Hampstead Bypass

I-140 to US 17

New Hanover and Pender Counties

STIP Project No. R-3300

WBS No. 40237.1.1

Traffic Forecast Report

Prepared For:
North Carolina Department of Transportation

Prepared By:
Patriot Transportation Engineering, PLLC

April 2017

TRAFFIC FORECAST COVER LETTER

April 6, 2017

MEMORANDUM TO: Trace Howell, PE
NCDOT Division 3

FROM: Peter Trencansky, PE, PTOE, AICP
Patriot Transportation Engineering, PLLC

SUBJECT: Traffic Forecast for R-3300
New Hanover and Pender Counties
Hampstead Bypass from I-140 to US 17

Please find attached the 2016 and 2040 traffic forecast for STIP Project Number U-3300 in Pender County. The proposed project will construct a new location freeway from I-140 to US 17. This forecast was requested for use during the development potential alternative design scenarios and for the development of the Final Roadway Design plans.

This is the second forecast for this project with the first forecast being approved in 2008. The project is located within the boundaries of the Wilmington Metropolitan Planning Organization. The following three scenarios are provided in this forecast:

- 2016 Base Year No-Build
- 2040 Future Year No-Build
- 2040 Future Year Build for seven design scenarios

Katie Hite (NCDOT Division 3 – Project Development Engineer), Jessi Leonard (NCDOT Division 3 – Division Traffic Engineer), Trace Howell (NCDOT Division 3 - Division Design Construct, Design Engineer), Patrick Riddle (NCDOT Division 3 – District 1 Engineer), Mason Herndon (NCDOT Division 3 - Environmental Program Supervisor), Nazia Sarder (NCDOT Transportation Planning Branch), Soon Chung (NCDOT Transportation Planning Branch), Mike Kozlosky (Wilmington MPO – Executive Director), Suraiya Motsinger (Wilmington MPO – Senior Transportation Planner), Tim Lowe (Wilmington MPO – Senior Project Engineer), Kyle Breuer (Pender County – Planning Director), Megan Crowe (Pender County – Senior Planner), Allen Vann (Pender County Schools - Chief Officer of Auxiliary Services), Darren LaFon (Pender County Schools - Transportation Director), Todd Rademacher (Town of Surf City – Planning Director), Brian Wert (NCDOT Transportation Planning Branch) and Keith Dixon (NCDOT State Traffic Forecast Engineer) were consulted during the development of this forecast.

Fiscal Constraint

The project is located within the boundaries of the Wilmington Urban Area Metropolitan Planning Organization; therefore, the travel demand model and traffic forecast is fiscally constrained to match the assumptions of the corresponding Metropolitan Transportation Plan (MTP).

The *Cape Fear Transportation 2040 Metropolitan Transportation Plan* includes the proposed projects expected to be completed by 2040 and describes them as follows:

Patriot Transportation Engineering, PLLC
3008 Anderson Drive, Suite 120
Raleigh, North Carolina 27609
Phone: 919.977.9125

- STIP Project U-4751 – Military Cutoff Road Extension: US 17 Bus/Market Street to US 17/Wilmington Bypass (MTP ID R-3)
- STIP Project U-4902 – US17BUS/Market Street Access Management: Military Cutoff Road to Porters Neck Road (MPT ID R-10)
- STIP Project U-5732 – US 17 Superstreet: Washington Acres Road to Sloop Point Road (MTP ID R-12)
- NC 210 Improvements: Island Creek/NC 210 to US 17 (MPT ID R-36)
- Country Club Drive/Doral Drive and Sloop Point Loop Road: intersection project (MTP ID R-39)

Travel Demand Model

The Wilmington Travel Demand Model (obtained from NCDOT on 6/28/2016) was utilized as a tool in the development of the forecast.

Forecast Methodology

The 2016 base year no-build traffic volumes and design factors were developed based upon current counts and historic AADT trend projections. The 2040 future year no-build traffic volumes generally included the development of compound annual growth rates based on a review of several data sources including the travel demand model, socioeconomic projections, historic growth rates and local development plans. The 2040 future year build volumes generally included utilizing the model data to determine diversion rates to the Hampstead Bypass and then the manual re-allocation of trips based on the proposed designs. Engineering judgment adjustments were applied as needed in finalizing the volumes in order to develop a balanced forecast.

Interpolation/Extrapolation

To estimate No-Build AADT volumes between 2016 and 2040, straight line interpolation between the 2016 and 2040 no-build forecast volumes is acceptable. AADT volumes may be extrapolated for up to two years immediately following 2040. Interpolation/extrapolation of Build scenario volumes is not allowable as there is not a 2016 Build forecast. If it is determined that any of these assumptions have become inconsistent with the project and surrounding area activity, please request updated projections at this location.

This forecast has been reviewed and approved by the NCDOT Transportation Planning Branch April 5, 2017.

cc: (Final distribution for your records via e-mail as PDF attachments):
Katie Hite, PE, PTOE, Division 3 Project Development Engineer
Alan Pythcher, Division 3 Division Planning Engineer
Glenn Mumford, PE, Roadway Design Unit
Clark Morrison, PhD, PE, Pavement Management
Keith Dixon, Transportation Planning Branch
Behshad Norowzi, Transportation Planning Branch
Nazia Sarder, Transportation Planning Branch
James Dunlop, PE, Congestion Management Section
Mike Kozlosky, Wilmington MPO

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Forecast Notes:

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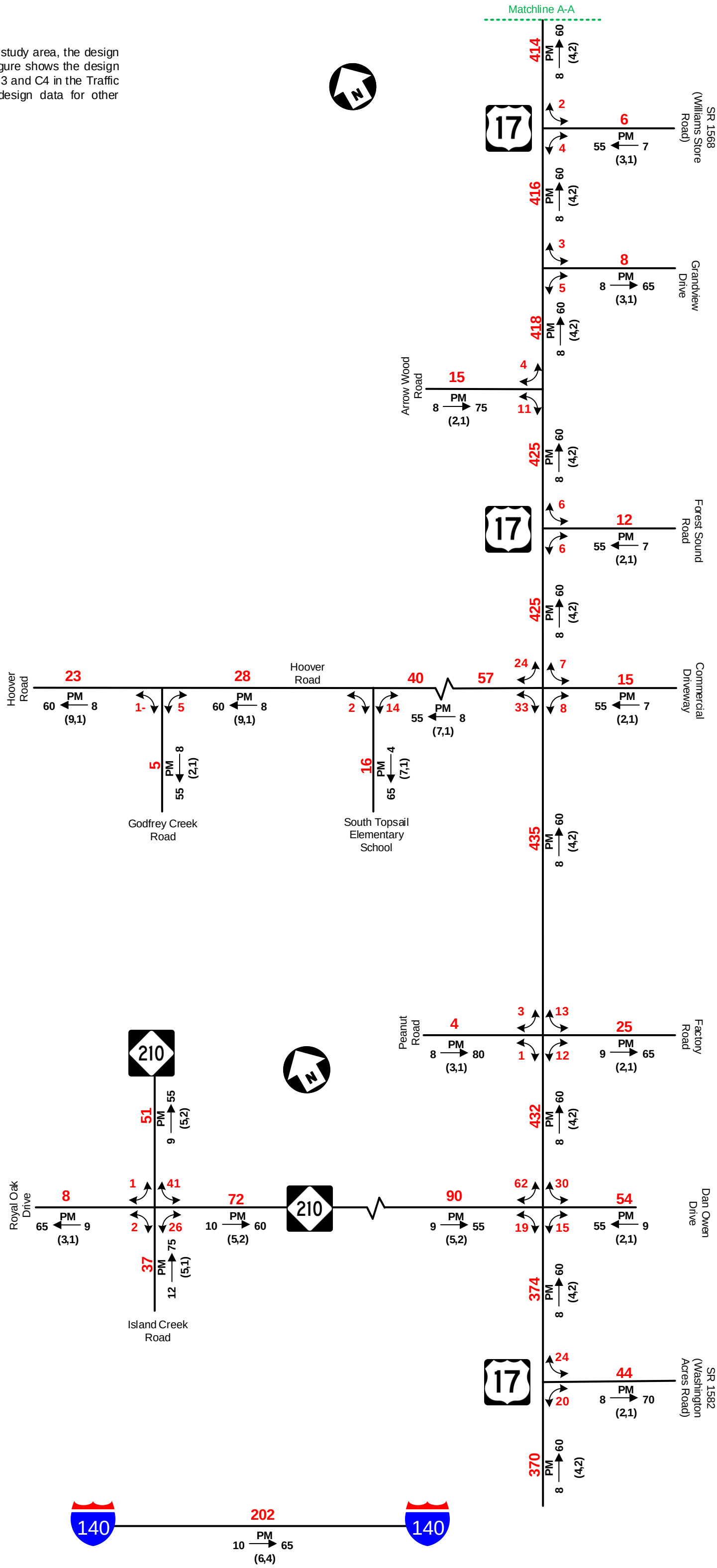

2016 AVERAGE ANNUAL DAILY TRAFFIC

NO-BUILD SCENARIO
SHEET 1 OF 2

L E G E N D

K PM → D
(d, t)

###	No. of Vehicles Per Day (VPD) in 100s
1-	Less than 50 VPD
X	Movement Prohibited
-------	Roadway
K	Design Hour Factor (%)
PM	PM Peak Period
D	Peak Hour Directional Split
→	Indicates Direction of D
(d,t)	Duals, TT-STs (%)

TIP: R-3300 | **WBS:** 40237.1.1

COUNTY: New Hanover & Pender | **DIVISION:** 3

DATE: 04-05-2017

PREPARED BY: Patriot Transportation Engineering, PLLC

LOCATION: **US 17 Hampstead Bypass**

PROJECT: Freeway on New Location

Forecast Notes:

