



STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
800 BAY ROAD
P.O. BOX 778
DOVER, DELAWARE 19903

NICOLE MAJESKI
SECRETARY

November 3, 2022

Christopher Duke, P.E.
Becker Morgan Group, Inc.
100 Discovery Blvd, Suite 102
Newark, DE 19713

Dear Mr. Duke:

The enclosed Traffic Impact Study (TIS) review letter for the proposed **Wawa – Elkton Road (f.k.a. Royal Farms Store No. 354)** (Tax Parcel: 18-054.00-090) development has been completed under the responsible charge of a registered professional engineer whose firm is authorized to work in the State of Delaware. They have found the TIS to conform to DelDOT's Development Coordination Manual and other accepted practices and procedures for such studies. DelDOT accepts this letter and concurs with the recommendations. If you have any questions concerning this letter or the enclosed review letter, please contact me at (302) 760-2124.

Sincerely,

Claudy Joinville
Project Engineer

CJ:km
Enclosures
cc with enclosures:

Mr. Fred Wittig, Diamond State Management
Mr. Mike Riemann, Becker Morgan Group, Inc.
Mr. David L. Edgell, Office of State Planning Coordination
Ms. Stephanie Petersen, City of Newark
Mr. Tim Filasky, City of Newark
Mr. George Haggerty, New Castle County Department of Land Use
Mr. Brad Shockley, New Castle County Department of Land Use
Mr. Owen C. Robatino, New Castle County Department of Land Use
Ms. Joanne Arellano, Johnson, Mirmiran & Thompson, Inc.
Mr. Mir Wahed, Johnson, Mirmiran & Thompson, Inc.
DelDOT Distribution

DelDOT Distribution

Brad Eaby, Deputy Attorney General
Shanté Hastings, Director, Deputy Secretary, Transportation Solutions (DOTS)
Pamela Steinebach, Director, Planning
Mark Luszcz, Deputy Director, DOTS
Peter Haag, Chief Traffic Engineer, Traffic, DOTS
Brian Schilling, Canal District Engineer, Canal District
Matthew Vincent, Chief of Project Development North, DOTS
Todd Sammons, Assistant Director, Development Coordination
Wendy Polasko, Subdivision Engineer, Development Coordination
Sireen Muhtaseb, TIS Group Manager, Development Coordination
Jared Kauffmann, Service Development Planner, Delaware Transit Corporation
Anthony Aglio, Planning Supervisor, Statewide & Regional Planning
John Pietrobono, New Castle Review Coordinator, Development Coordination
Pao Lin, Subdivision Manager, Development Coordination
Mark Galipo, Traffic Engineer, Traffic, DOTS
Annamaria Fumato, Project Engineer, Development Coordination



November 3, 2022

Mr. Claudy Joinville
Project Engineer
Delaware Department of Transportation
Development Coordination, Division of Planning
800 Bay Road
P.O. Box 778
Dover, DE 19903

RE: Agreement No. 1945F
Project Number T202069012/PO#611882
Traffic Impact Study Services
Task 11-2A General Engineering Services
Wawa – Elkton Road (f.k.a. Royal Farms Store No. 354)

Dear Mr. Joinville:

Johnson, Mirmiran and Thompson (JMT) has completed a technical memorandum dated January 23, 2019 that contains a traffic study for the proposed Royal Farms Store No. 354. The Royal Farms is proposed at the southeast corner of the Elkton Road (New Castle Road 11)/Otts Chapel Road (New Castle Road 397) intersection in New Castle County, Delaware. The study was prepared in a manner generally consistent with DelDOT's *Development Coordination Manual*.

The January 23, 2019 traffic study evaluates the impacts of a proposed 4,649 square-foot Royal Farms convenience store with 20 vehicle fueling positions and a car wash. Access is proposed via one rights-in/rights-out entrance along Elkton Road and one rights-in/rights-out entrance along Otts Chapel Road. The subject property is on an approximately 6.05-acre parcel that is currently zoned as I-UDC (Industrial) and is proposed to be rezoned to BG (General Business). The site is proposed to be annexed into the City of Newark.

The Elkton Road/Otts Chapel Road signalized intersection will be improved as part of the *Elkton Road, Maryland State Line to Casho Mill Road* project (DelDOT Contract No. T201504401). The intersection improvements include the addition of signalized pedestrian crossings and bike lanes. The traffic study incorporates these intersection improvements. Construction is currently underway for the DelDOT project and is anticipated to be complete fall of 2022.

Since that January 23, 2019 traffic study, the development has been modified to be a 5,585 square foot Wawa convenience store with 16 vehicle fueling positions. In addition, the entrance along Otts Chapel Road is proposed to be rights-in/rights-out/lefts-in. Based on the results from a separate traffic assessment conducted by Becker Morgan Group, Inc. in August 2019, the lefts-in movement from Otts Chapel Road was approved by the DelDOT Development Coordination Section. The recommendations within this letter are based on what is now proposed. A copy of the January 23, 2019 Technical Memorandum is attached for reference.



The trip generation for the proposed Wawa development was determined by using the comparable land use and rates contained in the *Trip Generation Manual, 11th Edition* published by the Institute of Transportation Engineers (ITE). Table 1 summarizes the trip generation.

Table 1
Wawa Trip Generation – Updated Full Build Out

Land Use	ADT	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
5,585 SF Convenience Store with 16 Vehicle Fueling Positions (Land Use Code 945)	5,532	253	253	506	215	215	430
Pass-By		192	192	384	161	161	322
New Trips		61	61	122	54	54	108

*76% pass by during the AM and 75% during the PM based on ITE Trip Generation Manual, 11th Edition

A comparison of the new trips between the proposed Wawa development and the previously proposed Royal Farms development was conducted. As depicted in Table 2, the new build out of the site is expected to generate a minimal difference in traffic from the previously proposed development.

Table 2
New Trips Comparison – ITE Trip Generation Manual 11th Edition

Land Use	ADT	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Updated Wawa Development New Trips	5,532	61	61	122	54	54	108
January 2019 Royal Farms Study New Trips	5,143	65	65	130	57	57	114
Difference	+389	-4	-4	-8	-3	-3	-6

*The trip generation for the updated Wawa development and the previously proposed Royal Farms is based on the GFA (5.5–10k) and GFA (4-5.5k) subcategory, respectively.

A supplemental assessment based on ITE *Trip Generation Manual*, 10th Edition, was conducted and is summarized in Table 3 and also depicts a minimal difference in trip generation. Therefore, the traffic analysis results contained within the January 23, 2019 study should be comparable to the analysis results for the new build out of the site. As such, in coordination with DelDOT, an updated traffic study is not required.



Table 3
New Trips Comparison – ITE Trip Generation Manual 10th Edition

Land Use	ADT	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Updated Wawa Development New Trips	4,674	86	86	172	66	66	132
January 2019 Royal Farms Study New Trips	3,886	72	71	143	55	55	110
Difference	+788	+14	+15	+29	+11	+11	+22

*The trip generation is based on ITE Trip Generation Manual, 10th Edition, Land Use Code 960: Super Convenience Market/Gas Station. Pass-by percentages of 63% in the AM and 66% in the PM were applied, consistent with the methodology from the January 2019 traffic study.

The January 23, 2019 study included a capacity analysis at the intersection of Elkton Road and Otts Chapel Road as well as at the proposed site entrances. The results indicate that all study intersections would operate at acceptable LOS under future 2040 conditions with the proposed convenience store with gas development.

Should the City of Newark approve the proposed development, the following items should be incorporated into the site design and reflected on the record plan. All applicable agreements (i.e. letter agreements for off-site improvements and traffic signal agreements) should be executed prior to entrance plan approval for the proposed development.

1. The developer should construct a rights-in/rights-out entrance along Elkton Road, approximately 400 feet south of the Elkton Road/Otts Chapel Road intersection and provide the lane configurations as shown in the table below:

Approach	Current Configuration	Proposed Configuration
Westbound Site Access A	Approach does not exist	One right turn lane
Northbound Elkton Road	Two through lanes	Two through lanes and one right turn lane

Based on DelDOT’s *Development Coordination Manual*, the recommended minimum storage length (excluding taper) is 350 feet for the Elkton Road right turn lane. An island should be provided at the entrance to prohibit the right-turning lane into the site to become a continuous right-turn lane to the Otts Chapel Road intersection. The location of the entrance will impact pedestrian and bicycle facilities that have been constructed as part of the *Elkton Road, Maryland State Line to Casho Mill Road* project (DelDOT Contract No. T201504401). As such, the developer should coordinate with DelDOT on the design at the site entrance to maintain access to pedestrian and bicycle facilities along Elkton Road.



- The developer should modify the existing rights-in/rights-out entrance along Otts Chapel Road to provide lefts in movements. The entrance was constructed as part of the *Elkton Road, Maryland State Line to Casho Mill Road* project (DeIDOT Contract No. T201504401), approximately 250 feet east of the Elkton Road/Otts Chapel Road intersection. The entrance should provide the lane configurations as shown in the table below:

Approach	Current Configuration	Proposed Configuration
Eastbound Otts Chapel Road	Two through lanes	Two through lanes and one right turn lane
Westbound Otts Chapel Road	Three through lanes*	One left turn lane and three through lanes*
Northbound Site Access B	Approach does not exist	One right turn lane

*Two of the three through lanes along the westbound Otts Chapel Road approach become turn lanes at the Elkton Road intersection

Based on DeIDOT’s *Development Coordination Manual* and the proximity of the entrance to the Elkton Road intersection, the recommended minimum storage length (excluding taper) is 100 feet for the eastbound Otts Chapel Road right turn lane and 145 feet for the westbound Otts Chapel Road left turn lane.

- The developer should maintain the yield sign along the northbound Elkton Road right-turn lane onto Otts Chapel Road. The right-turn lane should maintain a minimum storage length of 250 feet with a 50-foot taper. The acceleration lane for the movement from northbound Elkton Road onto Otts Chapel Road should be removed. The intersection geometry and striping should be updated accordingly. The developer should coordinate with DeIDOT on the design of the Elkton Road right-turn lane onto Otts Chapel Road during the Entrance Plan review process.
- The developer should enter into a traffic signal agreement with DeIDOT for the intersection of Elkton Road with Otts Chapel Road. The agreement should include any signal timing changes as well as any signal equipment necessary, such as signal heads, signal controller cabinet, pedestrian signals, crosswalks, interconnection, ITS equipment, etc. at DeIDOT’s discretion. The developer should coordinate with DeIDOT on the implementation and cost of these improvements. At DeIDOT’s discretion, the developer may contribute to the Traffic Signal Revolving Fund in lieu of a traffic signal agreement. The developer contribution is calculated to be \$6,122.



5. The following bicycle, pedestrian, and transit improvements should be included:
 - a. Connections to and from the site should be made to the proposed shared use paths as part of the *Elkton Road, Maryland State Line to Casho Mill Road* project (DelDOT Contract No. T201504401).
 - b. Where internal sidewalks are located alongside of perpendicular or angular parking spaces, a buffer, physical barrier, or signage should be added to eliminate vehicular overhang onto the sidewalk.
 - c. Utility covers should be moved outside of any designated bicycle lanes and any proposed sidewalks or should be flush with the pavement.
 - d. Bike parking racks should be provided near the building entrances. Where the building architecture provides for an awning or other overhang, the bike parking should be covered.

Please note that this review generally focuses on capacity and level of service issues; additional safety and operational issues will be further addressed through DelDOT's Plan Review process.

Improvements in this TIS may be considered "significant" under DelDOT's *Work Zone Safety and Mobility Procedures and Guidelines*. These guidelines are available on DelDOT's website at https://www.deldot.gov/Publications/manuals/de_mutcd/index.shtml. For any additional information regarding the work zone impact and mitigation procedures during construction, please contact Mr. Jeff VanHorn, Assistant Director for Traffic Operations and Management. Mr. VanHorn can be reached at (302) 659-4606 or by email at Jeffrey.VanHorn@delaware.gov.

Additional details on our traffic study are attached. Please contact me at (302) 266-9600 if you have any questions concerning this letter.

Sincerely,
Johnson, Mirmiran, and Thompson, Inc.

A handwritten signature in black ink, appearing to read 'Joanne M. Arellano'.

Joanne M. Arellano, PE., PTOE

cc: Mir Wahed, P.E., PTOE
Janna Brown, E.I.T.

