 OF THE STANDARD SPECIFICATIONS OR AS DIRECTED BY ENGINEER. EXISTING CONDUIT IS TO BE ABANDONED.
4. ALL GALVANIZED CONDUIT (GRC) SHALL BE REAMED AND THREADED. ALL GRC SHALL BE THREADED TOGETHER WITH APPROVED COUPLINGS. SET SCREW, BOLTED, AND COMPRESSION FITTING ARE NOT ACCEPTABLE.
5. ALL UNDERGROUND AND OVERHEAD UTILITIES SHOWN ON THESE PLANS ARE SCHEMATIC ONLY AND MAY NOT BE COMPLETE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING MISS UTILITY, AND/OR THE APPROPRIATE UTILITY PRIOR TO THE BEGINNING OF CONSTRUCTION FOR THE UTILITY MARKOUTS. IF THE CONTRACTOR PERCEIVES THAT A CONFLICT BETWEEN UTILITIES AND THE TRAFFIC SIGNAL WILL OCCUR, THE CONTRACTOR SHALL NOTIFY DELDOT TRAFFIC IMMEDIATELY BEFORE CONSTRUCTION.

RECOMMENDED _____ DATE: _____

RECOMMENDED _____ DATE: _____

RECOMMENDED Max Saintil DATE: 3/31/14

APPROVED TRAFFIC ENGINEER _____ DATE: 3/31/14

APPROVED FOR INSTALLATION
CHIEF TRAFFIC ENGINEER _____ DATE: 4/1/14

DELAWARE
DEPARTMENT OF TRANSPORTATION

ADDENDUM / REVISIONS

SCALE
0 30 60 90
FEET

SR 8, FORREST AVENUE PEDESTRIAN IMPROVEMENTS, CRANBERRY RUN DRIVE TO MARSH CREEK LANE

CONTRACT	T201401201	PERMIT NO.	K312
COUNTY	KENT	DESIGNED BY: MS	CHECKED BY: MH

HAWK SIGNAL PLAN
(PEDESTRIAN HYBRID BEACON)
SR 8 & HEATHERFIELD WAY

SHEET NO. 21
TOTAL SHTS. 21

Y:\TRAFFIC\SIGNALS\KENT\K312-DESIGN\CADD_DGN\K312_SR 8 @ HEATHERFIELD WAY.DGN

CONDUIT RUN SCHEDULE

CO#	# OF CONDUITS	SIZE	LENGTH	B/T/O	AMOUNT AND TYPE OF CABLE/ WIRE
1#	1	2.5 IN	88 FT	-	EX. (1) 4/#18, EX. (2) LIGHTING CABLES, <REMOVE EX. (1) 2/#8 U.F. W/GROUND>, [NEW (2) 9/#14], [NEW (1) #6 GROUND]
2#	2	2.5 IN	46 FT	-	EX. (2) FIBER OPTIC, SINGLE-MODE, 12 CT., EX. (2) COMM. CABLES, EX. (7) 4/#18 - TO REMAIN, <REMOVE EX. (2) 4/#18>, [NEW (7) 2/#14], [NEW (7) 5/#14], [NEW (2) 4/#14], [NEW (2) #6 GROUND]
3#	2	2.5 IN	46 FT	-	EX. (2) LIGHTING CABLES
4#	1	2.5 IN	24 FT	-	<REMOVE EX. (2) 16/#14, EX. (3) 4/#18>, [NEW (1) 9/#14], [NEW (2) 16/#14], [NEW (4) 4/#18], [NEW (1) #6 GROUND]
5#	1	2.5 IN	58 FT	-	<REMOVE EX. (1) 4/#18>, [NEW (2) 2/#14], [NEW (1) 5/#14], [NEW (1) #6 GROUND]
6#	2	2.5 IN	81 FT	-	EX. (6) 4/#18, EX. (2) FIBER OPTIC, SINGLE-MODE, 12 CT., EX. (1) FIBER OPTIC, SINGLE-MODE, 24 CT., EX. (2) COMM. CABLES, [NEW (3) 5/#14], [NEW (4) 2/#14], [NEW (2) 4/#14], [NEW (1) FIBER OPTIC, SINGLE-MODE, 6 CT.], [NEW (2) #6 GROUND]
7#	1	2.5 IN	285 FT	-	EX. (1) 4/#18
8#	1	2.5 IN	XX FT	-	EX. (1) FIBER OPTIC, SINGLE-MODE, 12 CT., EX. (1) FIBER OPTIC, SINGLE-MODE, 24 CT., EX. (1) COMM. CABLE, EX. (1) FIBER OPTIC, SINGLE-MODE, 48 CT.
9#	1	2.5 IN	3 FT	-	EX. (1) 4/#18
10#	1	2.5 IN	169 FT	-	EX. (3) 4/#18, [NEW (2) 5/#14], [NEW (2) 4/#14], [NEW (1) #6 GROUND]
11#	1	2.5 IN	389 FT	-	EX. (1) 4/#18
12#	1	4.0 IN	389 FT	-	EX. (1) FIBER OPTIC, SINGLE-MODE, 12 CT., EX. (1) FIBER OPTIC, SINGLE-MODE, 24 CT., EX. (1) COMM. CABLE, EX. (1) FIBER OPTIC, SINGLE-MODE, 48 CT., EX. (1) 4/#18
13#	1	2.5 IN	40 FT	-	EX. (2) LIGHTING CABLES, EX. (1) 4/#18, <REMOVE EX. (1) 2/#8 U.F. W/GROUND>
14#	1	2.5 IN	43 FT	-	EX. (2) LIGHTING CABLES, <REMOVE EX. (1) 2/#8 U.F. W/GROUND>
15#	1	2.5 IN	32 FT	-	EX. (2) LIGHTING CABLES, <REMOVE EX. (1) 2/#8 U.F. W/GROUND>
16#	2	1.5 IN	28 FT	-	EX. (2) LIGHTING CABLES, <REMOVE EX. (1) 2/#8 U.F. W/GROUND>
17#	1	4.0 IN	XX FT	-	EX. (1) COMM. CABLE, EX. (1) FIBER OPTIC, SINGLE-MODE, 12 CT., EX. (1) FIBER OPTIC, SINGLE-MODE, 24 CT., EX. (1) FIBER OPTIC, SINGLE-MODE, 48 CT.
18#	2	2.5 IN	65 FT	-	EX. (1) FIBER OPTIC, SINGLE-MODE, 24 CT.
19	1	4.0 IN	24 FT	T	[NEW (2) 2/#14], [NEW (1) #6 GROUND]
20	1	4.0 IN	31 FT	O	[NEW (1) 9/#14], [NEW (1) #6 GROUND]
21	1	2.5 IN	9 FT	T	[NEW (1) 5/#14], [NEW (1) #6 GROUND]
22	1	4.0 IN	27 FT	B	[NEW (1) 5/#14], [NEW (1) #6 GROUND]
23	1	2.5 IN	10 FT	T	[NEW (1) 5/#14], [NEW (1) #6 GROUND]
24	1	2.5 IN	10 FT	T	[NEW (1) 5/#14], [NEW (1) #6 GROUND]
25	1	2.5 IN	11 FT	O	[NEW (1) 5/#14], [NEW (1) #6 GROUND]
26	1	2.5 IN	19 FT	O	[NEW (1) 5/#14], [NEW (1) #6 GROUND]
27	1	4.0 IN	41 FT	B	[NEW (1) 5/#14], [NEW (2) 2/#14], [NEW (1) #6 GROUND]
28	1	2.5 IN	3 FT	T	[NEW (1) 5/#14], [NEW (1) #6 GROUND]
29	1	2.5 IN	58 FT	T	[NEW (1) 5/#14], [NEW (1) 4/#14], [NEW (1) #6 GROUND]
30	1	4.0 IN	57 FT	B	[NEW (1) 5/#14], [NEW (1) 4/#14], [NEW (1) #6 GROUND]
31	1	2.5 IN	46 FT	T	[NEW (1) 5/#14], [NEW (1) 4/#14], [NEW (1) #6 GROUND]
32	1	2.0 IN	10 FT	O	[NEW (1) 2/#8 U.F. W/GROUND - LINE SIDE]
33	1	2.0 IN	3 FT	O	[NEW (1) 2/#8 U.F. W/GROUND - LOAD SIDE]
34	1	2.0 IN	22 FT	O	[NEW (1) 2/#8 U.F. W/GROUND - LOAD SIDE]
35	1	4.0 IN	61 FT	O/T	NEW (2) 5/#14], [NEW (2) 4/#14], [NEW (1) FIBER OPTIC, SINGLE-MODE, 6 CT.], [NEW (1) #6 GROUND]

