MARCUS HOOK GRADE CROSSING STUDY

JULY 2019

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DELAWARE VALLEY
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REGIONAL
PLANNING COMMISSION

The Delaware Valley Regional Planning Commission

is the federally designated Metropolitan Planning Organization for a diverse nine-county region in two states: Bucks, Chester, Delaware, Montgomery, and Philadelphia in Pennsylvania; and Burlington, Camden, Gloucester, and Mercer in New Jersey.

DELAWARE VALLEY dvrpc REGIONAL PLANNING COMMISSION

DVRPC's vision for the Greater Philadelphia Region is a prosperous, innovative, equitable, resilient, and sustainable region that increases mobility choices by investing in a safe and modern transportation system; that protects and preserves our natural resources while creating healthy communities; and that fosters greater opportunities for all.

DVRPC's mission is to achieve this vision by convening the widest array of partners to inform and facilitate data-driven decision-making. We are engaged across the region, and strive to be leaders and innovators, exploring new ideas and creating best practices.

DVRPC is funded through a variety of funding sources including federal grants from the U.S. Department of Transportation's Federal Highway Administration (FHWA) and Federal Transit Administration (FTA), the Pennsylvania and New Jersey departments of transportation, as well as by DVRPC's state and local member governments. The authors, however, are solely responsible for the findings and conclusions herein, which may not represent the official views or policies of the funding agencies.

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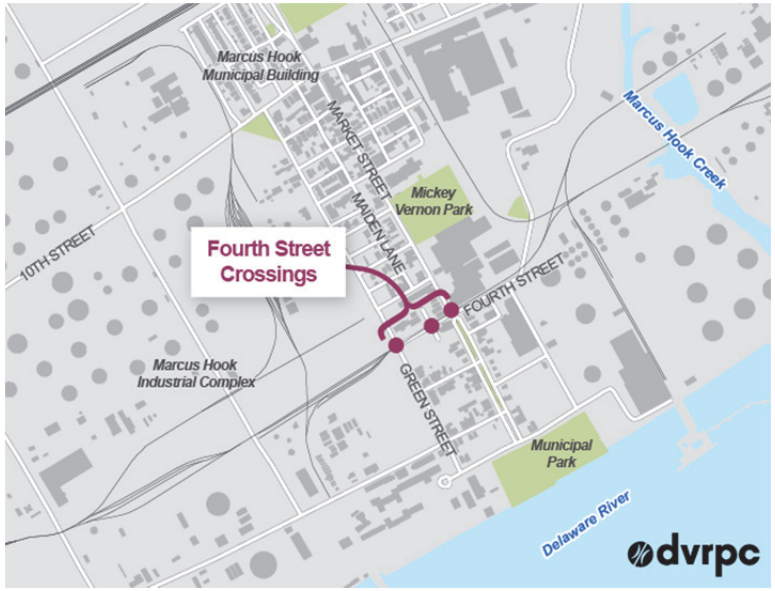
CHAPTER 1

Introduction

At the request of the Delaware County Planning Department, the *Marcus Hook Grade Crossing Study* was undertaken by the Delaware Valley Regional Planning Commission's (DVRPC) Office of Freight and Aviation Planning during Fiscal Year 2018. The primary tasks associated with this study were to document existing transportation operations and conditions at three inter-connected highway-railroad grade crossings located in Marcus Hook Borough, Delaware County, Pennsylvania and then, using available data and a review of best practices, to explore potential and appropriate improvements and options for the grade crossings.

Marcus Hook Borough is a very diverse community, made up of mature residential neighborhoods, a central business district, a massive industrial center (the Marcus Hook Industrial Complex), two rail lines (one freight line, the Conrail Chester Secondary, and one passenger line, the Amtrak Northeast Corridor/SEPTA Wilmington line), and an active marine terminal and public open space along the Delaware River. Given this wide variety of land uses and activities, the intent of the study was to identify the kinds of improvements which would balance the operation of freight trains serving the industrial center with the concerns and preferences of the community at the point where they converge at the three public grade crossings, where conflicts may occur (e.g., blocked traffic lanes).



The following grade crossings along Fourth Street in Marcus Hook, which are in close proximity to each other, were the primary focus of this study (U.S. DOT grade crossing numbers are shown in parentheses):

- Green Street (#592835V)
- Maiden Lane (#592837J)
- Market Street (#592836C)

A major attribute, that is inherently complex, and highly non-conventional is that the rail line which traverses the three crossings, Conrail's Chester Industrial Track, essentially runs down the middle of Fourth Street, from Market Street to Green Street, a distance of approximately a tenth of a mile.

The Chester Industrial Track runs down the cartway of Fourth Street, shown above facing north toward Market Street. Source: DVRPC, 2018

Steering Committee

A specially organized steering committee was an important element of this study effort. The steering committee met at three strategic times during the course of the study at the Marcus Hook Municipal Building and provided expertise, guidance, and recommendations. Steering committee members included:

- Marcus Hook Borough elected officials,
- Marcus Hook Borough staff,
- Delaware County Planning Department staff,
- Local business representatives,
- Conrail representatives,
- Pennsylvania Department of Transportation staff, and
- DVRPC staff.

Report Organization

The major study findings of the *Marcus Hook Grade Crossing Study* are documented and presented in the following three sections:

- Existing Conditions and Background
- Improvement Recommendations
- Next Steps

As a follow-up to this report and study effort, DVRPC staff will work with the stakeholders to further define the grade crossing improvement options and desirable improvements, and to pair them with potential funding sources.

CHAPTER 2

Existing Conditions and Background

This section of the report will explore the existing conditions in the study area including land use of the area, overview of the rail operations that utilize the Fourth Street corridor, highway traffic activity, and railroad safety inventory.

Marcus Hook Borough

Marcus Hook Borough, a municipality occupying about 1.11 square miles of land in Delaware County, Pennsylvania, reflects the industrial might that once, and to an extent, still does, exist on the Delaware River. Nicknamed the "Cornerstone of Pennsylvania" the municipality occupies the southeastern corner of Pennsylvania, along the Delaware River. Officially incorporated in 1892, the borough has long been a significant presence on the river. As the first port of call for Philadelphia, the town once rivaled Chester in size. By the early 20th century the petroleum industry took hold in the town. The first refinery began operation in 1892, and in 1902 land was acquired for the Sun Oil Refinery which would later be named Sunoco. The growth and development of the Marcus Hook Refinery brought jobs and supporting businesses to the local and surrounding communities. However, shifts in the petroleum industry led to the closure of the Sunoco Refinery in 2011. This facility was later renamed the Marcus Hook Industrial Complex (MHIC) and repositioned to handle natural gas liquids, which arrive on the Mariner East pipeline system.

Land Use in Marcus Hook Borough

The borough is comprised of a mix of uses dominated mostly by industrial land. Figure 1 shows the distribution of land use in the borough. From approximately Green Street and extending south and west to the Delaware border is the MHIC. The MHIC along with other industrial land on the eastern end of the borough account for a combined 75 percent of all the land area. Residential and Commercial land uses account for just 9 percent and 2 percent, respectively.