Enclosure

January 23, 2019 Technical Memorandum
Royal Farms – Elkton Road/Otts Chapel Road Traffic Study



Technical Memorandum

Date: January 23, 2019

To: Breanna Kovach

From: Mir Wahed

CC: Peter Haag, Bill Brockenbrough, Troy Brestel, Brad Herb, Joanne Arellano

Project: Elkton Road Improvements, Maryland State Line to Casho Mill Road

RE: Royal Farms – Elkton Road/Otts Chapel Road Traffic Study

Contract No: T201504401

JMT Project No: 14-0659-007

The Elkton Road/Otts Chapel Road signalized intersection will be improved as part of the *Elkton Road Improvements, Maryland State Line to Casho Mill Road* project (DeIDOT Contract No. T201504401). A developer is proposing a 4,649 square foot Royal Farms convenience store with gas pumps at the southeast corner of the Elkton Road/Otts Chapel Road intersection. The purpose of this technical memorandum is to present traffic impacts at the Elkton Road/Otts Chapel Road intersection with the construction of the Royal Farms development and evaluate the traffic operations at the proposed site entrances. This document will discuss the scenarios considered, procedures used for estimating the future volumes, the analysis results, and recommendations.

Background

Otts Chapel Road currently intersects Elkton Road and a Storage/Bank/Daycare Driveway to form a four-legged signalized intersection. Under existing conditions, one left turn lane, two through lanes, and one right turn lane are provided along the northbound Elkton Road approach, and two left turn lanes, two through lanes, and one right turn lane are provided along the southbound Elkton Road approach. One left turn lane, one shared through/left turn lane, and one right turn are provided along the westbound Otts Chapel Road approach and one left turn lane, one through lane, and one right turn lane are provided along the eastbound driveway approach.

As part of the *Elkton Road Improvements* project (DeIDOT Contract No. T201504401), the westbound Otts Chapel Road right turn lane will be modified to be free flow and signalized pedestrian crossings will be added to the intersection. Bike lanes will also be provided at the intersection.

JMT prepared the November 2014 *Transportation Needs Study Update* and the September 2018 *Final Transportation Management Plan Report* for the *Elkton Road Improvements* project. The traffic data from those reports have been utilized to create the Case 1 (Existing) and Case 2 (Future 2021 with the DeIDOT *Elkton Road Improvements* project and without the Royal Farms Development) weekday peak hour traffic volumes. Appendix A contains the Case 1 and Case 2 weekday traffic volume diagrams.



Proposed Royal Farms Trip Generation/Distribution

Trip generation for the Royal Farms development was computed using comparable land uses and equations contained in the ITE *Trip Generation* report, 10th Edition. Specifically, ITE Land Use Code 960 (Super Convenience Market with Gas Station) was utilized to develop the trip generation. Pass-by percentages were also applied consistent with ITE methodology. The resulting trip generation is summarized in Table 1.

Table 1
4,649 Square Foot Royal Farms Development
Peak Hour Trip Generation

	AM Peak Hour			PM Peak Hour		
	Enter	Exit	Total	Enter	Exit	Total
Total Trips	194	193	387	161	161	322
Pass-By Trips	122	122	244	106	106	212
Net New Trips	72	71	143	55	55	110

Note: As pass-by rates for Super Convenience Market/Gas Station are not provided by ITE, the pass-by percentages of 63% (AM) and 66% (PM) for the Convenience Market with Gasoline Pumps (LUC 853) was utilized.

Per the June 25, 2018 Concept Sketch Plan prepared by Becker Morgan Group, a rights-in/rights-out access is proposed along Elkton Road and a rights-in/rights-out access is proposed along Otts Chapel Road. Trip distributions were established for the new and pass-by traffic based on the locations of the access points and existing travel patterns. In addition, the existing Wawa located south of the proposed site at the Elkton Road/Fletcherwood Drive intersection was also taken into consideration when developing the trip distributions.

The trip assignment for the proposed Royal Farms development was added to the Case 2 2021 future volumes to develop the future 2021 and 2040 volumes with the Royal Farms development (Cases 3 and 4, respectively). Figures depicting the trip distributions and assignments as well as the resulting 2021 and 2040 future volumes with the Royal Farms development are included in Appendix A.

Capacity Analysis

JMT performed capacity analysis at the intersection of Elkton Road and Otts Chapel Road as well as at the proposed site entrances using Synchro/Simtraffic 9 software. This software was used to maintain consistency with the analysis performed for the November 2014 *Transportation Needs Study Update* and the September 2018 *Final Transportation Management Plan Report* associated with the *Elkton Road Improvements* project. The analysis performed incorporates the improvements proposed as part of the *Elkton Road Improvements* project. Appendix B contains tables summarizing the Level of Service (LOS), delay, and 95th percentile queue results.

Based on the Synchro/Simtraffic results, the Elkton Road and Otts Chapel Road intersection would operate at acceptable LOS C during the future 2021 weekday AM and PM peak hour conditions with or without the



Royal Farms development. Under future 2040 conditions, the Elkton Road and Otts Chapel Road intersection would operate at acceptable LOS D during the weekday AM and PM peak hours.

The proposed rights-in/rights-out entrances would operate at acceptable LOS B during the 2021 and 2040 conditions. However, the northbound through queue along Elkton Road at the Otts Chapel Road intersection is calculated to be approximately 450 feet and 480 feet during the 2021 and 2040 conditions, respectively, which would impact operations at the Elkton Road site entrance which is approximately 400 feet from the signalized intersection. The calculated 95th percentile queue length for the right-out movement from the Elkton Road site entrance would be approximately 100 feet and 190 feet during the 2021 and 2040 weekday AM peak hours, respectively. The calculated 95th percentile queue length for the right-out movement from the Otts Chapel Road site entrance would be approximately 20 feet during the 2021 and 2040 weekday AM peak hours, respectively. These projected queues would have minimal impact to on-site circulation based on the June 25, 2018 Concept Sketch Plan.

Supplemental VISSIM Analysis

Due to the closely spaced locations of the site entrances to the Elkton Road/Otts Chapel Road intersection, a supplemental microsimulation analysis was also performed using VISSIM 11 software to evaluate the study intersections and review the weaving operation between the Elkton Road/Otts Chapel Road intersection and the proposed Otts Chapel Road site entrance, as well as review the weaving operation between the Elkton Road/Otts Chapel Road intersection and the proposed Elkton Road site entrance. The supplemental VISSIM analysis evaluated the following two scenarios for the northbound right-turn movement from Elkton Road onto Otts Chapel Road:

Scenario 1 – Free-Flow Northbound Right-Turn Lane from Elkton Road onto Otts Chapel Road (as it is currently proposed)

Scenario 2 – Yield-Controlled Northbound Right-Turn Lane from Elkton Road onto Otts Chapel Road

Based on the current DeIDOT improvement project, the free-flow northbound right turn scenario (Scenario 1) would include its own acceleration lane that would also serve as the right turn lane onto the Otts Chapel Road site entrance. The yield-controlled northbound right turn scenario (Scenario 2) would not have an acceleration lane and the Otts Chapel Road site entrance would have its own right-turn lane into the site. Appendix C contains tables summarizing the LOS, delay, density, and 95th percentile queue results.

Similar to the Synchro results, the VISSIM results project the Elkton Road and Otts Chapel Road intersection to operate at acceptable LOS D or better during the future 2021 and 2040 weekday AM and PM peak hour conditions with the Royal Farms development for both scenarios. In addition, the 95th percentile queue length for the northbound right-turn lane from Elkton Road onto Otts Chapel Road during Scenario 2 is projected to be minimal (approximately 20 feet) with the elimination of the acceleration lane and under yield-control.

The proposed Elkton Road rights-in/rights-out entrance would operate at acceptable LOS C or better during the 2021 and 2040 conditions. However, the calculated 95th percentile queue length for the right-out



movement from the Elkton Road site entrance would be approximately 210 and 260 feet during the 2021 and 2040 conditions, respectively. These projected long queues may impact on-site circulation. The proposed Otts Chapel Road rights-in/rights-out entrance would operate at acceptable LOS A during the 2021 and 2040 conditions. In addition, the calculated 95th percentile queue length for the right-out movements from the Otts Chapel Road site entrance would be approximately 5 feet which would not impact on-site circulation.

The weaving between the site entrances and the Elkton Road/Otts Chapel Road intersections were also evaluated. Based on the results, the weaving movement for vehicles exiting the Elkton Road site entrance and seeking to execute a U-turning movement at the Otts Chapel Road intersection for both scenarios would operate at LOS D or better under 2021 conditions but operate at LOS F under 2040 conditions. Although the weaving movement would operate at LOS F, a minimal number of vehicles (approximately 20 vehicles during the AM and PM peak hours) are projected to execute this movement. In addition, the weaving movement for vehicles turning left onto Otts Chapel Road and seeking to execute a right-turning movement at the Otts Chapel Road site entrance would operate at LOS B or better for both scenarios.

Appendix C contains tables summarizing the LOS, delay, density, and 95th percentile queue results.

Elkton Road Left-In Access

An additional analysis was evaluated considering the provision of a left-in movement at the proposed Elkton Road site entrance. Based on the Synchro/Simtraffic results, the proposed site entrances and the Elkton Road/Otts Chapel Road intersection would operate at LOS C or better during the 2021 future conditions with the Royal Farms development (Case 3). However, due to the close proximity of the site entrance to the Otts Chapel Road intersection as well as the projected long queues along the northbound Elkton Road through movement (approximately 510 feet) which would impact operations at the site entrance, it is recommended that a left-in movement not be provided. The volumes and the results from this additional analysis is summarized in Appendix D.

Recommendations

Based on the results of the Synchro and VISSIM analysis, the current design of the Elkton Road/Otts Chapel Road intersection as part of the DeIDOT *Elkton Road Improvements* (DeIDOT Contract No. T201504401) project will be impacted by the operational effects on traffic due to the proposed Royal Farms development. As such, the following improvements are recommended. Appendix E contains a conceptual layout depicting the recommended improvements.

1. The entrance along Elkton Road should be configured as rights-in/rights out only and be located approximately 400 feet south from the Elkton Road/Otts Chapel Road intersection. The entrance should provide a right-turn lane with a storage length of a minimum 350 feet with a 50-foot taper length. An island should be provided at the entrance to prohibit the right-turning lane into the site to become a continuous right-turn lane to the Otts Chapel Road intersection.



2. The entrance along Otts Chapel Road should be configured as rights-in/rights out only and be located approximately 250 feet east from the Elkton Road/Otts Chapel Road intersection. The entrance should provide a channelized right-turn lane with a storage length of a minimum 100 feet with a 50-foot taper length.
3. The northbound Elkton Road right turn lane onto Otts Chapel Road should be controlled by a yield sign. The right turn lane should have a storage length of a minimum 250 feet with a 50-foot taper length. An acceleration lane for the movement from northbound Elkton Road onto Otts Chapel Road should not be provided to improve the safety of vehicles seeking to execute weaving movements into the Otts Chapel Road site entrance from southbound Elkton Road. The intersection geometry and striping should be updated accordingly.

A subsequent TIS review letter will be submitted to the DeIDOT Development Coordination section that will include these recommendations and any additional recommendations such as those associated with pedestrian/bicycle facilities.

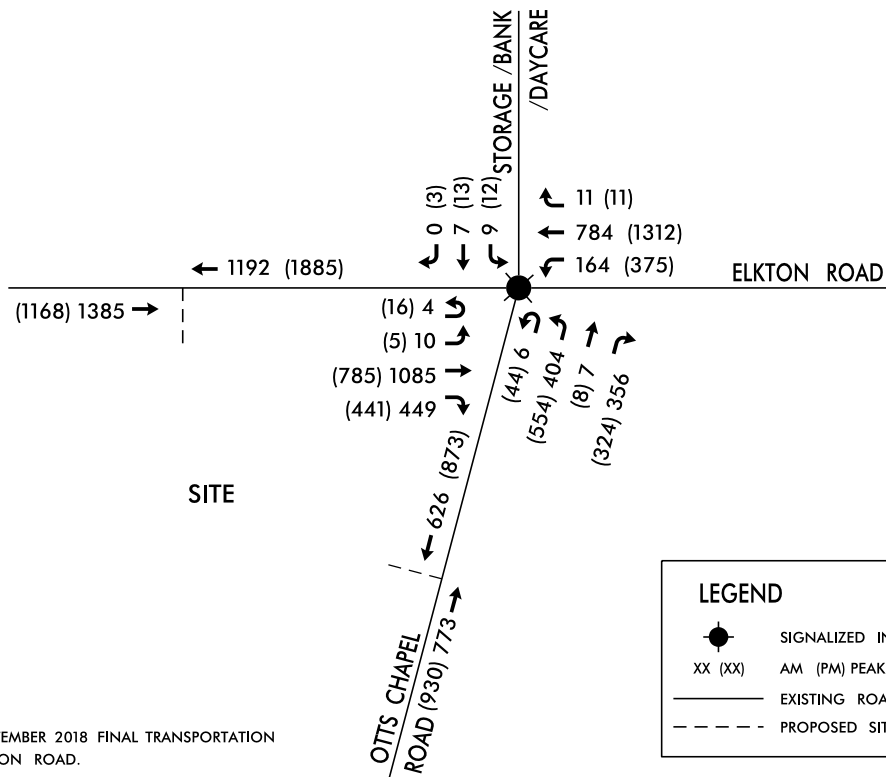
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APPENDIX