* DENOTES EXISTING CONDUIT — B = BORE, T = TRENCH, O = OPEN CUT

SEE NOTE 7

SEE NOTE 7

SEE NOTE 7

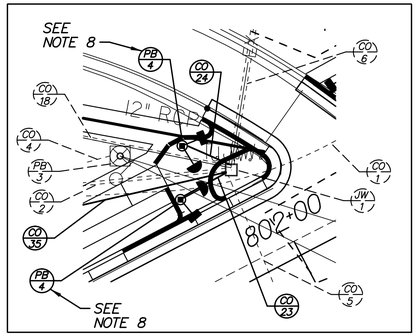
NOTES:

6. PROPOSED SIGNAL HEADS 6 AND 9 SHALL BE MOUNTED ON A PEDESTRIAN POLE SO THAT THE BOTTOM OF THE HEAD IS 11 FEET ABOVE THE GROUND, AS SHOWN IN THE PEDESTRIAN POLE ASSEMBLY DETAIL.
7. THE INSTALLATION OF INNERDUCT, INSTALLATION OF ALL FIBER OPTIC CABLE, AND SPLICING OF THE EXISTING FIBER OPTIC CABLE TO PROPOSED (1) FIBER OPTIC, SINGLE-MODE, 6 CT. CABLE SHALL BE COMPLETED BY DELDOT OIT.
8. PROPOSED POLE BASES SUPPORTING POLES WITH PEDESTRIAN PUSHBUTTONS SHALL BE CONSTRUCTED IMMEDIATELY ADJACENT TO THE FLAT (50:1 OR FLATTER) LANDING AREA OF THE CURB RAMP OR SIDEWALK IN ACCORDANCE WITH CURRENT ADA BEST PRACTICES. THESE POLE BASES SHALL BE FLUSH WITH THE ADJOINING LANDING AREA. THE PEDESTRIAN PUSHBUTTON SHOULD BE INSTALLED AT A HEIGHT OF 42 TO 48 INCHES ABOVE THE LANDING AREA/SIDEWALK, AND SHALL BE LOCATED SUCH THAT THE MAXIMUM REACH DISTANCE IS 10 INCHES FROM THE LANDING AREA TO THE FACE OF THE PUSHBUTTON. PEDESTRIAN SIGNAL HEADS SHALL BE MOUNTED WITH THE BOTTOM OF THE SIGNAL HOUSING INCLUDING BRACKETS NOT LESS THAN 7 FEET OR MORE THAN 10 FEET ABOVE SIDEWALK LEVEL.
9. DELDOT TRAFFIC/TMC SHALL MODIFY SIGNAL PHASING, AS SHOWN.
10. ALL PEDESTRIAN SIGNALS SHALL CONTAIN COUNTDOWN DISPLAYS.
11. DELDOT TRAFFIC SHALL INSTALL BACKPLATES ON PROPOSED SIGNAL HEADS 6-9.
12. THE CONTRACTOR SHALL INSTALL THE PROPOSED JUNCTION WELL, TYPE 11, SO THAT IT INTERCEPTS EXISTING CONDUIT RUN NO. 4 AND PROPOSED CONDUIT RUN NO. 20.
13. DELDOT TRAFFIC SHALL REMOVE THE EXISTING SIGNAL HEADS, SIGNAL HEAD CABLES, AND OPTICOM RECEIVERS AND INSTALL THE PROPOSED SIGNAL HEADS, OPTICOM RECEIVERS, AND SIGNAL HEAD CABLES, AS SHOWN.

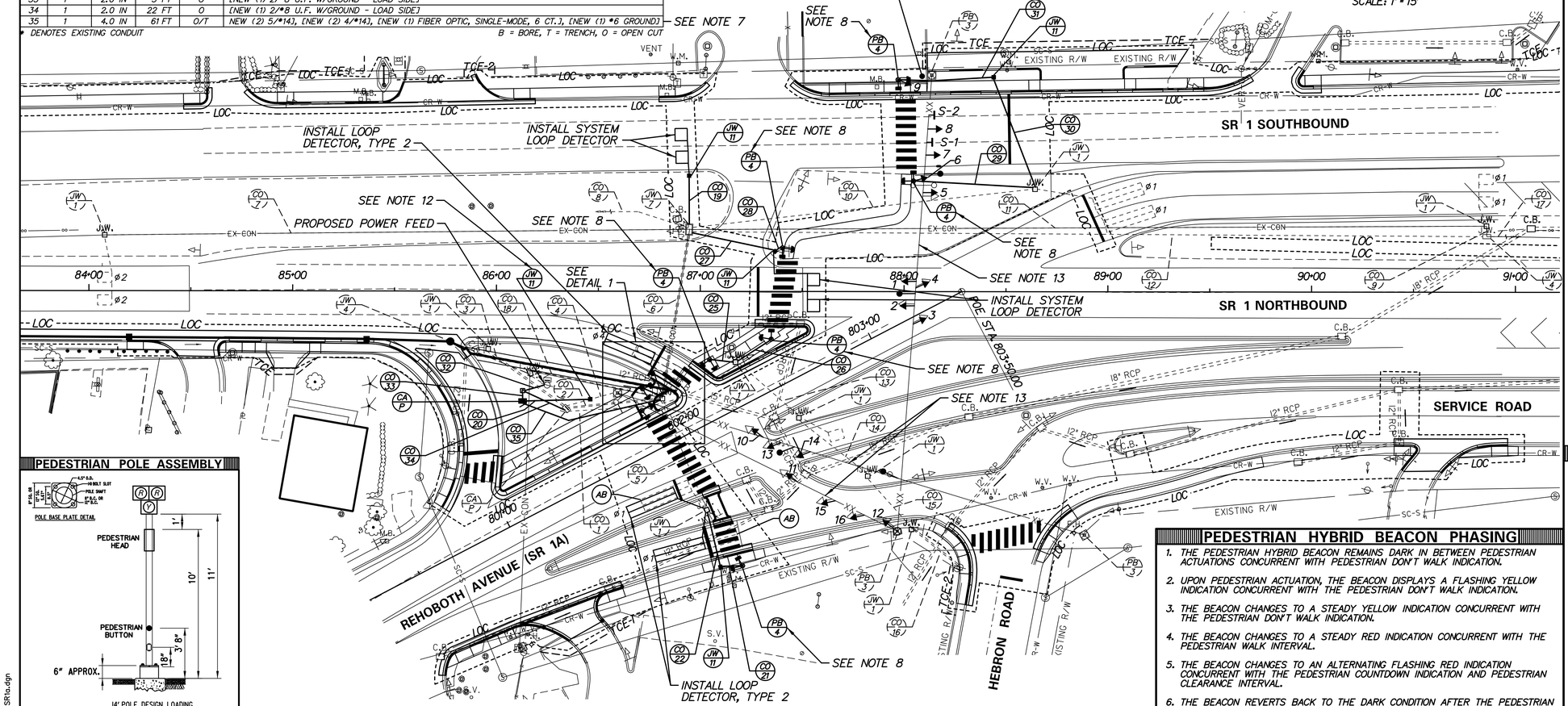
PROPOSED OVERHEAD SIGNS

S-1
R10-23
(30" x36")