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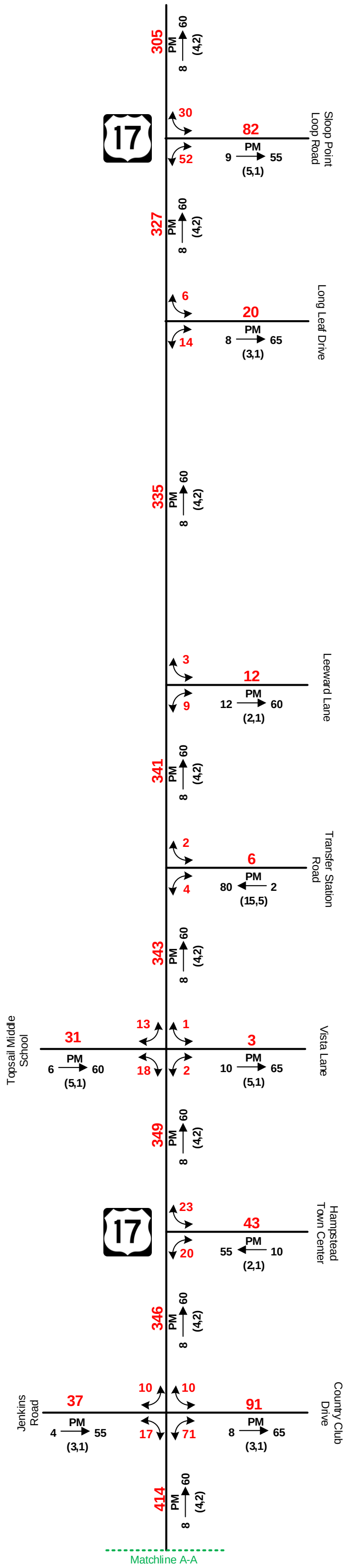

2016 AVERAGE ANNUAL DAILY TRAFFIC

NO-BUILD SCENARIO
SHEET 2 OF 2

L E G E N D

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TIP: R-3300 | **WBS:** 40237.1.1

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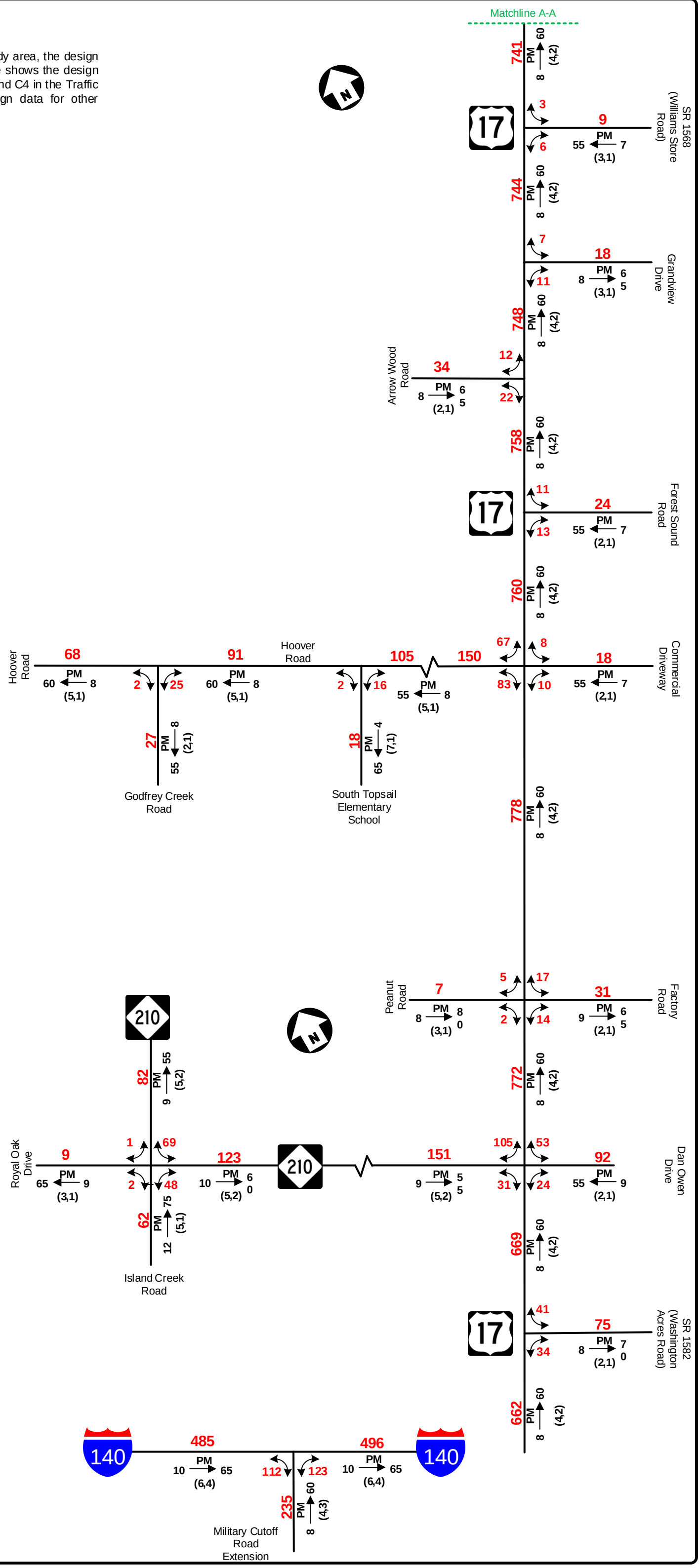

2040 AVERAGE ANNUAL DAILY TRAFFIC

NO-BUILD SCENARIO

SHEET 1 OF 2

L E G E N D

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TIP: R-3300 | **WBS:** 40237.1.1

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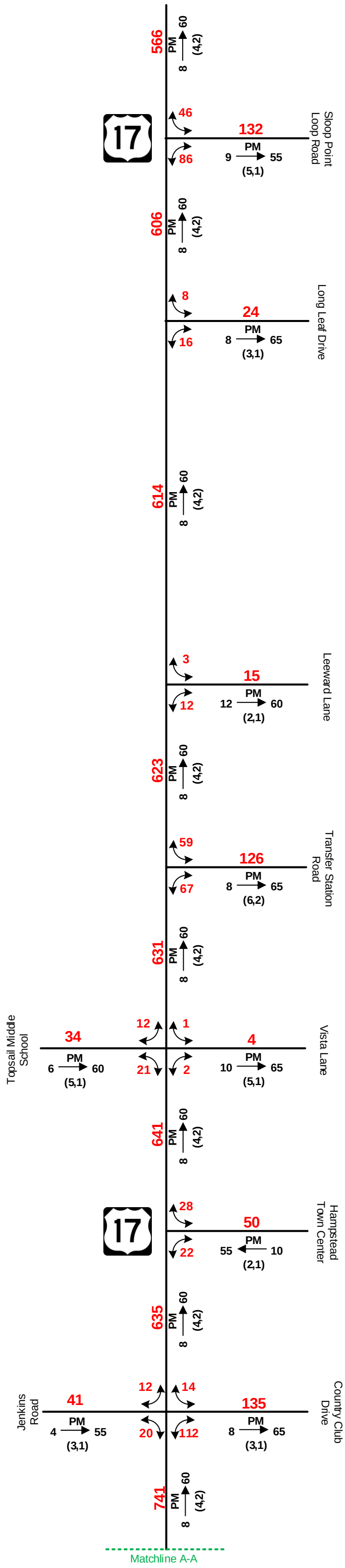

2040 AVERAGE ANNUAL DAILY TRAFFIC

NO-BUILD SCENARIO
SHEET 2 OF 2

L E G E N D

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TIP: R-3300 | **WBS:** 40237.1.1

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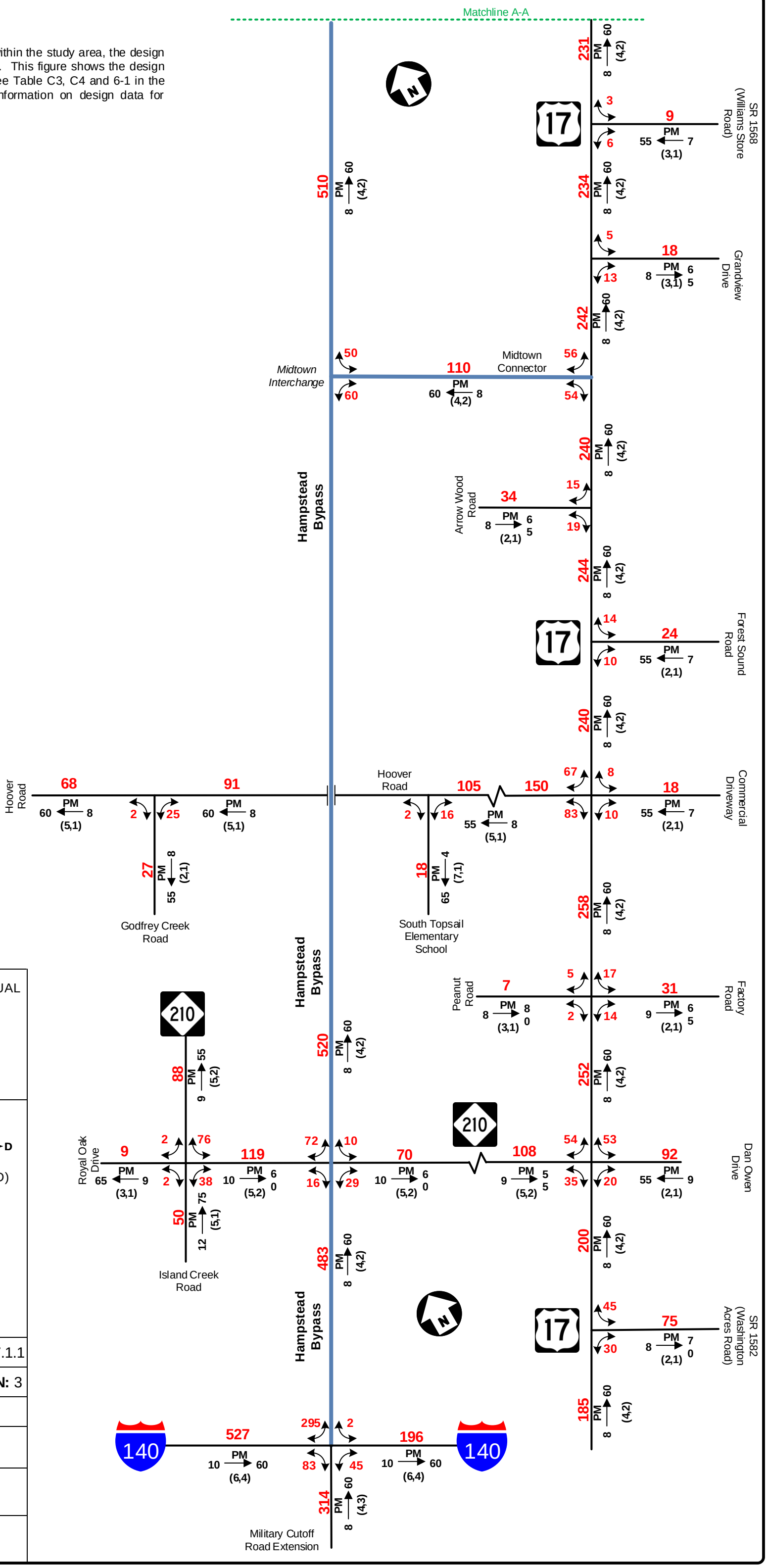