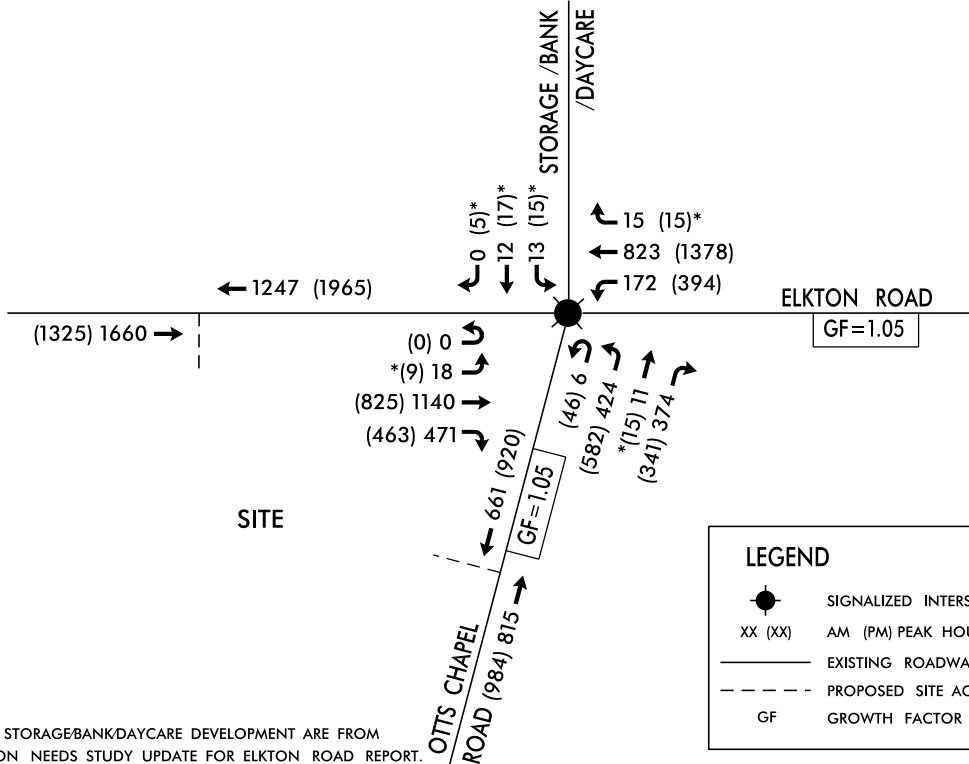
Appendix A – Volume Figures

CASE 1: EXISTING WEEKDAY TRAFFIC COUNT VOLUMES



*ALL VOLUMES TAKEN FROM THE SEPTEMBER 2018 FINAL TRANSPORTATION MANAGEMENT PLAN REPORT FOR ELKTON ROAD.

CASE 2: 2021 WEEKDAY TRAFFIC COUNT VOLUMES WITHOUT ROYAL FARMS DEVELOPMENT



*VOLUMES INTO AND OUT OF STORAGE/BANK/DAYCARE DEVELOPMENT ARE FROM NOVEMBER 2014 TRANSPORTATION NEEDS STUDY UPDATE FOR ELKTON ROAD REPORT.



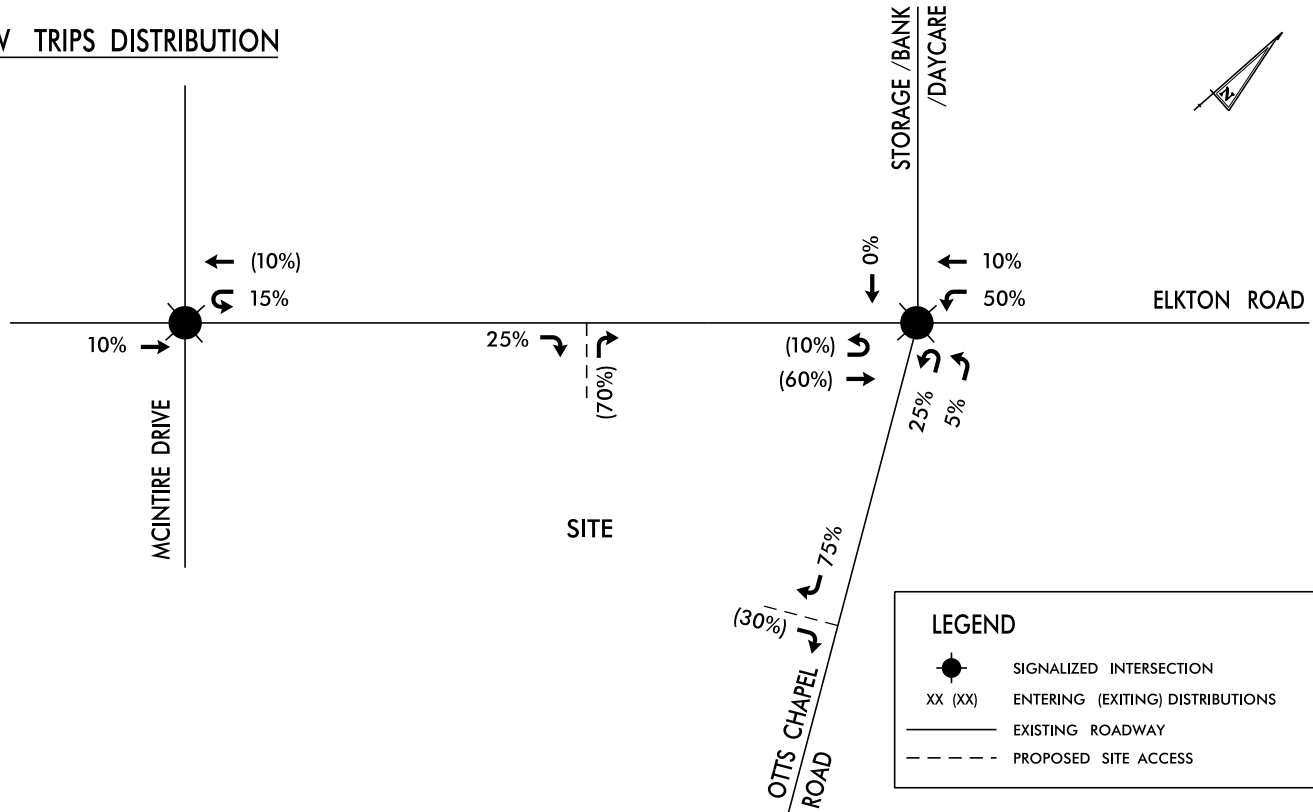
TRAFFIC IMPACT STUDY
 PROPOSED ROYAL FARMS
 AT ELKTON ROAD/OTTS CHAPEL ROAD
 NEW CASTLE COUNTY, DELAWARE

N.T.S

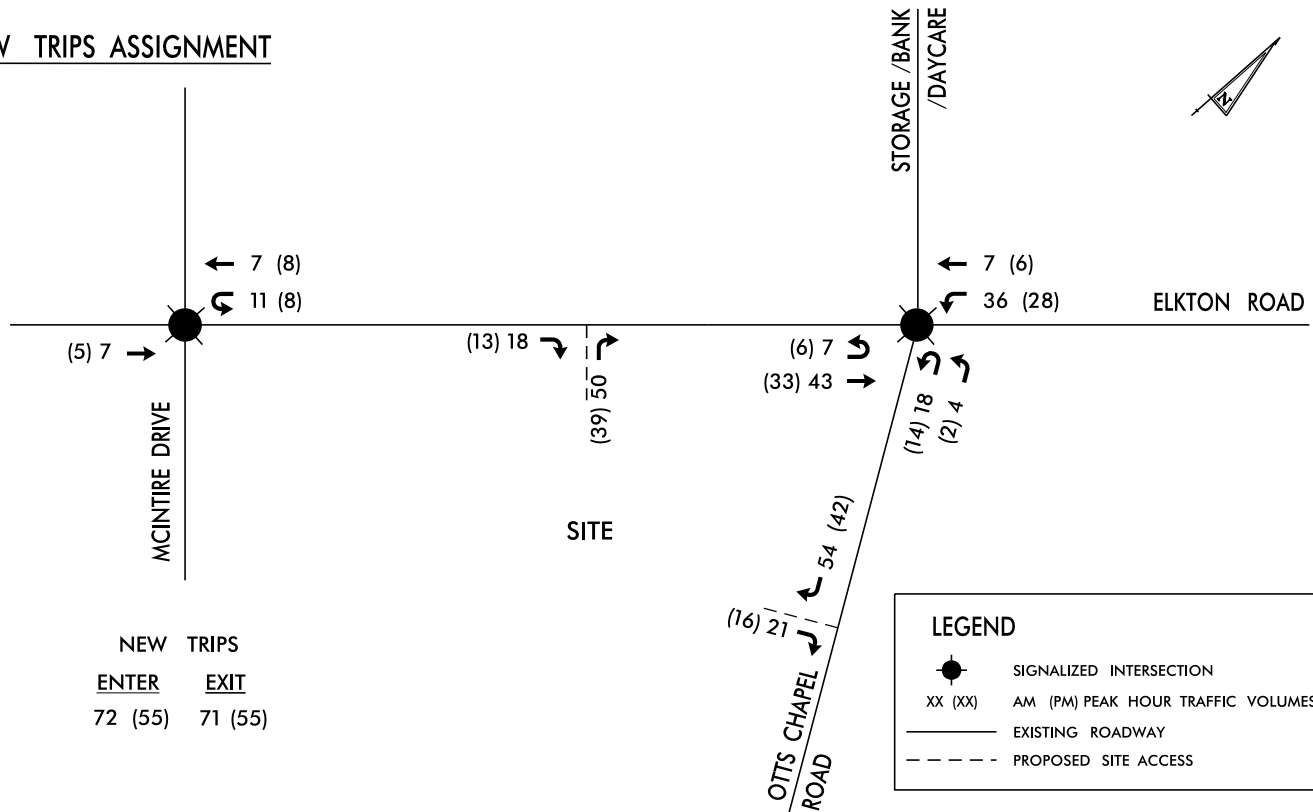
FIGURE A-1

JANUARY 2019

NEW TRIPS DISTRIBUTION



NEW TRIPS ASSIGNMENT



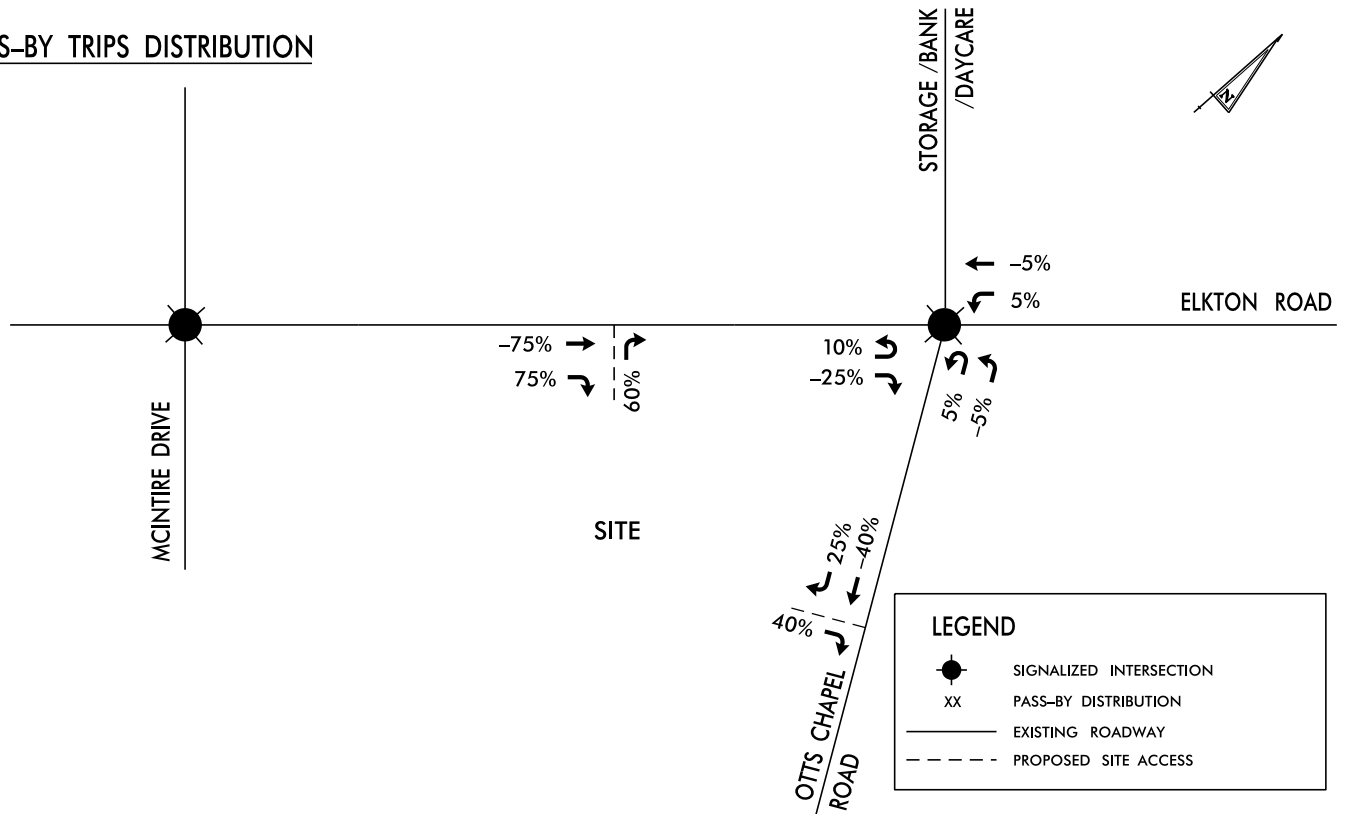
PROPOSED ROYAL FARMS
TRAFFIC IMPACT STUDY
AT ELKTON ROAD/OTTS CHAPEL ROAD
NEW CASTLE COUNTY, DELAWARE