S-2
W11-2
(48" x48")

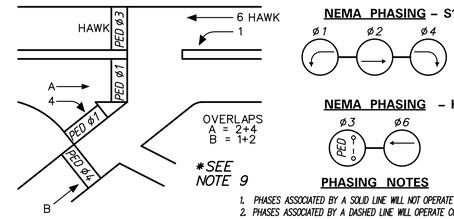


DETAIL 1
SCALE: 1" = 15'



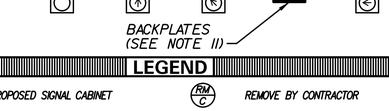
PEDESTRIAN POLE ASSEMBLY

SIGNAL PHASING



SIGNAL HEAD DIAGRAM

*ALL EXISTING SIGNAL HEADS SHALL BE REMOVED



LEGEND

PROPOSED SIGNAL CABINET		RM C	REMOVE BY CONTRACTOR
EXISTING SIGNAL CABINET		RM O	REMOVE BY OTHERS
PROPOSED SIGNAL POLE BASE		AB	ABANDON
EXISTING SIGNAL POLE BASE		PB X	PROPOSED POLE BASE IDENTIFIER (TYPE OF POLE BASE)
PROPOSED PEDESTRIAN POLE BASE		PB X	EXISTING POLE BASE IDENTIFIER (TYPE OF POLE BASE)
EXISTING PEDESTRIAN POLE BASE		JW X	PROPOSED JUNCTION WELL IDENTIFIER (TYPE OF JUNCTION WELL)
PROPOSED WOOD POLE		JW X	EXISTING JUNCTION WELL IDENTIFIER (TYPE OF JUNCTION WELL)
EXISTING UTILITY POLE		CO #	PROPOSED CONDUIT RUN IDENTIFIER (# OF CONDUIT RUN)
PROPOSED JUNCTION WELL		CO #	EXISTING CONDUIT RUN IDENTIFIER (# OF CONDUIT RUN)
EXISTING JUNCTION WELL		OH #	PROPOSED OVERHEAD RUN IDENTIFIER (# OF OVERHEAD RUN)
PROPOSED SIGNAL HEAD		OH #	EXISTING OVERHEAD RUN IDENTIFIER (# OF OVERHEAD RUN)
EXISTING SIGNAL HEAD		MA XX	PROPOSED MAST ARM IDENTIFIER (LENGTH OF ARM)
PROPOSED PEDESTRIAN SIGNAL HEAD		MA XX	EXISTING MAST ARM IDENTIFIER (LENGTH OF ARM)
EXISTING PEDESTRIAN SIGNAL HEAD		CA X	PROPOSED CABINET IDENTIFIER (TYPE OF CABINET)
PROPOSED PEDESTRIAN PUSHBUTTON		CA X	EXISTING CABINET IDENTIFIER (TYPE OF CABINET)
EXISTING PEDESTRIAN PUSHBUTTON			PROPOSED SPAN WIRE
PROPOSED VIDEO DETECTION		XX	EXISTING SPAN WIRE
EXISTING VIDEO DETECTION			RIGHT-OF-WAY OR PROPERTY LINE
PROPOSED MICROWAVE DETECTION			PROPOSED SPAN INSULATOR
EXISTING MICROWAVE DETECTION			EXISTING SPAN INSULATOR
OVERHEAD SIGNING		P	SERVICE PEDESTAL
PROPOSED OPTICOM RECEIVER			
EXISTING OPTICOM RECEIVER			
PROPOSED MAST ARM			
EXISTING MAST ARM			
PROPOSED LUMINAIRE			
EXISTING LUMINAIRE			
PROPOSED LOOP DETECTOR (TYPE 1 OR 2)			EXISTING LOOP DETECTOR (TYPE 1 OR 2)

PEDESTRIAN HYBRID BEACON PHASING

1. THE PEDESTRIAN HYBRID BEACON REMAINS DARK IN BETWEEN PEDESTRIAN ACTUATIONS CONCURRENT WITH PEDESTRIAN DON'T WALK INDICATION.
2. UPON PEDESTRIAN ACTUATION, THE BEACON DISPLAYS A FLASHING YELLOW INDICATION CONCURRENT WITH THE PEDESTRIAN DON'T WALK INDICATION.
3. THE BEACON CHANGES TO A STEADY YELLOW INDICATION CONCURRENT WITH THE PEDESTRIAN DON'T WALK INDICATION.
4. THE BEACON CHANGES TO A STEADY RED INDICATION CONCURRENT WITH THE PEDESTRIAN WALK INTERVAL.
5. THE BEACON CHANGES TO AN ALTERNATING FLASHING RED INDICATION CONCURRENT WITH THE PEDESTRIAN COUNTDOWN INDICATION AND PEDESTRIAN CLEARANCE INTERVAL.
6. THE BEACON REVERTS BACK TO THE DARK CONDITION AFTER THE PEDESTRIAN CLEARANCE INTERVAL ENDS.

GENERAL SIGNAL NOTES

1. EXISTING LOOP DETECTORS (TO REMAIN):
   TYPE #1 - 5' x 7' - SOUTHBOUND SR 1 LEFT-TURN MOVEMENT AND NORTHBOUND SR 1 THROUGH MOVEMENT.
   TYPE #2 - 6' x 25' - SOUTHBOUND SR 1 LEFT-TURN MOVEMENT.
   SYSTEM - 5' x 7' - EASTBOUND SR 1A AND WESTBOUND SR 1A TO NORTHBOUND SR 1.

   PROPOSED LOOP DETECTORS:
   TYPE #2 - 6' x 25' - TO BE INSTALLED ON NORTHBOUND SR 1 RIGHT-TURN MOVEMENT AND SR 1A MOVEMENTS.
   SYSTEM - 6' x 6' - TO BE INSTALLED IN SR 1 RECEIVING LANES, AS SHOWN.
2. ALL GALVANIZED CONDUIT (GRC) SHALL BE REAMED AND THREADED. ALL GRC SHALL BE THREADED TOGETHER WITH APPROVED COUPLINGS. SET, SCREW, BOLTED, AND COMPRESSION FITTING ARE NOT ACCEPTABLE.
3. ALL SIGNAL EQUIPMENT REMOVED FROM A PROJECT IS TO BE RETURNED TO DELDOT TRAFFIC - DOVER, DELAWARE.
4. CONDUIT JUNCTION WELLS ARE TO BE REMOVED IN ACCORDANCE WITH SECTION 201 AND 202 OF THE STANDARD SPECIFICATIONS OR AS DIRECTED BY ENGINEER. EXISTING CONDUIT IS TO BE ABANDONED.
5. ALL UNDERGROUND AND OVERHEAD UTILITIES SHOWN ON THESE PLANS ARE SCHEMATIC ONLY AND MAY NOT BE COMPLETE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING MISS UTILITY, AND/OR THE APPROPRIATE UTILITY PRIOR TO THE BEGINNING OF CONSTRUCTION FOR THE UTILITY MARKOUTS. IF THE CONTRACTOR PERCEIVES THAT A CONFLICT BETWEEN UTILITIES AND THE TRAFFIC SIGNAL WILL OCCUR, THE CONTRACTOR SHALL NOTIFY DELDOT TRAFFIC IMMEDIATELY BEFORE CONSTRUCTION.