2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 1
SHEET 1 OF 2

L E G E N D

K PM (d, t) D

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TIP: R-3300	**WBS:** 40237.1.1
COUNTY: New Hanover & Pender	**DIVISION:** 3
DATE: 04-05-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
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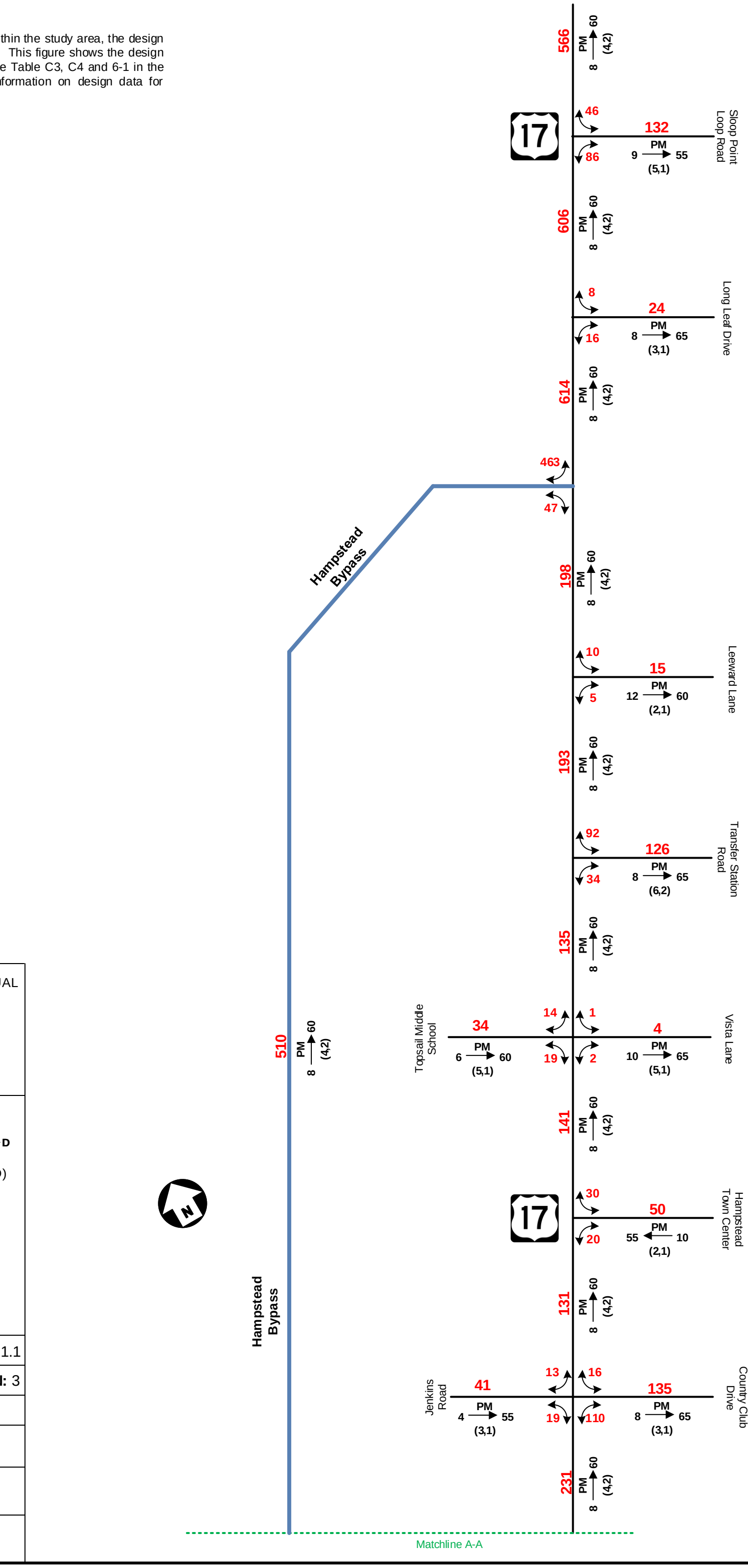

2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 1
SHEET 2 OF 2

L E G E N D

K PM (d, t) D

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TIP: R-3300 | **WBS:** 40237.1.1

COUNTY: New Hanover & Pender | **DIVISION:** 3

DATE: 04-05-2017

PREPARED BY: Patriot Transportation Engineering, PLLC

LOCATION: US 17 Hampstead Bypass

PROJECT: Freeway on New Location

Forecast Notes:

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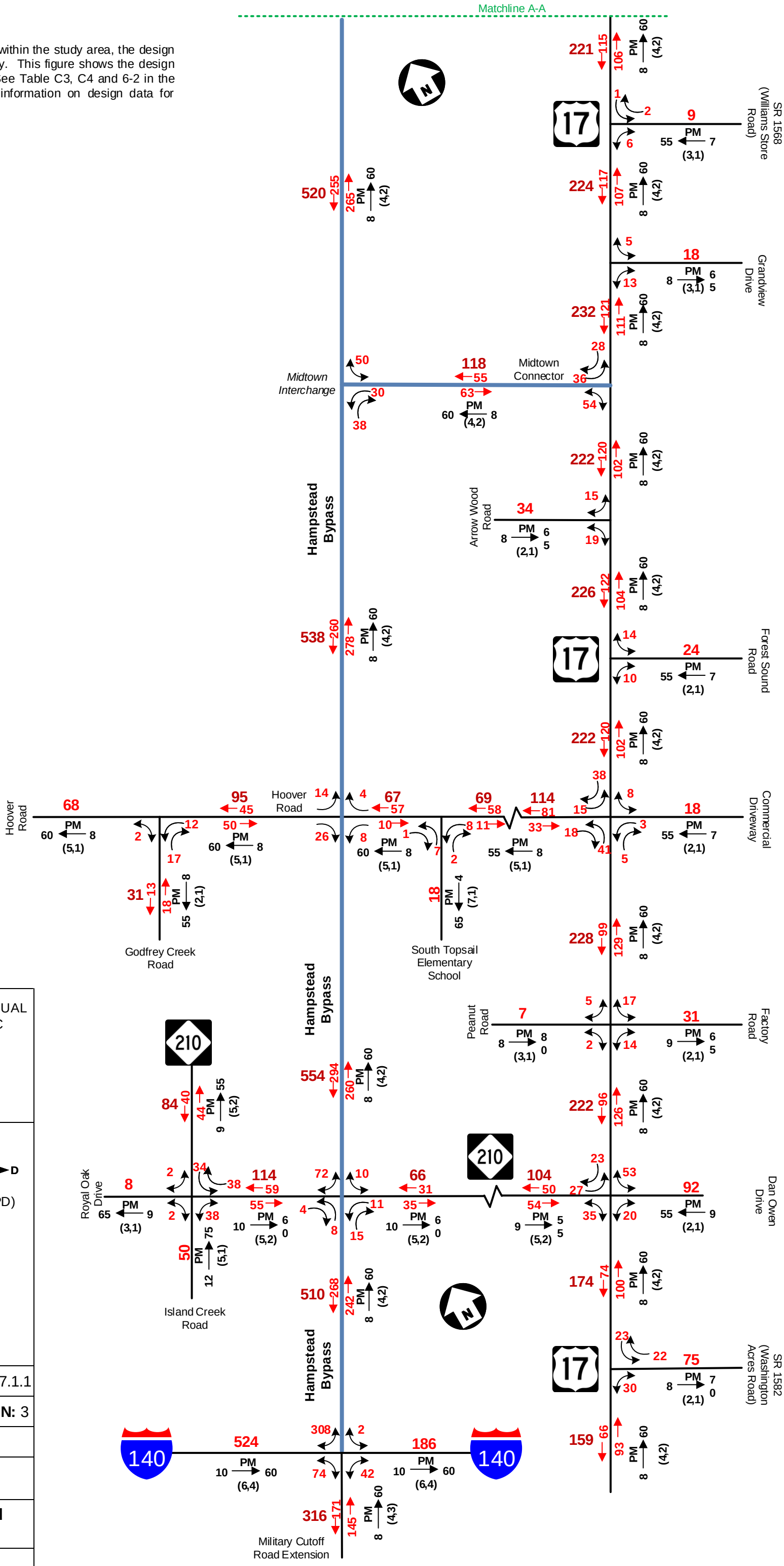

2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 2
SHEET 1 OF 2

L E G E N D

K PM (d, t) D

###	No. of Vehicles Per Day (VPD) in 100s
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TIP: R-3300 | **WBS:** 40237.1.1