N.T.S

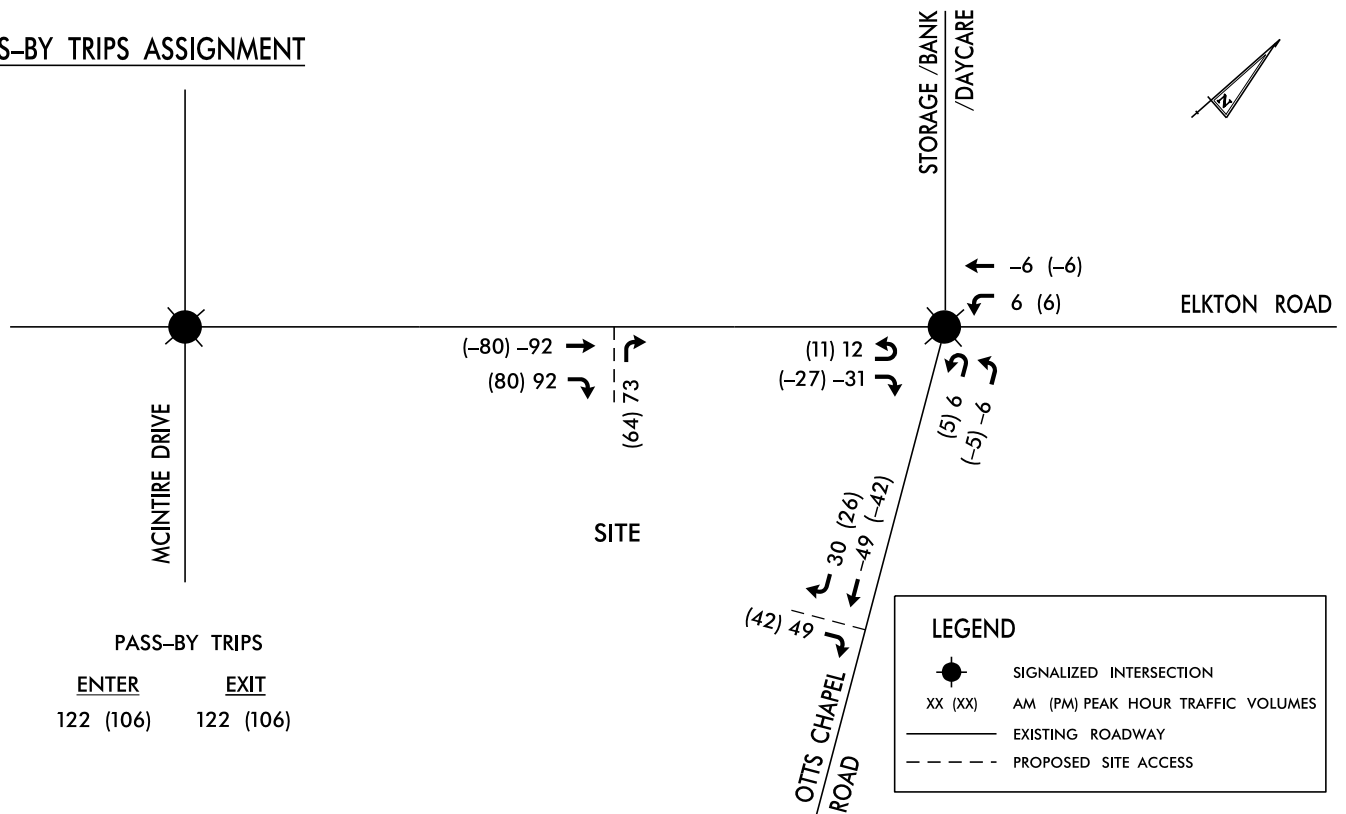
FIGURE A-2

JANUARY 2019

PASS-BY TRIPS DISTRIBUTION



PASS-BY TRIPS ASSIGNMENT



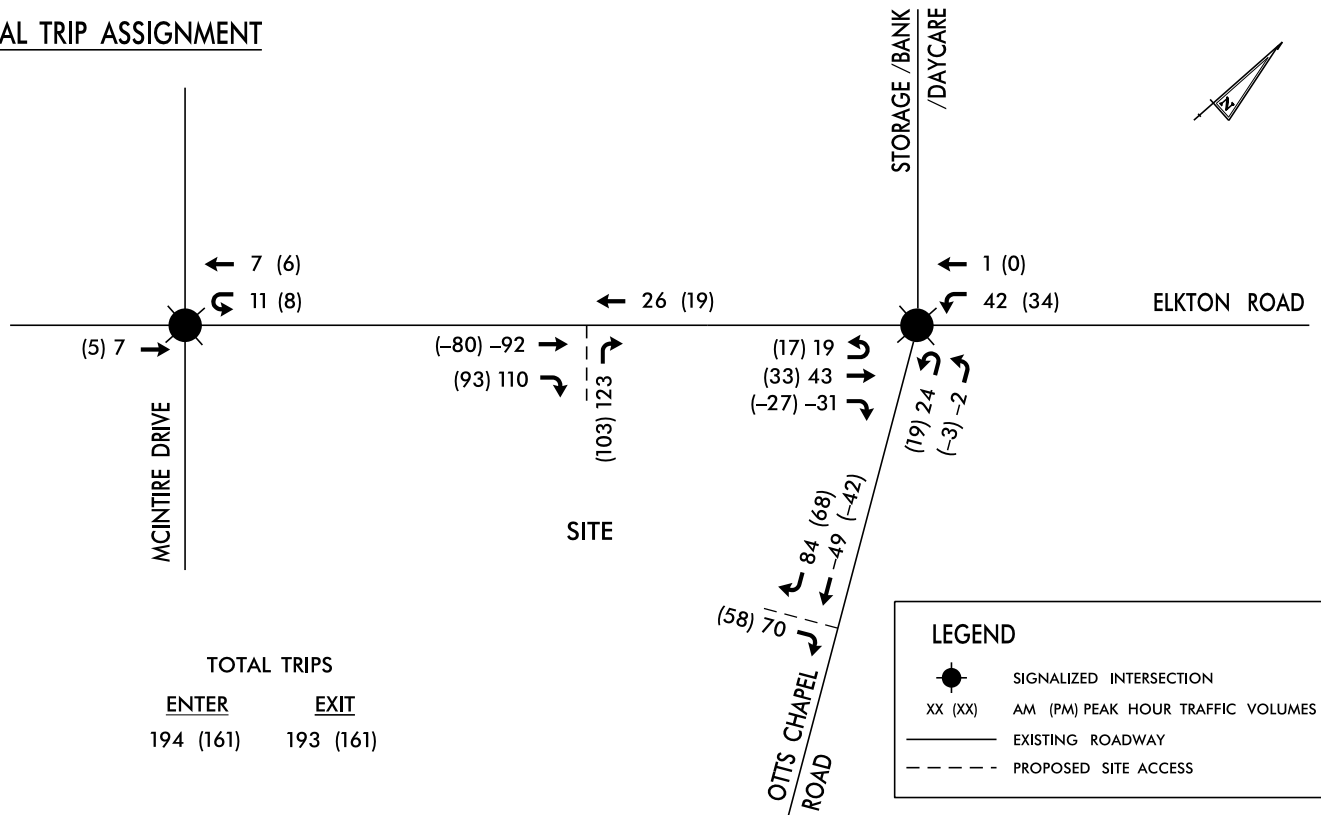
PROPOSED ROYAL FARMS
TRAFFIC IMPACT STUDY
AT ELKTON ROAD/OTTS CHAPEL ROAD
NEW CASTLE COUNTY, DELAWARE

