



Delaware Department
of Transportation

HAWK Pedestrian Signal Compliance Review

December 2017



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 four (4) 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 motorists' compliance 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 25% of motorists were observed disregarding the red signal. The latest findings from all four (4) of Delaware's HAWK beacon installations are briefly summarized below:

- **SR 72 at Farm Lane; Newark, DE:** The most recent observations showed a relatively high level of motorist compliance (92%) with the HAWK signal. During the previous compliance studies at this location, it was relatively uncommon for a pedestrian to be 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. It should be noted that at this location, 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.
- **SR 8 at Heatherfield Way, near Dover High School; Dover, DE:** Recent observations showed a relatively high level of motorists' compliance (91%) with 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. This occurred one (1) to two (2) times each day in 2016 during the AM peak observations. However, more recently, this occurred only once during the 2017 observations.
- **SR 1 at Rehoboth Avenue; Rehoboth Beach, DE:** Recent observations showed a relatively modest level of compliance (72%) with the HAWK signal. Recent observations revealed that the majority (57%) of pedestrians and bicyclists that activate the HAWK signal, cross before the HAWK signal activated. 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. This may be a factor in the increase of vehicles disregarding the HAWK signal between 2016 and 2017.
- **SR 1 at Holland Glade Road; Rehoboth Beach, DE:** Recent observations at the HAWK signal showed a decrease in the level of motorist compliance, from a high of 97% in 2016 down to 78% in 2017. 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'.

Following the 2016 HAWK Compliance Study, DeIDOT installed new regulatory signs at the HAWK signals along SR 1, which state “Crosswalk, Stop on Red, Proceed on Flashing Red When Clear” (See Appendix G). The results from 2017 showed that this sign may have had a positive effect on motorists’ behavior at both HAWK signals. The results from the 2017 observations at Rehoboth Avenue showed that approximately 74% of motorists departed from the intersection correctly in 2017, up from only 28% in 2016. Similarly, the results from the 2017 observations at Holland Glade Road showed that approximately 72% of motorists departed from the intersection correctly in 2017, up from only 44% in 2016. **DeIDOT may want to consider installing these signs at the other HAWK signals in Delaware.**

Field observations revealed issues with pedestrian behavior at both HAWK signals on SR 1 in Rehoboth Beach. At Rehoboth Avenue, approximately 57% of pedestrians and bicyclists hit the pedestrian button to activate the HAWK signal, but then crossed before it activated. The results for the HAWK signal at Holland Glade Drive were similar. This resulted in the HAWK signal activating after the pedestrians had already crossed the intersection, and in some cases vehicles arrived at the intersection when the pedestrians had already departed from view. This may be a factor in the decrease in motorists’ compliance of the HAWK signal observed at both locations between 2016 and 2017. DeIDOT is planning to conduct a detailed study to compare pedestrian behavior at HAWK signals with pedestrian behavior at traditional signalized intersections with varying levels of coordination and cycle lengths. Based on the results of that study, **DeIDOT may want to consider providing a more rapid signal response (hot response) to pushbutton activation when installing future HAWK signals.**

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Introduction

On August 10, 2005, President 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, as well as submitting 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 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⁾. DeIDOT, the Delaware Office of Highway Safety, and the Delaware State Police have been working on ways to lower the frequency of pedestrian crashes involving fatalities and serious injuries. HAWK signals are one (1) of the countermeasures that may improve pedestrian safety.

Delaware's first HAWK signal was installed in August 2010 on SR 72 at the intersection with Farm Lane, which is located next to a University of Delaware farm in New Castle County. This site served as a pilot study for DeIDOT to monitor its effectiveness and pedestrian/motorist compliance⁽⁵⁾. DeIDOT 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, DeIDOT made several improvements to the HAWK signal at Farm Lane. Following these changes, DeIDOT conducted additional compliance studies at this location in 2012, 2013, and 2015. The results from the compliance studies showed mixed results. In addition, motorists on the Farm Lane approaches frequently activated the HAWK signal to stop traffic on SR 72, so that they could turn left onto SR 72 from Farm Lane.

In 2013, the City of Dover Safety Advisory and Transportation Committee requested that DeIDOT 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. DeIDOT installed the HAWK signal in 2014^(6,7,8). DeIDOT completed field observations of this HAWK signal immediately after Dover High School opened in 2014, and subsequently, in 2015.

House Resolution 22, passed on July 1, 2013, established 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, DeIDOT installed HAWK signals on SR 1 at Rehoboth Avenue in September 2015, and Holland Glade Road in May 2016.

In 2016, DeIDOT requested that RK&K, LLP (RK&K) complete compliance studies at the two (2) HAWK signals in Rehoboth Beach (Holland Glade Road and Rehoboth Avenue), as well as the HAWK signal at SR 8 and Heatherfield Way. Based on the results of the 2016 compliance study, DeIDOT requested that RK&K complete additional compliance studies at all four (4) locations in 2017. The results from these studies are summarized in this report.

FHWA Research

In 2010, 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 on motorists by requiring them to stop for pedestrians, but allowing them to proceed once the pedestrian was given the opportunity to cross safely. The FHWA study cited previous research, which showed that red signal or beacon devices, including HAWK beacons, 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 percent (69%) reduction in pedestrian crashes, and a 29 percent (29%) reduction in overall crashes⁽¹⁰⁾.

Study Methodology

During the spring, summer, and fall of 2017, RK&K conducted follow-up signal compliance studies at all four (4) HAWK pedestrian signals currently in operation in Delaware: SR 8 at Heatherfield Way, SR 72 at Farm Lane, SR 1 at Holland Glade Road, and SR 1 at Rehoboth Avenue. The results from the four (4) sites were subsequently compared with the results from prior compliance studies conducted between 2011 and 2016. Specifically, the 2011, 2012, 2013, and 2015 HAWK compliance studies for the site on SR 72 in Newark, as well as the 2014, 2015, and 2016 studies from the HAWK signal at SR 8 and Heatherfield Way in Dover, and the 2016 studies for the sites of SR 1 at Holland Glade Road, and SR 1 at Rehoboth Avenue.

During the 2016 and 2017 compliance studies, two 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. Instead, 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.

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 DE MUTCD. Based on the initial results from HAWK installations in Tucson, Arizona, as well as installations in other states, DeIDOT installed a pilot HAWK location near the University of Delaware's campus in Newark, Delaware, in 2010. DeIDOT and the University of Delaware chose SR 72 at Farm Lane as the pilot location because of the difficulty students had 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 (24,000 ADT) makes 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. Similarly, pedestrian volumes were too low to meet the MUTCD warrant thresholds⁽¹¹⁾.

DeIDOT conducted multiple observations at the HAWK pedestrian signal in Newark, following its installation in August 2010, and through the following February. DeIDOT staff manually activated the signal and crossed SR 72, while wearing reflective vest. During the first few months after the HAWK signal was installed, there was relatively low compliance at the signal by motorists. The Newark Police Department stopped by the site on several occasions and observed operations at the HAWK signal. Following their observations, the Newark Police Department conducted red light enforcement at the signal in December 2010. During this time, field staff handed out pamphlets to motorists about the proper procedures for both motorists and pedestrians at a HAWK signal.

DeIDOT 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, DeIDOT staff opted to manually activate the signal to collect a sufficient amount of data. Specifically, DeIDOT staff wearing reflective vests manually activated the HAWK signal and crossed the road when the pedestrian walk indication was activated. However, the notes from the DeIDOT 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, DeIDOT made several improvements at the intersection of SR 72 and Farm Lane in September 2012⁽¹²⁾. Specifically, SR 72 was restriped to provide a left-turn lane, shared through-right-turn lane, and five (5) foot bike lanes on the northbound and southbound SR 72 approaches to Farm Lane. DeIDOT also added supplemental signal heads to the HAWK signal increasing the number to five (5) signal heads per direction, from two (2) signal faces. DeIDOT 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.

DeIDOT completed 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 again required DeIDOT staff to manually operate the signal. Like the 2011 and 2012 study, DeIDOT staff manually activated the HAWK signal and crossed the road, while wearing reflective vests.

RK&K completed field observations at the SR 72 HAWK signal in May 2017, on days when classes were scheduled at the University's Animal Management Teaching Facility. Perhaps for that reason, a higher percentage of University of Delaware students utilized the signal during the 2017 study than during the 2015 study.

The university students contributed to the majority of the data points collected. However, despite the increase in pedestrian activity compared to the 2015 study, RK&K staff opted to increase the number of observations and manually activated the HAWK signal by means of 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 technicians made sure that sufficient time elapsed between HAWK activations, for all of the traffic to clear the area.

HAWK Compliance Study		December 2017						
Table 1: SR 72 at Farm Lane Motor Vehicle Compliance								
Year	Vehicle Arrival				Vehicle Departure			
	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 Appears 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 results from the compliance study in Table 1 show 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 partially 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 very 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 that they would stop.

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 the pedestrian clears and the signal turns to flashing red; 2017 saw the highest percentage of motorists correctly proceeding on flashing red after stopping (44%), 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.

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

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

Dover High School

The City of Dover moved its 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. A HAWK signal was installed to provide a safe crossing for students at the auxiliary entrance, located at the intersection of SR 8 and Heatherfield Way. The High School incorporated a walking path from the main building to its auxiliary access.

DeIDOT completed field observations immediately after Dover High School opened in 2014 and subsequently in 2015. RK&K conducted field observations in October 2016 and October 2017 during the school arrival and departure periods. The results from all four studies are summarized in Table 2.

HAWK Compliance Study					December 2017			
Table 2: SR 8 at Heatherfield Way Motor Vehicle Compliance								
Year	Vehicle Arrival				Vehicle Departure			
	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 Appears 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%

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

Based on the results presented in Table 2, compliance has been improving and motorists appear to have a better understanding of how the HAWK signal works than during the first year or two of the signal's operation. The percentage of motorists stopping for the HAWK signal increased (improved) to 91% in 2017, from 82% in 2015. More significantly, there were no reports of vehicles disregarding the traffic signal and entering the intersection during the pedestrian walk phase when pedestrians may have been crossing the intersection.

With respect to vehicle departures, the results presented in Table 2 indicate that motorists are becoming more familiar with how HAWK signals work. During the 2017 observations, 43% of motorists correctly proceeded on flashing red after stopping, compared to 25% in 2016. Additionally, only 2% of motorists appeared confused, compared to 6% in 2014.

It should be noted that during the 2016 and 2017 observations, 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.

SR 1 at Rehoboth Avenue

DeIDOT installed the third HAWK signal in the state on southbound SR 1 at Rehoboth Avenue in Rehoboth Beach, DE in September 2015. 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 higher speed (40 MPH) lanes. RK&K staff conducted field observations at the HAWK signal in August 2016 and July 2017. The field staff sat in their cars and had no interaction with the HAWK signal, limiting the likelihood of motorists being aware of the study.

At this location, many pedestrians and bicyclists were observed pushing the HAWK signal button to activate it. However, more than half (57%) of the pedestrians and bicyclists that hit the button to activate the HAWK signal, crossed before the signal activated. Therefore, many of the vehicle observations in Table 3 are based on motorists' behavior when no pedestrians or bicyclists were present while the signal was activated. It should be noted that the times when pedestrians crossed without activating the HAWK signal were not included in Table 3.

HAWK Compliance Study					December 2017			
Table 3: SR 1 at Rehoboth Avenue Motor Vehicle Compliance								
Year	Vehicle Arrival				Vehicle Departure			
	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 Appears Confused*
2016	87%	9%	2%	2%	22%	6%	70%	2%
2017	72%	7%	1%	20%	63%	11%	25%	1%

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

Based on the results presented in Table 3, the percentage of vehicles stopping correctly for the HAWK signal decreased (worsened) from 87% in 2016 to 72% in 2017. Of those that disregarded the signal, seven percent (7%) entered the intersection immediately after the signal turned red, one (1) vehicle entered the intersection during the pedestrian walk phase when the signal was solid red, and twenty percent (20%) entered the intersection during the pedestrian clearance interval without stopping when the HAWK signal was flashing red. Field observations indicated that that the higher percentage of vehicles disregarding the HAWK signal (compared to 2016, and compared to the other HAWK locations) may be partially attributable to pedestrian behavior. Pedestrians were often observed activating the HAWK signal, but crossing when they saw a gap in traffic before the HAWK signal activated. Once

the HAWK signal activates the pedestrians have already cleared the intersection and the motorists are legally required to stop for the HAWK signal when no pedestrians are present. Over the past year, motorists who are familiar with this location may have become aware of this pedestrian behavior and have lost respect for the HAWK signal.