COUNTY: New Hanover & Pender | **DIVISION:** 3

DATE: 04-05-2017

PREPARED BY: Patriot Transportation Engineering, PLLC

LOCATION: US 17 Hampstead Bypass

PROJECT: Freeway on New Location

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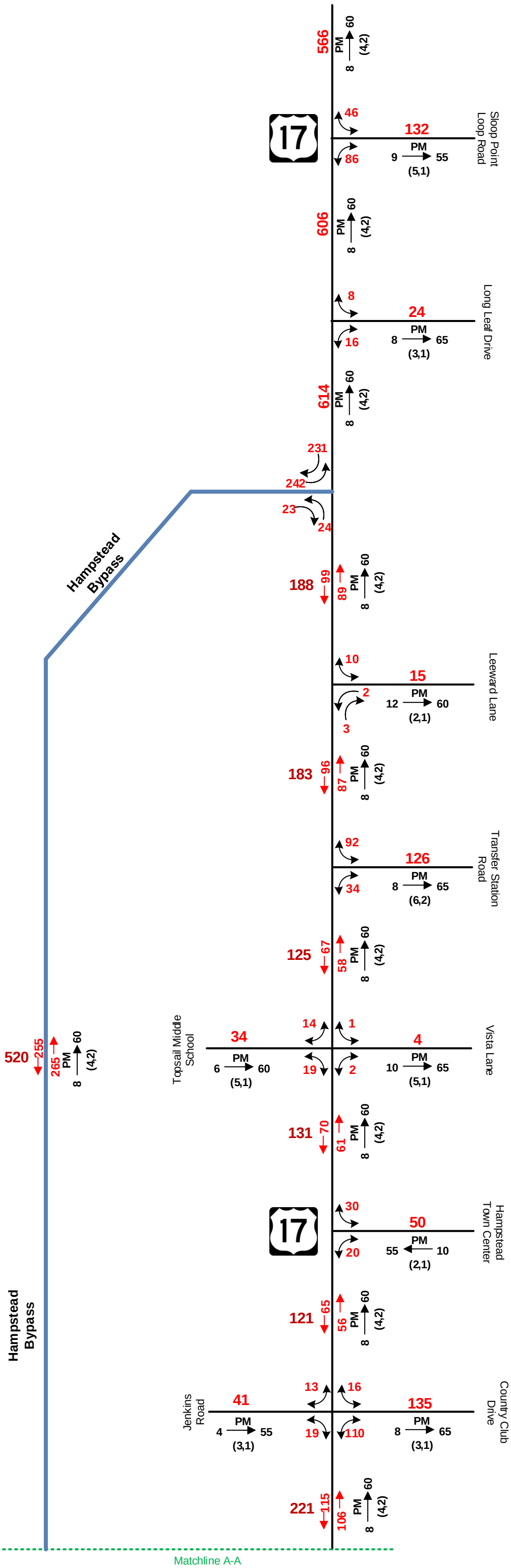

2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 2
SHEET 2 OF 2

L E G E N D

K PM (d, t) D

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TIP: R-3300	**WBS:** 40237.1.1
COUNTY: New Hanover & Pender	**DIVISION:** 3
DATE: 04-05-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

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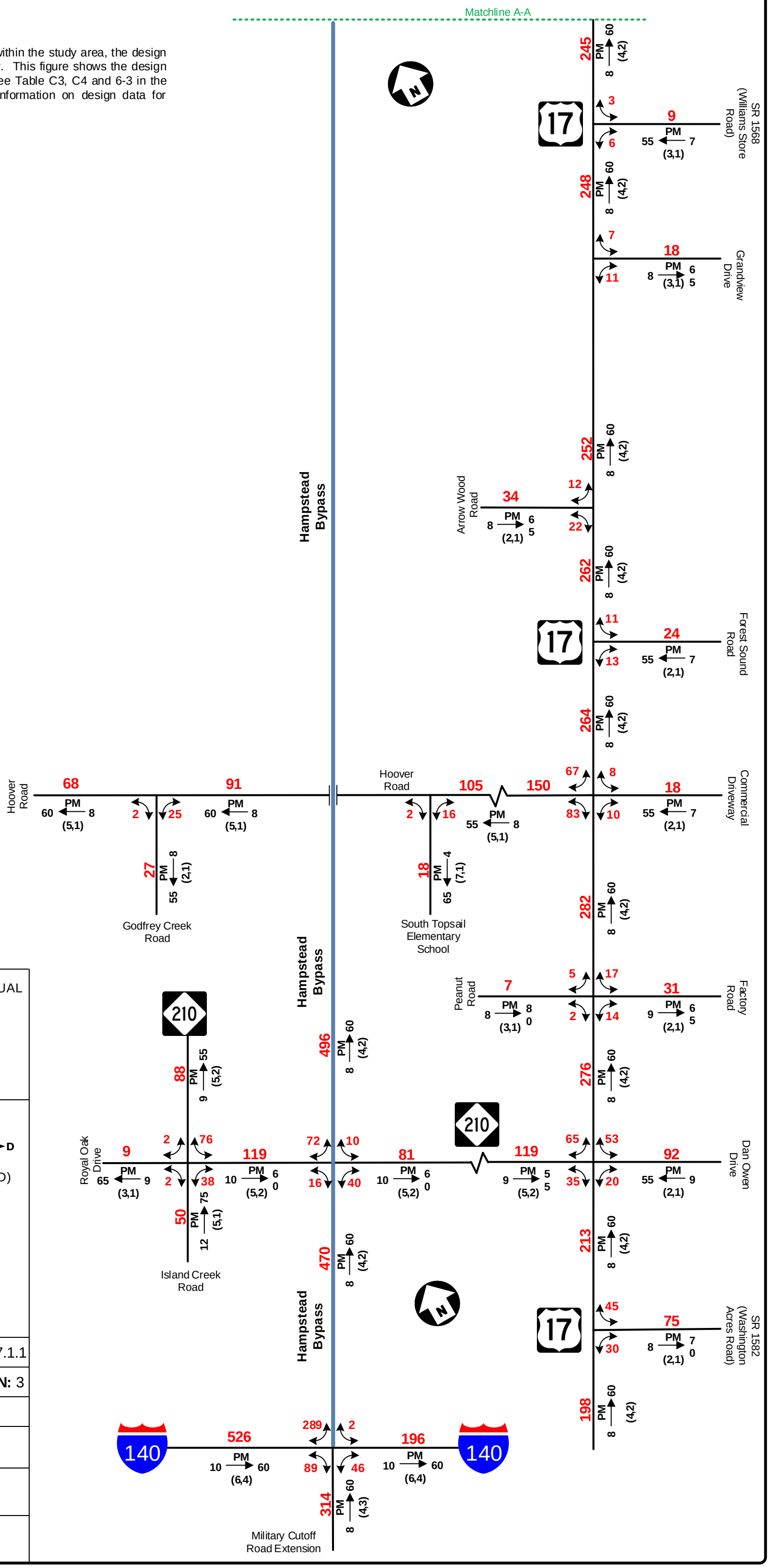

2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 3
SHEET 1 OF 2

L E G E N D

K PM→ D (d, t)

###	No. of Vehicles Per Day (VPD) in 100s
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K	Design Hour Factor (%)
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(d,t)	Duals, TT-STs (%)

TIP: R-3300	**WBS:** 40237.1.1
COUNTY: New Hanover & Pender	**DIVISION:** 3
DATE: 04-05-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

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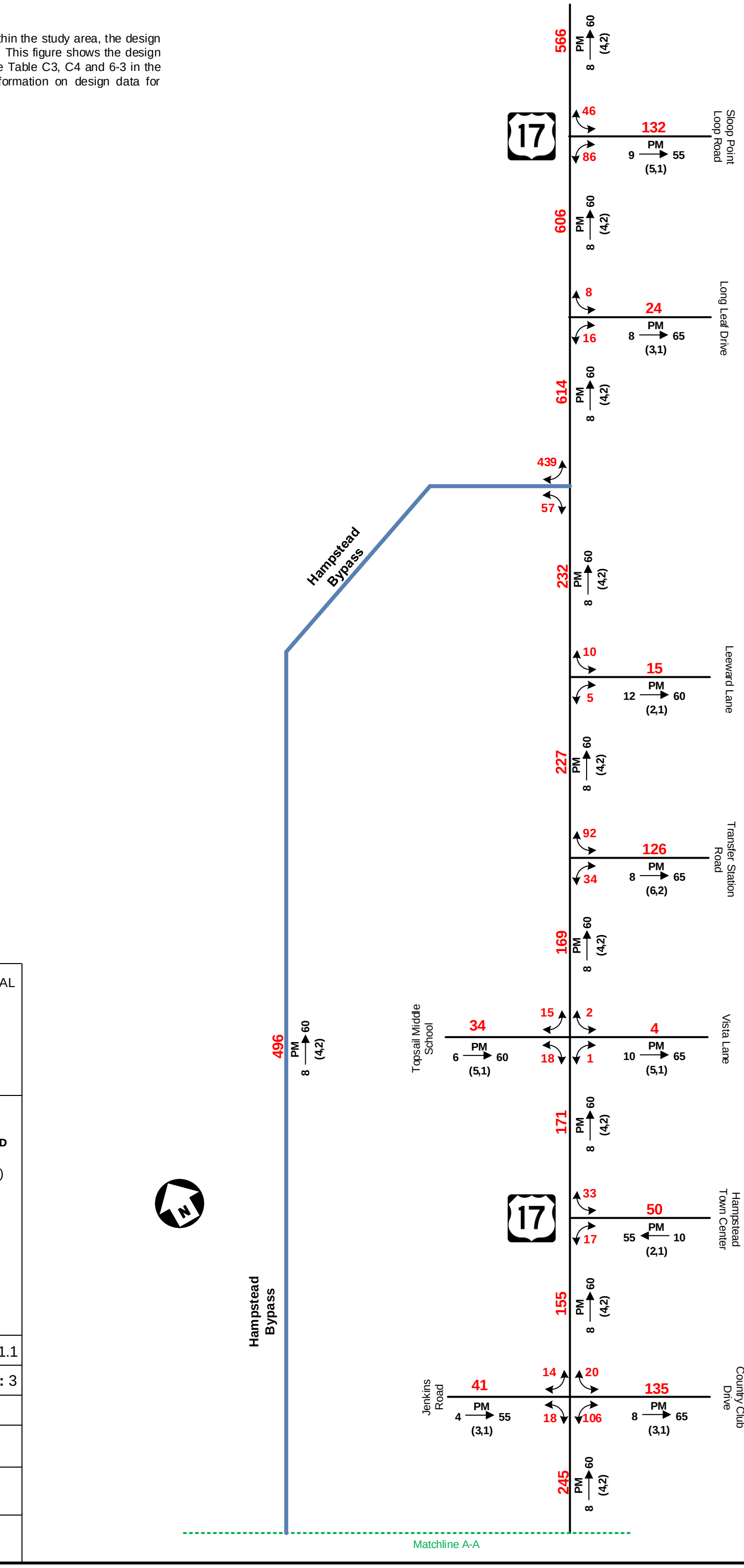