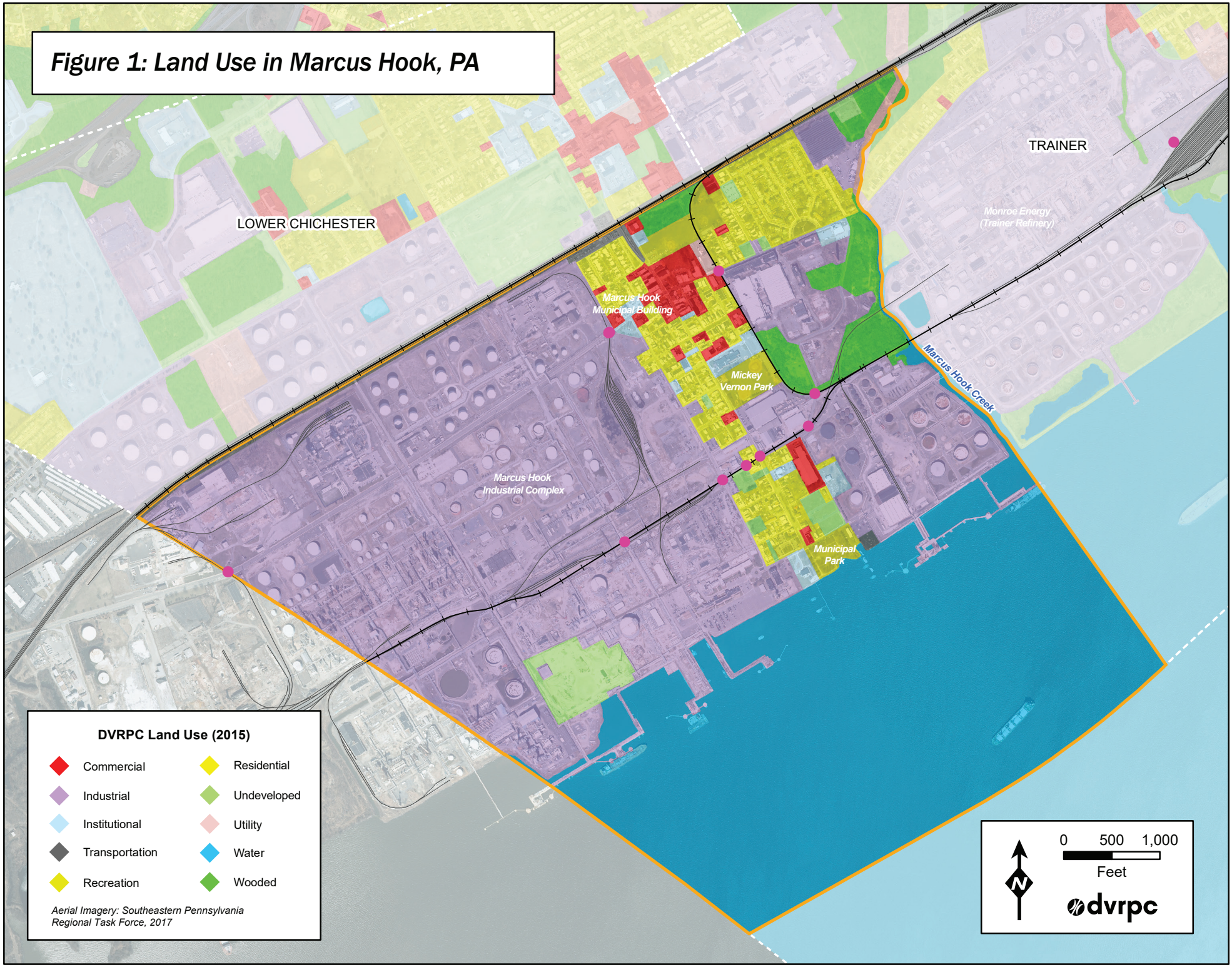


Figure 1: Land Use in Marcus Hook, PA
LOWER CHICHESTER
TRAINER
Monroe Energy
(Trainer Refinery)
Marcus Hook
Municipal Building
Mickey
Vernon Park
Marcus Hook Creek
Marcus Hook
Industrial Complex
Municipal
Park
DVRPC Land Use (2015)
Commercial
Residential
Industrial
Undeveloped
Institutional
Utility
Transportation
Water
Recreation
Wooded
Aerial Imagery: Southeastern Pennsylvania
Regional Task Force, 2017
N
0
500
1,000
Feet
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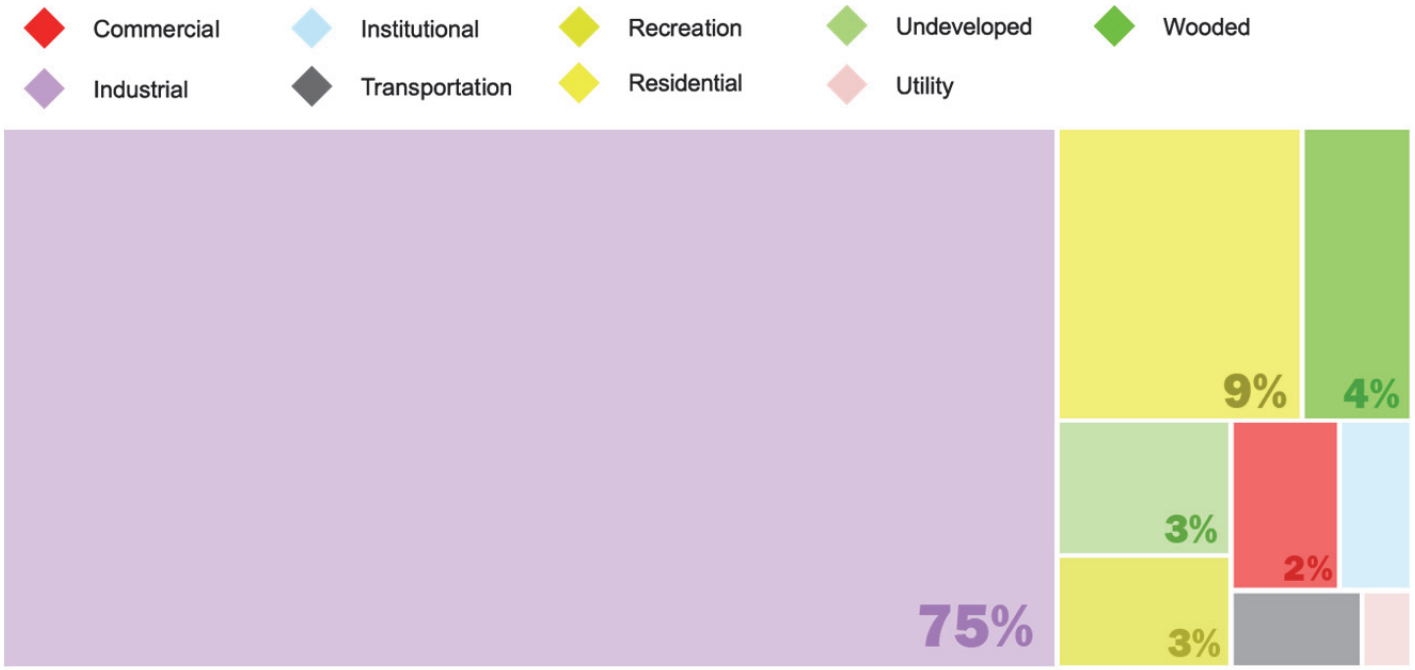
Figure 2: Land Use Composition of Marcus Hook, PA



Source: DVRPC, 2015

The core commercial district in Marcus Hook is located along Tenth Street, centered on the intersection with Market Street. Residential land surrounds the commercial district and extends along Market and Green Streets to the waterfront. This creates a unique dynamic between non-industrial land uses and the large, economically significant land holders that exist in the borough.

Development Adjacent to Crossings

The activity at the railroad grade crossings on the Fourth Street corridor are heavily influenced by the adjacent land uses in the community. This section of Marcus Hook is uniquely situated with residential development sandwiched between large industrial properties. Despite having 1.1 miles of waterfront in the borough, just 675 feet is dedicated to non-industrial waterfront. This section is occupied by the Marcus Hook Community Center and Market Square

Memorial Park. This waterfront facility along with the small residential community that exists along the Market and Green Street corridor are only accessible through the grade crossings in the study area.

In addition to the local residential development in the study area, the MHIC to the south is responsible for the generation of both vehicle and train trips through the study area. The MHIC has gone through several major changes in recent years. The closing of the Sun Refinery and repositioning of the complex has resulted in shifting demands on inbound and outbound transportation infrastructure. The complex is now occupied by several large operators including Braskem, Energy Transfer Partners, and Honeywell, among other supporting businesses. Each of these operations relies on both truck and rail access to different degrees. While some have truck access points located on routes that do not traverse the study area, all rail traffic serving these operations must utilize the Fourth Street corridor.