Following the 2016 HAWK Compliance Study, DeIDOT 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 G). The results from 2017 showed that the signs may have had a positive effect on motorists’ behavior departing the HAWK signal at this location. The results from the 2017 observations at Rehoboth Avenue showed that approximately 74% of motorists (63% + 11% in Table 3) departed from the intersection correctly in 2017, up from only 28% (22% + 6% in Table 3) 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.

According to the signal timesheet for Rehoboth Avenue, the HAWK signal is coordinated and the pattern changes throughout the day. During the field observations, there was a significant delay between the button activation and the HAWK signal activation.

SR 1 at Holland Glade Road

In May 2016, DeIDOT 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 width of the roadway. At this location, 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.

RK&K conducted observations at the HAWK signal on SR 1 at Holland Glade Road, in July 2016 and July 2017, 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 4, 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.

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 78% in 2017. In 2016, only 3% of motorists disregarded the traffic signal (3%+0%+0% in Table 4). However, in 2017 approximately 22% of motorists (6%+1%+15% in Table 4) 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. Therefore, some of the 22% of motorists disregarding the HAWK signal, did so 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’.

HAWK Compliance Study		December 2017						
Table 4: SR 1 at Holland Glade Road 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 Appears Confused*
2016	97%	3%	0%	0%	27%	17%	56%	0%
2017	78%	6%	1%	15%	57%	15%	27%	1%

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

Following the 2016 HAWK Compliance Study, DeIDOT 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 G). The results from 2017 showed that the signs may have had a positive effect on motorists’ behavior departing the HAWK signal at this location. The results from the 2017 observations at Holland Glade Road showed that approximately 72% of motorists (57%+15% in Table 4) departed from the intersection correctly in 2017, 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.

According to the signal timesheet for Holland Glade Road, the HAWK signals are coordinated and the pattern changes throughout the day. There are separate sets of HAWK signals controlling the northbound lanes and the southbound lanes. The pedestrians need to activate each set of HAWK signals separately. During the field observations in 2017, the delay between the pushbutton activation and the HAWK signal activation appeared shorter than the field observations in 2016.

Following the 2017 field observations, DeIDOT received complaints from pedestrian and bicycle advocates about vehicles stopping downstream or within the crosswalk at Holland Glade Drive. This issue was not observed during the 2017 field observations. However, based on the recent complaints, DeIDOT will revisit this issue during future compliance studies.

Summary

This HAWK Pedestrian Signal Compliance Study revealed issues when HAWK signals are installed at four-legged intersections. At each of DeIDOT's HAWK signals that are located at intersections (e.g., not at mid-block locations), motorists on the minor street were observed manually activating the HAWK signal (via the pedestrian pushbutton) to facilitate making a left turn. Based on these observations, **DeIDOT may want to consider using caution when installing future HAWK signals at intersections.**

During the field observations at the intersection of SR 8 and Heatherfield Way, the regulatory sign at the HAWK signal, which states "STEADY RED, Stop and Stay Stopped, FLASHING RED, Stop, Yield to Pedestrians, Proceed with Caution" is turned 90 degrees away from SR 8 and is facing the minor street. **DeIDOT may want to consider adjusting the placement of the sign to face motorists on SR 8.**

Following the 2016 HAWK Compliance Study, DeIDOT installed new regulatory signs at the HAWK signals along SR 1, which state "Crosswalk, Stop on Red, Proceed on Flashing Red When Clear" (See Appendix G). The results from 2017 showed that this sign may have had a positive effect on motorists' behavior at both HAWK signals. The results from the 2017 observations at Rehoboth Avenue showed that approximately 74% of motorists departed from the intersection correctly in 2017, up from only 28% in 2016. Similarly, the results from the 2017 observations at Holland Glade Road showed that approximately 72% of motorists departed from the intersection correctly in 2017, up from only 44% in 2016. **DeIDOT may want to consider installing these signs at the other HAWK signals in Delaware.**

Field observations revealed issues with pedestrian behavior at both HAWK signals on SR 1 in Rehoboth Beach. At Rehoboth Avenue, approximately 57% of pedestrians and bicyclists hit the pedestrian button to activate the HAWK signal, but then crossed before it activated. The results for the HAWK signal at Holland Glade Drive were similar. This resulted in the HAWK signal activating after the pedestrians had already crossed the intersection, and in some cases vehicles arrived at the intersection when the pedestrians had already departed from view. This may be a factor in the decrease in motorists' compliance of the HAWK signal observed at both locations between 2016 and 2017. DeIDOT is planning to conduct a detailed study to compare pedestrian behavior at HAWK signals with pedestrian behavior at traditional signalized intersections with varying levels of coordination and cycle lengths. Based on the results of that study, **DeIDOT may want to consider providing a more rapid signal response (hot response) to pushbutton activation when installing future HAWK signals.**

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 listed passive detection as a possible 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; however, these devices are still experimental and their reliability is still being reviewed. No recommendations are being made at this time with regard to the use of passive detectors at HAWK signals.

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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 DeIDOT 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

Start Time	Button Pushed	Southbound Arrivals				Southbound Departures				Northbound Arrivals				Northbound Departures				SB Running Red During Walk	NB Running Red During Walk
		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%	0		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



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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 be 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.

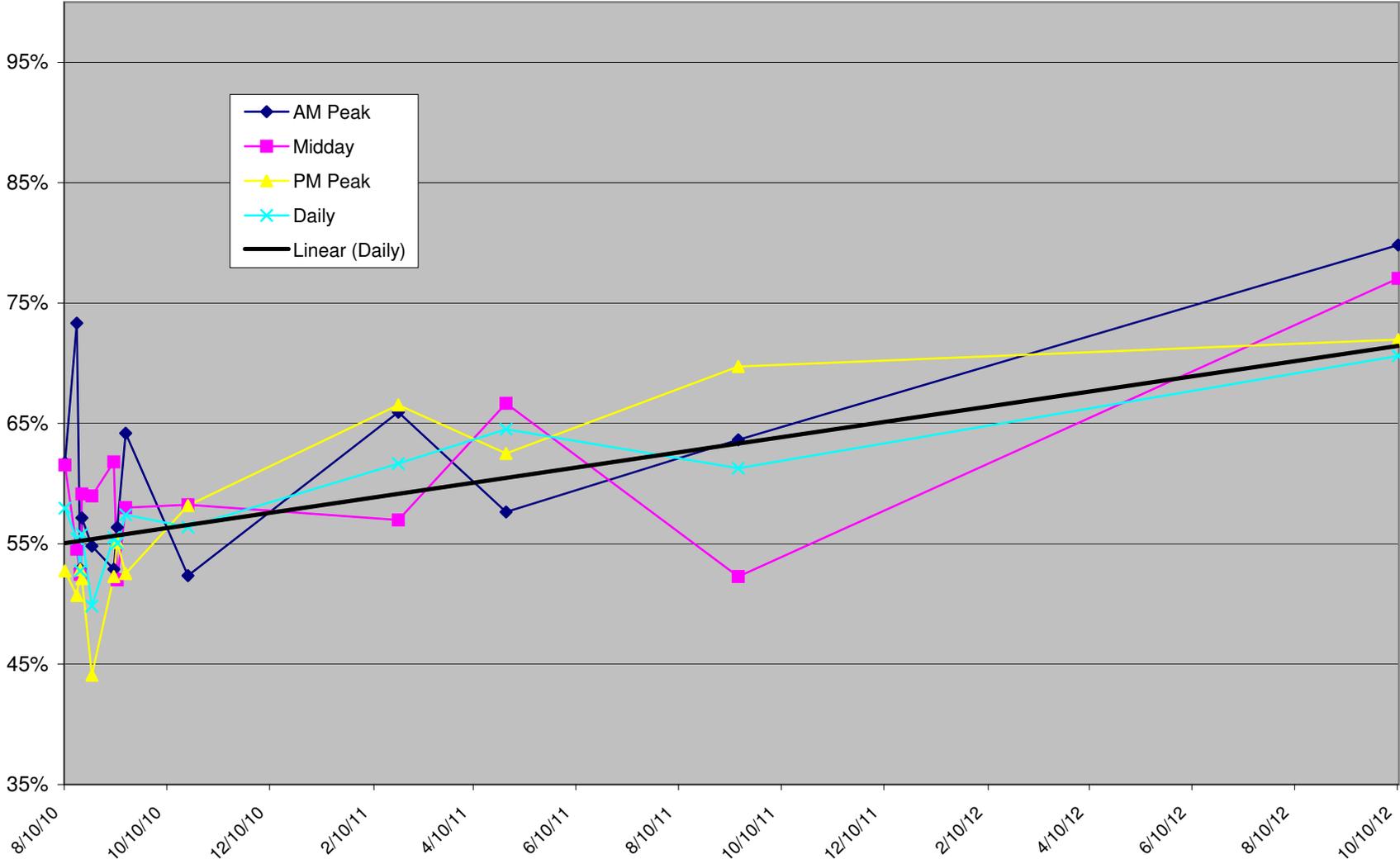
10-10-12

Start Time	Button Pushed	Southbound Arrivals				Southbound Departures				Northbound Arrivals				Northbound Departures				SB Running Red During Walk	NB Running Red During Walk
		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%

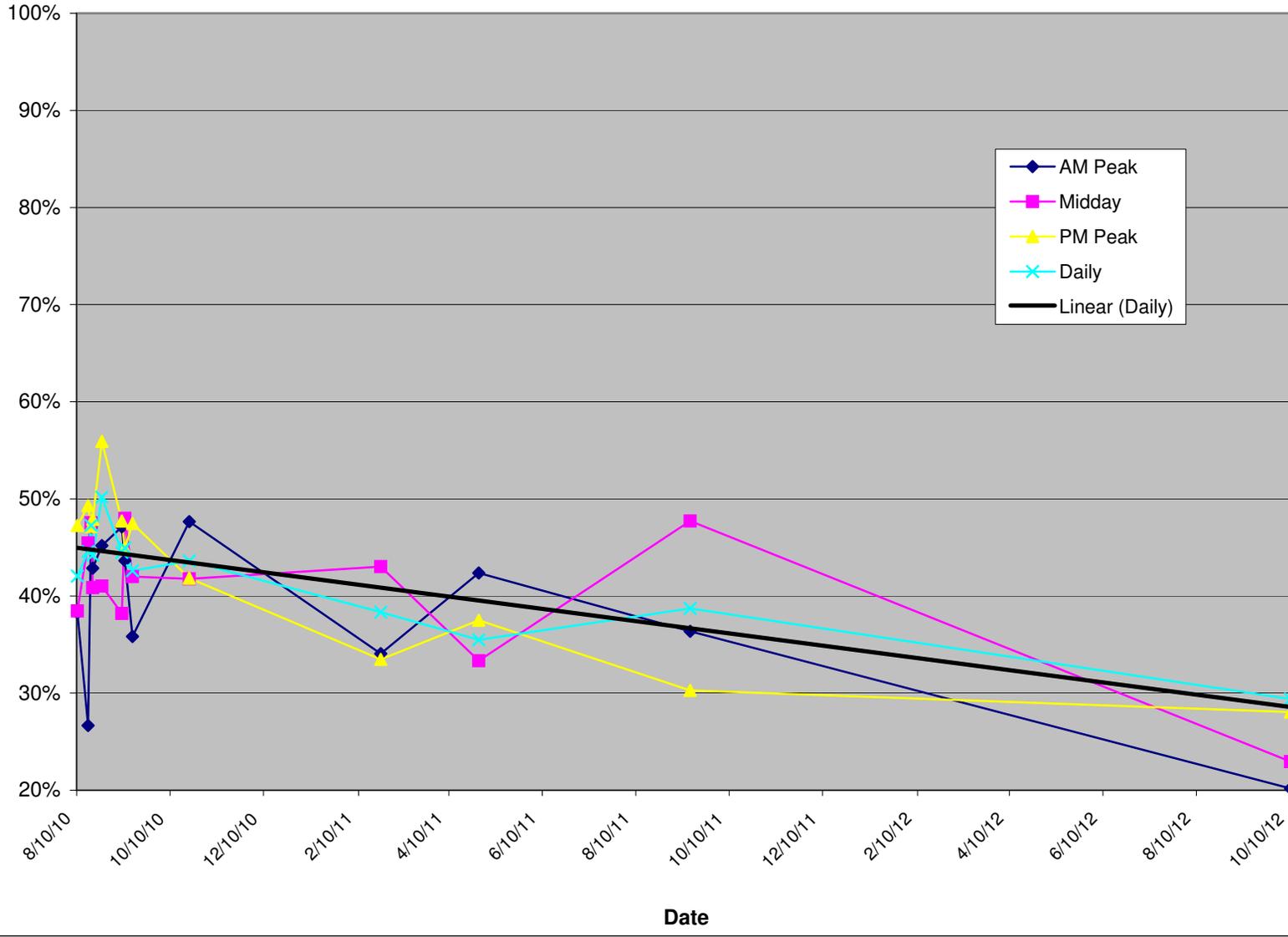
	Steady Red		Flashing Red	
SB Compliance	155	33	63	142
NB Compliance	154	54	58	144
Overall Compliance	309	87	121	286
	78%	22%	30%	70%