2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 3
SHEET 2 OF 2

L E G E N D

K PM (d, t) D

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COUNTY: New Hanover & Pender	**DIVISION:** 3
DATE: 04-05-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

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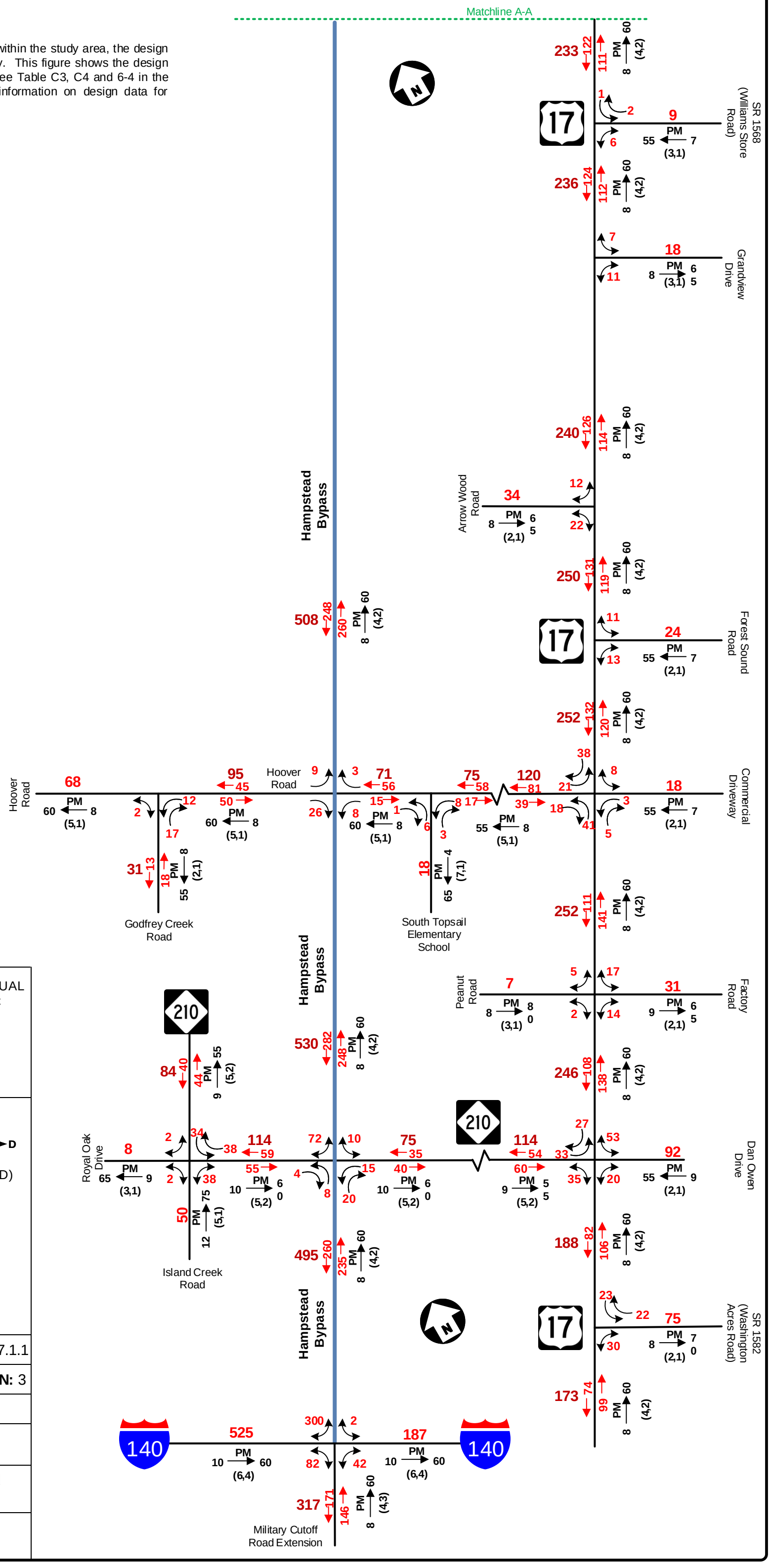

2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 4
SHEET 1 OF 2

L E G E N D

K PM (d, t) D

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PM	PM Peak Period
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(d,t)	Duals, TT-STs (%)

TIP: R-3300	**WBS:** 40237.1.1
COUNTY: New Hanover & Pender	**DIVISION:** 3
DATE: 04-05-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

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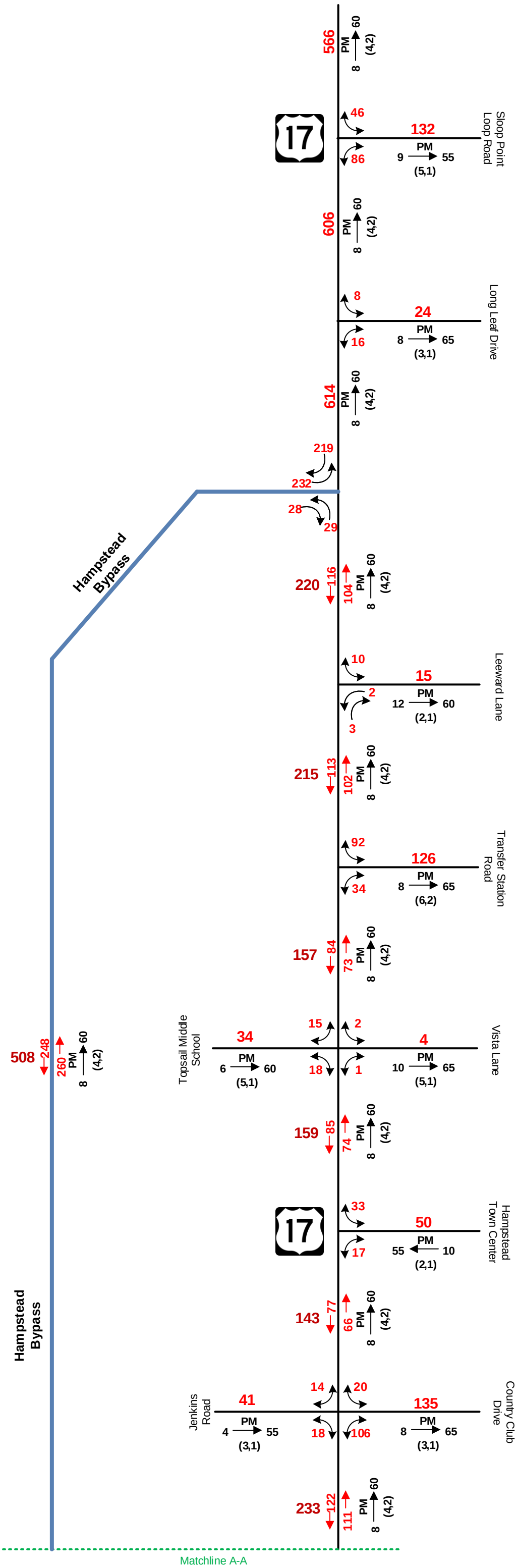

2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 4
SHEET 2 OF 2

L E G E N D

K PM (d, t) D

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TIP: R-3300	**WBS:** 40237.1.1
COUNTY: New Hanover & Pender	**DIVISION:** 3
DATE: 04-05-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