N.T.S

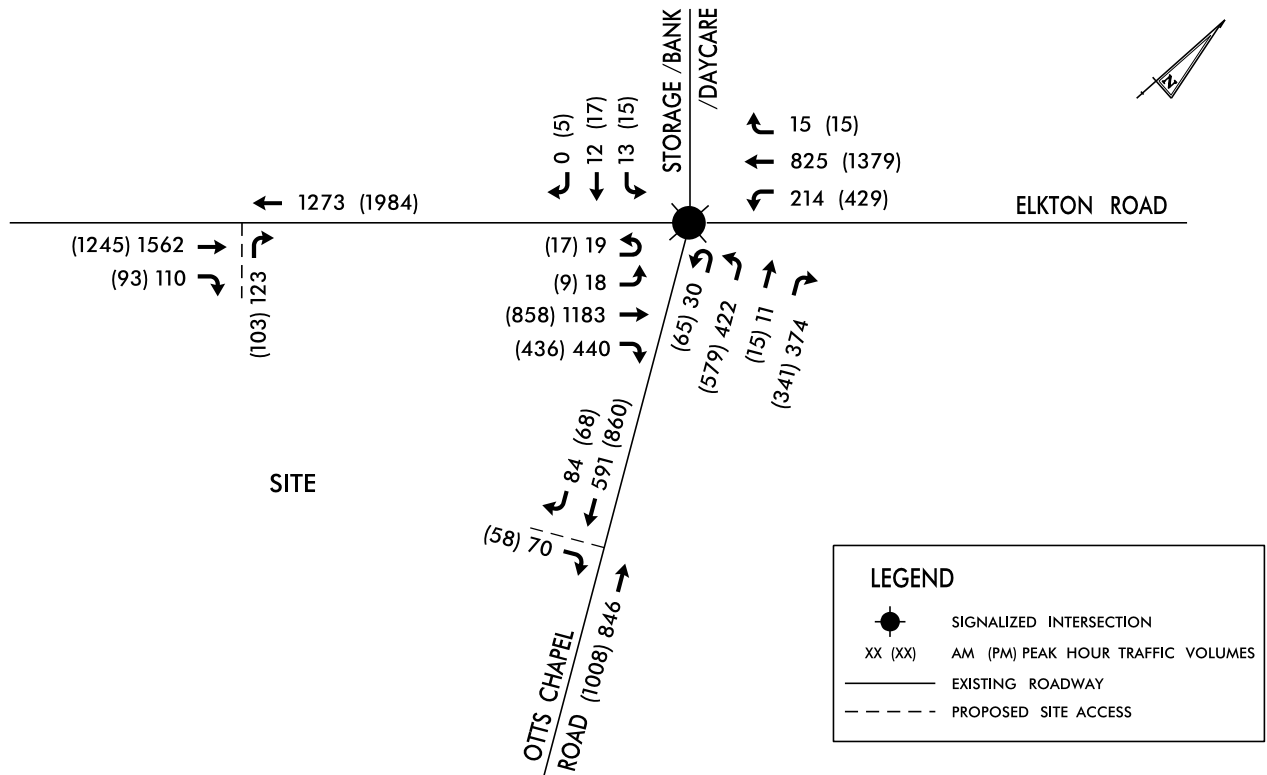
FIGURE A-3

JANUARY 2019

TOTAL TRIP ASSIGNMENT



CASE 3: 2021 WEEKDAY TRAFFIC COUNT VOLUMES WITH ROYAL FARMS DEVELOPMENT



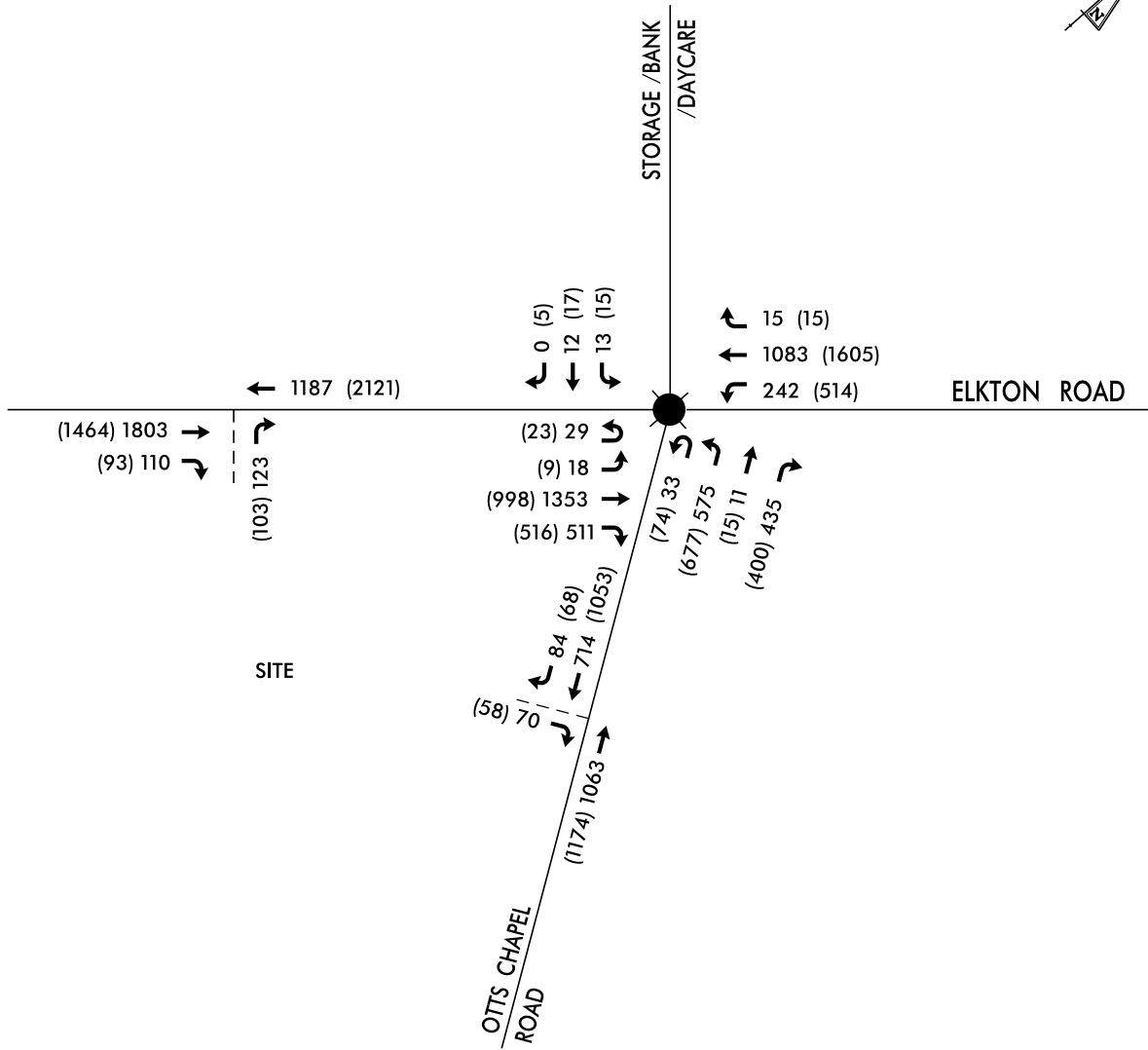
PROPOSED ROYAL FARMS
TRAFFIC IMPACT STUDY
AT ELKTON ROAD/OTTS CHAPEL ROAD
NEW CASTLE COUNTY, DELAWARE

N.T.S

FIGURE A-4

JANUARY 2019

CASE 4: 2040 FUTURE TRAFFIC VOLUMES WITH ROYAL FARMS DEVELOPMENT



*VOLUMES ARE BASED ON 2040 VOLUMES FROM NOVEMBER 2014 TRANSPORTATION NEEDS STUDY UPDATE FOR ELKTON ROAD REPORT.

LEGEND

- SIGNALIZED INTERSECTION
- XX (XX) AM (PM) PEAK HOUR TRAFFIC VOLUMES
- EXISTING ROADWAY
- - - - - PROPOSED SITE ACCESS



TRAFFIC IMPACT STUDY
 PROPOSED ROYAL FARMS
 AT ELKTON ROAD/OTTS CHAPEL ROAD
 NEW CASTLE COUNTY, DELAWARE



Appendix B – Synchro Analysis Results

Signalized Intersection	Peak Hour	Peak Hour LOS Results							
		Case 1 Existing		Case 2 2021 Without Royal Farms Development		Case 3 2021 With Royal Farms Development		Case 4 2040 With Royal Farms Development	
		LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)
Elkton Road/Otts Chapel Road	AM	C	25.2	C	25.2	C	28.1	D	39.2
	PM	C	31.8	C	28.9	C	38.2	D	38.4

Note:

The LOS results are based on Synchro methodology from Synchro 9.2 software.

Unsignalized Intersection	Peak Hour	Royal Farms Peak Hour LOS Results			
		Case 3 2021 With Royal Farms Development		Case 4 2040 With Royal Farms Development	
		LOS	Delay (sec)	LOS	Delay (sec)
Site Entrance/Elkton Road Westbound Approach	AM	B	11.0	B	13.2
	PM	B	11.4	B	10.3
Site Entrance/Otts Chapel Road Northbound Approach	AM	B	10.5	B	10.9
	PM	B	11.2	B	11.9

Note:

The LOS results are based on Synchro methodology from Synchro 9.2 software.

Intersection	Peak Hour	Approach	Peak Hour 95th Percentile Critical Queue Lengths (feet)			
			Case 1 Existing	Case 2 2021 Without Royal Farms Development	Case 3 2021 With Royal Farms Development	Case 4 2040 With Royal Farms Development
Elkton Road/Otts Chapel Road	AM	WBL Otts Chapel Rd	303	293	231	221
		WBLT Otts Chapel Rd	258	248	198	221
		NBL Elkton Rd	63	121	171	214
		NBT Elkton Rd	397	430	451	476
		NBR Elkton Rd	308	169	317	465
		SBL Elkton Rd	133	139	172	190
		SBT Elkton Rd	173	188	210	247
	PM	WBL Otts Chapel Rd	422	367	270	243
		WBLT Otts Chapel Rd	381	317	254	268
		NBL Elkton Rd	104	49	97	128
		NBT Elkton Rd	325	353	372	416
		NBR Elkton Rd	213	224	222	335
		SBL Elkton Rd	240	264	322	336
		SBT Elkton Rd	237	249	592	443
Elkton Road/Site Entrance	AM	WBR Site Entrance	-	-	104	188
	PM	WBR Site Entrance	-	-	49	73
Otts Chapel/Site Entrance	AM	NBR Site Entrance	-	-	11	11
	PM	NBR Site Entrance	-	-	23	9*

Note:

Queue lengths reported here are the averaged 95th percentile queue lengths from five (5) 60-minute simulation runs using SimTraffic software.

*SimTraffic did not show any results due to minimum queue length therefore queue length is based on the Synchro methodology from Synchro 9.2 software.



Appendix C – VISSIM Analysis Results

Case 3 – Future 2021 With Royal Farms Development

Signalized Intersection	Peak Hour	Peak Hour LOS Results			
		Case 3 2021 With Royal Farms Development Scenario 1		Case 3 2021 With Royal Farms Development Scenario 2	
		LOS	Delay (sec)	LOS	Delay (sec)
Elkton Road/Otts Chapel Road	AM	C	28.2	C	34.4
	PM	C	34.1	D	35.2

Unsignalized Intersection	Peak Hour	Peak Hour LOS Results			
		Case 3 2021 With Royal Farms Development Scenario 1		Case 3 2021 With Royal Farms Development Scenario 2	
		LOS	Delay (sec)	LOS	Delay (sec)
Site Entrance/Elkton Road Westbound Approach	AM	A	8.7	B	10.0
	PM	A	5.9	A	6.4
Site Entrance/Otts Chapel Road Northbound Approach	AM	A	0.7	A	0.6
	PM	A	0.5	A	0.4

Notes:

Results reported here are the averaged delay results from five (5) 60-minute simulation runs using VISSIM 11 software. LOS is based on HCM methodology.

Scenario 1 – Free-Flow Northbound Right-Turn Lane from Elkton Road onto Otts Chapel Road

Scenario 2 – Yield-Controlled Northbound Right-Turn Lane from Elkton Road onto Otts Chapel Road

Intersection	Peak Hour	Approach	Peak Hour 95th Percentile Critical Queue Lengths (feet)	
			Case 3 2021 With Royal Farms Development Scenario 1	Case 3 2021 With Royal Farms Development Scenario 2
Elkton Road/Otts Chapel Road	AM	WBL Otts Chapel Rd	112	112
		WBLT Otts Chapel Rd	112	112
		NBL Elkton Rd	153	125
		NBT Elkton Rd	153	125
		NBR Elkton Rd	2	11
		SBL Elkton Rd	108	107
		SBT Elkton Rd	108	107
	PM	WBL Otts Chapel Rd	144	144
		WBLT Otts Chapel Rd	144	144
		NBL Elkton Rd	134	151
		NBT Elkton Rd	134	151
		NBR Elkton Rd	134	151
		SBL Elkton Rd	207	208
		SBT Elkton Rd	207	208
Elkton Road/Site Entrance	AM	WBR Site Entrance	210	201
		NBR Elkton Rd	14	7
	PM	WBR Site Entrance	67	68
		NBR Elkton Rd	4	6
Otts Chapel/Site Entrance	AM	NBR Site Entrance	4	5
		SBR Otts Chapel	0	0
	PM	NBR Site Entrance	3	0
		SBR Otts Chapel	0	0

Notes:

-Queue lengths reported here are the averaged 95th percentile queue lengths from five (5) 60-minute simulation runs using VISSIM 11 software.

Scenario 1 – Free-Flow Northbound Right-Turn Lane from Elkton Road onto Otts Chapel Road

Scenario 2 – Yield-Controlled Northbound Right-Turn Lane from Elkton Road onto Otts Chapel Road

Density	Peak Hour	Peak Hour LOS Results			
		Case 3 2021 With Royal Farms Development Scenario 1		Case 3 2021 With Royal Farms Development Scenario 2	
		LOS	Density (veh/mi/ln)	LOS	Density (veh/mi/ln)
Elkton Road Weave	AM	D	35.0	D	33.1
	PM	C	25.1	D	28.7
Otts Chapel Road Weave	AM	A	9.9	A	8.5
	PM	B	11.9	B	10.6

Notes:

Results reported here are the averaged density results from five (5) 60-minute simulation runs using VISSIM 11 software. LOS is based on HCM methodology.

Scenario 1 – Free-Flow Northbound Right-Turn Lane from Elkton Road onto Otts Chapel Road

Scenario 2 – Yield-Controlled Northbound Right-Turn Lane from Elkton Road onto Otts Chapel Road

Case 4 – Future 2040 With Royal Farms Development

Signalized Intersection	Peak Hour	Peak Hour LOS Results			
		Case 4 2040 With Royal Farms Development Scenario 1		Case 4 2040 With Royal Farms Development Scenario 2	
		LOS	Delay (sec)	LOS	Delay (sec)
Elkton Road/Otts Chapel Road	AM	C	31.8	C	31.7
	PM	D	35.6	D	36.3

Unsignalized Intersection	Peak Hour	Peak Hour LOS Results			
		Case 4 2040 With Royal Farms Development Scenario 1		Case 4 2040 With Royal Farms Development Scenario 2	
		LOS	Delay (sec)	LOS	Delay (sec)
Site Entrance/Elkton Road Westbound Approach	AM	C	16.3	C	15.9
	PM	C	18.4	C	19.2
Site Entrance/Otts Chapel Road Northbound Approach	AM	A	0.7	A	0.6
	PM	A	0.5	A	0.4

Notes:

Results reported here are the averaged delay results from five (5) 60-minute simulation runs using VISSIM 11 software. LOS is based on HCM methodology.

Scenario 1 – Free-Flow Northbound Right-Turn Lane from Elkton Road onto Otts Chapel Road

Scenario 2 – Yield-Controlled Northbound Right-Turn Lane from Elkton Road onto Otts Chapel Road

Intersection	Peak Hour	Approach	Peak Hour 95th Percentile Critical Queue Lengths (feet)	
			Case 4 2040 With Royal Farms Development Scenario 1	Case 4 2040 With Royal Farms Development Scenario 2
Elkton Road/Otts Chapel Road	AM	WBL Otts Chapel Rd	220	200
		WBLT Otts Chapel Rd	220	200
		NBL Elkton Rd	246	247
		NBT Elkton Rd	246	247
		NBR Elkton Rd	6	20
		SBL Elkton Rd	135	134
		SBT Elkton Rd	135	134
	PM	WBL Otts Chapel Rd	149	148
		WBLT Otts Chapel Rd	149	148
		NBL Elkton Rd	241	234
		NBT Elkton Rd	241	234
		NBR Elkton Rd	241	234
		SBL Elkton Rd	240	241
		SBT Elkton Rd	240	241
Elkton Road/Site Entrance	AM	WBR Site Entrance	257	256
		NBR Elkton Rd	53	59
	PM	WBR Site Entrance	77	139
		NBR Elkton Rd	16	109
Otts Chapel/Site Entrance	AM	NBR Site Entrance	5	5
		SBR Otts Chapel	0	0
	PM	NBR Site Entrance	4	0
		SBR Otts Chapel	0	0

Notes:

-Queue lengths reported here are the averaged 95th percentile queue lengths from five (5) 60-minute simulation runs using VISSIM 11 software.