* Percentage of Severe Red Light Running per Ped Phase Activation

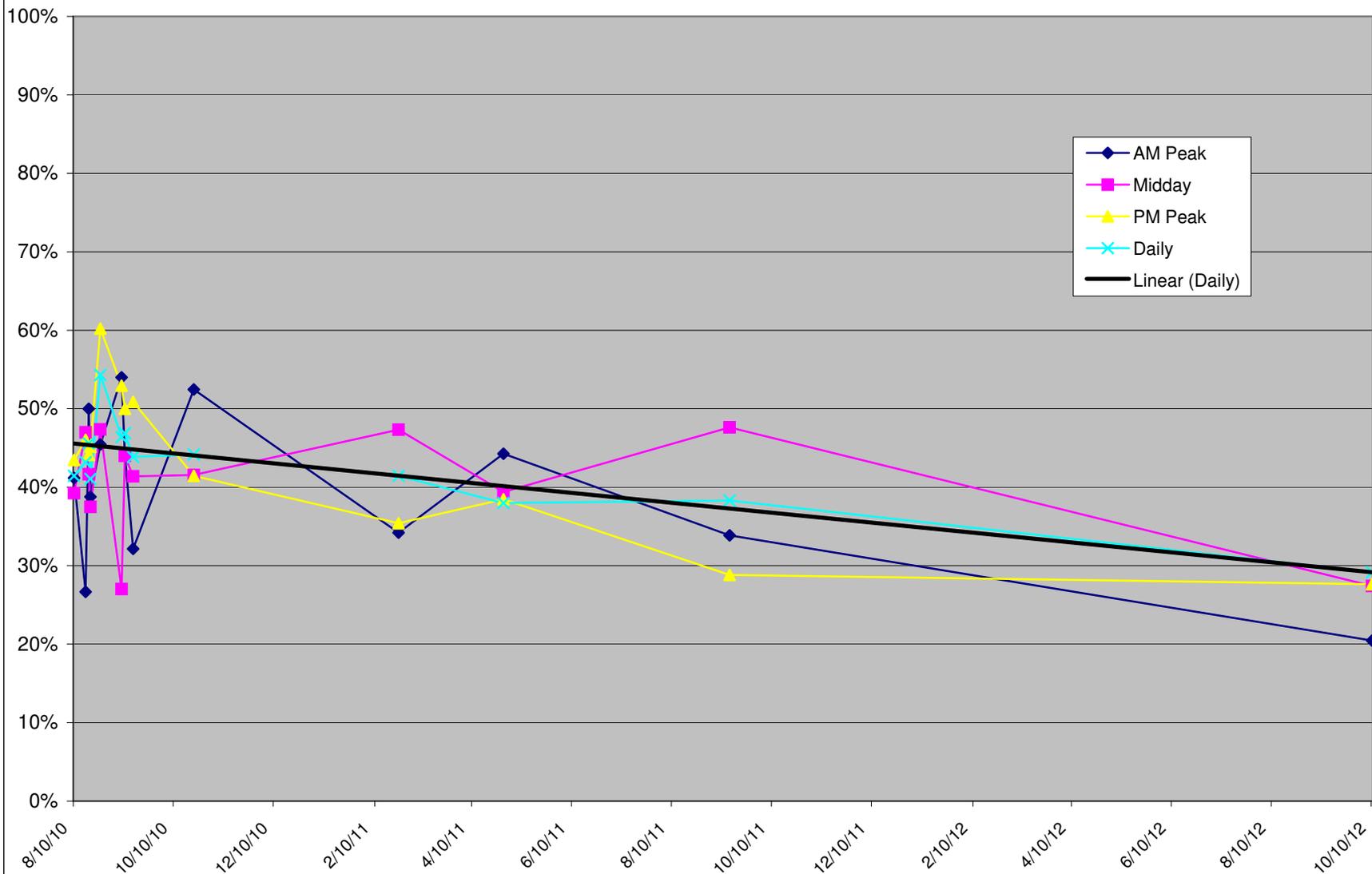
Red Light Compliance



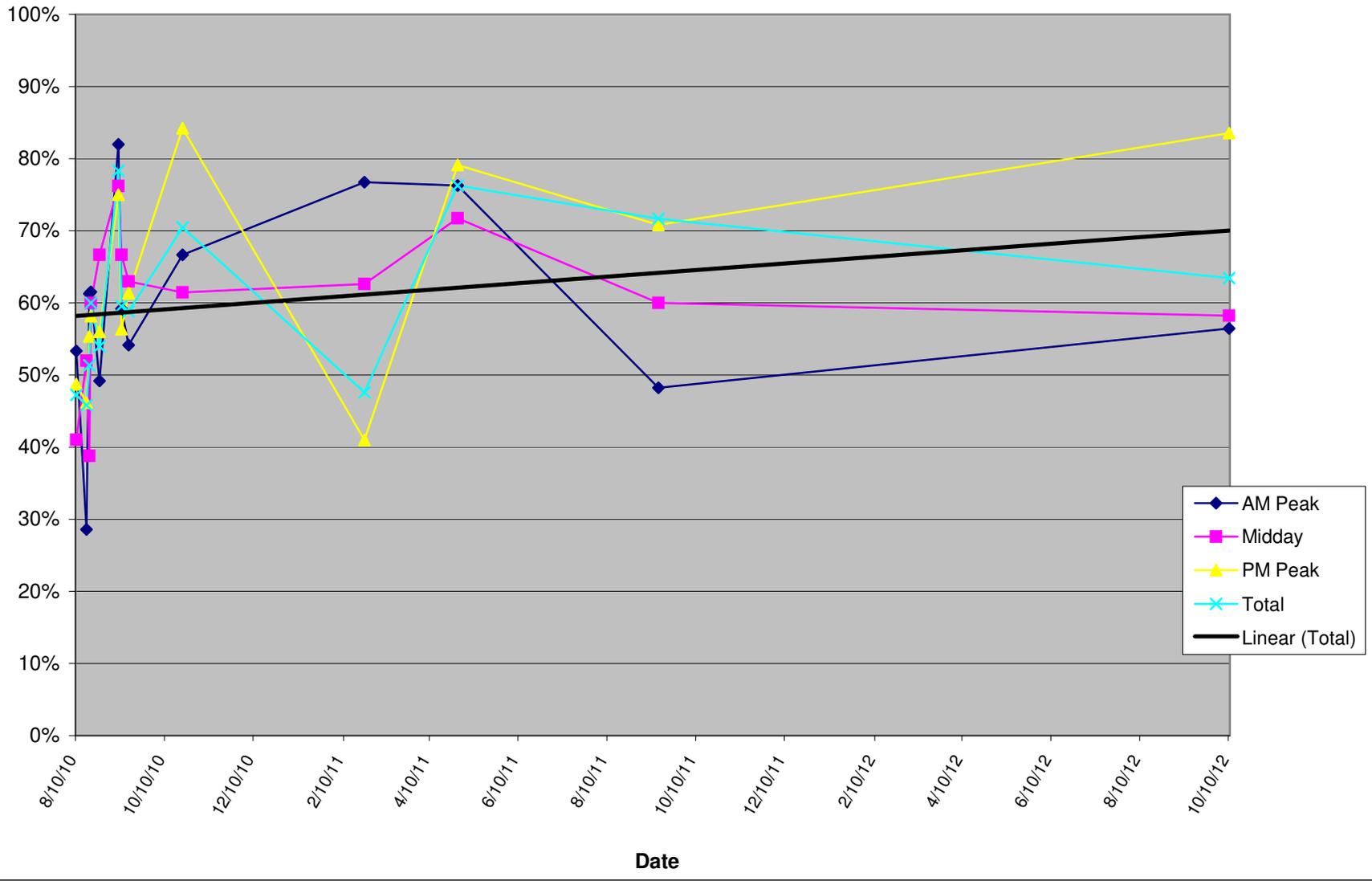
Combined Running Red Light



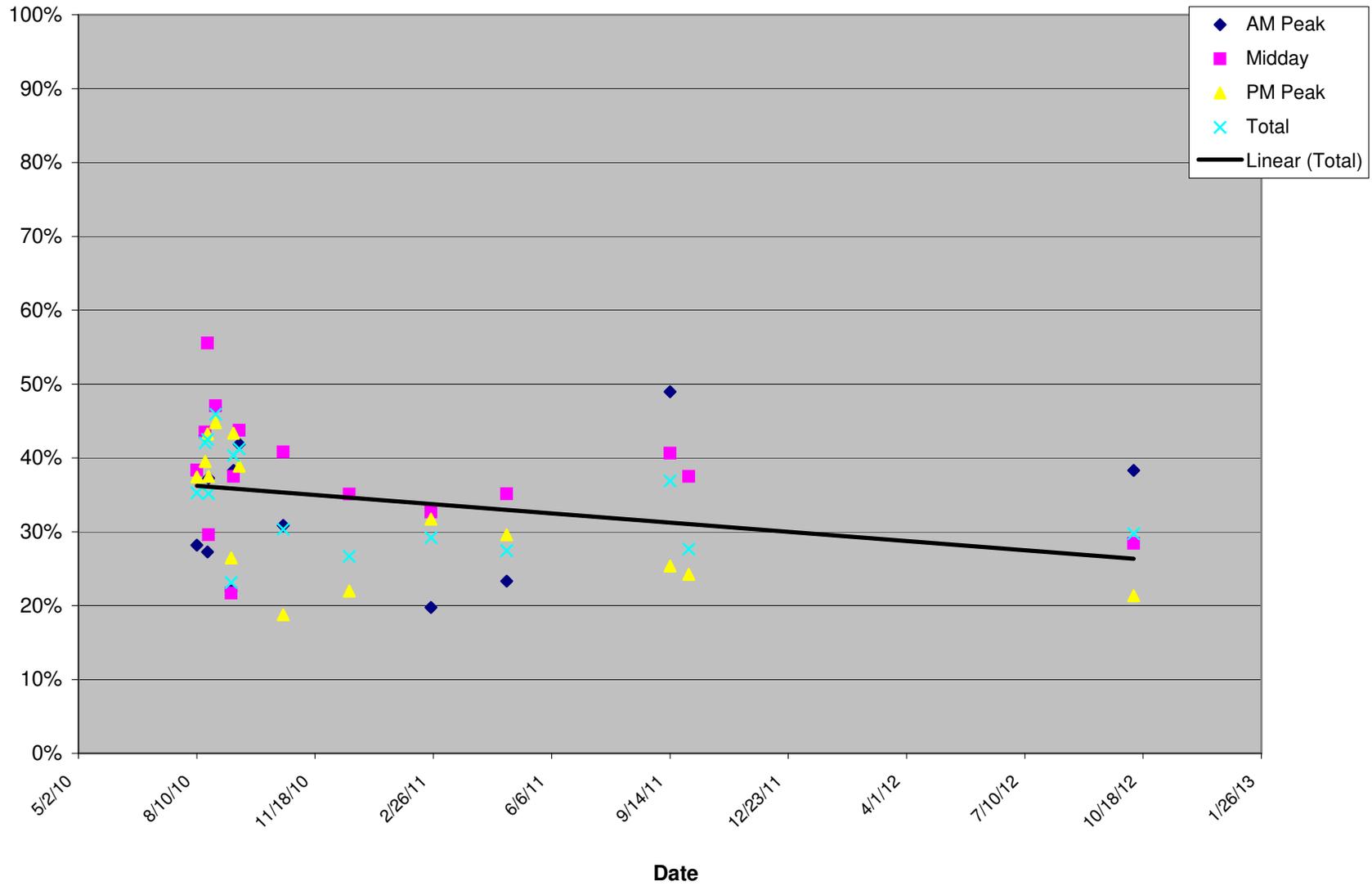
Southbound Running Red Light



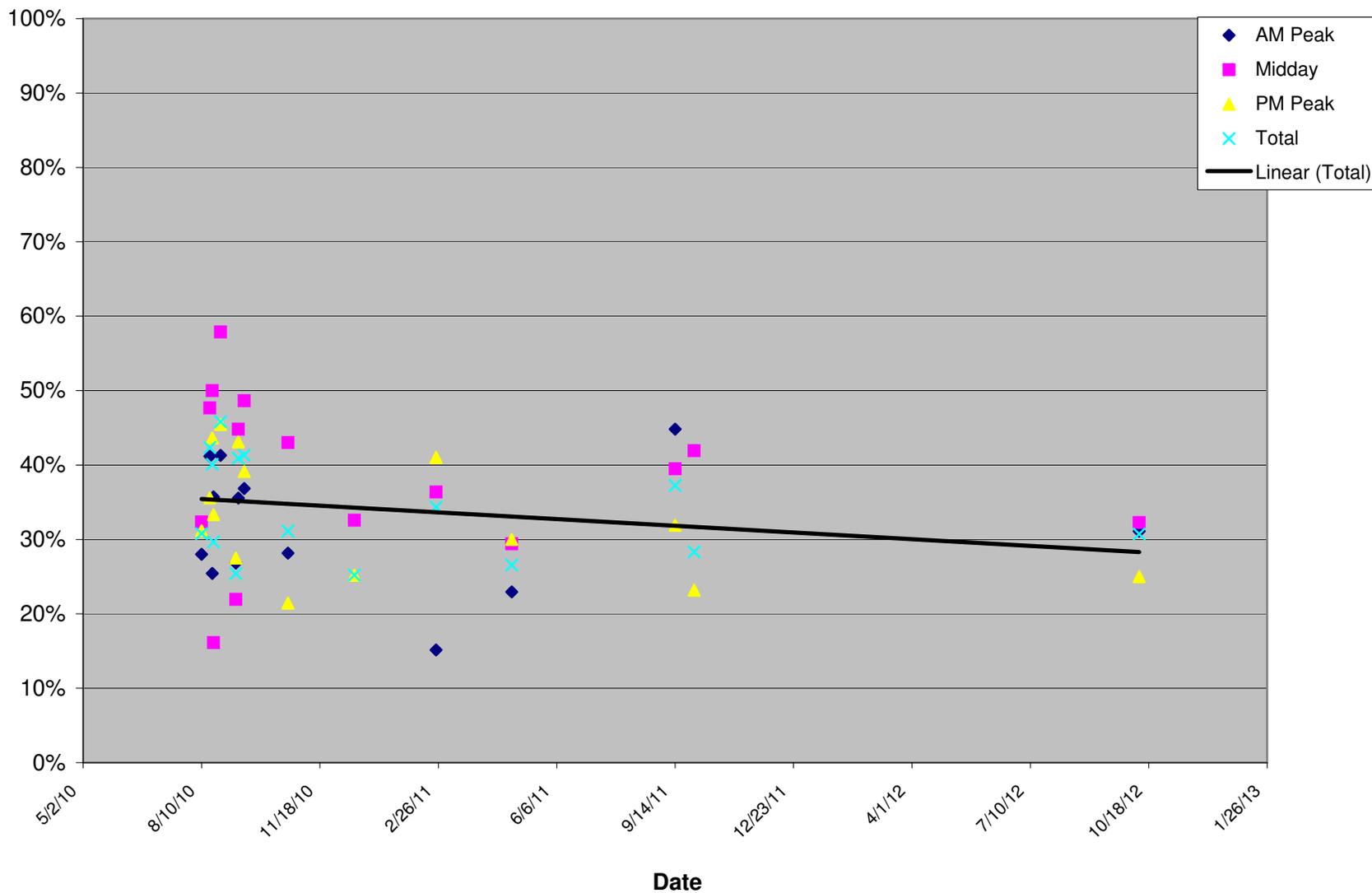
Northbound Waited for Dark



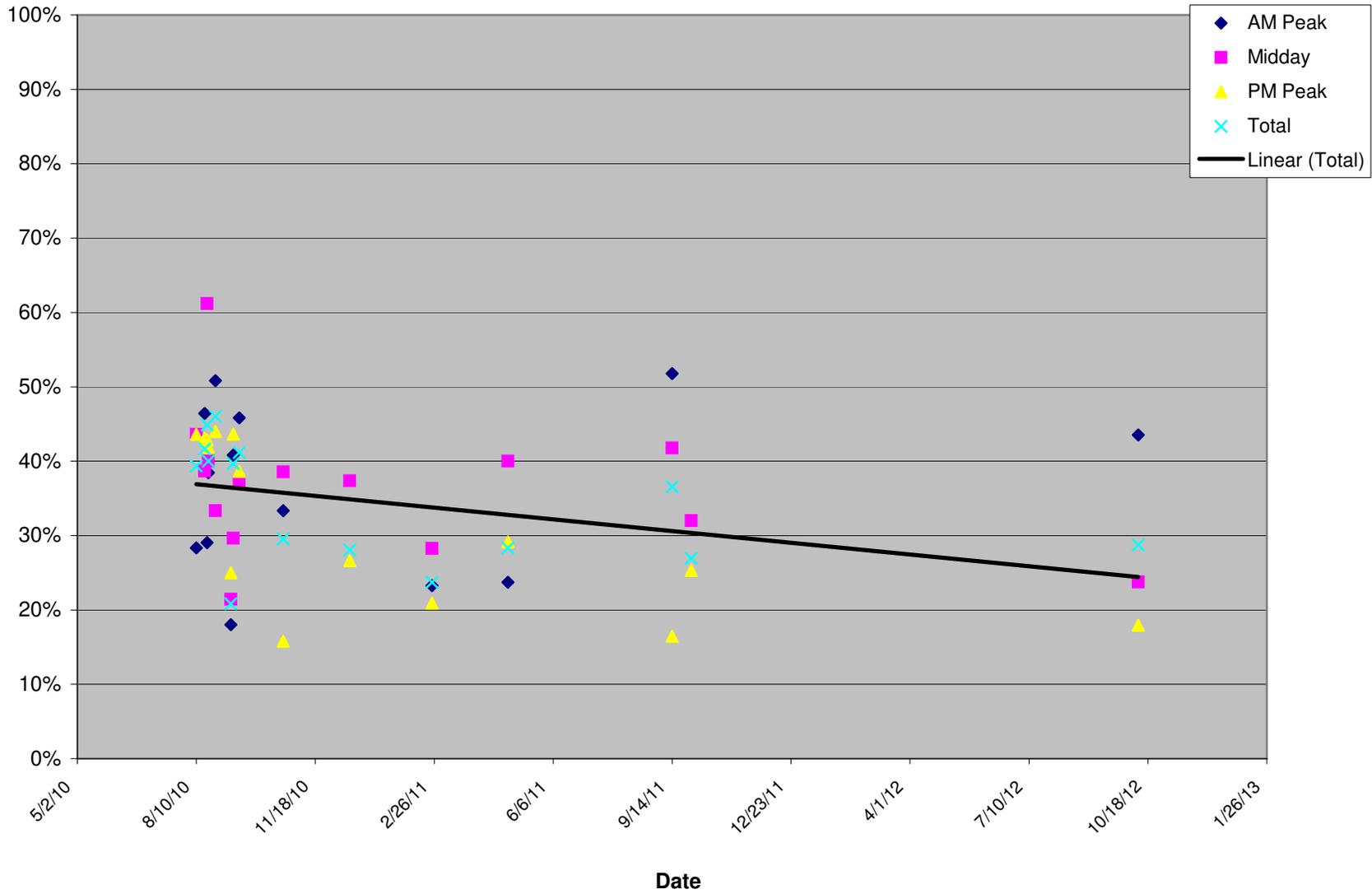
Combined Understanding Flashing Red



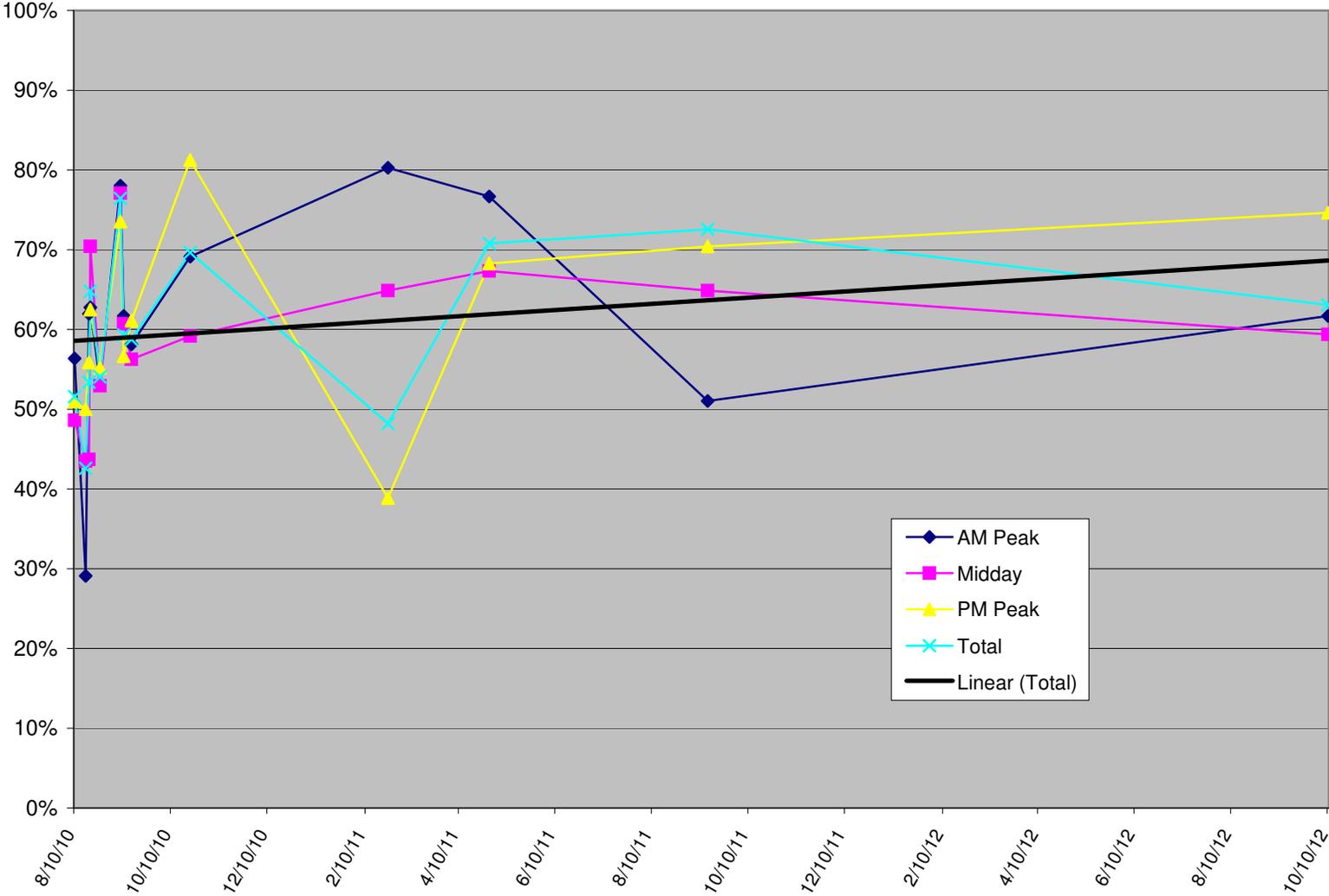
Southbound Understanding Flashing Red



Northbound Understanding Flashing Red

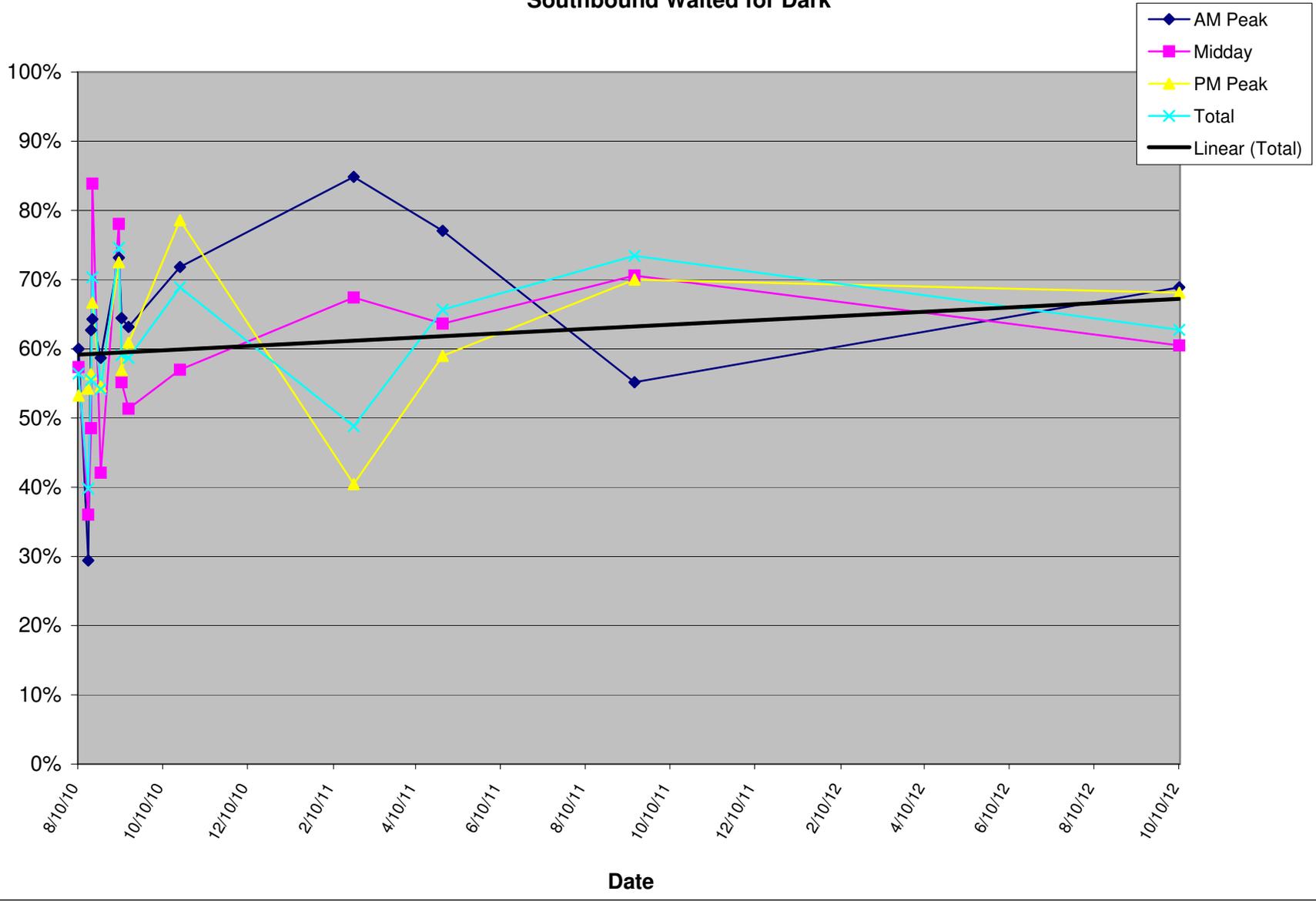


Combined Waited for Dark

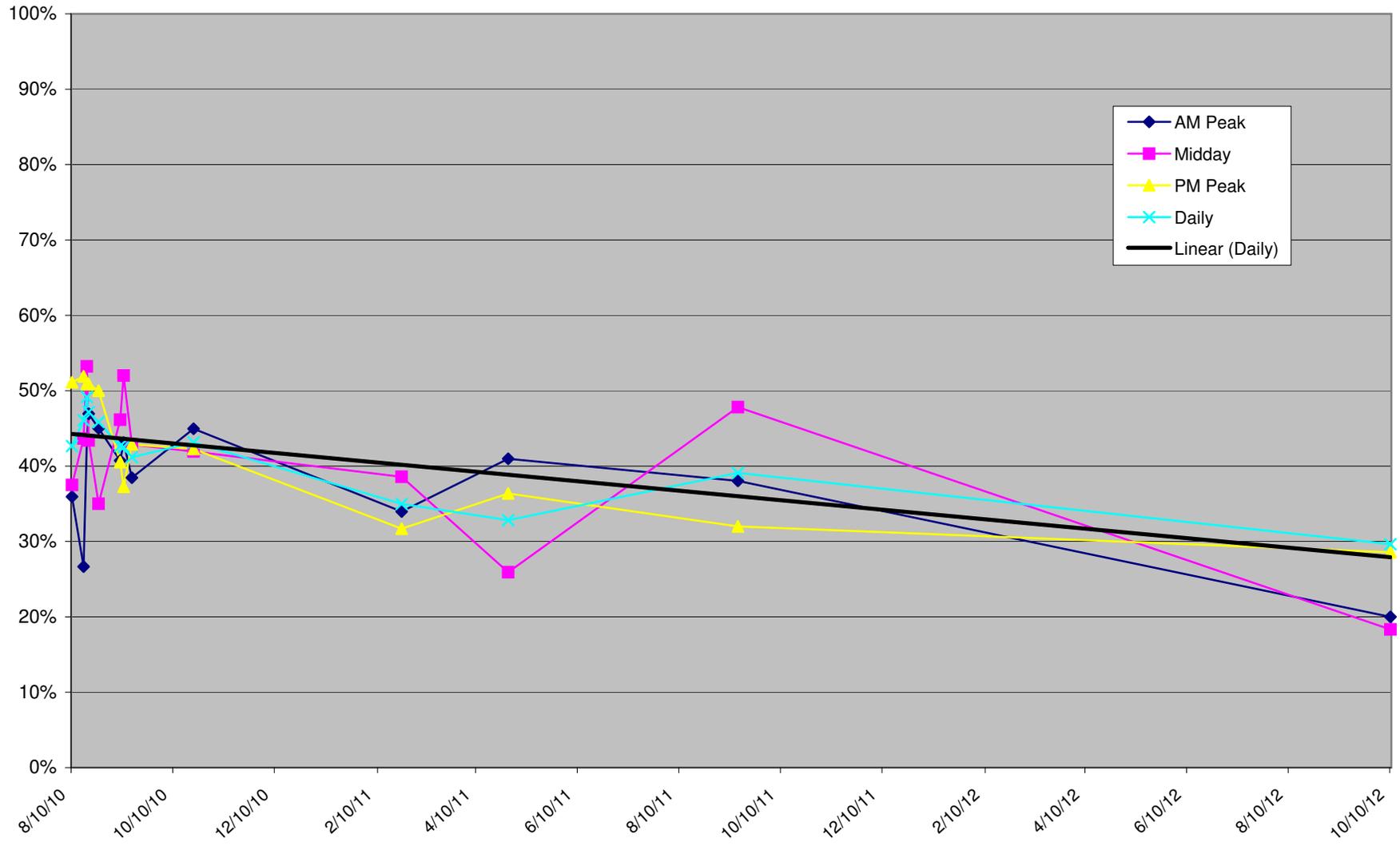


Date

Southbound Waited for Dark



Northbound Running Red Light



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

Start Time	Button Pushed	Southbound Arrivals				Southbound Departures				Northbound Arrivals				Northbound Departures				SB Running Red During Walk	NB Running Red During Walk
		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		
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	8	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	0
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
NB Compliance
Overall Compliance

74	48
68	49
142	97
59%	41%

28	62
32	60
60	122
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

Start Time	Button Pushed	Southbound Arrivals				Southbound Departures				Northbound Arrivals				Northbound Departures				SB Running Red During Walk	NB Running Red During Walk
		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**

October 14, 2014

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

Start Time	Button Pushed	Eastbound Arrivals				Eastbound Departures				Westbound Arrivals				Westbound Departures				EB Running Red During Walk	WB Running Red During Walk	
		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	5	3	1	2	0	1	4	0	0	2	0	0	0	0	4	0	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	0
7:00 AM	8	6	1	0	0	3	6	0	0	7	1	1	0	0	6	1	0	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	0
7:30 AM	6	6	1	2	0	7	4	2	0	4	2	3	0	3	4	0	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	0
8:00 AM	6	3	0	4	1	4	4	1	0	2	0	1	0	0	2	0	1	0	0	0