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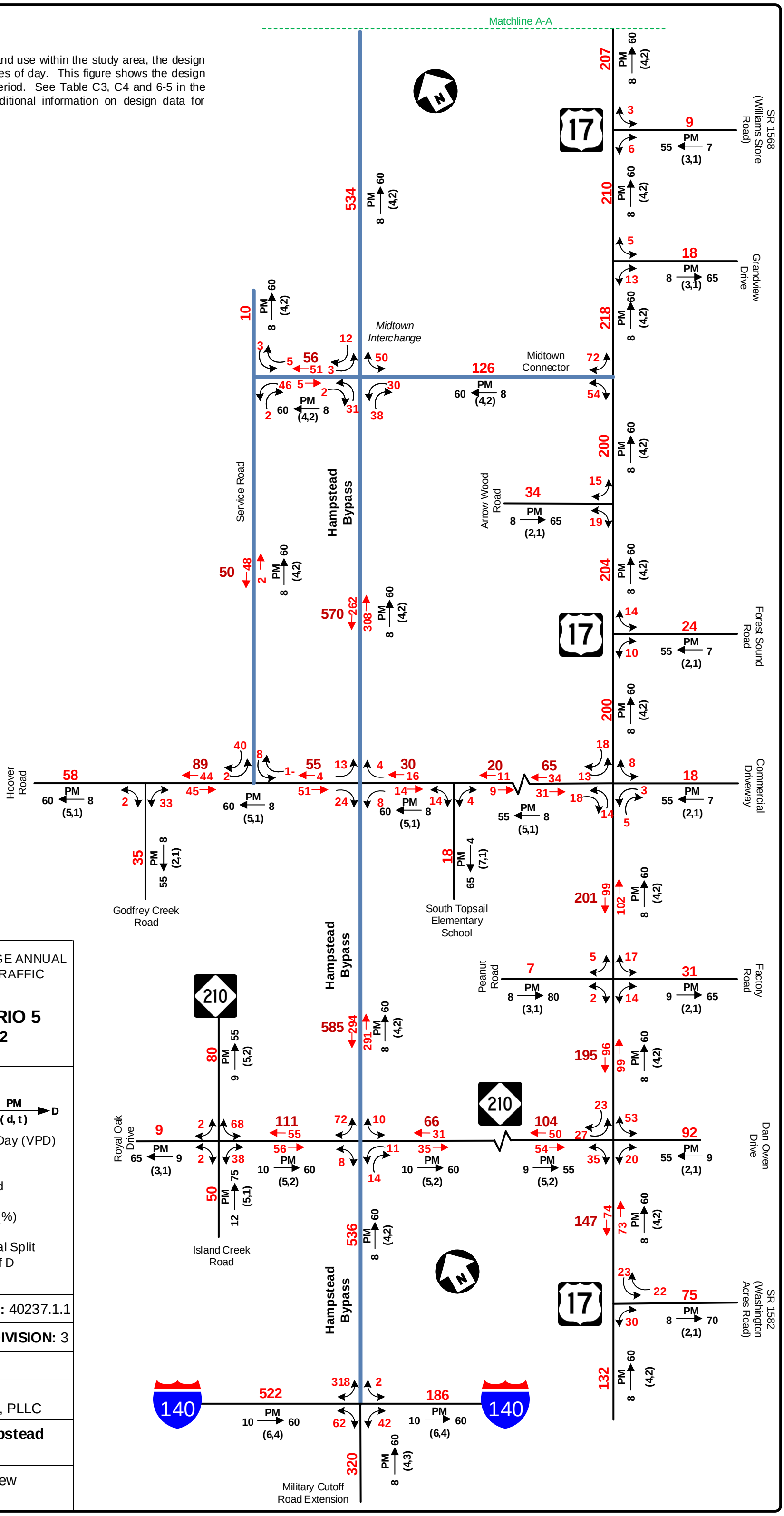

2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 5
SHEET 1 OF 2

LEGEND

K PM (d, t) D

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TIP: R-3300	**WBS:** 40237.1.1
COUNTY: New Hanover & Pender	**DIVISION:** 3
DATE: 03-24-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

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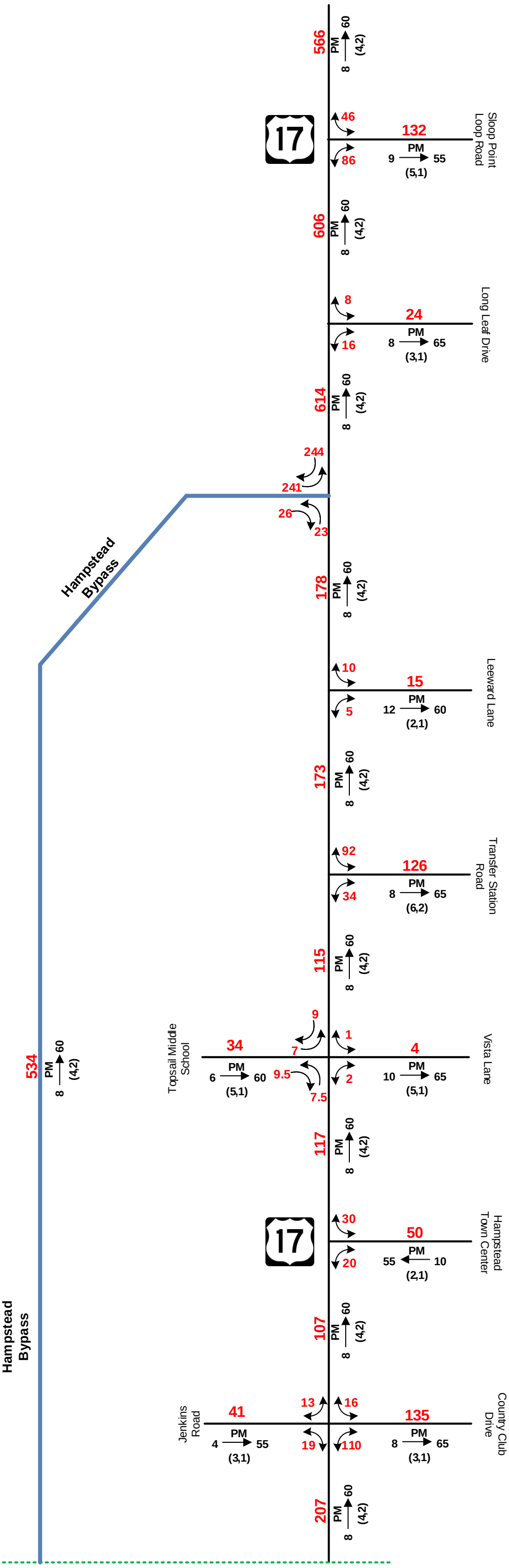

2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 5
SHEET 2 OF 2

L E G E N D

K PM D (d, t)

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TIP: R-3300 | **WBS:** 40237.1.1

COUNTY: New Hanover & Pender | **DIVISION:** 3

DATE: 04-05-2017

PREPARED BY: Patriot Transportation Engineering, PLLC

LOCATION: US 17 Hampstead Bypass

PROJECT: Freeway on New Location

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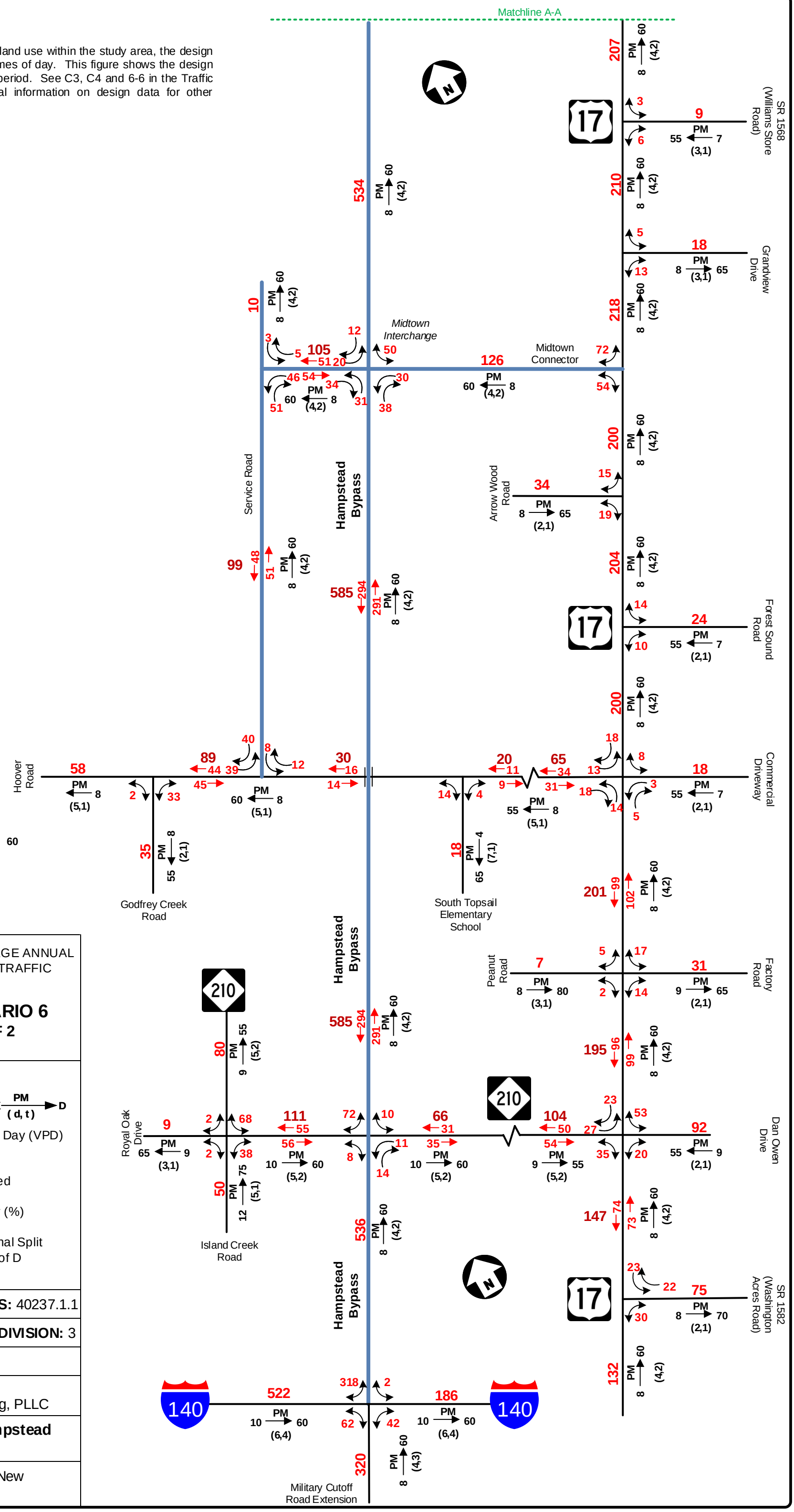