Scenario 1 – Free-Flow Northbound Right-Turn Lane from Elkton Road onto Otts Chapel Road

Scenario 2 – Yield-Controlled Northbound Right-Turn Lane from Elkton Road onto Otts Chapel Road

Density	Peak Hour	Peak Hour LOS Results			
		Case 4 2040 With Royal Farms Development Scenario 1		Case 4 2040 With Royal Farms Development Scenario 2	
		LOS	Density (veh/mi/ln)	LOS	Density (veh/mi/ln)
Elkton Road Weave	AM	F	55.4	F	52.3
	PM	F	60.6	F	62.2
Otts Chapel Road Weave	AM	B	11.5	A	9.9
	PM	B	13.9	B	12.5

Notes:

Results reported here are the averaged density results from five (5) 60-minute simulation runs using VISSIM 11 software. LOS is based on HCM methodology.

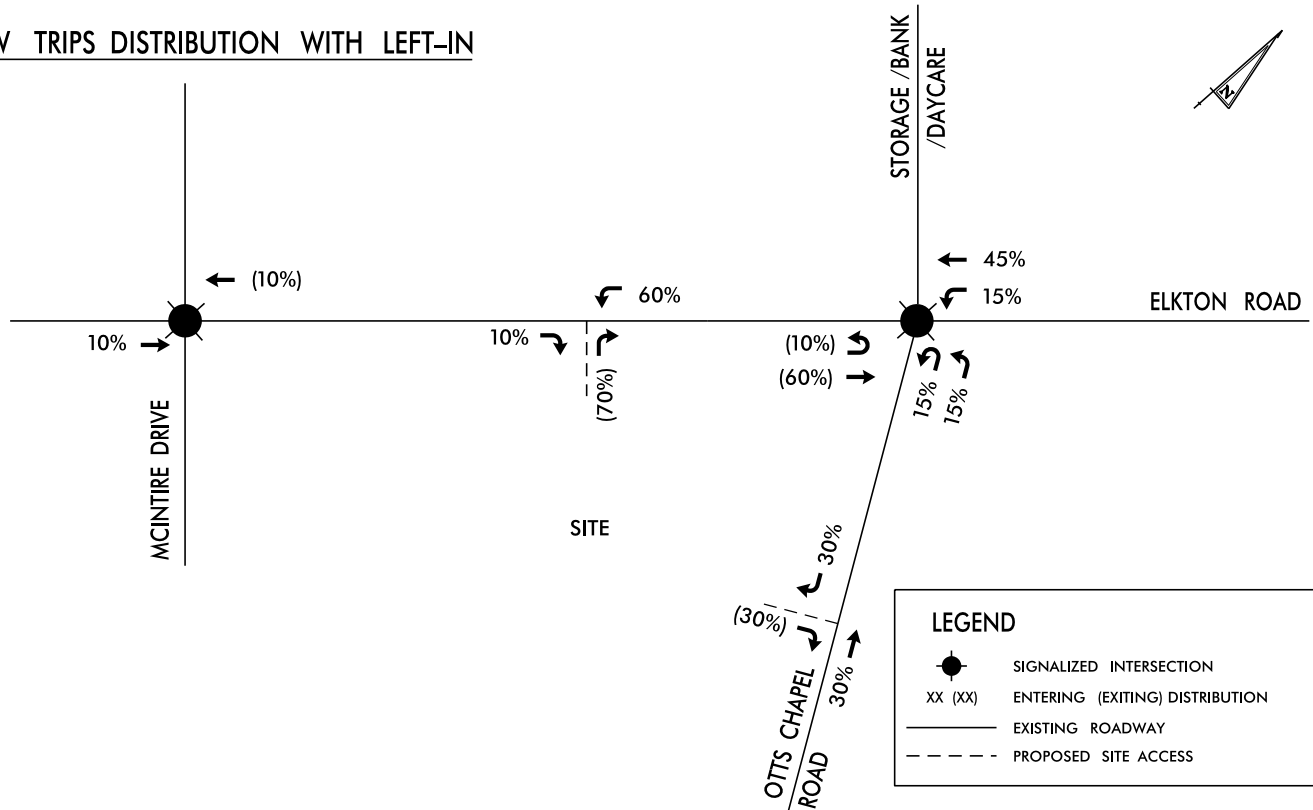
Scenario 1 – Free-Flow Northbound Right-Turn Lane from Elkton Road onto Otts Chapel Road

Scenario 2 – Yield-Controlled Northbound Right-Turn Lane from Elkton Road onto Otts Chapel Road

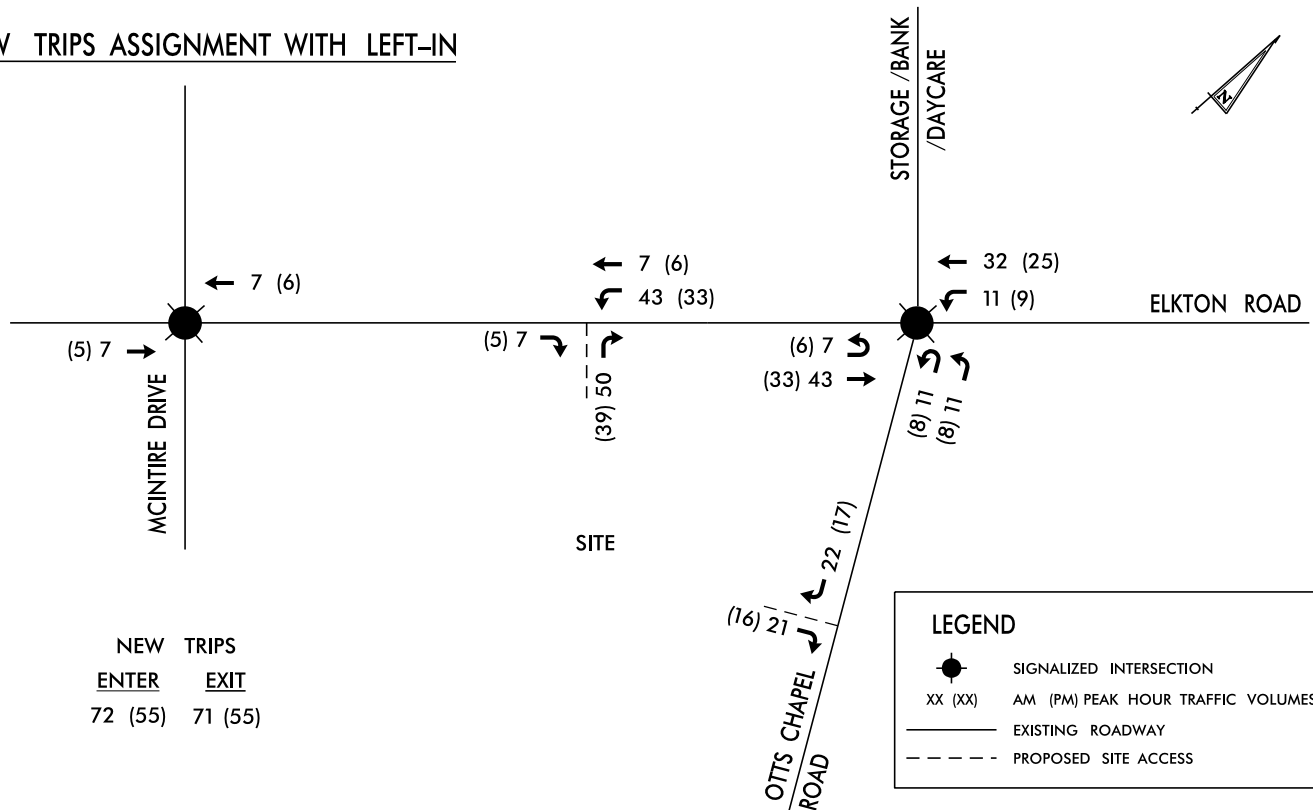


Appendix D – Left-In Scenario

NEW TRIPS DISTRIBUTION WITH LEFT-IN



NEW TRIPS ASSIGNMENT WITH LEFT-IN



NEW TRIPS
ENTER EXIT
 72 (55) 71 (55)



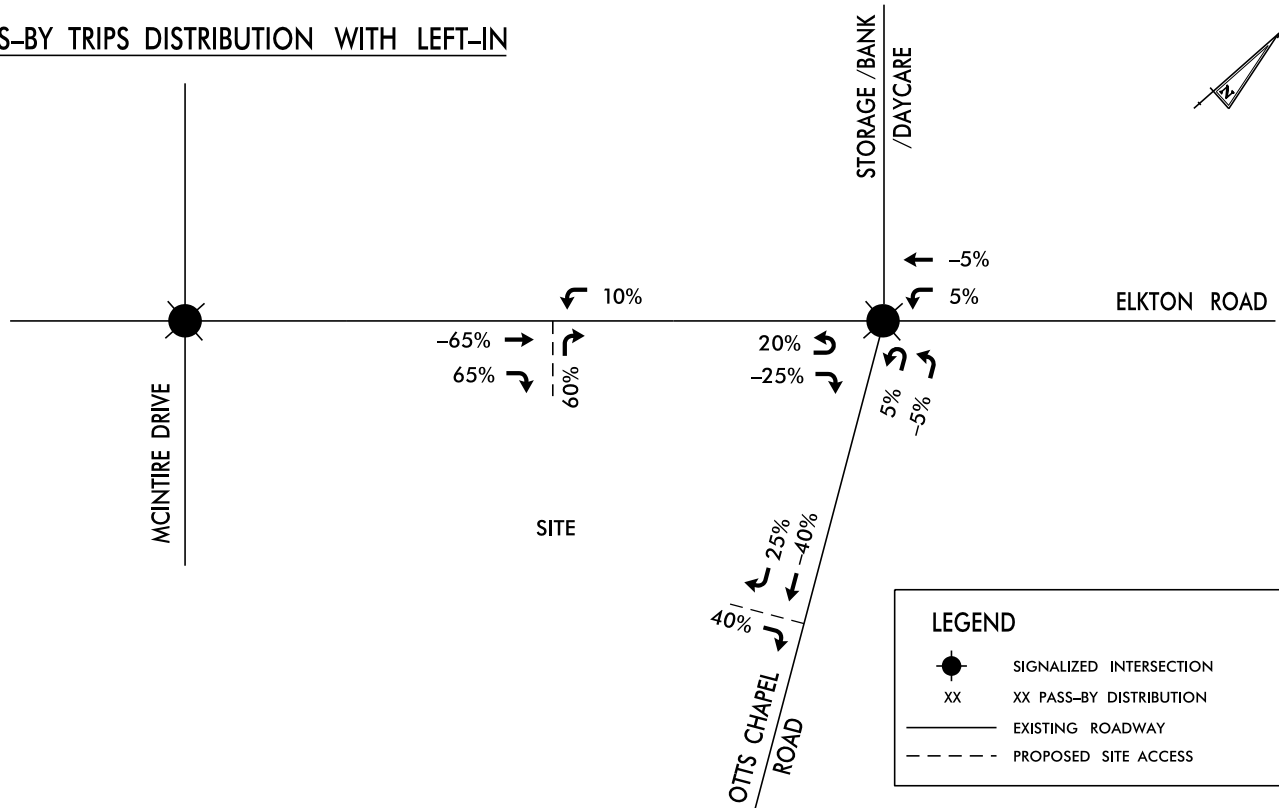
PROPOSED ROYAL FARMS
 TRAFFIC IMPACT STUDY
 AT ELKTON ROAD/OTTS CHAPEL ROAD
 NEW CASTLE COUNTY, DELAWARE