RECOMMENDED _____ DATE:_____

RECOMMENDED _____ DATE:_____

RECOMMENDED _____ DATE:_____

APPROVED TRAFFIC ENGINEER _____ DATE:_____

APPROVED FOR INSTALLATION
CHIEF TRAFFIC ENGINEER _____ DATE:_____

DELAWARE DEPARTMENT OF TRANSPORTATION

ADDENDUM / REVISIONS

SCALE
0 30 60 90
FEET

SR 1, REHOBOTH CANAL TO NORTH OF FIVE POINTS - PEDESTRIAN IMPROVEMENTS

CONTRACT	PERMIT NO.	S119
T200612501	DESIGNED BY: D.W.C. (WR&A)	
COUNTY	CHECKED BY: M.J.B. (WR&A)	
SUSSEX		

SIGNAL PLAN
SR 1 @ SR 1A
(REHOBOTH AVENUE)

SHEET NO.
201
TOTAL SHTS.
220

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CONDUIT RUN SCHEDULE

CO*	# OF CONDUITS	SIZE	LENGTH	B/T/O	AMOUNT AND TYPE OF CABLE/ WIRE	
1	1	2.0 IN	5 FT	T	(1) 2/#8 U.F. W/GROUND - LOAD SIDE	
2	3	4.0 IN	3 FT	T	(1) FIBER OPTIC, SINGLE-MODE, 6 CT., (4) 5/#14, (2) 9/#14, (8) 2/#14, (4) 4/#14, (3) #6 GROUND	
3	1	4.0 IN	58 FT	B	(1) 9/#14, (1) #6 GROUND	
4	1	3.0 IN	5 FT	T	(1) 9/#14, (1) #6 GROUND	
5	1	2.0 IN	40 FT	T	(1) 2/#8 U.F. W/GROUND - LINE SIDE	
6	2	4.0 IN	42 FT	T	(1) 9/#14, (4) 5/#14, (8) 2/#14, (4) 4/#14, (2) #6 GROUND	
7	1	4.0 IN	80 FT	B	(1) FIBER OPTIC, SINGLE-MODE, 6 CT.	SEE NOTE 8
8	2	4.0 IN	66 FT	B	(1) 9/#14, (3) 5/#14, (8) 2/#14, (3) 4/#14, (2) #6 GROUND	
9	1	4.0 IN	117 FT	T	(1) FIBER OPTIC, SINGLE-MODE, 6 CT.	SEE NOTE 8
10	1	4.0 IN	35 FT	T	(4) 2/#14, (1) 5/#14, (1) 4/#14, (1) #6 GROUND	
11	1	2.5 IN	7 FT	T	(1) 5/#14, (1) 4/#14, (1) #6 GROUND	
12	1	4.0 IN	125 FT	T	(4) 2/#14, (1) #6 GROUND	
13	1	2.5 IN	13 FT	T	(1) 5/#14, (1) 4/#14, (1) #6 GROUND	
14	1	2.5 IN	12 FT	T	(1) 5/#14, (1) 4/#14, (1) #6 GROUND	
15	1	4.0 IN	85 FT	B	(1) 9/#14, (1) 5/#14, (1) 4/#14, (1) #6 GROUND	
16	1	2.5 IN	14 FT	T	(1) 5/#14, (1) 4/#14, (1) #6 GROUND	
17	1	3.0 IN	24 FT	T	(1) 9/#14, (1) #6 GROUND	
18*	1	2.5 IN	348 FT	-	EX. (1) COMM. CABLE, EX. (1) FIBER OPTIC, SINGLE-MODE, 12 CT., EX. (1) FIBER OPTIC, SINGLE-MODE, 24 CT., EX. (1) FIBER OPTIC, SINGLE-MODE, 48 CT.	
19*	1	2.5 IN	362 FT	-	EX. (1) COMM. CABLE, EX. (1) FIBER OPTIC, SINGLE-MODE, 12 CT., EX. (1) FIBER OPTIC, SINGLE-MODE, 24 CT., EX. (1) FIBER OPTIC, SINGLE-MODE, 48 CT.	
20	1	4.0 IN	75 FT	T	(4) 2/#14, (1) #6 GROUND	

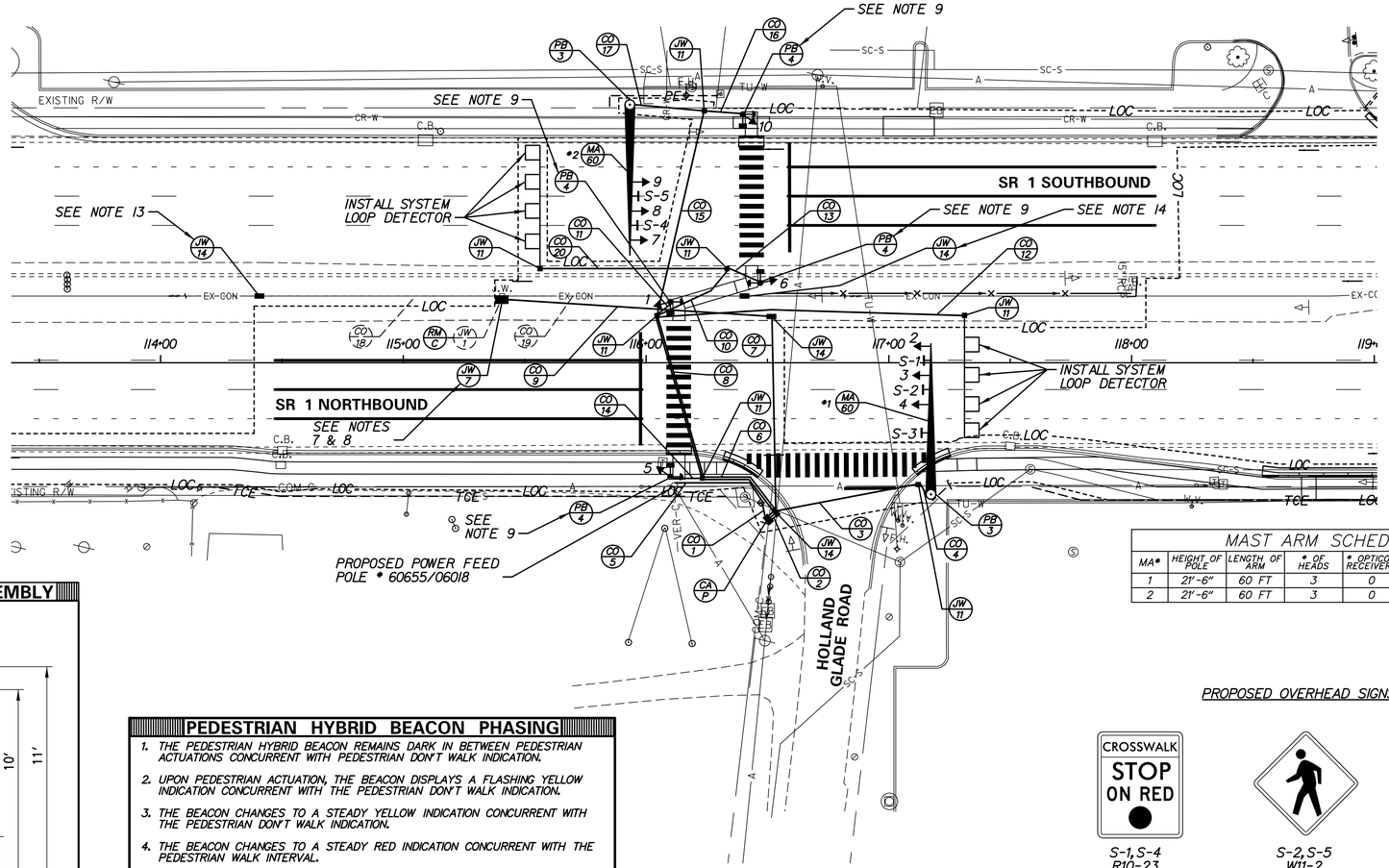
* DENOTES EXISTING CONDUIT

B = BORE, T = TRENCH, O = OPEN CUT

** ALL CABLES ARE NEW UNLESS OTHERWISE NOTED

NOTES:

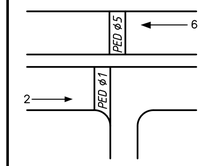
7. THE CONTRACTOR SHALL REMOVE THE EXISTING JUNCTION WELL, TYPE 1, AND INSTALL THE PROPOSED JUNCTION WELL, TYPE 7.
8. THE INSTALLATION OF INNERDUCT, INSTALLATION OF ALL FIBER OPTIC CABLE, AND SPLICING OF THE EXISTING FIBER OPTIC CABLE TO PROPOSED (1) FIBER OPTIC, SINGLE-MODE, 6 CT. CABLE SHALL BE COMPLETED BY DELDOT OIT.
9. PROPOSED POLE BASES SUPPORTING POLES WITH PEDESTRIAN PUSHBUTTONS SHALL BE CONSTRUCTED IMMEDIATELY ADJACENT TO THE FLAT (50:1 OR FLATTER) LANDING AREA OF THE CURB RAMP OR SIDEWALK IN ACCORDANCE WITH CURRENT ADA BEST PRACTICES. THESE POLE BASES SHALL BE FLUSH WITH THE ADJOINING LANDING AREA. THE PEDESTRIAN PUSHBUTTON SHOULD BE INSTALLED AT A HEIGHT OF 42 TO 48 INCHES ABOVE THE LANDING AREA/SIDEWALK, AND SHALL BE LOCATED SUCH THAT THE MAXIMUM REACH DISTANCE IS 10 INCHES FROM THE LANDING AREA TO THE FACE OF THE PUSHBUTTON. PEDESTRIAN SIGNAL HEADS SHALL BE MOUNTED WITH THE BOTTOM OF THE SIGNAL HOUSING INCLUDING BRACKETS NOT LESS THAN 7 FEET OR MORE THAN 10 FEET ABOVE SIDEWALK LEVEL.
10. ALL PEDESTRIAN SIGNALS SHALL CONTAIN COUNTDOWN DISPLAYS.
11. PROPOSED SIGNAL HEADS 1,5,6, AND 10 SHALL BE MOUNTED ON A PEDESTRIAN POLE SO THAT THE BOTTOM OF THE HEAD IS 11 FEET ABOVE THE GROUND, AS SHOWN IN THE PEDESTRIAN POLE ASSEMBLY DETAIL.
12. DELDOT TRAFFIC SHALL INSTALL BACKPLATES ON PROPOSED SIGNAL HEADS 1-10.
13. THE CONTRACTOR SHALL INSTALL THE PROPOSED JUNCTION WELL, TYPE 14, SO THAT IT INTERCEPTS EXISTING CONDUIT RUN NO. 18.
14. THE CONTRACTOR SHALL INSTALL THE PROPOSED JUNCTION WELL, TYPE 14, SO THAT IT INTERCEPTS EXISTING CONDUIT RUN NO. 19.



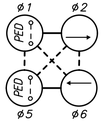
MAST ARM SCHEDULE

MA*	HEIGHT OF POLE	LENGTH OF ARM	# OF HEADS	# OPTICOM RECEIVERS	SF OF BR SIGNING	ARM MOUNT HEIGHT
1	21'-6"	60 FT	3	0	37.0 S.F.	20'-0"
2	21'-6"	60 FT	3	0	23.5 S.F.	20'-0"

SIGNAL PHASING



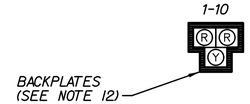
NEMA PHASING



PHASING NOTES

1. PHASES ASSOCIATED BY A SOLID LINE WILL NOT OPERATE CONCURRENTLY.
2. PHASES ASSOCIATED BY A DASHED LINE WILL OPERATE CONCURRENTLY.

SIGNAL HEAD DIAGRAM



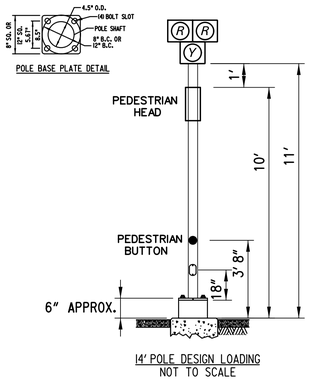
LEGEND

- PROPOSED SIGNAL CABINET
- EXISTING SIGNAL CABINET
- PROPOSED SIGNAL POLE BASE
- EXISTING SIGNAL POLE BASE
- PROPOSED PEDESTRIAN POLE BASE
- EXISTING PEDESTRIAN POLE BASE
- PROPOSED WOOD POLE
- EXISTING UTILITY POLE
- PROPOSED JUNCTION WELL
- EXISTING JUNCTION WELL
- PROPOSED SIGNAL HEAD
- EXISTING SIGNAL HEAD
- PROPOSED PEDESTRIAN SIGNAL HEAD
- EXISTING PEDESTRIAN SIGNAL HEAD
- PROPOSED PEDESTRIAN PUSHBUTTON
- EXISTING PEDESTRIAN PUSHBUTTON
- PROPOSED VIDEO DETECTION
- EXISTING VIDEO DETECTION
- PROPOSED MICROWAVE DETECTION
- EXISTING MICROWAVE DETECTION
- OVERHEAD SIGNING
- PROPOSED OPTICOM RECEIVER
- EXISTING OPTICOM RECEIVER
- PROPOSED MAST ARM
- EXISTING MAST ARM
- PROPOSED LUMINAIRE
- EXISTING LUMINAIRE
- PROPOSED LOOP DETECTOR (TYPE 1 OR 2)
- EXISTING LOOP DETECTOR (TYPE 1 OR 2)
- REMOVE BY CONTRACTOR
- REMOVE BY OTHERS
- ABANDON
- PROPOSED POLE BASE IDENTIFIER (TYPE OF POLE BASE)
- EXISTING POLE BASE IDENTIFIER (TYPE OF POLE BASE)
- PROPOSED JUNCTION WELL IDENTIFIER (TYPE OF JUNCTION WELL)
- EXISTING JUNCTION WELL IDENTIFIER (TYPE OF JUNCTION WELL)
- PROPOSED CONDUIT RUN IDENTIFIER (# OF CONDUIT RUN)
- EXISTING CONDUIT RUN IDENTIFIER (# OF CONDUIT RUN)
- PROPOSED OVERHEAD RUN IDENTIFIER (# OF OVERHEAD RUN)
- EXISTING OVERHEAD RUN IDENTIFIER (# OF OVERHEAD RUN)
- PROPOSED MAST ARM IDENTIFIER (LENGTH OF ARM)
- EXISTING MAST ARM IDENTIFIER (LENGTH OF ARM)
- PROPOSED CABINET IDENTIFIER (TYPE OF CABINET)
- EXISTING CABINET IDENTIFIER (TYPE OF CABINET)
- PROPOSED SPAN WIRE
- EXISTING SPAN WIRE
- RIGHT-OF-WAY OR PROPERTY LINE
- PROPOSED SPAN INSULATOR
- EXISTING SPAN INSULATOR
- SERVICE PEDESTAL

GENERAL SIGNAL NOTES

1. PROPOSED LOOP DETECTORS:
   SYSTEM - 6' x 6' - TO BE INSTALLED IN SR 1 RECEIVING LANES, AS SHOWN.
2. ALL GALVANIZED CONDUIT (GRC) SHALL BE REAMED AND THREADED. ALL GRC SHALL BE THREADED TOGETHER WITH APPROVED COUPLINGS. SET, SCREW, BOLTED, AND COMPRESSION FITTING ARE NOT ACCEPTABLE.
3. ALL SIGNAL EQUIPMENT REMOVED FROM A PROJECT IS TO BE RETURNED TO DELDOT TRAFFIC - DOVER, DELAWARE.
4. CONDUIT JUNCTION WELLS ARE TO BE REMOVED IN ACCORDANCE WITH SECTION 201 AND 202 OF THE STANDARD SPECIFICATIONS OR AS DIRECTED BY ENGINEER. EXISTING CONDUIT IS TO BE ABANDONED.
5. ALL UNDERGROUND AND OVERHEAD UTILITIES SHOWN ON THESE PLANS ARE SCHEMATIC ONLY AND MAY NOT BE COMPLETE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING MISS UTILITY, AND/OR THE APPROPRIATE UTILITY PRIOR TO THE BEGINNING OF CONSTRUCTION FOR THE UTILITY MARKOUTS. IF THE CONTRACTOR PERCEIVES THAT A CONFLICT BETWEEN UTILITIES AND THE TRAFFIC SIGNAL WILL OCCUR, THE CONTRACTOR SHALL NOTIFY DELDOT TRAFFIC IMMEDIATELY BEFORE CONSTRUCTION.
6. ALL PROPOSED SIGNAL POLES ARE DELDOT MAST ARMS.