2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 6
SHEET 1 OF 2

L E G E N D

K PM (d, t) D

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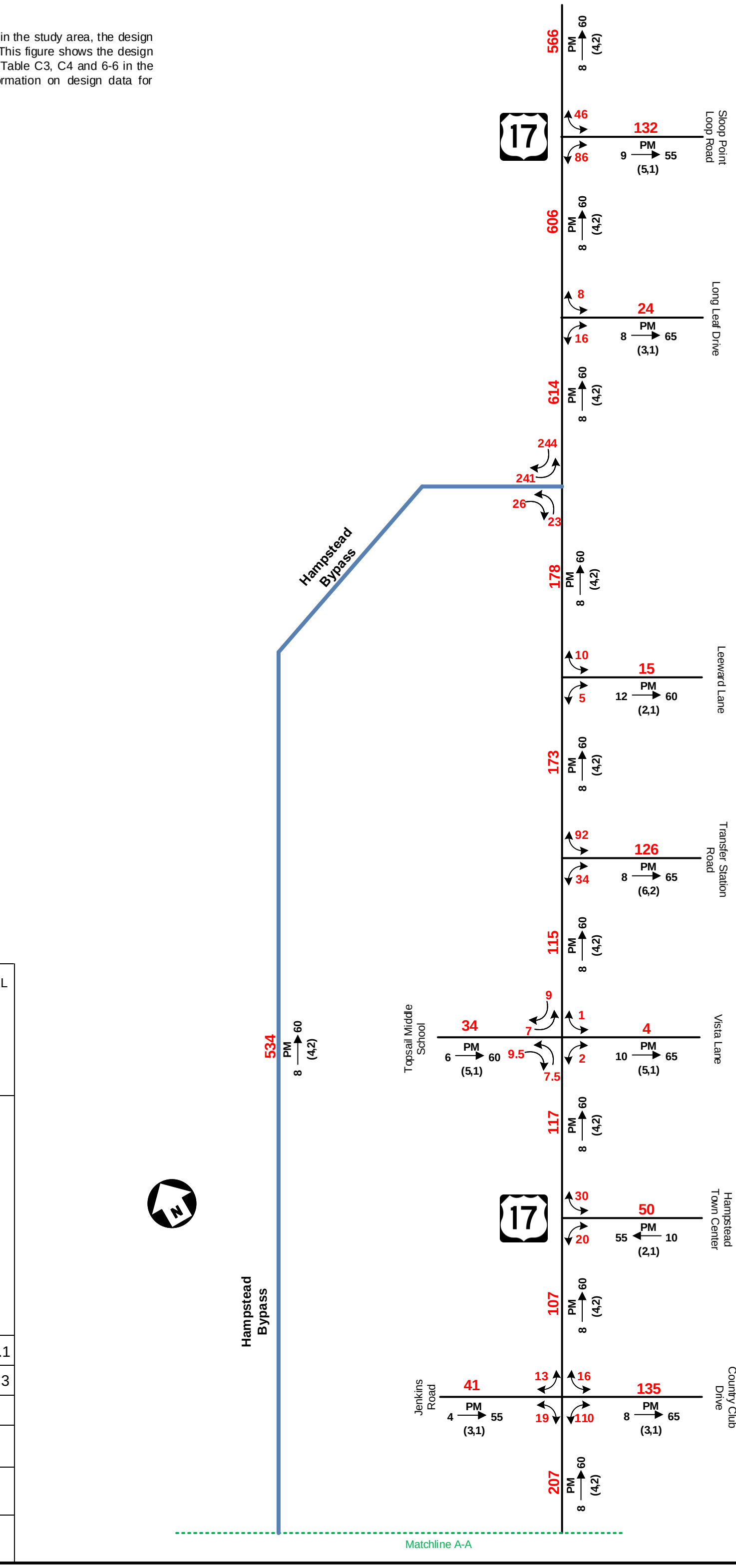

2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 6
SHEET 2 OF 2

L E G E N D

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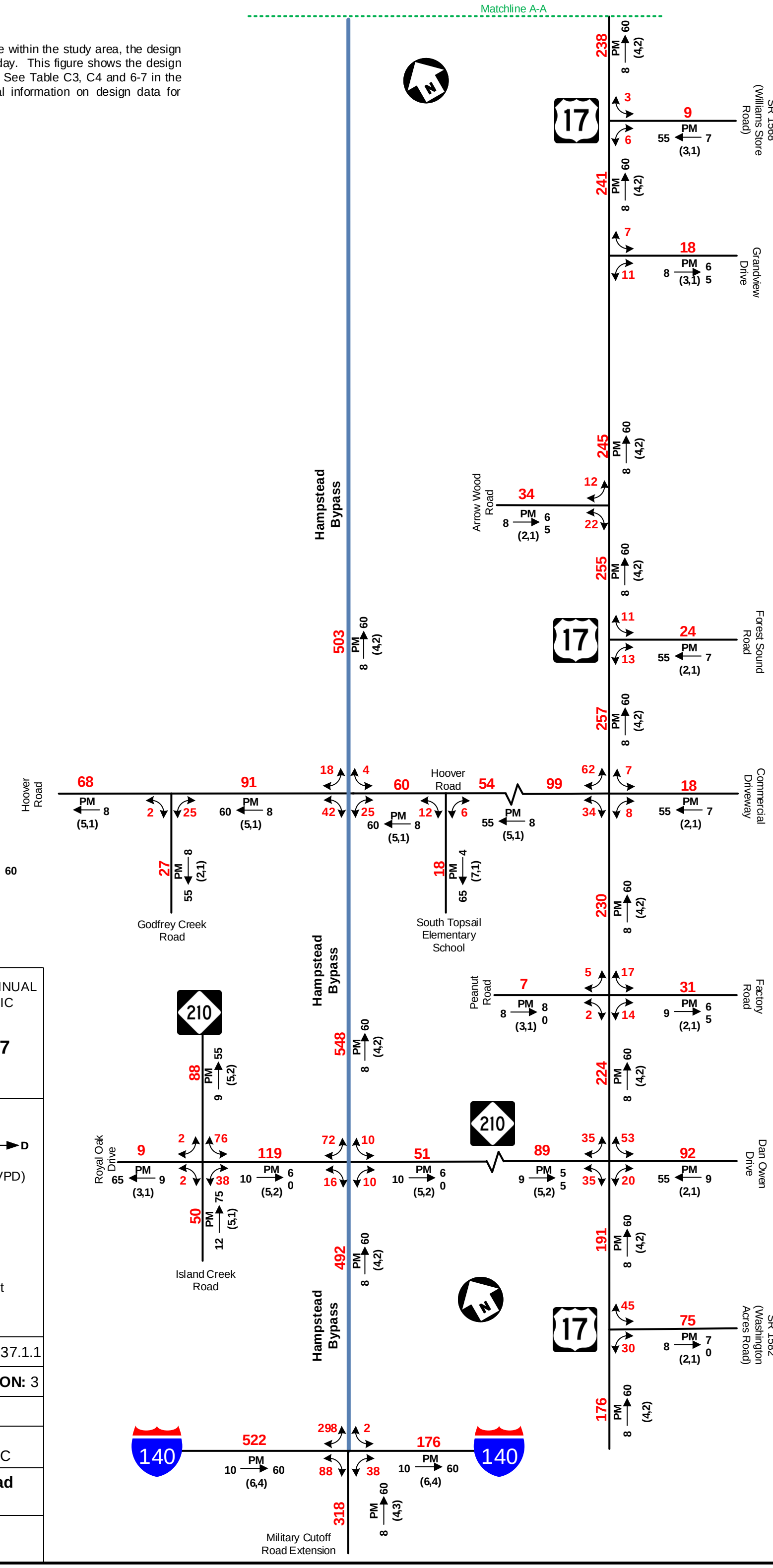
PM	PM Peak Period
D	Peak Hour Directional Split
→	Indicates Direction of D
(d,t)	Duals, TT-STs (%)

TIP: R-3300	**WBS:** 40237.1.1
COUNTY: New Hanover & Pender	**DIVISION:** 3
DATE: 04-05-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Forecast Notes:

1 - Due to the varied types of land use within the study area, the design factors vary during different times of day. This figure shows the design data for a standard PM peak period. See Table C3, C4 and 6-7 in the Traffic Forecast Report for additional information on design data for other periods of the day.



2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 7

SHEET 1 OF 2

L E G E N D

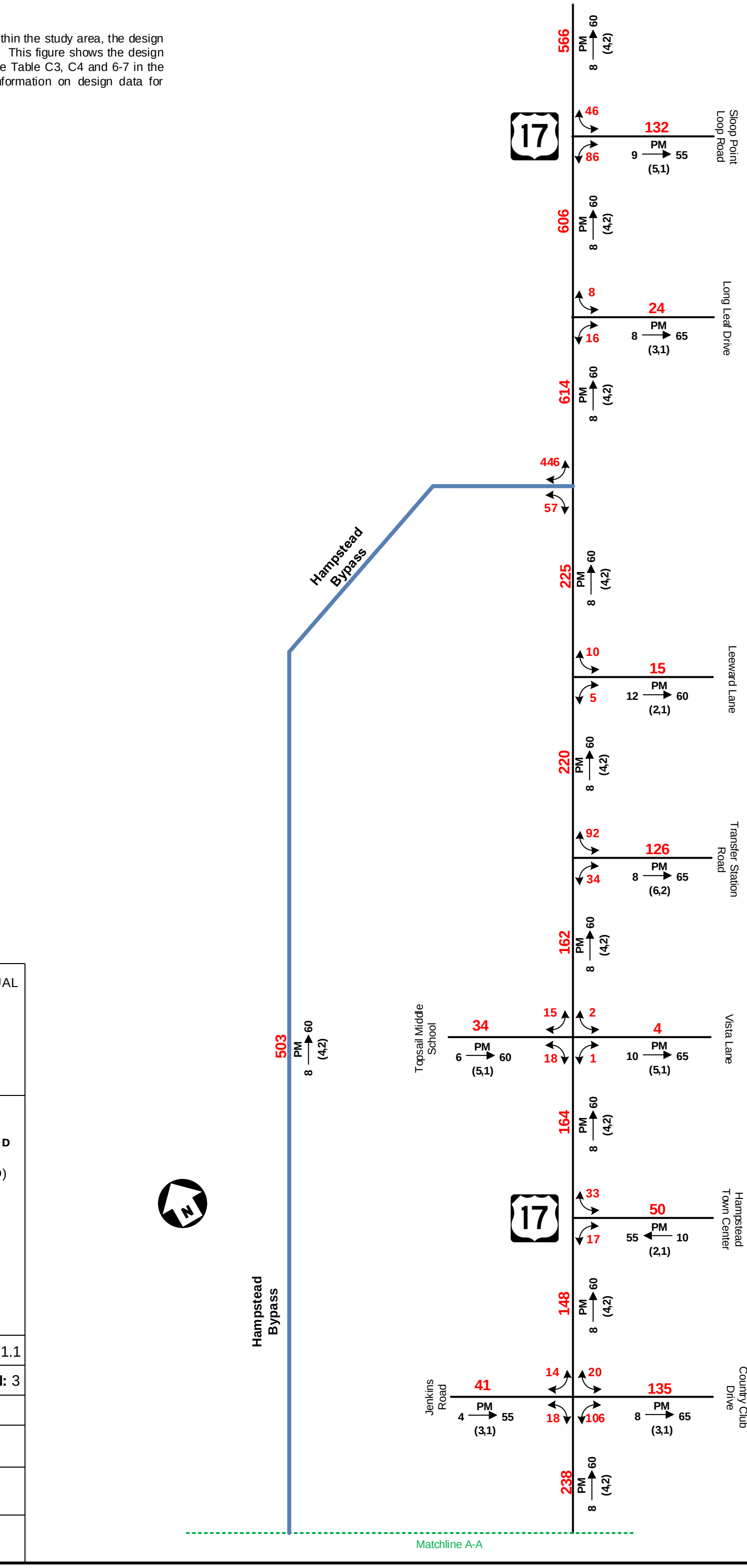
K PM → D (d, t)