N.T.S

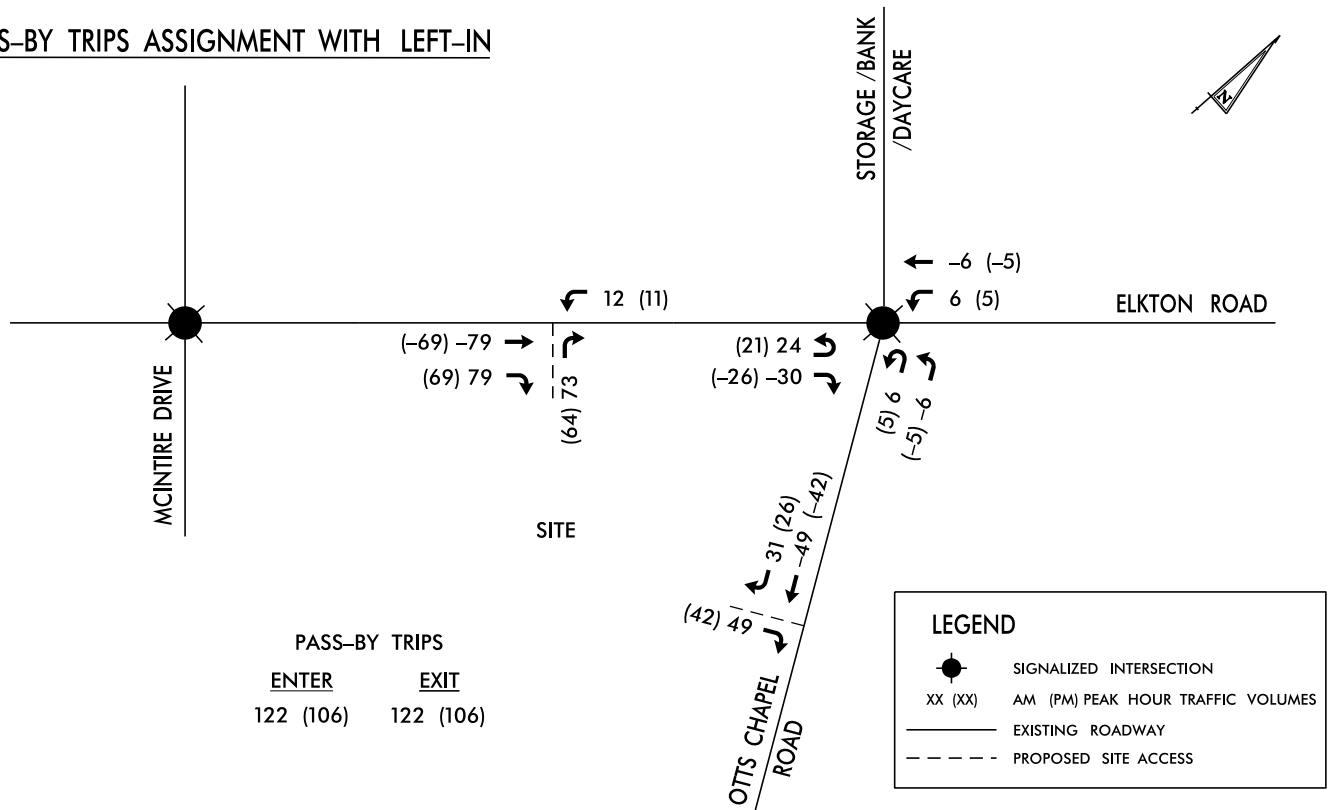
FIGURE D-1

JANUARY 2019

PASS-BY TRIPS DISTRIBUTION WITH LEFT-IN



PASS-BY TRIPS ASSIGNMENT WITH LEFT-IN



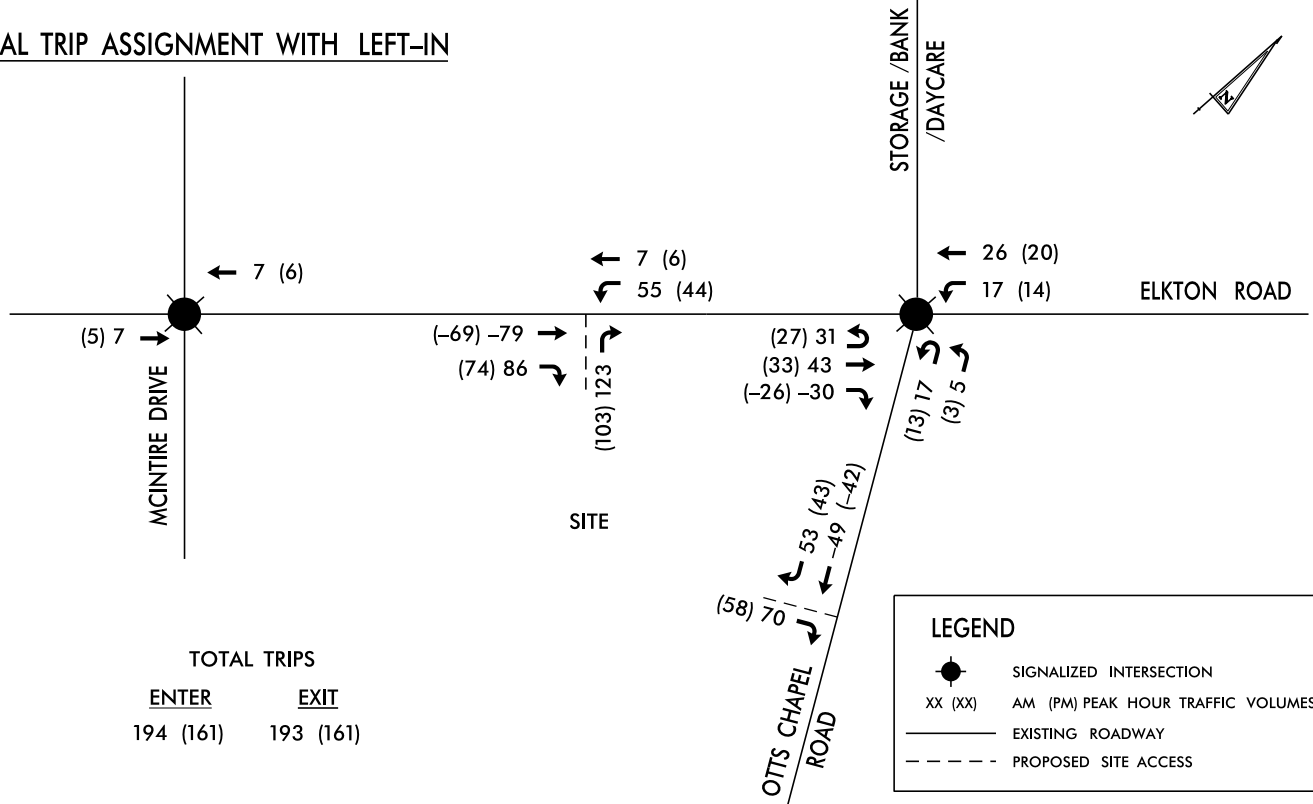
**PROPOSED ROYAL FARMS
TRAFFIC IMPACT STUDY
AT ELKTON ROAD/OTTS CHAPEL ROAD
NEW CASTLE COUNTY, DELAWARE**

N.T.S

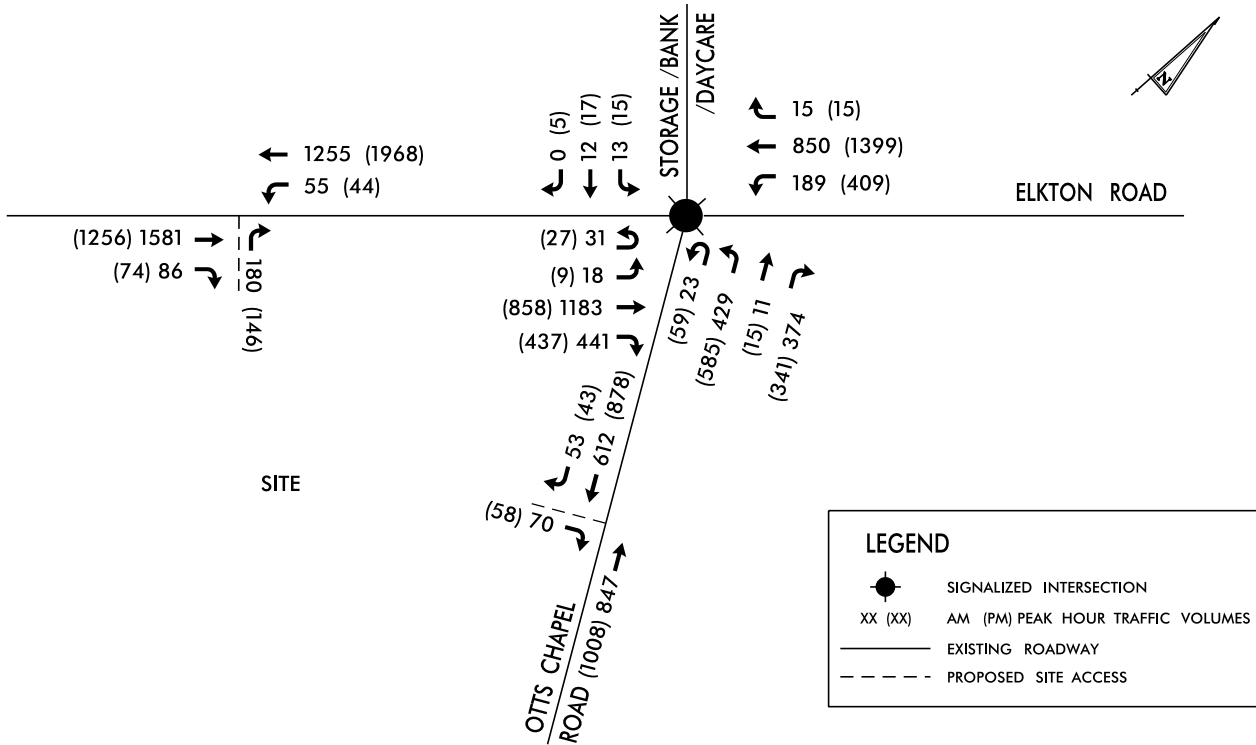
FIGURE D-2

JANUARY 2019

TOTAL TRIP ASSIGNMENT WITH LEFT-IN



CASE 3: 2021 WEEKDAY TRAFFIC COUNT VOLUMES WITH ROYAL FARMS DEVELOPMENT AND LEFT-IN



PROPOSED ROYAL FARMS
TRAFFIC IMPACT STUDY
AT ELKTON ROAD/OTTS CHAPEL ROAD
NEW CASTLE COUNTY, DELAWARE

N.T.S

FIGURE D-3

JANUARY 2019

Signalized Intersection	Peak Hour	Peak Hour LOS Results	
		Case 3 2021 With Royal Farms Development and Left-In	
		LOS	Delay (sec)
Elkton Road/Otts Chapel Road	AM	C	27.6
	PM	C	33.8

Note:

The LOS results are based on Synchro methodology from Synchro 9.2 software.

Unsignalized Intersection	Peak Hour	Royal Farms Peak Hour LOS Results	
		Case 3 2021 With Royal Farms Development and Left-In	
		LOS	Delay (sec)
Site Entrance/Elkton Road Westbound Approach	AM	B	12.0
	PM	B	11.5
Site Entrance/Otts Chapel Road Northbound Approach	AM	B	10.4
	PM	B	11.1
Left-In Site Entrance/Elkton Road	AM	C	15.6
	PM	B	12.7

Note:

The LOS results are based on Synchro methodology from Synchro 9.2 software.