Highways and Streets

The study area for this project covers four highway facilities that interact with the railroad as well as corresponding pedestrian infrastructure. The unique routing of the railroad between Market Street and Green Street results in a shared right-of-way along Fourth Street. The officially designated highway-railroad grade crossings are at Market Street, Maiden Lane, and Green Street. The fourth road of concern is Fourth Street, which becomes Penn Avenue north of the study area.

To better understand the activity on these roads, 24-hour classification counts were conducted. These provided hourly counts of the number of vehicles using the roads, by direction, by vehicle class, allowing the study team to differentiate between trucks and passenger vehicles. Table 1 shows the summary of the count activity for each of the roads for which counts were conducted. Counts were unable to be conducted on Fourth Street between Green and Market Streets due to the existence of the rail line in the pavement, so counts were taken north of Market Street.

Table 1: Summary of Vehicular Counts

Count Location	Average Annual Daily Traffic (AADT)	Percent Truck
Green Street	1,300	9.5%
Market Street	1,030	7.2%
Fourth Street	1,100	0.8%

Source: DVRPC, 2017

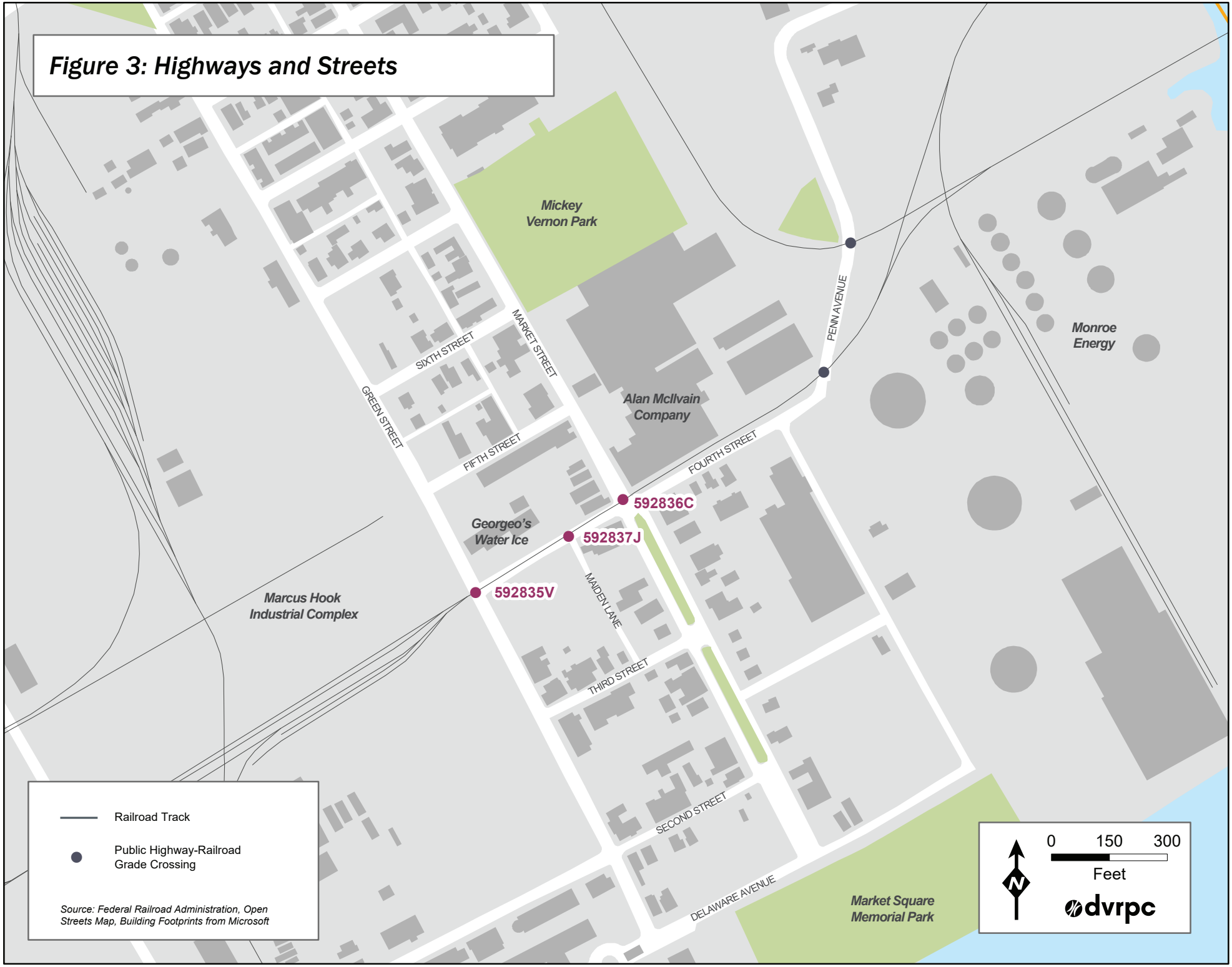


Figure 3: Highways and Streets
Mickey Vernon Park
Alan McIlvain Company
Monroe Energy
Georgeo's Water Ice
Marcus Hook Industrial Complex
Market Square Memorial Park
PENN AVENUE
MARKET STREET
SIXTH STREET
GREEN STREET
FIFTH STREET
FOURTH STREET
MAIDEN LANE
THIRD STREET
SECOND STREET
DELAWARE AVENUE
592836C
592837J
592835V
Railroad Track
Public Highway-Railroad Grade Crossing
Source: Federal Railroad Administration, Open Streets Map, Building Footprints from Microsoft
0
150
300
Feet
N
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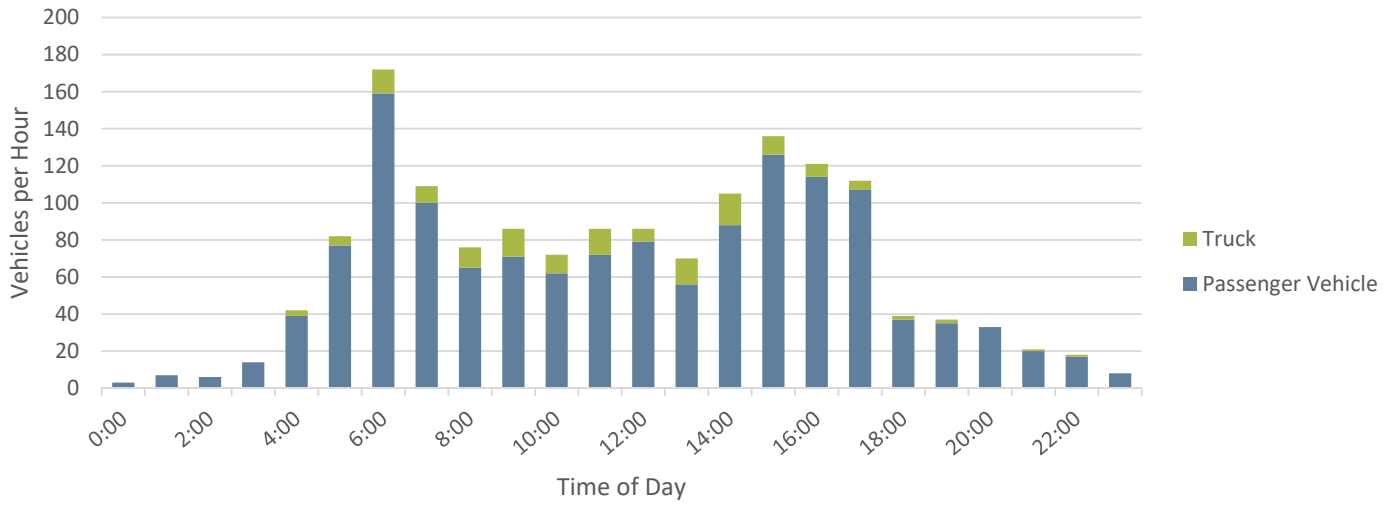
Green Street

Green Street is the busiest of the three roads with a measured Average Annual Daily Traffic of approximately 1,300 vehicles. This road displays a typical AM and PM peak distribution of traffic with volumes of 100–150 vehicles per hour during these peak periods. This road also exhibits the highest volume of trucks by both raw value and percent of total traffic. The counts show that approximately 9.5 percent of all traffic is truck. Green Street does have a designated parking lane on the northbound side of the street for much of its length; however, parking is prohibited on both approaches to the crossing for at least 140 feet. There are several driveways in close proximity to the crossing serving the Georgeo's Water Ice property.