PEDESTRIAN POLE ASSEMBLY



14' POLE DESIGN LOADING
NOT TO SCALE

PEDESTRIAN HYBRID BEACON PHASING

1. THE PEDESTRIAN HYBRID BEACON REMAINS DARK IN BETWEEN PEDESTRIAN ACTUATIONS CONCURRENT WITH PEDESTRIAN DON'T WALK INDICATION.
2. UPON PEDESTRIAN ACTUATION, THE BEACON DISPLAYS A FLASHING YELLOW INDICATION CONCURRENT WITH THE PEDESTRIAN DON'T WALK INDICATION.
3. THE BEACON CHANGES TO A STEADY YELLOW INDICATION CONCURRENT WITH THE PEDESTRIAN DON'T WALK INDICATION.
4. THE BEACON CHANGES TO A STEADY RED INDICATION CONCURRENT WITH THE PEDESTRIAN WALK INTERVAL.
5. THE BEACON CHANGES TO AN ALTERNATING FLASHING RED INDICATION CONCURRENT WITH THE PEDESTRIAN COUNTDOWN INDICATION AND PEDESTRIAN CLEARANCE INTERVAL.
6. THE BEACON REVERTS BACK TO THE DARK CONDITION AFTER THE PEDESTRIAN CLEARANCE INTERVAL ENDS.

PROPOSED OVERHEAD SIGNS

S-1, S-4
R10-23
(30" x 36")

S-2, S-5
W11-2
(48" x 48")

S-3
D3-1 (108" x 18")
8" & 6" D-SERIES
FREE-SWINGING MOUNTS

RECOMMENDED _____ DATE:_____ | RECOMMENDED _____ DATE:_____ | RECOMMENDED _____ DATE:_____ | APPROVED TRAFFIC ENGINEER _____ DATE:_____ | APPROVED FOR INSTALLATION CHIEF TRAFFIC ENGINEER _____ DATE:_____

DELAWARE
DEPARTMENT OF TRANSPORTATION

ADDENDUM / REVISIONS

SCALE
0 30 60 90
FEET

SR 1, REHOBOTH CANAL TO NORTH OF FIVE POINTS - PEDESTRIAN IMPROVEMENTS

CONTRACT	PERMIT NO.	SXXX
T200612501	DESIGNED BY: D.W.C. (WR&A)	
COUNTY	CHECKED BY: M.J.B. (WR&A)	
SUSSEX		

PEDESTRIAN HYBRID BEACON SIGNAL PLAN
SR 1 @
HOLLAND GLADE ROAD

SHEET NO.	TOTAL SHTS.
204	220

N:\31533-022\CADD\SIG04_SR1@HollandGlade.dgn
4/22/2014 11:18:55 AM

FINAL PLANS

ADDITIONAL NOTES

7. THE PEDESTRIAN PUSHBUTTONS SHOULD BE INSTALLED AT A HEIGHT OF 42 TO 48 INCHES ABOVE THE LANDING AREA/SIDEWALK, AND SHALL BE LOCATED SUCH THAT THE MAXIMUM REACH DISTANCE IS 10 INCHES FROM THE LANDING AREA TO THE FACE OF THE PUSHBUTTON. PEDESTRIAN SIGNAL HEADS SHALL BE MOUNTED WITH THE BOTTOM OF THE SIGNAL HOUSING INCLUDING BRACKETS NOT LESS THAN 7 FEET OR MORE THAN 10 FEET ABOVE SIDEWALK LEVEL. ALL PEDESTRIAN SIGNAL HEADS WILL BE COUNTDOWN SIGNALS.

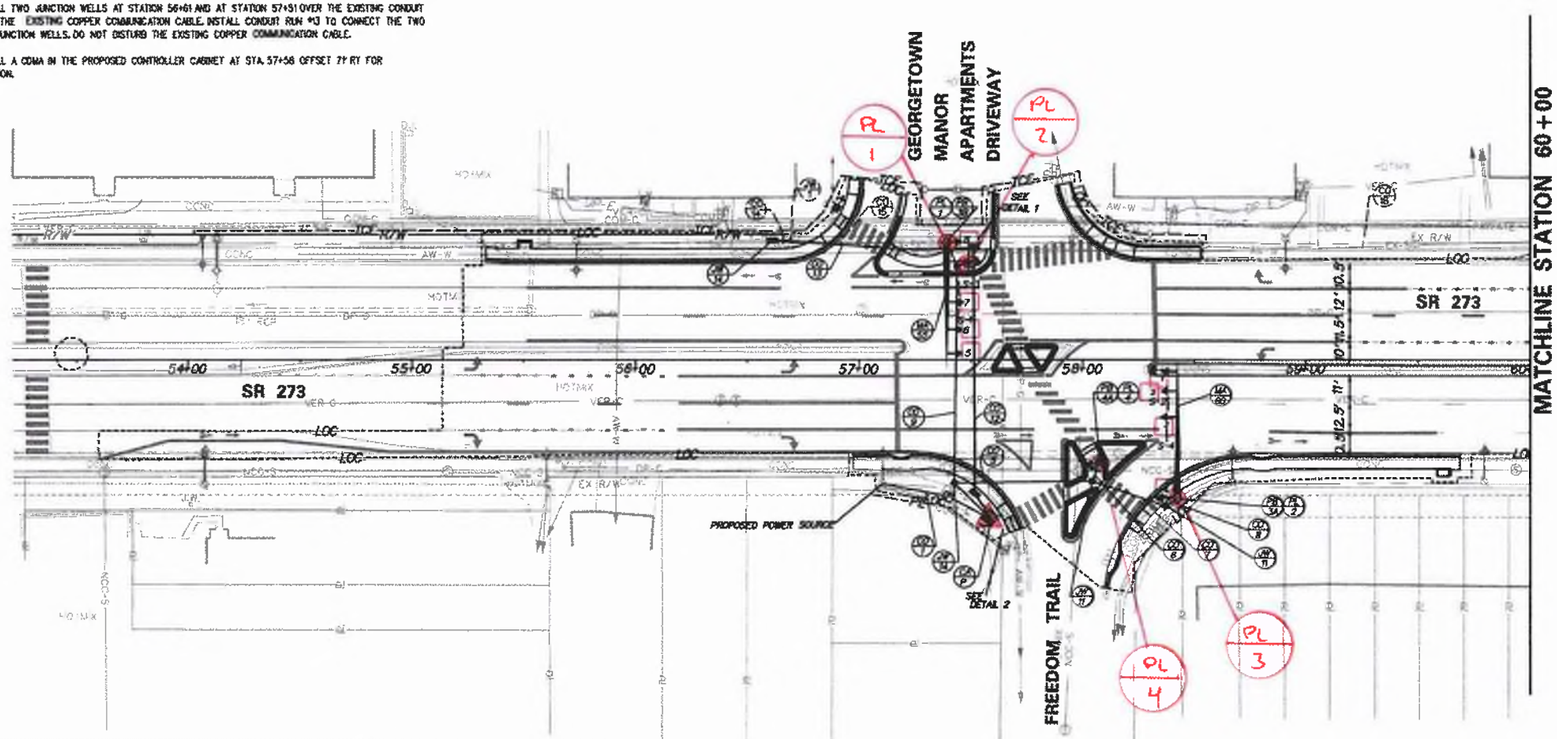
8. POWER FOR THE PROPOSED TRAFFIC CONTROLLER CABINET WILL BE PROVIDED FROM THE DELMARVA UTILITY POLE (#46150-40893) LOCATED ALONG SR 273 AT STATION 57+71, OFFSET 55' RIGHT.