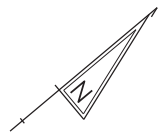
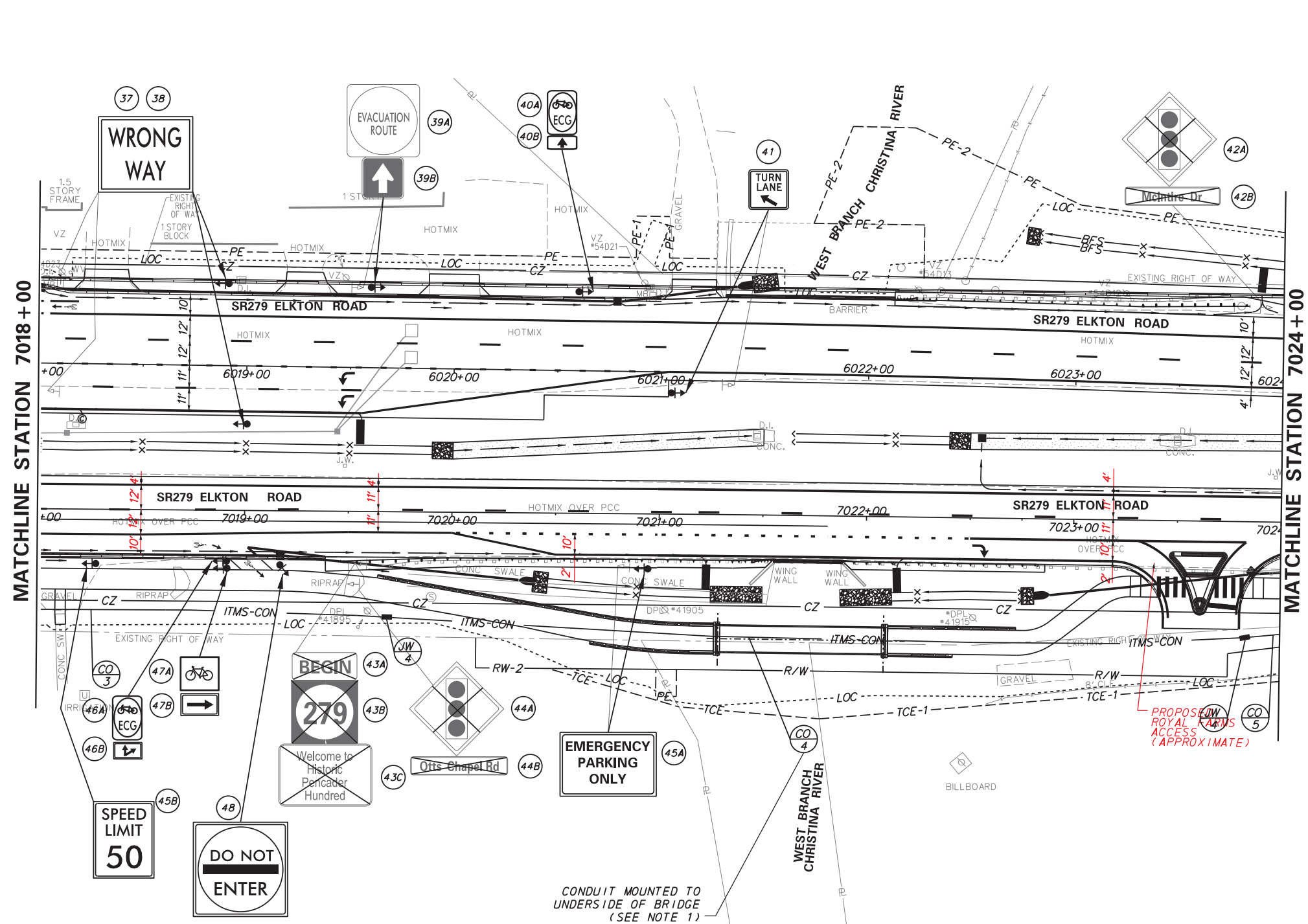
Intersection	Peak Hour	Approach	Peak Hour 95th Percentile Critical Queue Lengths (feet)
			Case 3 2021 With Royal Farms Development and Left-In
Elkton Road/Otts Chapel Road	AM	WBL Otts Chapel Rd	226
		WBLT Otts Chapel Rd	195
		NBL Elkton Rd	185
		NBT Elkton Rd	512
		NBR Elkton Rd	373
		SBL Elkton Rd	162
		SBT Elkton Rd	230
	PM	WBL Otts Chapel Rd	267
		WBLT Otts Chapel Rd	255
		NBL Elkton Rd	137
		NBT Elkton Rd	393
		NBR Elkton Rd	222
		SBL Elkton Rd	268
		SBT Elkton Rd	307
Elkton Road/Site Entrance	AM	WBR Site Entrance	112
		SBL Elkton Rd	94
	PM	WBR Site Entrance	48
		SBL Elkton Rd	59
Otts Chapel/Site Entrance	AM	NBR Site Entrance	8
	PM	NBR Site Entrance	6

Note:

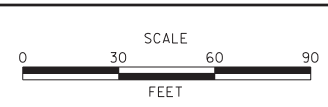
Queue lengths reported here are the averaged 95th percentile queue lengths from five (5) 60-minute simulation runs using SimTraffic software.



Appendix E – Conceptual Layout



ADDENDA / REVISIONS



**ELKTON ROAD
 MD LINE TO
 CASHO MILL ROAD**

CONTRACT	BRIDGE NO.	1-322 1-322P
T201504401	DESIGNED BY:	GYB
COUNTY	CHECKED BY:	MAW
NEW CASTLE		

**SIGNING, STRIPING
 AND CONDUIT PLAN**

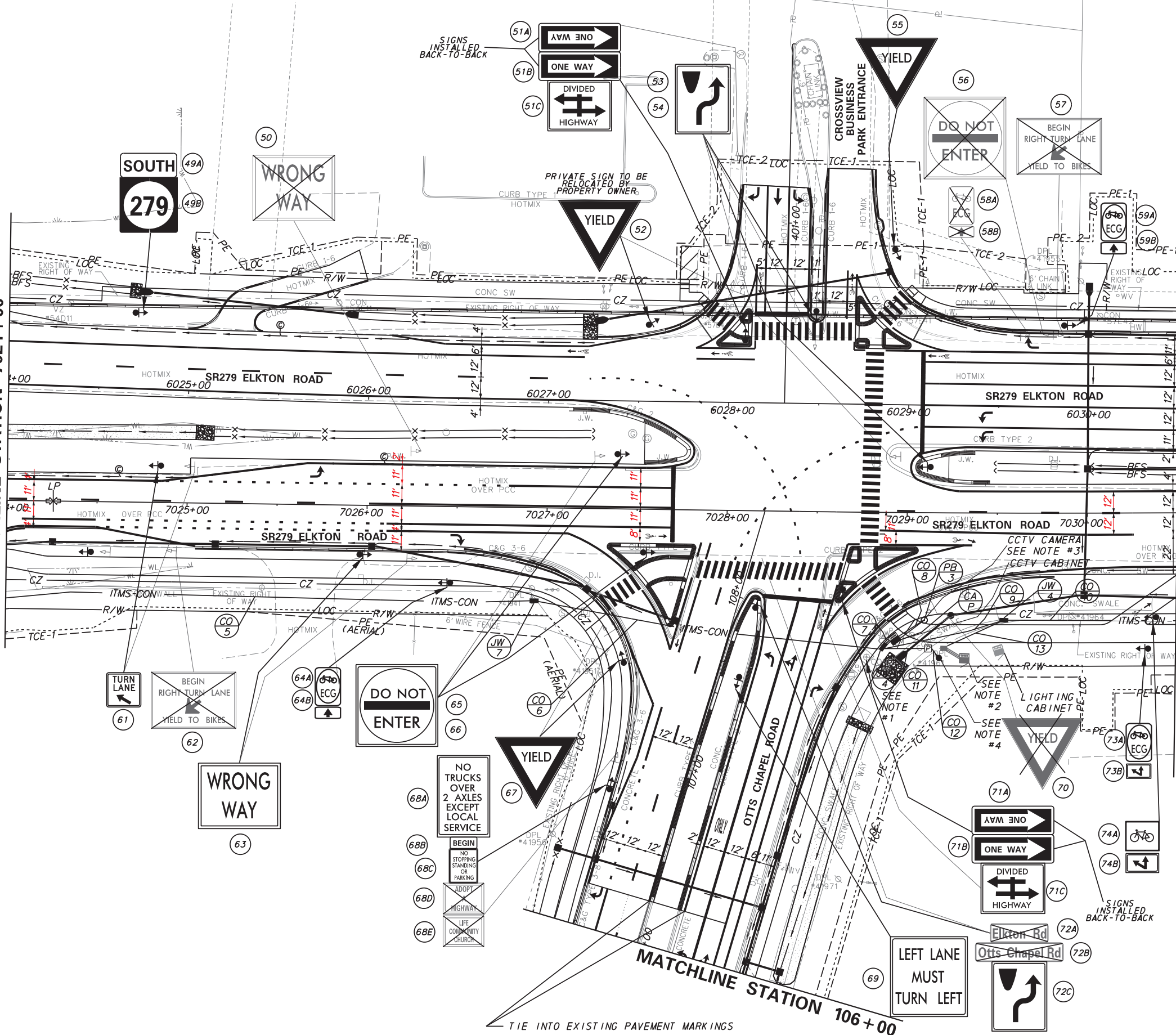
SS-04
SECTION
JMT
SHEET NO.
363

PLOTTED BY: LBERZINA DATE: 1/4/2019
 FILE LOCATION: Q:\INDE\140659_007_ELKTON_RD_CASHO_MILL\CADD\PRESENTATIONS\ROYAL_FARMS\SCENARIO 11-30-18\SS.DGN [SHEET: SS05]

MATCHLINE STATION 7024 + 00

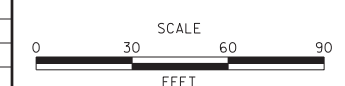
MATCHLINE STATION 7030 + 50

MATCHLINE STATION 106 + 00



TIE INTO EXISTING PAVEMENT MARKINGS

ADDENDA / REVISIONS

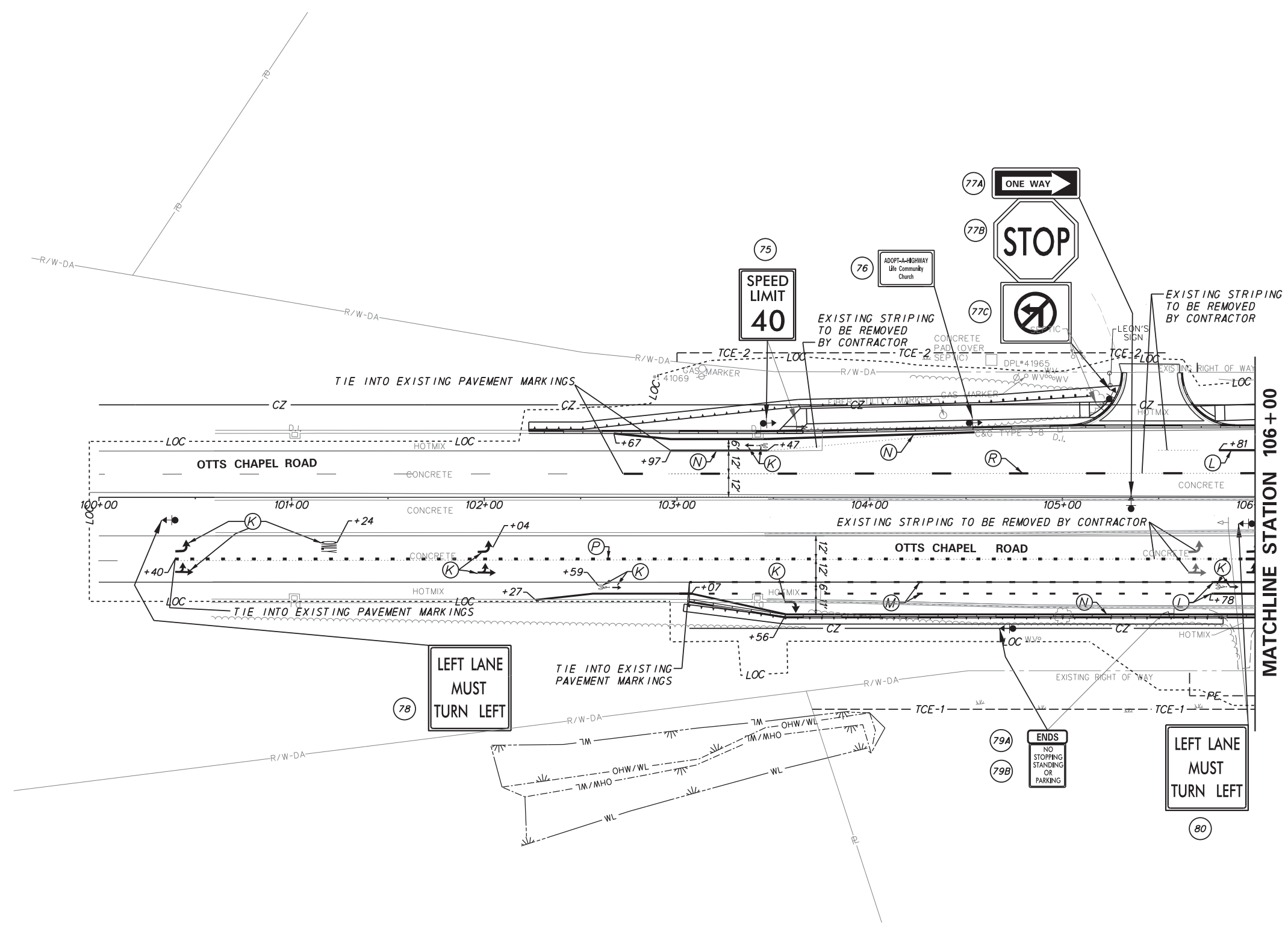
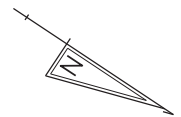


**ELKTON ROAD
MD LINE TO
CASHO MILL ROAD**

CONTRACT	BRIDGE NO.	1-322	1-322P
T201504401	DESIGNED BY:	GYB	
COUNTY	CHECKED BY:	MAW	
NEW CASTLE			

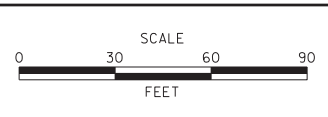
**SIGNING, STRIPING
AND CONDUIT PLAN**

SS-05
SECTION
JMT
SHEET NO.
364



PLOTTED BY: LBERZINA DATE: 1/4/2019
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ADDENDA / REVISIONS



**ELKTON ROAD
 MD LINE TO
 CASHO MILL ROAD**

CONTRACT	BRIDGE NO.	1-322 1-322P
T201504401		1-323 1-323P
COUNTY	DESIGNED BY:	GYB
NEW CASTLE	CHECKED BY:	MAW

**SIGNING, STRIPING
 AND CONDUIT PLAN**

SS-06
SECTION
JMT
SHEET NO.
365