Figure 4: 24-hour Profile of Vehicular Traffic on Green Street (both directions)

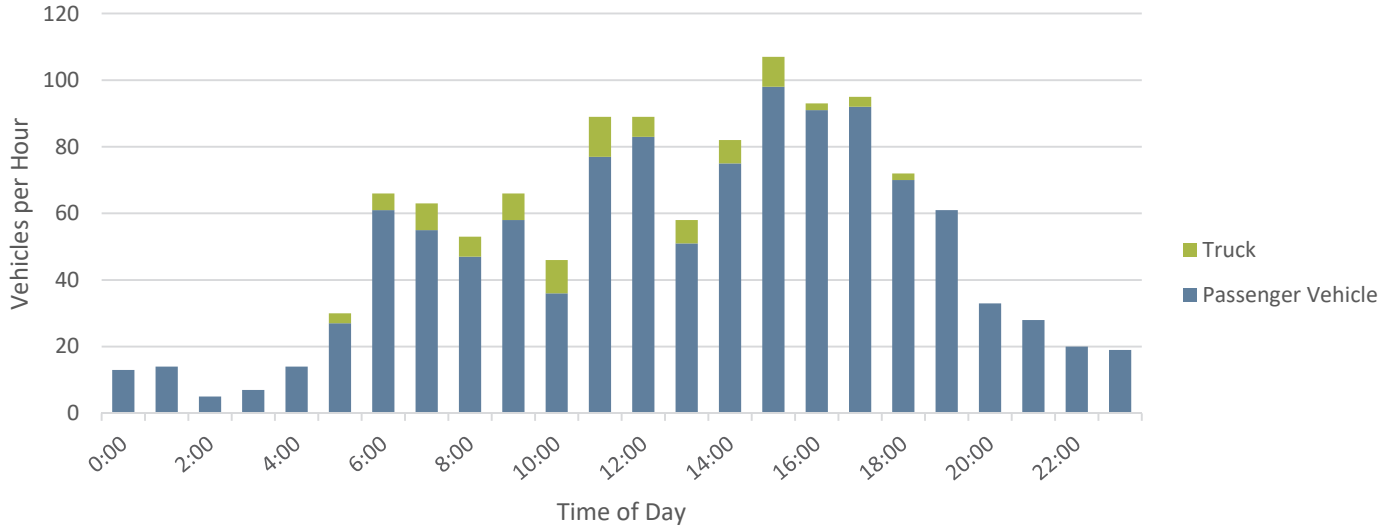


Source: DVRPC, 2017

Market Street

Market Street serves as a primary connector into the residential neighborhood along the waterfront. This road has an Average Annual Daily Traffic of approximately 1,030 vehicles. The counts for Market Street do not demonstrate the same AM/PM peaks as Green Street, but peak volume on this road were around 100 vehicles per hour during the PM peak period. Market Street has a unique geometry that changes at the intersection with Fourth Street. To the north of the intersection the road is one-lane by direction with a single parking lane on the southbound side. To the south of the intersection the road becomes divided by a landscaped median with a single travel lane and a parking lane in each direction. In addition, parking is permitted to the corner on all three segments with a parking lane.

Figure 5: 24-hour Profile of Vehicular Traffic on Market Street (both directions)



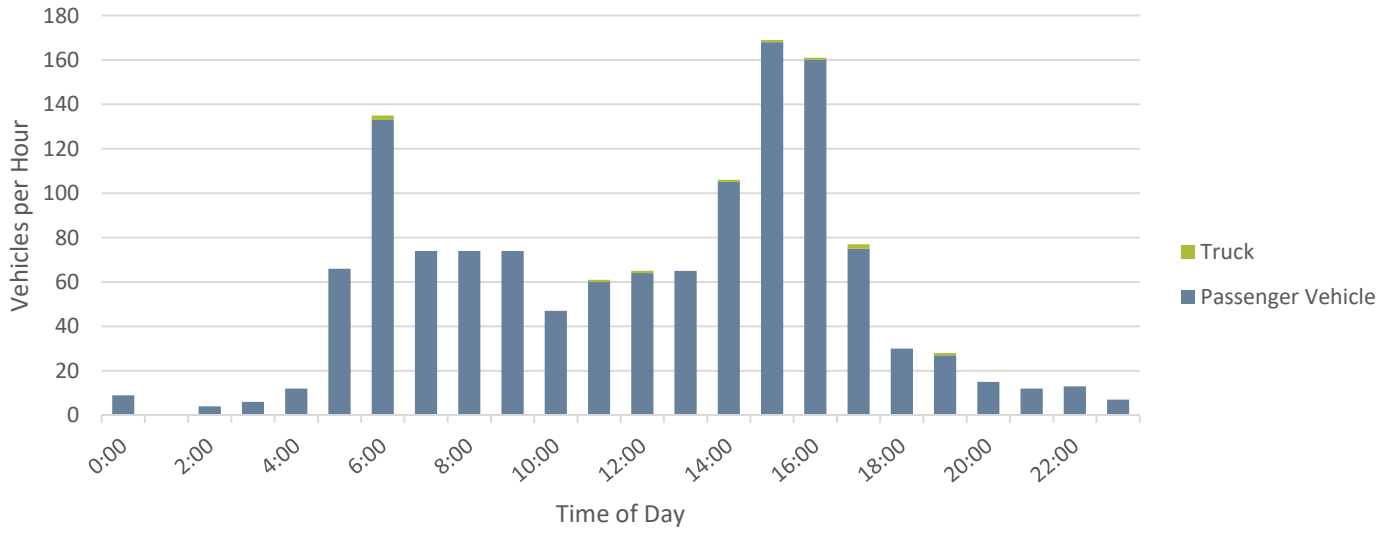
Source: DVRPC, 2017

Fourth Street

Fourth Street runs perpendicular to the other major roads in the study area. Beyond the crossings the road serves as a connector to Penn Avenue which provides an alternate access route to Tenth Street. Fourth Street was measured to the north of the study area and has an Average Annual Daily Traffic of approximately 1,100 vehicles. The activity

demonstrated a typical AM and PM peak distribution with peak volumes of 140–160 vehicles per hour. This road also has several sections marked for permit parking, towards the northern end where Fourth Street intersects with Market Street.

Figure 6: 24-hour Profile of Vehicular Traffic on Fourth Street (both directions)



Source: DVRPC, 2017

Maiden Lane

No counts were taken on Maiden Lane as it is a small alley that operates one-way away from Fourth Street.

10th Street

Additional counts were taken on 10th Street to verify vehicular volumes just beyond the study area and understand the relative activity. The counts on 10th Street show an Average Annual Daily Traffic of approximately 7,000 vehicles per day. This activity, on the main thoroughfare through Marcus Hook's commercial district, is at least four times greater than the volume on any of the roads intersecting grade crossings in the study area. This difference in volume

is significant when comparing the safety measures employed at the 10th Street crossings relative to those crossings in the study area.

These vehicular volume counts were not consistent with existing Federal Railroad Administration Crossing Inventory reports for the crossings in the study. The data collected in this study was provided to Pennsylvania Department of Transportation to be updated in the FRA database.

Railroad Activity

Overview of Rail Operations

In order to understand rail operations in the study area it is necessary to explore a wider context. The study area, more specifically the crossings on the Fourth Street corridor, is on the Chester Industrial Track that provides service to the MHIC, including Braskem and Honeywell. This spur runs off of the Chester Secondary just north of Penn Avenue. All service on the Chester Industrial Track is operated by Conrail and originates from the Stoney Creek Yard in Trainer, Pennsylvania. The Stoney Creek Yard is a classification yard that handles all inbound/outbound CSX Transportation and Norfolk Southern Corporation trains from the national rail network. These inbound manifest trains are sorted and assembled/disassembled in the yard.