8:15 AM	6	3	1	6	1	0	3	0	1	3	0	3	1	0	4	0	1	0	0	0
AM	50	38	5	16	3	25	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	0
2:15 PM	9	4	3	5	1	5	5	0	0	6	2	3	1	3	6	0	1	0	0	0
2:30 PM	9	10	6	2	0	4	7	0	0	6	0	3	0	2	5	0	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	0
3:00 PM	5	4	0	2	1	3	2	0	1	4	0	2	4	2	3	0	1	0	0	0
3:15 PM	8	2	0	5	0	1	5	0	0	3	0	6	0	2	6	0	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	0
3:45 PM	6	4	1	2	0	2	2	0	3	3	0	6	0	5	4	0	1	1	0	0
4:00 PM	5	3	0	3	0	1	5	0	0	5	1	0	0	0	5	0	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	0
4:30 PM	6	2	0	3	0	1	4	0	0	6	2	0	0	0	5	0	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	0
5:00 PM	7	3	0	5	1	2	6	0	1	4	3	2	0	0	6	0	1	0	1	0
5:15 PM	9	7	0	0	0	2	6	0	1	6	1	4	0	2	8	0	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	0
5:45 PM	7	7	0	1	1	2	6	0	0	6	2	1	0	3	6	0	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

EB Compliance	111	19
WB Compliance	109	23
Overall Compliance	220	42
	84%	16%

Flashing Red

EB Compliance	57	120
WB Compliance	33	123
Overall Compliance	90	243
	27%	73%

* Percentage of Severe Red Light Running per Ped Phase Activation

May 6, 2015

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

Start Time	Button Pushed	Eastbound Arrivals				Eastbound Departures				Westbound Arrivals				Westbound Departures				EB Running Red During Walk	WB Running Red During Walk
		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

EB Compliance
WB Compliance
Overall Compliance

137	32
103	38
240	70
77%	23%

Flashing Red

42 146
44 139
86 285

42	146
44	139
86	285
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.

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.

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.

APPENDIX E
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: B11
 Monitor Type: NEMAR
 Coordination Address: 166.245.117.240
 Baud Rate: 9600

Phase Data

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

OVERLAP DATA

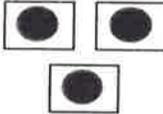
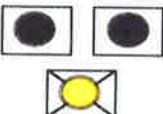
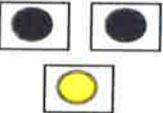
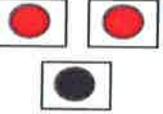
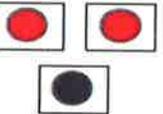