9. INSTALL BACKPLATES ON PROPOSED SIGNAL HEADS 1-8. A 2" REFLECTIVE YELLOW STRIPING WILL BE INSTALLED ON THE BORDER OF THE BACKPLATES.

10. INSTALL TWO JUNCTION WELLS AT STATION 56+61 AND AT STATION 57+51 OVER THE EXISTING CONDUIT CONTAINING THE EXISTING COPPER COMMUNICATION CABLE. INSTALL CONDUIT RUN #13 TO CONNECT THE TWO PROPOSED JUNCTION WELLS. DO NOT DISTURB THE EXISTING COPPER COMMUNICATION CABLE.

11. INSTALL A CDMA IN THE PROPOSED CONTROLLER CABINET AT STA. 57+58 OFFSET 71' RT FOR COMMUNICATION.

FINAL



CONDUIT RUN SCHEDULE

CR#	# OF CONDUITS	SIZE	B/T/O	LENGTH	AMOUNT AND TYPE OF CABLE / WIRE
1	1 (GALV STEEL)	2"	T	30'	(1)2/#8 U.F. W/GROUND
2	1 (GALV STEEL)	2"	T	20'	(1)2/#8 U.F. W/GROUND
3	1	4"	T	15'	EMPTY
4	3	3"	T	25'	(2)9/#14, (2)5/#14, (1)1/#6 GRD
5	1 (SCHD 80 HDPE)	4"	B	65'	(1)9/#14, (1)5/#14, (1)1/#6 GRD
6	1	2.5"	T	10'	(1)5/#14, (1)1/#6 GRD
7	1 (SCHD 80 HDPE)	4"	B	35'	(1)9/#14, (1)1/#6 GRD
8	1	3"	T	10'	(1)9/#14, (1)1/#6 GRD
9	1 (SCHD 80 HDPE)	4"	B	100'	(1)9/#14, (1)5/#14, (1)1/#6 GRD
10	1	2.5"	T	5'	(1)5/#14, (1)1/#6 GRD
11	1	3"	T	15'	(1)9/#14, (1)1/#6 GRD
12	1 (SCHD 80 HDPE)	4"	B	110'	EMPTY
13	1 (SCHD 80 HDPE)	4"	B	95'	EMPTY
#14	1	3"	-	10'	EXISTING COPPER CABLE
#15	1	4"	-	85'	EXISTING COPPER CABLE
#16	1	4"	-	275'	EXISTING COPPER CABLE

* EXISTING OR CONSTRUCTED DURING PREVIOUS PHASE
NOTE: ALL CONDUITS WILL BE SCHEDULE 80 PVC UNLESS OTHERWISE NOTED

POLE SCHEDULE

NO.	TYPE	STATION	OFFSET
1	55' MAST ARM W/ TYPE 3B BASE	57+39'	52' LT
2	60' MAST ARM W/ TYPE 3A BASE	58+42'	62' RT
3	PEDESTRIAN POLE W/ TYPE 4A BASE	57+48'	43' LT
4	PEDESTRIAN POLE W/ TYPE 4A BASE	58+08'	45' RT

* EXISTING OR CONSTRUCTED DURING PREVIOUS PHASE

As Built 3-15-18 MJP/MSK

JUNCTION WELL AND CABINET SCHEDULE

NO.	STATION	OFFSET
CA	57+58'	71' RT
14	57+52'	60' RT
11	58+04'	54' RT
11	58+37'	65' RT
7	57+51'	50' LT
14	57+43'	55' RT
14	56+61'	53' LT
11	57+44'	42' LT

* EXISTING OR CONSTRUCTED DURING PREVIOUS PHASE

SIGNAL PHASING

1. THE PEDESTRIAN HYBRID BEACON REMAINS DARK (NOT ILLUMINATED) DURING PERIOD BETWEEN ACTUATIONS CONCURRENT WITH PEDESTRIAN DON'T WALK INDICATION.
2. UPON PEDESTRIAN ACTUATION, THE BEACON DISPLAYS A FLASHING YELLOW INDICATION CONCURRENT WITH THE PEDESTRIAN DON'T WALK INDICATION.
3. THE BEACON CHANGES TO A STEADY YELLOW INDICATION CONCURRENT WITH THE PEDESTRIAN DON'T WALK INDICATION.
4. THE BEACON CHANGES TO A STEADY RED INDICATION CONCURRENT WITH THE PEDESTRIAN WALK INTERVAL.
5. THE BEACON CHANGES TO AN ALTERNATING FLASHING RED INDICATION CONCURRENT WITH THE PEDESTRIAN COUNTDOWN INDICATION AND PEDESTRIAN CLEARANCE INTERVAL.
6. THE BEACON REVERTS BACK TO THE DARK CONDITION AFTER THE PEDESTRIAN CLEARANCE INTERVAL ENDS.

SIGNAL HEAD DIAGRAM

1 - 8

LEGEND

AB	ABANDON	EXISTING CABINET RUN IDENTIFIER (# OF CONDUIT RUN)	
EC	EXISTING CABINET IDENTIFIER (TYPE OF CABINET)	PROPOSED JUNCTION RUN IDENTIFIER (# OF CONDUIT RUN)	
PC	PROPOSED CABINET IDENTIFIER (TYPE OF CABINET)	EXISTING POLE BASE IDENTIFIER (TYPE OF POLE BASE)	
EJ	EXISTING CONDUIT RUN IDENTIFIER (# OF CONDUIT RUN)	PROPOSED POLE BASE IDENTIFIER (TYPE OF POLE BASE)	
PJ	PROPOSED CONDUIT RUN IDENTIFIER (# OF CONDUIT RUN)	EXISTING POLE IDENTIFIER (# OF POLE)	
EJ	EXISTING JUNCTION WELL IDENTIFIER (TYPE OF JUNCTION WELL)	PROPOSED POLE IDENTIFIER (# OF POLE)	
PJ	PROPOSED JUNCTION WELL IDENTIFIER (TYPE OF JUNCTION WELL)	REMOVE BY CONTRACTOR	
EM	EXISTING MAST ARM IDENTIFIER (LENGTH OF ARM)	REMOVE BY OTHERS	
PM	PROPOSED MAST ARM IDENTIFIER (LENGTH OF ARM)	REMOVE BY TRAFFIC CONTRACTOR	

	EXISTING SYMBOL	PROPOSED SYMBOL
JUNCTION WELL	JW	
LOOP DETECTOR, TYPE 1		
LOOP DETECTOR, TYPE 2		
LUMINAIRE		
MAST ARM		
MICROWAVE DETECTION		
OPTICOM RECEIVER		
OVERHEAD SIGNING		
PEDESTRIAN POLE/BASE		
PEDESTRIAN PUSHBUTTON		
PEDESTRIAN SIGNAL HEAD		
RIGHT-OF-WAY	R/W	R/W
SERVICE PEDESTAL		
SIGNAL CABINET		
SIGNAL HEAD		
SIGNAL POLE/BASE		
SPAN INSULATOR		
SPAN WIRE		
UTILITY POLE		
VIDEO DETECTION		