Train carloads originating from or destined to the MHIC must move through the Stoney Creek Yard. These carloads are moved via switching operations by Conrail on a schedule that is responsive to the needs of the operators in MHIC. Current activity in the MHIC results in approximately three operations in and out per day for a total of six daily trains through the study area. While these trains operate on a “fixed” schedule they are heavily influenced by the availability of crew and locomotive power as well as upstream delays. This can often produce variations in timing from day to day.

Another significant factor in the railroad operations in the study area is the presence of a secure gate at the MHIC entrance. This gate creates a unique operational challenge for the railroad and potential hazards for the public at the crossings. To the credit of the MHIC and Conrail, the operations have been modified in recent years to address

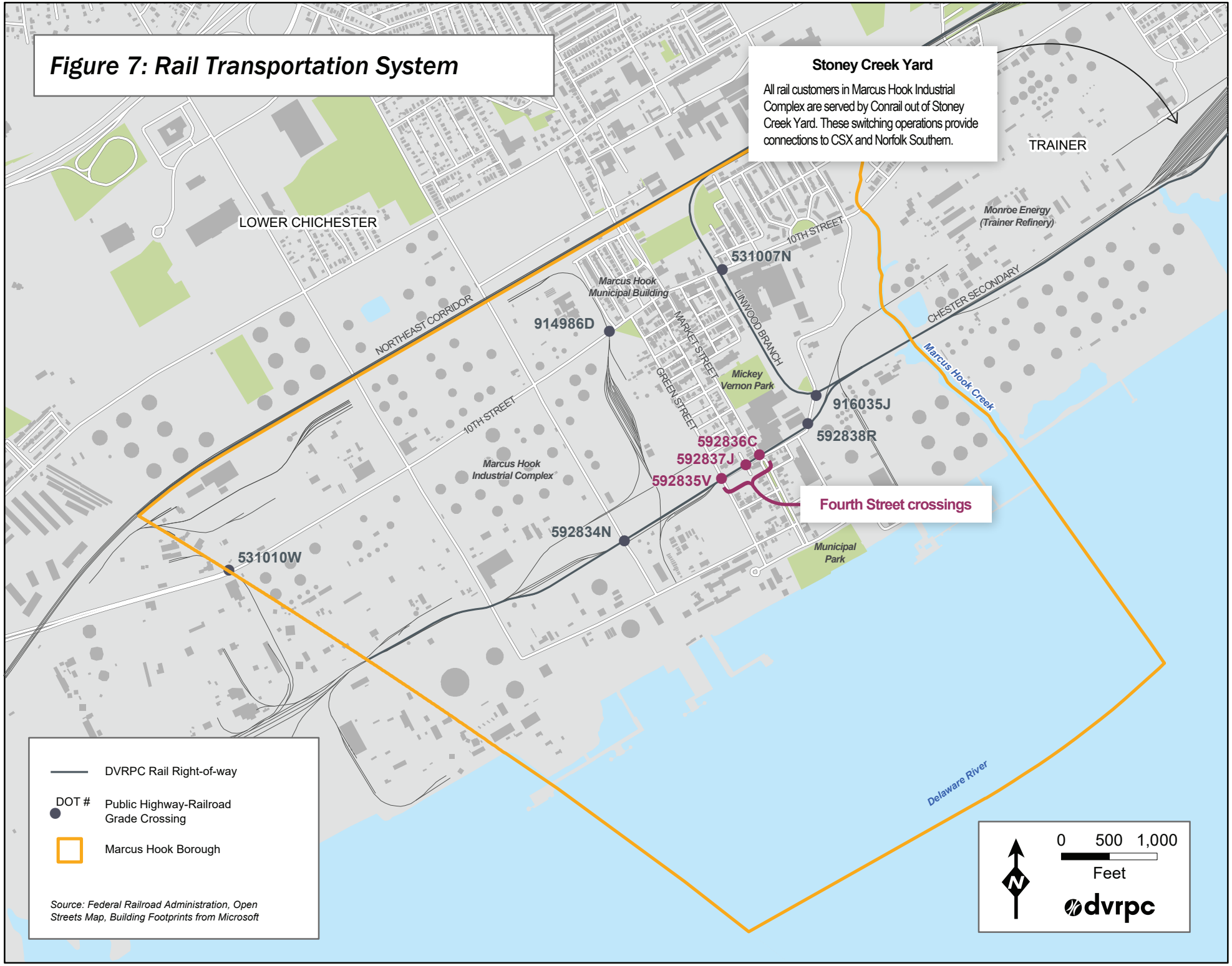


Figure 7: Rail Transportation System
Stoney Creek Yard
All rail customers in Marcus Hook Industrial Complex are served by Conrail out of Stoney Creek Yard. These switching operations provide connections to CSX and Norfolk Southern.
LOWER CHICHESTER
TRAINER
Monroe Energy (Trainer Refinery)
10TH STREET
531007N
Marcus Hook Municipal Building
LINWOOD BRANCH
CHESTER SECONDARY
NORTHEAST CORRIDOR
914986D
MARKET STREET
GREEN STREET
Mickey Vernon Park
Marcus Hook Creek
916035J
592838R
592836C
592837J
592835V
Fourth Street crossings
10TH STREET
Marcus Hook Industrial Complex
592834N
531010W
Municipal Park
Delaware River
DVRPC Rail Right-of-way
DOT #
Public Highway-Railroad Grade Crossing
Marcus Hook Borough
Source: Federal Railroad Administration, Open Streets Map, Building Footprints from Microsoft
N
0 500 1,000
Feet
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concerns from the public. Currently, approaching Conrail trains radio to MHIC security their intent to access the facility and stop to the north of Market Street. The train queues at this point until security can register the train crew and advance to opening the gate south of Green Street. Once MHIC security advances to opening the gate, the Conrail train crew begins its operations across Market Street and down the Fourth Street corridor into the MHIC. If all operations are executed as planned, the Conrail train should advance from Market Street into the complex without having to stop. These operations occur at a low speed as the track is considered exempted track.

Grade Crossing Background

This section provides general information regarding grade crossings. Most of the information is taken from the *Railroad-Highway Grade Crossing Handbook*, US Department of Transportation, Revised Second Edition, August 2007.

Horn Noise

All locomotives are equipped with air-powered horns which they are required by law to use when approaching a crossing. The engineer inside the locomotive will sound the horn in a sequence of two long blasts, followed by a short blast, followed by another long blast as the train approaches the crossing. The federal regulations require that the horn sequence be initiated between 15 and 20 seconds prior to the arrival of the train at the grade crossing; however, most existing state laws and railroad rules require that the horn be sounded beginning at a point ¼ mile in advance of the crossing and continue to be sounded until the crossing is occupied by the locomotive. There are a series of exceptions to the train horn rules, the most prevalent and well known of which are quiet zones.

Quiet zone regulations are intended to maintain a high level of public safety, while providing local communities with relief from unwanted train noise. There is a series of supplementary safety measures, alternative safety measures, and education and enforcement options that can be used to raise public safety at a grade crossing to qualify for quiet zone status. Once a quiet zone is established the railroad is barred from sounding the horn at the affected grade crossing, or grade crossings. (Note: a railroad may still need to initiate the horn in a quiet zone for railroad operations related reasons.) The agency tasked with maintenance or enforcement of the roadway at the grade crossing is the only agency that may apply for a quiet zone. Additionally, both the capital and maintenance costs of the added safety measures needed to secure quiet zone statutes falls on the applying agency, not the railroad.

Responsibilities at Grade Crossings

Grade crossing safety problems have existed since the 19th century, which has caused a complicated series of jurisdictional issues surrounding the crossings. There are many federal, state, local, and private agencies that play a role in maintaining crossings. Below is a list of the most important agencies and a brief one-sentence description of their general responsibility.

- Federal Highway Administration (FHWA). FHWA administers federally-funded programs, several of which can be used to fund capital improvements at grade crossings.

- Federal Railroad Administration (FRA). FRA maintains data about each highway-railroad grade crossing in the "National Highway Rail Crossing Inventory," and data about each incident at a crossing in the "Railroad Accident/Incident Reporting System."