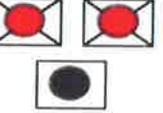
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
OVERLAP LOCATION				
OVERLAP PHASES				

****DO NOT USE TIMESHEET****
****UNDER CONSTRUCTION****

1/13/12

 OK TO USE TIMESHEET

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

Signal Display	Ped Display	Summary of sequence
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">DW</div>	<p>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)</p>
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">DW</div>	<p>Flashing yellow is activated by ped call (phase 2 & 6 calls are placed at 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</p>
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">DW</div>	<p>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.</p>
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">DW</div>	<p>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)</p>
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">W</div>	<p>Phase 2 walk activates pedestrian display Phase 6 walk activates pedestrian display</p>
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">PdCl</div>	<p>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</p>
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">DW</div>	<p>Return to beginning sequence</p>

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: EDAC-PED HAWK
 Coordination Type: TALICS

Location: DEB@HEATHERFIELD WAY
 Revision Number: A.1
 Monitor Type: NEMAT
 Coordination Address: _____
 Baud Rate: _____

Phase Data

	1	2	3	4	5	6	7	8
PHASE #	1	2						
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	<u>NORTH PED</u>		<u>SOUTH PED</u>	
OVERLAP PHASES				

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

Signal
Display

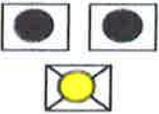
Ped
Display

Summary of sequence



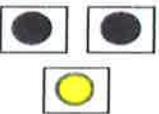
DW

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)



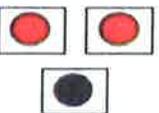
DW

Flashing yellow is activated by ped call (phase 2 & 6 calls are placed at 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



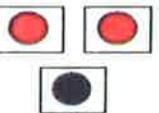
DW

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.