GENERAL SIGNAL NOTES

1. ALL MAST ARM SIGNAL POLES WILL BE 21.5 FEET, EXCEPT WHERE SHOWN.
2. ALL SIGNAL EQUIPMENT REMOVED FROM A PROJECT IS TO BE RETURNED TO DELDOT TRAFFIC - DOVER, DELAWARE.
3. POLE BASES, CABINET BASE AND CONDUIT JUNCTION WELLS TO BE REMOVED IN ACCORDANCE WITH SECTION 201 AND 202 OF THE STANDARD SPECIFICATIONS OR AS DIRECTED BY ENGINEER. EXISTING CONDUIT IS TO BE ABANDONED.
4. ALL GALVANIZED CONDUIT (GRC) SHALL BE REAMED AND THREADED. ALL GRC SHALL BE THREADED TOGETHER WITH APPROVED COUPLINGS. SET SCREW, BOLTED, AND COMPRESSION FITTING ARE NOT ACCEPTABLE.
5. ALL UNDERGROUND AND OVERHEAD UTILITIES SHOWN ON THESE PLANS ARE SCHEMATIC ONLY AND MAY NOT BE COMPLETE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING MISS UTILITY, AND/OR THE APPROPRIATE UTILITY PRIOR TO THE BEGINNING OF CONSTRUCTION FOR THE UTILITY MARKOUTS. IF THE CONTRACTOR PERCEIVES THAT A CONFLICT BETWEEN UTILITIES AND THE TRAFFIC SIGNAL WILL OCCUR, THE CONTRACTOR SHALL NOTIFY DELDOT TRAFFIC IMMEDIATELY BEFORE CONSTRUCTION.
6. PROPOSED POLE BASES SUPPORTING POLES WITH PEDESTRIAN PUSHBUTTONS SHALL BE CONSTRUCTED IMMEDIATELY ADJACENT TO THE FLAT (5.0% OR FLATTER) LANDING AREA OF THE CURB RAMP OR SIDEWALK IN ACCORDANCE WITH CURRENT ADA BEST PRACTICES. FIELD ADJUST THE LOCATION OF THE PEDESTRIAN POLE BASES ON THE NORTH SIDE AND SOUTHWEST CORNER, AS NEEDED. THESE POLE BASES SHALL BE FLUSH WITH THE ADJOINING LANDING AREA.

RECOMMENDED Mir Hakeel DATE: 2/16/17	RECOMMENDED DATE:	RECOMMENDED DATE:	APPROVED TRAFFIC ENGINEER DATE: 2/20/17

APPROVED FOR INSTALLATION CHIEF TRAFFIC ENGINEER DATE: 2/22/17

DELAWARE DEPARTMENT OF TRANSPORTATION

ADDENDUM / REVISIONS

SCALE 0 30 60 90 FEET

HAWK SIGNAL AT SR 273 AND FREEDOM TRAIL

CONTRACT	N/A
COUNTY	NEW CASTLE
PERMIT NO.	N813
DESIGNED BY:	JDS (JMT)
CHECKED BY:	MAW (JMT)

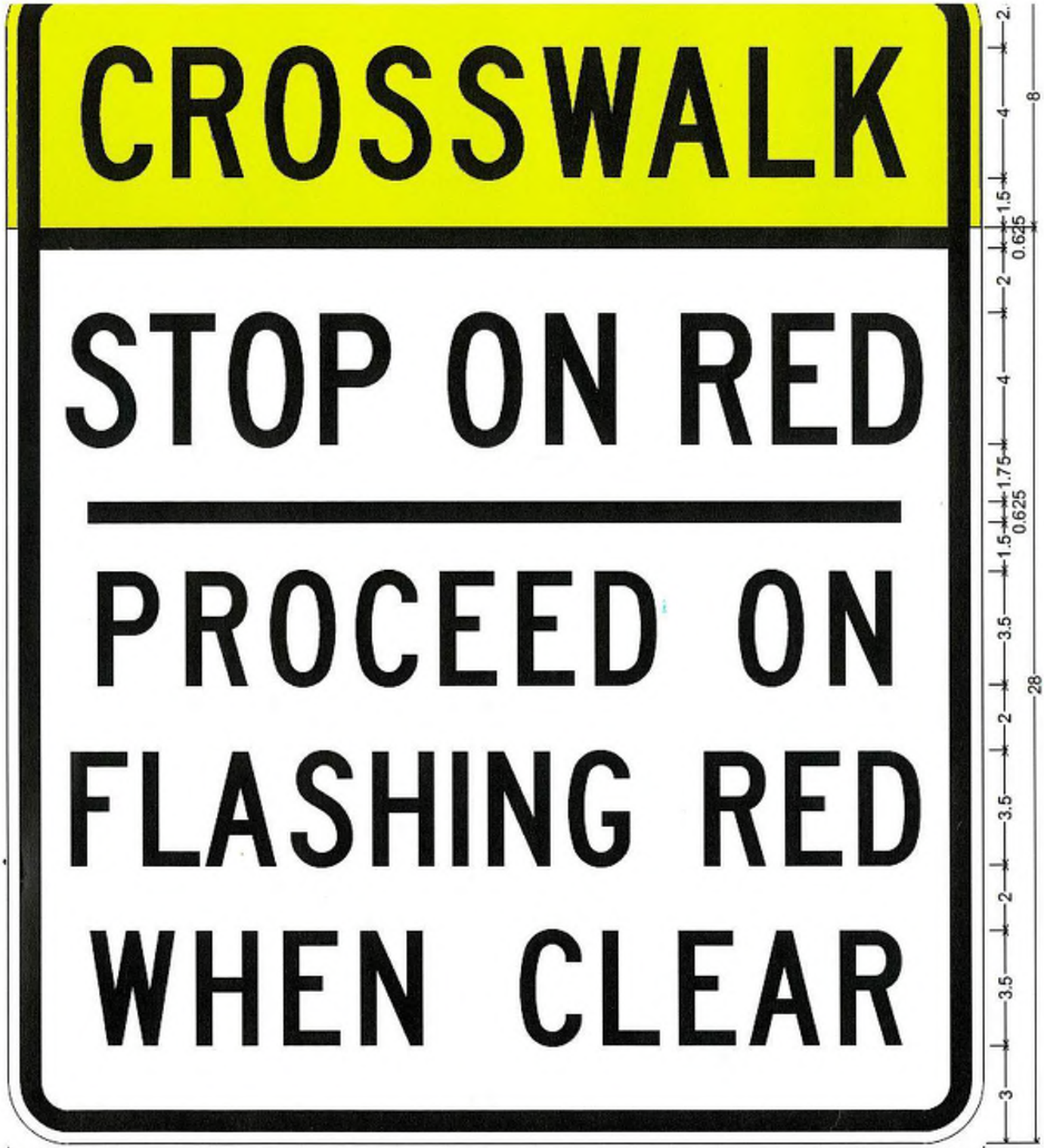
HAWK SIGNAL PLAN (PEDESTRIAN HYBRID BEACON) SR 273 (CHRISTIANA ROAD) @ FREEDOM TRAIL

SHEET NO.	18
TOTAL SHTS.	19

PLOTTED BY: JDSMITH DATE: 2/16/2017
FILE LOCATION: D:\NBK\110500.002_SR_273_APPLEBY_ROAD_\CADD\HAWK SIGNAL BREAKOUT\SG ULT PRINT FILES.DGN [SHEET: SG01]

APPENDIX H

Proposed sign for HAWK beacons



1.875" Radius, 0.625" Border, 0.375" Indent, Black on White;

"STOP" C specified length; "ON" C specified length; "RED" C specified length; "PROCEED" C specified length;