- Pennsylvania Utility Commission (PUC). Jurisdiction over highway-railroad grade crossing falls mostly to each state. In Pennsylvania, the responsible agency is the PUC. Anything regarding improvements, cost allocation, and closings that has to do with grade crossings must go through the PUC.

- Railroads. Railroads are responsible for all installation and maintenance of tracks and roadway within the grade crossing. The railroad is also responsible for the design, construction, operation, and maintenance of railroad crossing signals (crossbucks, lights, gates, etc.)

- State and Local Government. The enforcement of traffic laws within a grade crossing falls to whoever owns the roadway. Additionally, the roadway owner, be it the state or local entity, is responsible for making sure that the standards set forth by the federal government are followed by the railroad regarding the design, construction, operation, and maintenance of railroad crossing signals (crossbucks, lights, gates, etc.). Additionally, these agencies are responsible for all traffic control devices on the approaches to the grade crossing, this includes but is not limited to: traffic signals (even if interconnected with the railroad warning systems), and passive signs such as "Do Not Stop on Tracks."

Traffic Laws at Grade Crossings

In general, the laws of the roadway extend into the grade crossing when no train is in the vicinity. Once an active warning system has been initiated, vehicles that enter the grade crossing are subject to heavy fines and suspension of their driver license. All buses (including school buses and taxi cabs) are legally required to come to a complete stop at every grade crossing regardless of whether or not the active train warning devices are in operation. This law also extends to all trucks that are carrying hazardous materials.

Operation Lifesaver Events

Operation Lifesaver is a non-profit organization devoted to increasing the safety at highway-railroad grade crossings through public education. The organization was founded in Idaho in 1972, and in 1986 a national office was opened to support the efforts of the state level programs and raise national awareness. Today, Operation Lifesaver provides a network of certified volunteer speakers to speak to a wide range of groups including schools, community groups, professional groups, and law enforcement. The national Operation Lifesaver office produces flyers and free giveaway items intended to raise awareness and educate about the dangers of grade crossings.

Grade Crossing Inventory

All highway-railroad grade crossings in the United States, public or private, both at-grade and separated, are required by law (Rail Safety Improvement Act of 2008) to have a DOT Crossing Inventory Number. For at-grade crossings, the number should be posted at the crossing. The Crossing Inventory Number is also used for tracking equipment information, owner/operator details, activity levels, maintenance needs, and incident history.

Using the DOT Crossing Inventory reports and field verification, the existing railroad safety equipment at each crossing in the study area was inventoried.

Warning Devices and Supplemental Safety Measures

A component of the U.S. DOT Crossing Inventory and State railroad database information system addresses the existing safety measures located at each designated grade crossing. The existing conditions of these crossings are

important in helping to understand the current visibility of these crossings as well as identify potential deficiencies that may adversely impact safety at the crossing. In addition to the railroad warning devices, other traffic control measures exist for these crossings. The existing conditions safety measures for each of the crossings are listed below.

#592835V – Green Street Crossing

The Green Street Crossing is equipped with railroad crossing crossbuck signage (crossbucks) on both approaches. A single advanced warning sign exists on the westbound approach. The roadway has no markings or stop bars related to the railroad crossing.

Figure 8: Green Street Existing Warning Devices and Safety Measures

Source: Google Street View, 2018

#592837J – Maiden Lane Crossing

The Maiden Lane Crossing is equipped with two crossbucks mounted on the southwest corner of the intersection. No additional striping or signage exists at the crossing.

Figure 9: Maiden Lane Existing Warning Devices and Safety Measures

Source: Google Street View, 2018

#592836C – Market Street Crossing

The Market Street Crossing is a stop-controlled four-way intersection. The crossing is equipped with two crossbucks for Market Street traffic on a sign mounted on the northwest corner of the intersection. A single advance warning sign exists on the westbound approach. The roadway has poor pavement markings for pedestrian crossings and no markings or stop bars related to the railroad crossing.

In addition to the Market Street approaches, the southbound Fourth Street approach intersects with the rail crossing but has no advanced warning devices and/or striping related to the railroad crossing.

Figure 10: Market Street Existing Warning Devices and Safety Measures

Source: Google Street View, 2018

Accidents/Incidents

The FRA maintains a database containing reported cases of impacts between on-track equipment and any user of a public or private highway-railroad intersection dating back to 1975. The database contains three accident reports

for the crossings in the study area, which are summarized below, starting with the most recent:

- **January 8, 2015 at 1:15pm [#592836C]** – A Conrail train with 13 cars, operating at eight miles per hour struck a vehicle on Market Street that stopped in the crossing. This accident injured one of three occupants of the vehicle and caused an estimated $14,015 in damages to the vehicle.

- **July 22, 2005 at 6:45pm [#592835V]** – A Conrail train with three cars, operating at five miles per hour was struck by a vehicle on Green Street that failed to yield at the crossing. No injuries were reported in the accident.

- **November 21, 1975 at 8:00pm [#592835V]** – A Reading Railroad Company train with six cars, operating at less than five miles per hour was struck by a vehicle on Green Street that failed to yield at the crossing. The driver of the vehicle was injured in the accident.

In addition to the FRA reported crashes, the local police department provided the study team with several accident reports involving activity at or near the grade crossings. These incidents did not provide quantifiable data that would suggest any significant pattern of activity. However, the reports did provide additional anecdotal evidence of issues with visibility as well as dangerous vehicular behavior.

CHAPTER 3

Improvement Recommendations

This chapter details a list of possible improvements that could be made to improve safety and traffic conditions at the study area grade crossings. These recommendations were the product of analysis of incident history, existing safety equipment at the crossings, and input from key stakeholders.

Short-term Improvements

The condition of the existing safety equipment at the crossings was found to be insufficient to provide the necessary awareness and visibility to road users. The implementation of appropriate passive control devices would provide Marcus Hook with a substantial improvement to the visibility of the crossings for all roadway users. These low-cost measures can be implemented by the municipality given that all roads are locally owned.

The recommended passive control measures include:

- advance railroad warning signage (W10-1) on all approaches,
- advance grade crossing pavement markings, and
- upgraded crossbuck signage (R15-1).

Passive Control Measures

Far left: An Advanced grade crossing warning sign (W10-1). Center: Advanced grade crossing warning striping. Right: Grade crossing crossbuck (R15-1) (Source: Operation Lifesaver)

To further improve the visibility of the Green Street crossing, it is recommended that Marcus Hook convert the intersection of Green and Fourth Streets to a stop-controlled intersection. This modification would require the addition of new stop signs on the Green Street approaches. The conversion to a stop-controlled intersection ensures that road users come to a stop at the crossing, become aware of the cross-movement activity, and then safely advance.

Additional improvements are recommended to further enhance the visibility and demarcation of appropriate space within the right-of-way for all road users. These improvements include:

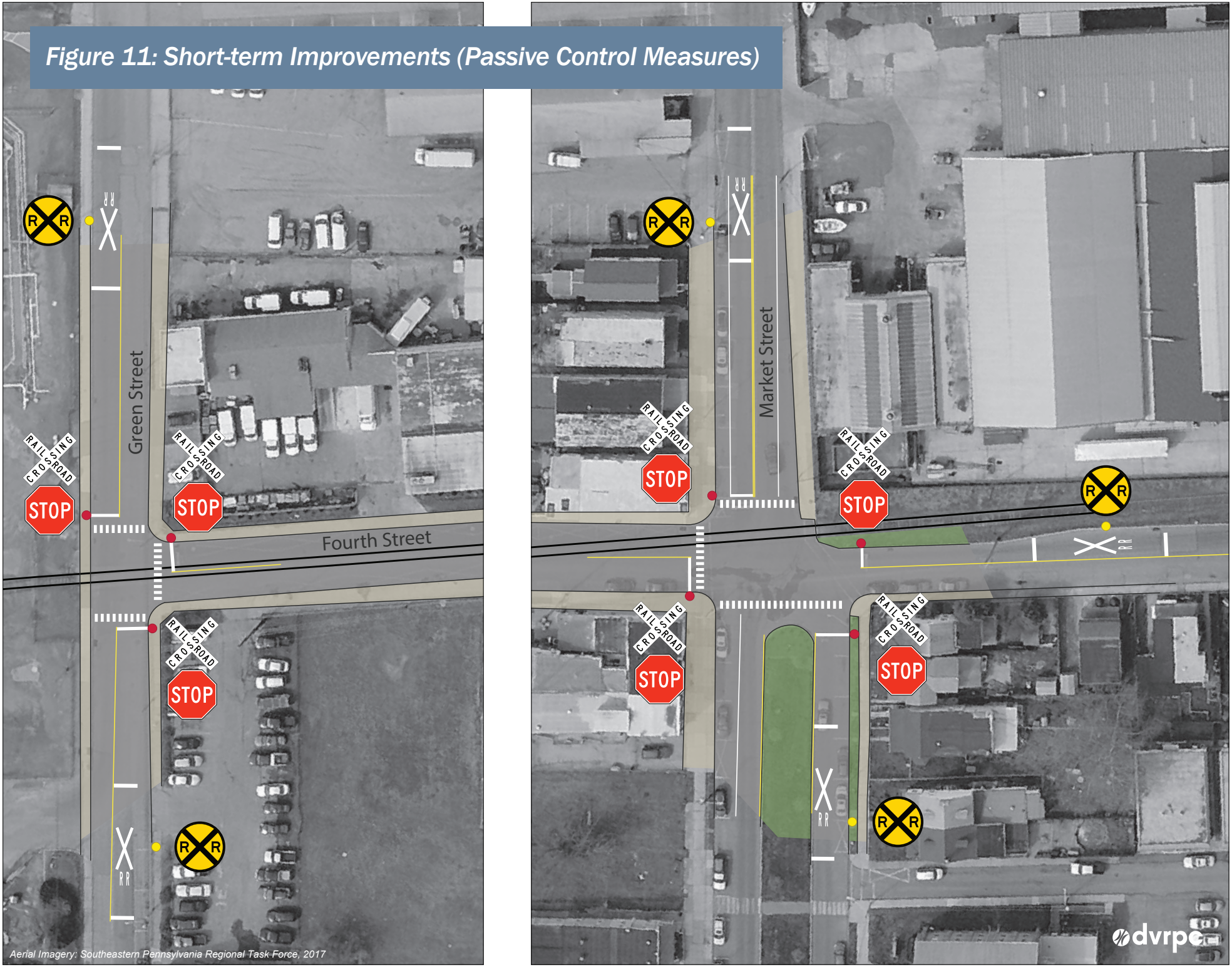
- new lane striping of both center lane and shoulder,
- no parking signage and striping,
- stop bars, and
- high visibility crosswalks.

The improvements at each crossing are illustrated for conceptual purposes in Figure 11.[1]

The Maiden Lane crossing has only one approach from the alley to the north of the crossing. It is recommended that the crossing be outfitted with new crossbuck signage. Given the low levels of activity, no additional safety measures are recommended.

[1] Final design and location of improvements should be determined with the support of a licensed engineer according to MUTCD standards.

Figure 11: Short-term Improvements (Passive Control Measures)



Medium-term Improvements

The next tier of improvements that should be considered for the crossings in the study area are active control devices. These additional measures provide warnings to road users when a train is approaching the crossing. The implementation of these measures would be in addition to the short-term improvements outlined in the previous section.

The highest level of active control devices includes lights, gates, and warning bells. A preliminary evaluation of these measures was conducted by the study team to determine the feasibility and benefits of each. The inclusion of gates in the recommended improvements would require substantial changes to the highway infrastructure. This would include the closure of Fourth Street between Market and Green, to eliminate traffic from within the railroad right-of-way. This closure was not preferable given the access requirements of adjacent properties.

The evaluation of medium-term improvements found that given the current conditions and safety record of the crossings, as well as concerns of the community, the addition of flashing warning lights and bells at crossings would provide necessary visibility and warning to road users. These active warning devices are proposed for the Green and Market Street crossings, in addition to the new/upgraded signage (see short-term).

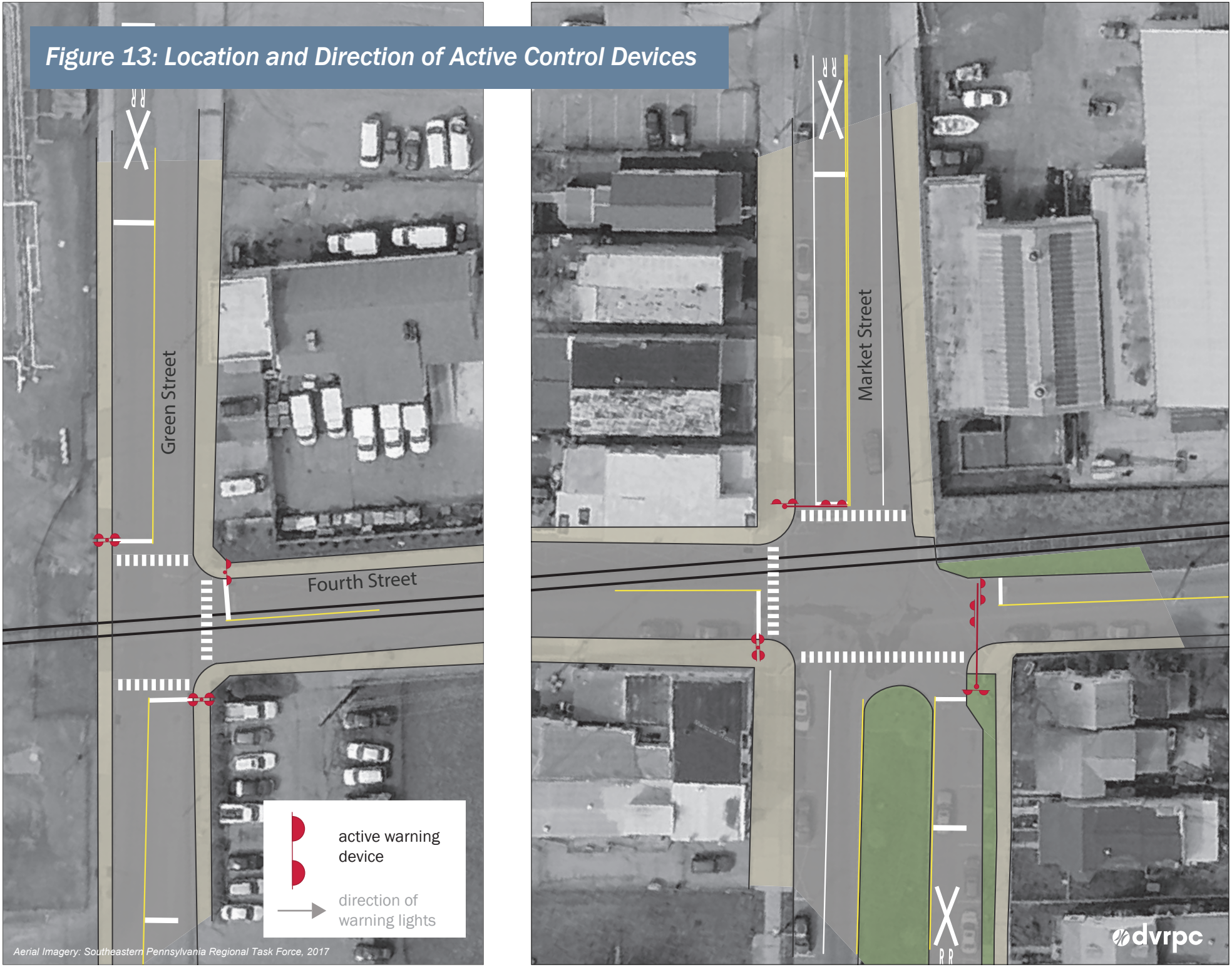
The proposed stop signs and automatic flashing lights can be installed as depicted in Figure 12. Figure 13 illustrates the proposed locations and direction of the active control devices.[2] Several approaches at the Market Street crossing would require cantilevered signals that would project over the travel lane. The active warning devices would require integration with a radio-activated system, known as dual-tone multi-frequency signaling (DTMF), due to the unique operating conditions experienced at these crossings requiring access to the secured gate facility at MHIC.