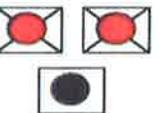
DW

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)



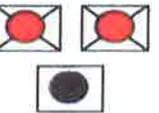
W

Phase 2 walk activates pedestrian display
Phase 6 walk activates pedestrian display



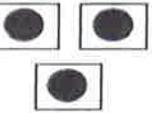
PdCl

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							
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							
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	Bank1=16 Bank2=11 Bank3=11 Bank4=11	Bank1=11 Bank2=11 Bank3=11 Bank4=11			Bank1=16 Bank2=11 Bank3=11 Bank4=11	Bank1=11 Bank2=11 Bank3=11 Bank4=11		
Min Ped Time	Bank1=35 Bank2=0 Bank3=0 Bank4=0	Bank1=20 Bank2=0 Bank3=0 Bank4=0			Bank1=35 Bank2=0 Bank3=0 Bank4=0	Bank1=20 Bank2=0 Bank3=0 Bank4=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							
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							
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

Handwritten notes:
11/20/16
1000 1
2080000 =
1000000 = 1000000

Signal Permit Number: 5346
Date of Timesheet: 5/1/15
Controller Type: EDAC (HAWK PED)
Coordination Type: TACTICS

Location: DEI @ DEI A (HAWK)
Revision Number: A.1
Monitor Type: NETAT
Coordination Address: 1
Baud Rate: 9600

Handwritten notes:
IL = 172.24.169.14
Subnet = 255.255.255.0

Phase Data

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

OVERLAP DATA

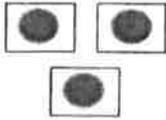
	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
OVERLAP LOCATION	<u>E/W PED RIVER</u>			
OVERLAP PHASES	<u>DEI SB (PHASE 2)</u>			

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

Signal
Display

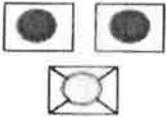
Ped
Display

Summary of sequence



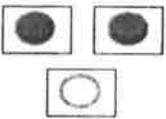
DW

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)



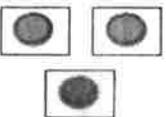
DW

Flashing yellow is activated by ped call (phase 2 & 6 calls are placed at 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



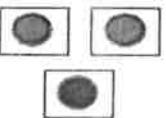
DW

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.



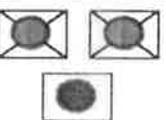
DW

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)



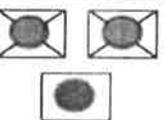
W

Phase 2 walk activates pedestrian display
Phase 6 walk activates pedestrian display



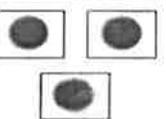
PdCl

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	<input type="checkbox"/>	111 - 90 BAL	ABA	<input type="checkbox"/>	111 - 90 BAL
AAB	<input type="checkbox"/>	111 - 90 BAL	ABB	<input type="checkbox"/>	111 - 90 BAL
AAC	<input type="checkbox"/>	111 - 90 BAL	ABC	<input type="checkbox"/>	111 - 90 BAL

BAA	<input type="checkbox"/>	121 - 120 BAL	BBA	<input type="checkbox"/>	121 - 120 BAL
BAB	<input type="checkbox"/>	121 - 120 BAL	BBB	<input type="checkbox"/>	121 - 120 BAL
BAC	<input type="checkbox"/>	121 - 120 BAL	BBC	<input type="checkbox"/>	121 - 120 BAL

CAA	<input type="checkbox"/>	231 - 150 NB	CBA	<input type="checkbox"/>	231 - 150 NB
CAB	<input type="checkbox"/>	221 - 150 BAL	CBB	<input type="checkbox"/>	221 - 150 BAL
CAC	<input type="checkbox"/>	211 - 150 SB	CBC	<input type="checkbox"/>	211 - 150 SB

DAA	<input type="checkbox"/>	331 - 165 NB	DBA	<input type="checkbox"/>	331 - 165 NB
DAB	<input type="checkbox"/>	321 - 165 BAL	DBB	<input type="checkbox"/>	321 - 165 BAL
DAC	<input type="checkbox"/>	311 - 165 SB	DBC	<input type="checkbox"/>	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							
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							
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							
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							
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							
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							
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							
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							
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 TIMESHEET PACKET
NOTICE TO PROCEED

Signal Permit Number: 5347
 Date of Timesheet: 5/11/15
 Controller Type: EPAL-PEDHAWK
 Coordination Type: TACTICS

Location: DEI @ HOLLAND GLADE RD
 Revision Number: A.1
 Monitor Type: NEMAT
 Coordination Address: 1
 Baud Rate: 9600

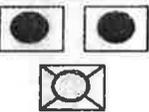
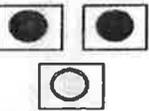
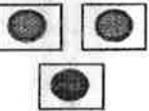
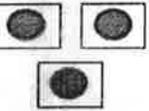
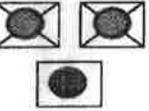
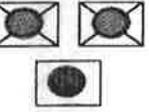
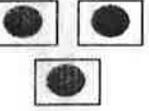
Phase Data

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

OVERLAP DATA

	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
OVERLAP LOCATION	<u>PHASE 2 PED</u>		<u>PHASE 6 PED</u>	
OVERLAP PHASES				

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

Signal Display	Ped Display	Summary of sequence
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">DW</div>	<p>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)</p>
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">DW</div>	<p>Flashing yellow is activated by ped call (phase 2 & 6 calls are placed at 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</p>
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">DW</div>	<p>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.</p>
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">DW</div>	<p>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)</p>
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">W</div>	<p>Phase 2 walk activates pedestrian display Phase 6 walk activates pedestrian display</p>
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">PdCl</div>	<p>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</p>
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">DW</div>	<p>The wig/wag flash continues through the red intervals for phase 2 & 6 The pedestrian display is solid red - don't walk display</p>
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">DW</div>	<p>Return to beginning sequence</p>

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	<input type="checkbox"/>	111 - 90 BAL	ABA	<input type="checkbox"/>	111 - 90 BAL
AAB	<input type="checkbox"/>	111 - 90 BAL	ABB	<input type="checkbox"/>	111 - 90 BAL
AAC	<input type="checkbox"/>	111 - 90 BAL	ABC	<input type="checkbox"/>	111 - 90 BAL

BAA	<input type="checkbox"/>	121 - 120 BAL	BBA	<input type="checkbox"/>	121 - 120 BAL
BAB	<input type="checkbox"/>	121 - 120 BAL	BBB	<input type="checkbox"/>	121 - 120 BAL
BAC	<input type="checkbox"/>	121 - 120 BAL	BBC	<input type="checkbox"/>	121 - 120 BAL

CAA	<input type="checkbox"/>	231 - 150 NB	CBA	<input type="checkbox"/>	231 - 150 NB
CAB	<input type="checkbox"/>	221 - 150 BAL	CBB	<input type="checkbox"/>	221 - 150 BAL
CAC	<input type="checkbox"/>	211 - 150 SB	CBC	<input type="checkbox"/>	211 - 150 SB

DAA	<input type="checkbox"/>	331 - 165 NB	DBA	<input type="checkbox"/>	331 - 165 NB
DAB	<input type="checkbox"/>	321 - 165 BAL	DBB	<input type="checkbox"/>	321 - 165 BAL
DAC	<input type="checkbox"/>	311 - 165 SB	DBC	<input type="checkbox"/>	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							
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							
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							
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							
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							
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							
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							
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							
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

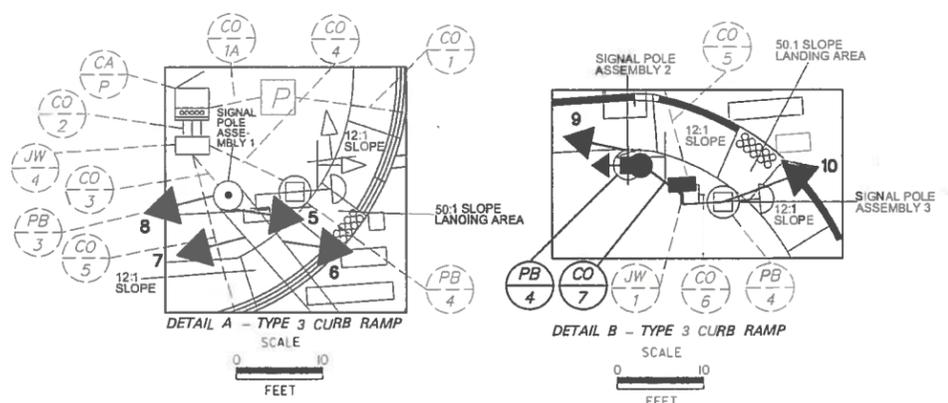
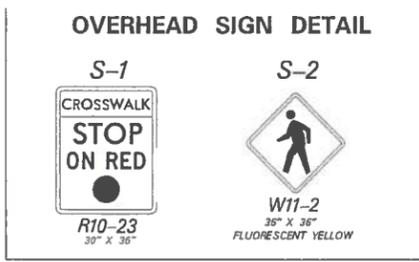
APPENDIX F

Signal Construction Plans

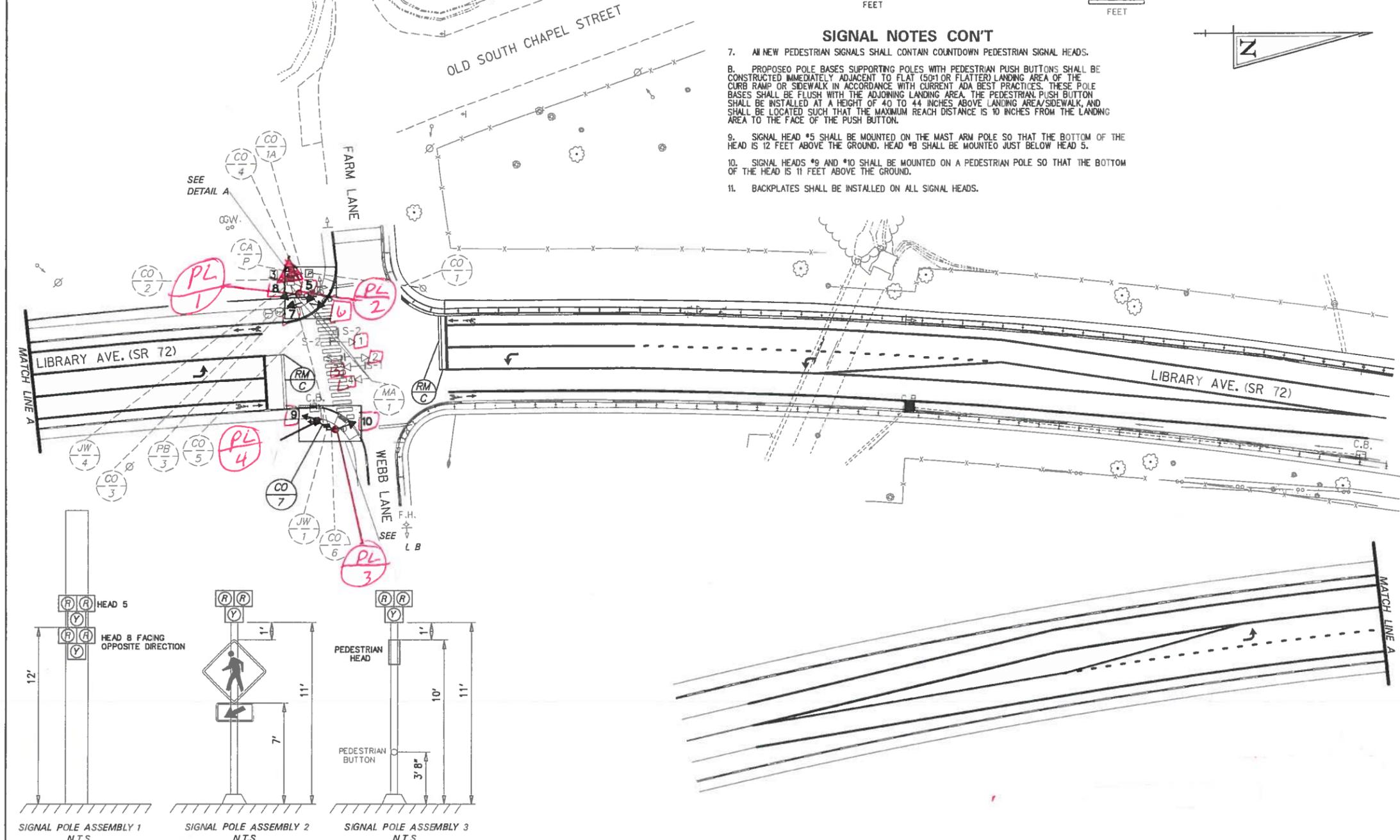
CONDUIT RUN SCHEDULE				
CR#	# OF CONDUITS	SIZE	LENGTH	AMOUNT AND TYPE OF CABLE/ WIRE
*1	1	2.0"	59'	(112)*8 U.F.W./ GROUND
*1A	1	2.0"	11'	(112)*8 U.F.W./ GROUND
*2	3	2.5"	7'	(419)*14 (NEW) (219)*14
*3	1	2.5"	10'	(219)*14 (NEW) (219)*14
*4	1	2.5"	15'	(119)*14
*5	1	2.5"	79'	(119)*14 (NEW) (219)*14
*6	1	2.5"	7'	(119)*14 (NEW) (119)*14
*7	1	2.5"	10'	(119)*14

* DENOTES EXISTING

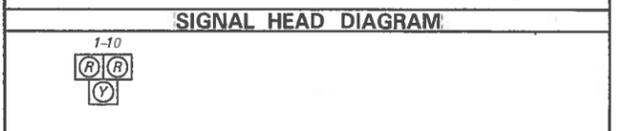
MAST ARM SCHEDULE				
MA#	HEIGHT OF POLE	LENGTH OF ARM	# OF HEADS	S.F. OF SIGNING
1	21'	60'	6	33



- SIGNAL NOTES CONT'**
- ALL NEW PEDESTRIAN SIGNALS SHALL CONTAIN COUNTDOWN PEDESTRIAN SIGNAL HEADS.
 - PROPOSED POLE BASES SUPPORTING POLES WITH PEDESTRIAN PUSH BUTTONS SHALL BE CONSTRUCTED IMMEDIATELY ADJACENT TO 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 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.
 - 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.
 - 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.
 - BACKPLATES SHALL BE INSTALLED ON ALL SIGNAL HEADS.



- SIGNAL PHASING**
- THE PEDESTRIAN HYBRID BEACON REMAINS DARK IN BETWEEN PEDESTRIAN ACTUATIONS CONCURRENT WITH PEDESTRIAN DON'T WALK INDICATION.
 - UPON PEDESTRIAN ACTUATION, THE BEACON DISPLAYS A FLASHING YELLOW INDICATION CONCURRENT WITH THE PEDESTRIAN DON'T WALK INDICATION.
 - THE BEACON CHANGES TO A STEADY YELLOW INDICATION CONCURRENT WITH THE PEDESTRIAN DON'T WALK INDICATION.
 - THE BEACON CHANGES TO A STEADY RED INDICATION CONCURRENT WITH THE PEDESTRIAN WALK INTERVAL.
 - THE BEACON CHANGES TO AN ALTERNATING FLASHING RED INDICATION CONCURRENT WITH THE PEDESTRIAN COUNTDOWN INDICATION AND PEDESTRIAN CLEARANCE INTERVAL.
 - THE BEACON REVERTS BACK TO THE DARK CONDITION AFTER THE PEDESTRIAN CLEARANCE INTERVAL ENDS.



LEGEND

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

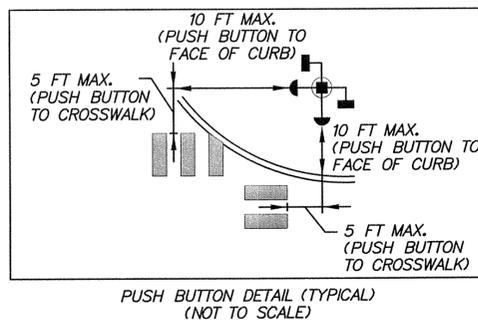
- GENERAL SIGNAL NOTES**
- ALL MAST ARM POLES WILL BE 21 FEET, EXCEPT WHERE SHOWN.
 - ALL SIGNAL EQUIPMENT REMOVED FROM A PROJECT IS TO BE RETURNED TO DELDOT TRAFFIC -DOVER, DELAWARE.
 - POLE BASES, CABINET BASE AND CONDUIT JUNCTION WELLS TO BE REMOVED IN ACCORDANCE WITH SECTION 201 AND 202 OF THE STANDARD SPECIFICATIONS OR AS DIRECTED BY ENGINEER. EXISTING CONDUIT IS TO BE ABANDONED.
 - ALL GALVANIZED CONDUIT (GRC) SHALL BE REAMED AND THREADED. ALL CRC SHALL BE THREADED TOGETHER WITH APPROVED COUPLINGS. SET SCREW, BOLTED, AND COMPRESSION FITTING ARE NOT ACCEPTABLE.
 - 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 <i>[Signature]</i> DATE: 7/12/12	RECOMMENDED <i>[Signature]</i> DATE: 7/2/12	APPROVED TRAFFIC ENGINEER <i>[Signature]</i> DATE: 7/2/12	APPROVED FOR INSTALLATION CHIEF TRAFFIC ENGINEER <i>[Signature]</i> DATE: 7/3/12
DELAWARE DEPARTMENT OF TRANSPORTATION ADDENDUM / REVISIONS [X] 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 31-041-03 COUNTY NEW CASTLE PERMIT NO. N768 DESIGNED BY: GG CHECKED BY:	PEDESTRIAN HYBRID BEACON SIGNAL PLAN SR 72 @ FARM LANE SHEET NO. 1 TOTAL SHTS. 2

AS Built Rev 9-3-13 SJR

ADDITIONAL NOTES

- ALL PEDESTRIAN SIGNALS SHALL CONTAIN PEDESTRIAN COUNTDOWN MODULES.
- INSTALL CDMA FOR COMMUNICATION WITH TMC.
- PROGRAM SIGNAL CONTROLLER TO KEEP A STEADY DON'T WALK FOR PEDS WHEN EMERGENCY PREEMPTION IS ACTIVATED.
- 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.
- STATUS OF RIGHT-OF-WAY ACQUISITION FOR NW AND NE CORNERS TO BE VERIFIED PRIOR TO STARTING SIGNAL CONSTRUCTION WORK.



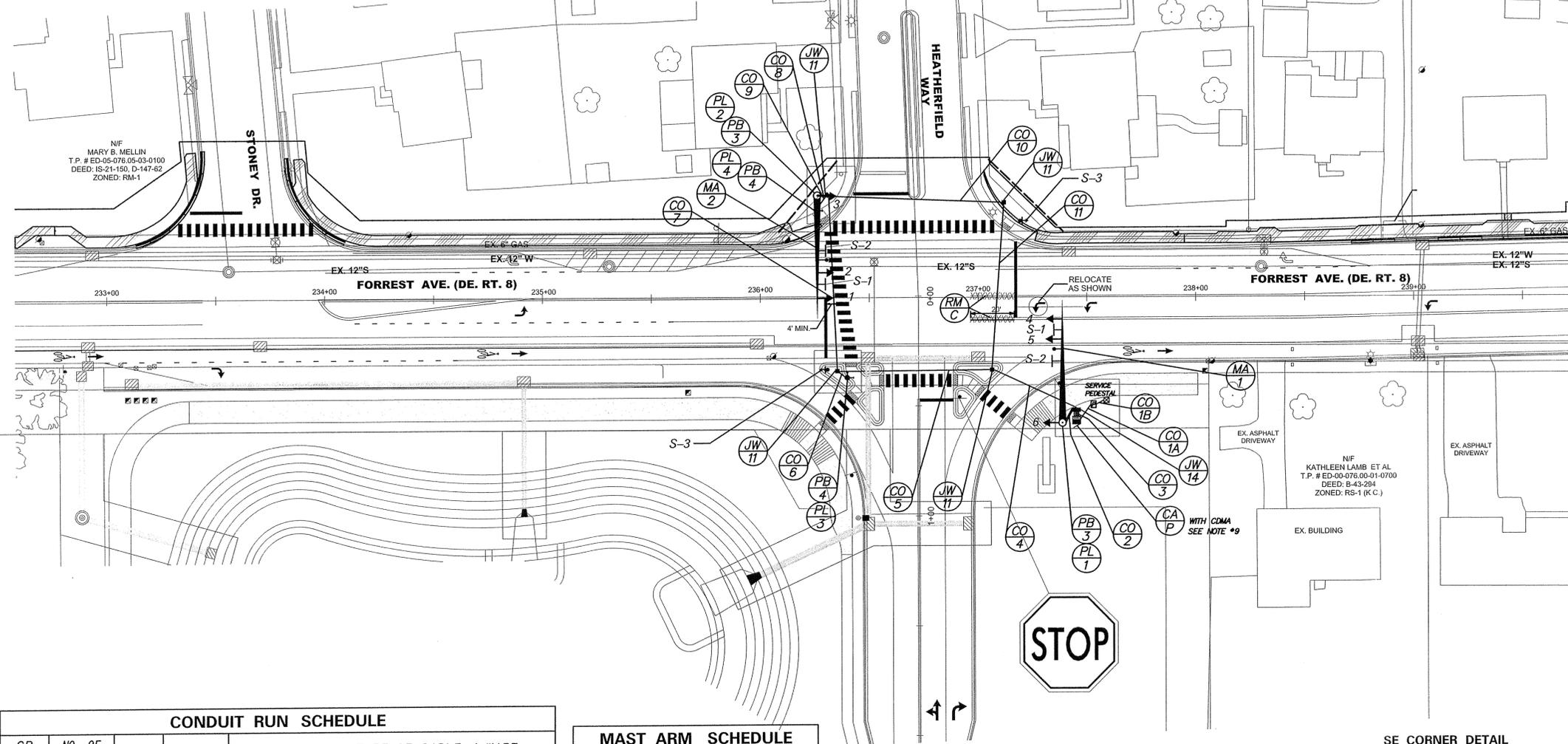
EXISTING SIGN & POST TO BE UPGRADED & RELOCATED



NW CORNER DETAIL
SCALE 1"=10'

SW ISLAND DETAIL
SCALE 1"=10'

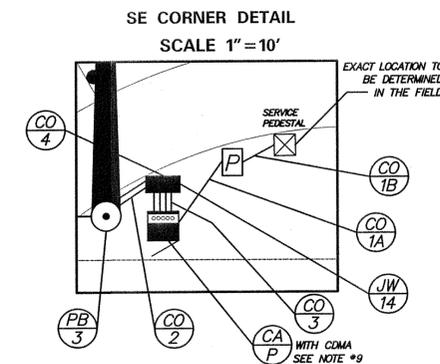
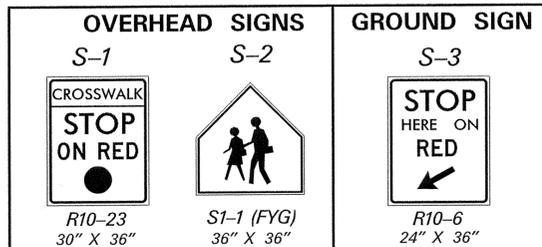
TYPE 2 CURB AREA SHOWN AROUND PED POLE FLUSH WITH RAMP PAVEMENT



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) 9/#14 (1) #6
11	1	4"	80'	(1) 5/#14 (1) #6
12	1	2.5"	25'	(1) 5/#14 (1) #6

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

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



SIGNAL PHASING

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

SIGNAL HEAD DIAGRAM



LEGEND

(AB) ABANDON	(OH) EXISTING OVERHEAD RUN IDENTIFIER (# OF OVERHEAD RUN)
(CA) EXISTING CABINET IDENTIFIER (TYPE OF CABINET)	(OH) PROPOSED OVERHEAD RUN IDENTIFIER (# OF OVERHEAD RUN)
(CB) PROPOSED CABINET IDENTIFIER (TYPE OF CABINET)	(PB) EXISTING POLE BASE IDENTIFIER (TYPE OF POLE BASE)
(CO) EXISTING CONDUIT RUN IDENTIFIER (# OF CONDUIT RUN)	(PB) PROPOSED POLE BASE IDENTIFIER (TYPE OF POLE BASE)
(CO) PROPOSED CONDUIT RUN IDENTIFIER (# OF CONDUIT RUN)	(PL) EXISTING POLE IDENTIFIER (# OF POLE)
(JW) EXISTING JUNCTION WELL IDENTIFIER (TYPE OF JUNCTION WELL)	(PL) PROPOSED POLE IDENTIFIER (# OF POLE)
(JW) PROPOSED JUNCTION WELL IDENTIFIER (TYPE OF JUNCTION WELL)	(RM) REMOVE BY CONTRACTOR
(MA) EXISTING MAST ARM IDENTIFIER (LENGTH OF ARM)	(RM) REMOVE BY OTHERS
(MA) PROPOSED MAST ARM IDENTIFIER (LENGTH OF ARM)	(RM) REMOVE BY TRAFFIC CONTRACTOR