Figure 12: Active Warning Device Assembly

Source: DVRPC

[2] Final design and location of improvements should be determined with the support of a licensed engineer according to MUTCD standards and in coordination with Pennsylvania Department of Transportation.

Figure 13: Location and Direction of Active Control Devices



Aerial Imagery: Southeastern Pennsylvania Regional Task Force, 2017

Ongoing Coordination

In addition to the proposed safety measures at the crossings, the project team explored opportunities to reduce other negative impacts of the crossings, including noise and potential street obstructions due to trains blocking crossings. In order to create an open dialogue between the community and industry, the steering committee formed during this study should continue to meet on a regular basis to address concerns. During the course of the study the committee engaged community members and industry representatives and provided opportunities to discuss concerns and identify steps that can be taken to reduce negative impacts.

Emergency Service Access
One of the major challenges identified that will require ongoing coordination by this group is the obstruction of the study area crossings during incidents. This was raised as a concern by multiple community representatives as it could leave the residential area between Fourth Street and the river without access to critical emergency service access.

Community Based Improvements

As these crossings are located on critical connecting routes in a residential area of the borough, there is a significant level of activity by pedestrians. This activity can lead to increased safety risks at the crossing. There are several community-based actions that could help encourage safe and appropriate behavior at and near the crossings.

- **Create Continuing Public Education Campaign.** Operation Lifesaver is a nationwide, non-profit public awareness program which is designed to draw attention to grade crossing safety. Through Operation Lifesaver, certified presenters meet with school children and other groups to outline safe practices at grade crossings. The Federal Highway Administration estimates that safety awareness initiatives through Operation Lifesaver have saved 10,000 lives in 30 years. This emphasis on safety is critical, particularly given the fact that both train and highway volumes are on the rise.

- **Pedestrian Improvements.** The study area grade crossings are in close proximity to Marcus Hook Elementary School, Mickey Vernon Park, and occur on key corridors connecting to the Delaware River. Therefore, there should be a focused effort to improve the safety within the area for these pedestrians. The inclusion of new warning devices for vehicles can help to alert pedestrians; however, additional effort can be made to pursue a Safe Routes to School (SRTS) initiative. SRTS focuses on improving children's safety while walking and bicycling to and from school. It looks to actively engage the children as well as the community in discovering potential hazards surrounding the schools and neighborhoods.

  Safe Routes to School incorporates education, encouragement, enforcement, and engineering into its goal of increasing the number of children walking to and from school. Education activities instruct students, parents, and the community about pedestrian safety. SRTS encourages schools and communities to generate excitement about walking and biking to and from school. Enforcement activities can help to improve driver behavior as well as bicyclist and pedestrian behaviors. Finally, the engineering aspect of SRTS aids in transforming the community to a safe and pedestrian-friendly environment, through maintenance, operational and construction projects.

  One suggestion to encourage students and their families to walk to school is to begin a walking school bus. A walking school bus is a group of children walking to and from school with one or more adults. This allows children to walk to school even if their parents are unable to walk with them. It enables parents to feel that their children are safe when walking to school.

Evaluation of Alternative Measures

As a part of the evaluation of improvement recommendations by the study team and steering committee, several alternative measures were evaluated that are worth acknowledging. While these measures could alleviate noise and operational issues at the study area grade crossings, they were not deemed to be feasible recommendations based on the scope of this study.

Quiet Zone Designation

As outlined in Chapter 2, quiet zones are federally designated areas where trains are relieved of the requirements to sound their warning horns as they approach at-grade highway-railroad crossings. Federal regulations identify very specific conditions where quiet zones may be implemented. Quiet zones are required to be at least one-half mile long. In this corridor, the quiet zone would be required to run from the Marcus Hook Industrial Complex gates through the Penn Avenue North Crossing to meet the half-mile requirement. Additionally, at-grade crossings (both public and private) must have existing Supplemental Safety Measures (SSM) in place prior to applying to be a quiet zone. SSMs include four-quadrant gated and signaled crossings and channelization. These conditions are not currently feasible in the study area due to physical constraints created by the rail running down the Fourth Street cartway. To fully close the crossing, traffic would need to be removed from Fourth Street and alternative access would need to be provided for driveways currently served between Green and Market Streets. Finally, all of the improvements would need to be fully funded utilizing local funds, as the Pennsylvania Department of Transportation would not fund the improvements for a quiet zone using Section 130 funds.

Due to these engineering constraints and the high local cost for improvements, the study team was not able to recommend pursuing a quiet zone for this corridor. Before this recommendation could be made, Marcus Hook Borough would need to undertake a comprehensive engineering study to ascertain the feasibility, cost, and potential funding sources of these required improvements.

Rerouting Freight Rail Traffic

Over the course of the study several members of the steering committee inquired about the potential for rerouting freight rail traffic to avoid rail movements on the Chester Industrial Track and Fourth Street. A complete feasibility of this type of traffic rerouting fell beyond the scope of this study. However, the project team did conduct a preliminary evaluation of rerouting traffic around the Fourth Street corridor. The most obvious alternative identified would be a route that would access the MHIC from the Northeast Corridor (NEC). There were several challenges identified by the study team that would make this routing a challenge to implement.

- There currently exist no legal rights or physical access connecting the NEC to the MHIC despite close proximity.

- The nature of the rail switching activity would mean that rail movements to/from MHIC would still start/end in Stoney Creek Yard. This would result in additional crossing activity at the crossings on Tenth Street. Additionally, it is unclear if the legal trackage rights would allow this type of activity across the NEC.

- Given the already high passenger rail volumes on the NEC, the existence of a passenger rail station platform, and limited right-of-way, the addition of more freight volume, even short switching trains, is not consistent with plans for the corridor. Further feedback from Amtrak would be required.

- Several steering committee members cited previous discussions about a similar new access to MHIC from the NEC that was unable to be advanced due to physical constraints, legal rights, and operational challenges.

Further assessment of the feasibility of this routing around the Fourth Street crossings would require additional engagement of the Class I parents of Conrail (CSX and Norfolk Southern), as well as Amtrak and SEPTA.

CHAPTER 4

Next Steps

While the three highly unique grade crossings on Fourth Street in Marcus Hook Borough, Pennsylvania have existed for many decades, the *Marcus Hook Grade Crossing Study* provides the opportunity to closely examine the crossings and to re-imagine their design and presentation. The study methodology utilizes available data and was carefully guided by a study steering committee which ultimately assessed and reached consensus on potential improvements.

Looking ahead, and in conjunction with the publishing of this report and its findings, DVRPC staff will assist in organizing a follow-up field investigation of the three crossings to finalize and package a set of complementary improvements. Participants in the field investigation may include representatives from Marcus Hook Borough, Conrail, Marcus Hook Industrial Complex, Pennsylvania Public Utility Commission, Pennsylvania Department of Transportation, and Federal Railroad Administration.

Based on the findings of the field investigation and an agreed upon set of improvements, the stakeholders will be positioned to more accurately estimate project costs and pursue appropriate funding sources. With such a diverse intersection of interests at the crossings, all appropriate funding sources should be considered, including public (especially Federal and State transportation programs), private, and public-private joint ventures.

Depending upon stakeholder interest, other possible follow-up tasks to this study include:

- periodic meetings of some or all members of the study steering committee,
- conduct an Operation Lifesaver railroad safety education event for the local community, and
- update information contained in the U.S. DOT grade crossing inventory forms

Working together, the improvements and actions referred to in this study are intended to continue to balance rail freight service to the MHIC with an assured quality of life for the residents of the adjacent Marcus Hook neighborhoods.

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Abstract: This study examines three highway-railroad grade crossings in Marcus Hook Borough, Delaware County, Pennsylvania. The purpose is to document existing conditions at the grade crossings and provide recommendations on possible grade crossing improvements. This report is divided into four chapters: an introduction; existing conditions and background; improvement recommendations; and next steps.

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