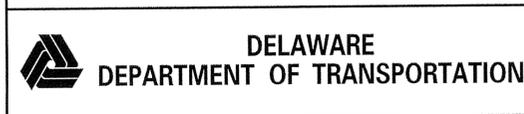
	EXISTING SYMBOL	PROPOSED SYMBOL
JUNCTION WELL	J.W.	■
LOOP DETECTOR, TYPE 1	□	□
LOOP DETECTOR, TYPE 2	□	□
LUMINAIRE	⬇	⬇
MAST ARM	⬇	⬇
MICROWAVE DETECTION	⬇	⬇
OPTICOM RECEIVER	⬇	⬇
OVERHEAD SIGNING	⬇	⬇
PEDESTRIAN POLE/BASE	⊙	⊙
PEDESTRIAN PUSHBUTTON	⬇	⬇
PEDESTRIAN SIGNAL HEAD	⬇	⬇
RIGHT-OF-WAY	---	---R/W---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

GENERAL SIGNAL NOTES

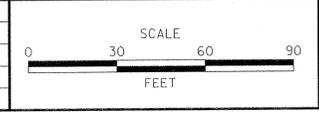
- ALL MAST ARM SIGNAL POLES WILL BE 21 FEET, EXCEPT WHERE SHOWN.
- ALL SIGNAL EQUIPMENT REMOVED FROM A PROJECT IS TO BE RETURNED TO DELDOT TRAFFIC - DOVER, DELAWARE.
- POLE BASES, CABINET BASE AND CONDUIT JUNCTION WELLS TO BE REMOVED IN ACCORDANCE WITH SECTION 201 AND 202 OF THE STANDARD SPECIFICATIONS OR AS DIRECTED BY ENGINEER. EXISTING CONDUIT IS TO BE ABANDONED.
- 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.
- 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.

Y:\TRAFFIC SIGNALS\KENT\K312\DESIGN\CADD_DGN\K312_SR_8 @ HEATHERFIELD WAY.DGN

RECOMMENDED _____ DATE: _____ RECOMMENDED _____ DATE: _____ RECOMMENDED *Alex SAVOIL* DATE: 3/31/14 APPROVED TRAFFIC ENGINEER *Wm. L. F.* DATE: 3/31/14 APPROVED FOR INSTALLATION CHIEF TRAFFIC ENGINEER *Wm. L. F.* DATE: 4/1/14



ADDENDUM / REVISIONS

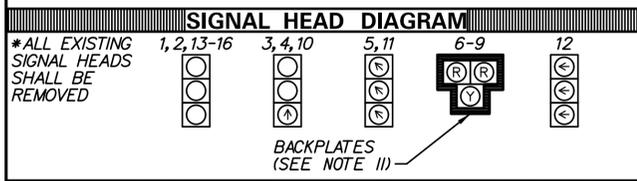
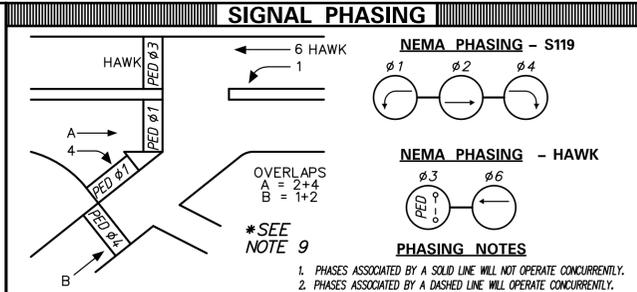
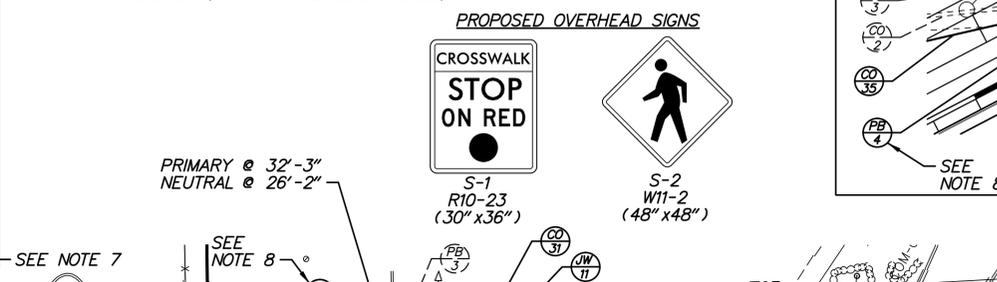


SR 8, FORREST AVENUE PEDESTRIAN IMPROVEMENTS, CRANBERRY RUN DRIVE TO MARSH CREEK LANE

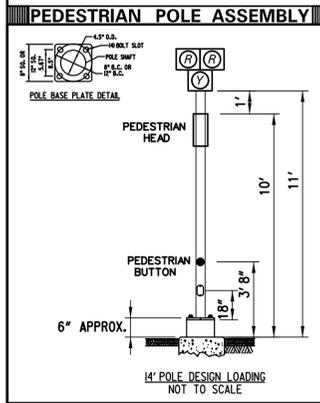
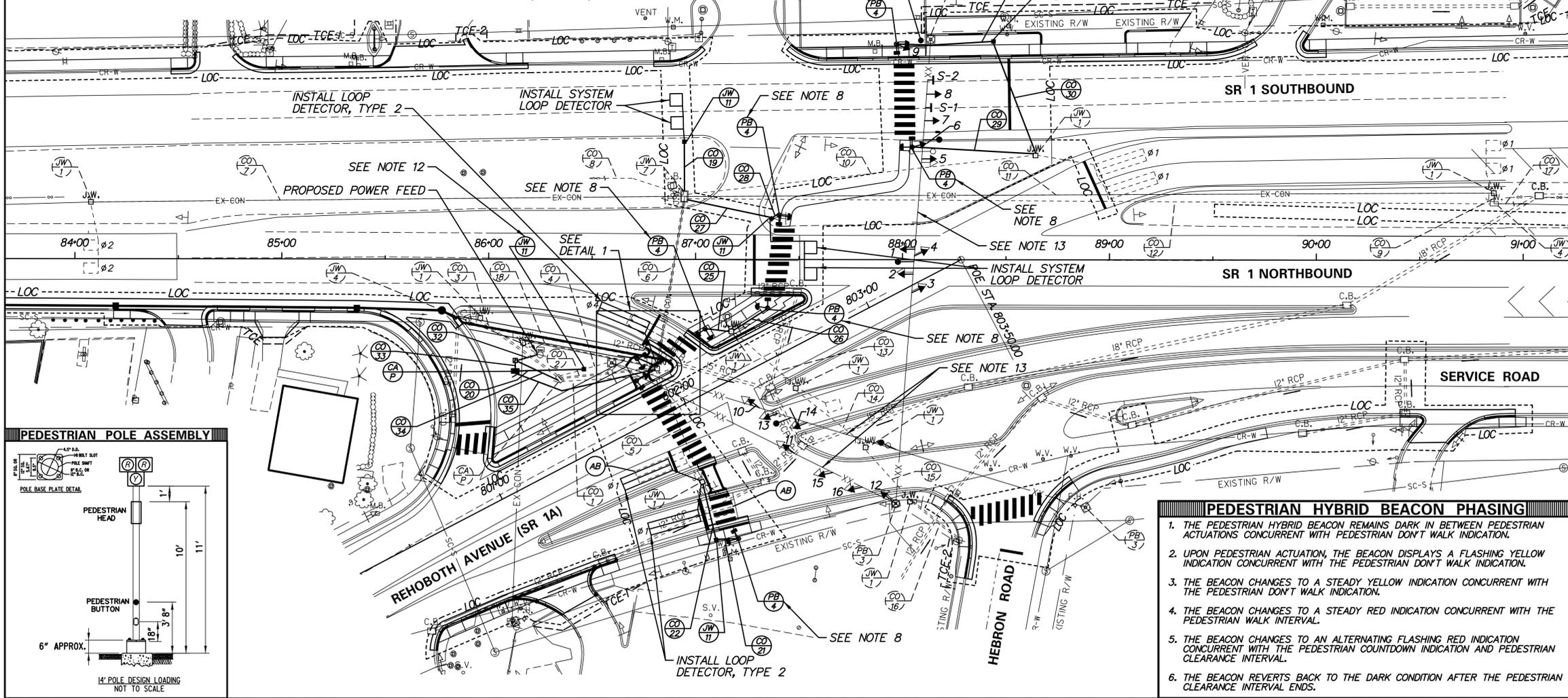
CONTRACT	T201401201	PERMIT NO.	K312	HAWK SIGNAL PLAN		SHEET NO.	21
COUNTY	KENT	DESIGNED BY:	MS	(PEDESTRIAN HYBRID BEACON)		TOTAL SHTS.	21
		CHECKED BY:	MH	SR 8 & HEATHERFIELD WAY			

CO#	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]

- NOTES:**
- 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.
 - 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.
 - 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.
 - DELDOT TRAFFIC/TMC SHALL MODIFY SIGNAL PHASING, AS SHOWN.
 - ALL PEDESTRIAN SIGNALS SHALL CONTAIN COUNTDOWN DISPLAYS.
 - DELDOT TRAFFIC SHALL INSTALL BACKPLATES ON PROPOSED SIGNAL HEADS 6-9.
 - 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.
 - 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.



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



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

- GENERAL SIGNAL NOTES**
- 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.
 - 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.
 - ALL SIGNAL EQUIPMENT REMOVED FROM A PROJECT IS TO BE RETURNED TO DELDOT TRAFFIC - DOVER, DELAWARE.
 - 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.
 - 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: _____
ADDENDUM / REVISIONS			CONTRACT T200612501	
SCALE 0 30 60 90 FEET			PERMIT NO. S119	
SR 1, REHOBOTH CANAL TO NORTH OF FIVE POINTS - PEDESTRIAN IMPROVEMENTS			DESIGNED BY: D.W.C. (WR&A)	
DELAWARE DEPARTMENT OF TRANSPORTATION			CHECKED BY: M.J.B. (WR&A)	
			SIGNAL PLAN SR 1 @ SR 1A (REHOBOTH AVENUE)	
			SHEET NO. 201	
			TOTAL SHTS. 220	

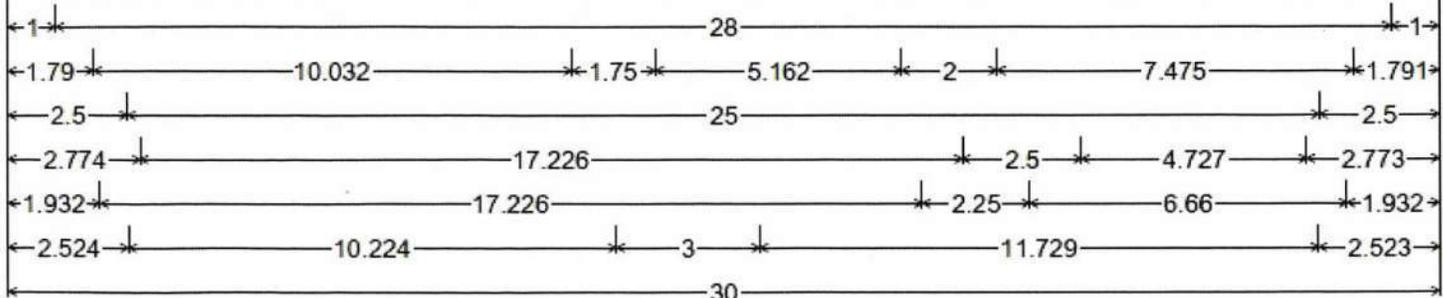
APPENDIX G

Proposed sign for HAWK beacons

CROSSWALK

STOP ON RED

**PROCEED ON
FLASHING RED
WHEN CLEAR**



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;