###	No. of Vehicles Per Day (VPD) in 100s
1-	Less than 50 VPD
X	Movement Prohibited
-------	Roadway
K	Design Hour Factor (%)
PM	PM Peak Period
D	Peak Hour Directional Split
→	Indicates Direction of D
(d,t)	Duals, TT-STs (%)

TIP: R-3300	**WBS:** 40237.1.1
COUNTY: New Hanover & Pender	**DIVISION:** 3
DATE: 04-05-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Forecast Notes:

1 - Due to the varied types of land use within the study area, the design factors vary during different times of day. This figure shows the design data for a standard PM peak period. See Table C3, C4 and 6-7 in the Traffic Forecast Report for additional information on design data for other periods of the day.



2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 7
SHEET 2 OF 2

L E G E N D

K PM (d, t) D

###	No. of Vehicles Per Day (VPD) in 100s
1-	Less than 50 VPD
X	Movement Prohibited
-------	Roadway
K	Design Hour Factor (%)
PM	PM Peak Period
D	Peak Hour Directional Split
→	Indicates Direction of D
(d,t)	Duals, TT-STs (%)

TIP: R-3300 | **WBS:** 40237.1.1

COUNTY: New Hanover & Pender | **DIVISION:** 3

DATE: 04-05-2017

PREPARED BY: Patriot Transportation Engineering, PLLC

LOCATION: US 17 Hampstead Bypass

PROJECT: Freeway on New Location

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1. PROJECT BACKGROUND

Patriot Transportation Engineering, PLLC (Patriot) has been contracted by the North Carolina Department of Transportation (NCDOT) to develop base and future year traffic forecasts for NCDOT State Transportation Improvement Program (STIP) Project Number R-3300; the Hampstead Bypass.

1.1 PROJECT REQUEST INFORMATION

The traffic forecast request for this project was requested by NCDOT Division 3 in support of the final design for the project. The scope of work for the traffic forecast was finalized in October 2016 and supplemented in March 2017.

For the purposes of the forecast, it was decided through project scoping with NCDOT that Base Year scenarios would use 2016 and Future Year scenarios would use 2040. The 2016 Base Year traffic forecast includes only the No-Build scenario. The 2040 Future Year traffic forecast includes a No-Build scenario and Build scenarios for seven alternative scenarios.

1.2 FORECAST HISTORY

This is the second request for a traffic forecast for this project, a traffic forecast for R-3300 (combined with U-4571) was developed in 2008.

1.3 PROJECT DESCRIPTION

NCDOT proposes to construct the Hampstead Bypass, a new freeway facility. The new facility would be approximately 12 miles in length and connect from I-140 to US 17, north of the Topsail High School/Middle School complex.

This traffic forecast considers seven build scenarios for the Hampstead Bypass:

- Scenario 1 – includes interchanges at NC 210, Midtown and US 17 (R-3300 Preferred Alternative from NEPA)
- Scenario 2 – Includes interchanges at NC 210, Midtown, US 17 and on-ramps from Hoover Road
- Scenario 3 – Includes interchanges at NC 210 and US 17
- Scenario 4 – Includes interchanges at NC 210, US 17 and on-ramps from Hoover Road
- Scenario 5 – Includes interchanges at NC 210, Midtown, US 17, on-ramps from Hoover Road and a service road from the Midtown interchange to Hoover Road
- Scenario 6 - Includes interchanges at NC 210, Midtown, US 17 and a service road from the Midtown interchange to Hoover Road
- Scenario 7 - Includes interchanges at NC 210, Hoover Road (full-movement) and US 17

1.4 AREA INFORMATION

Pender County has an estimated population of 52,217 citizens based on 2010 census data and a 2015 population of 57,900 according to the North Carolina Office of State Budget and Management. The county covers approximately 933 square miles and consists of several towns including: Atkinson, Burgaw, Surf City, Topsail Beach, Wallace, and Watha. Hampstead is a Census-designated Place. Burgaw is the county seat of Pender County.

New Hanover County has an estimated population of 202,688 citizens based on 2010 census data and a 2015 population of 220,200 according to the North Carolina Office of State Budget and Management. The county covers approximately 328 square miles and consists of the City of Wilmington and several towns including: Carolina Beach, Kure Beach and Wrightsville Beach. Wilmington is the county seat of New Hanover County.

The project location map for the R-3300 forecast is shown on Figure 1-1: Project Vicinity Map (South) and Figure 1-1: Project Vicinity Map (North).

Figure 1-1: Project Vicinity Map (South)

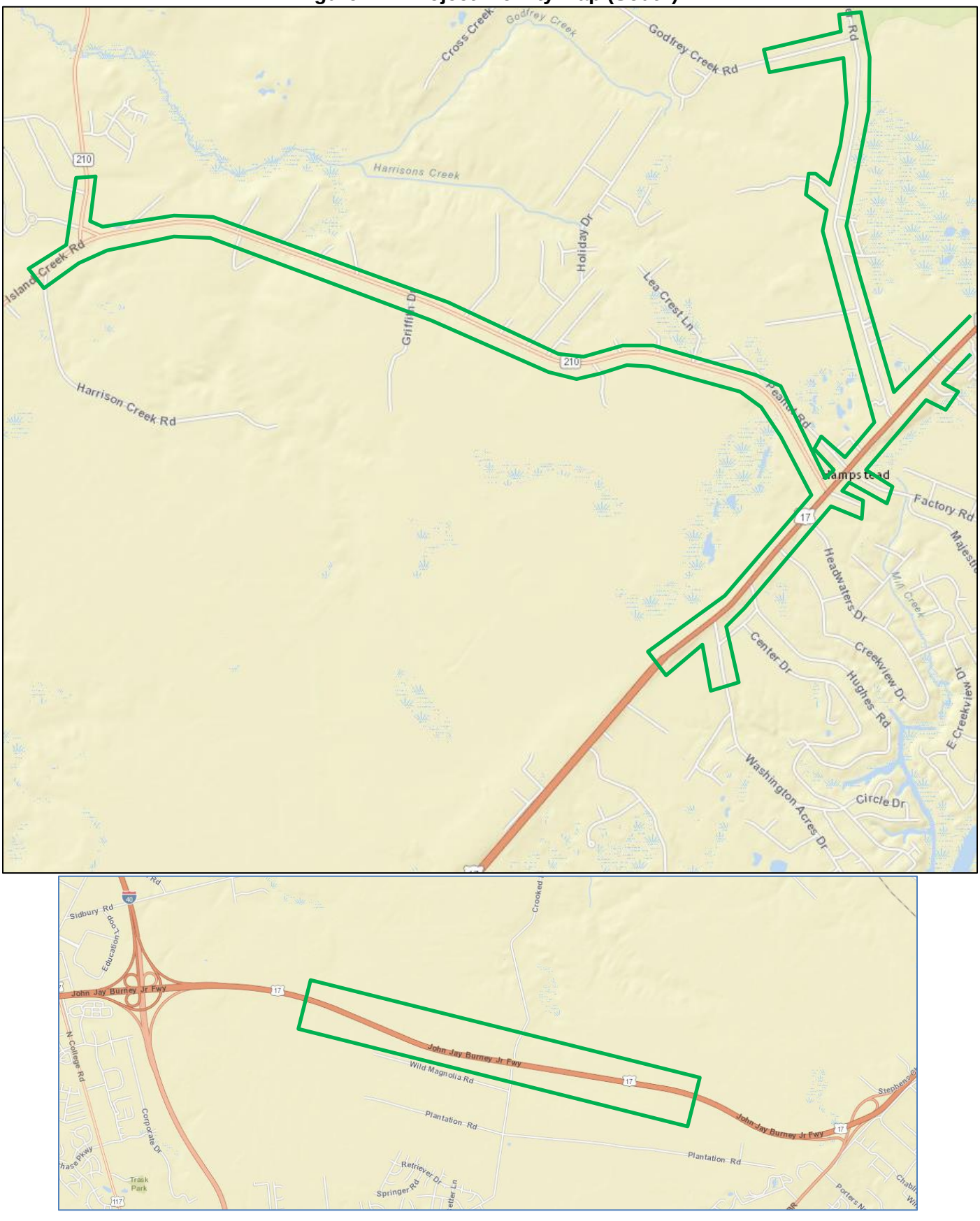
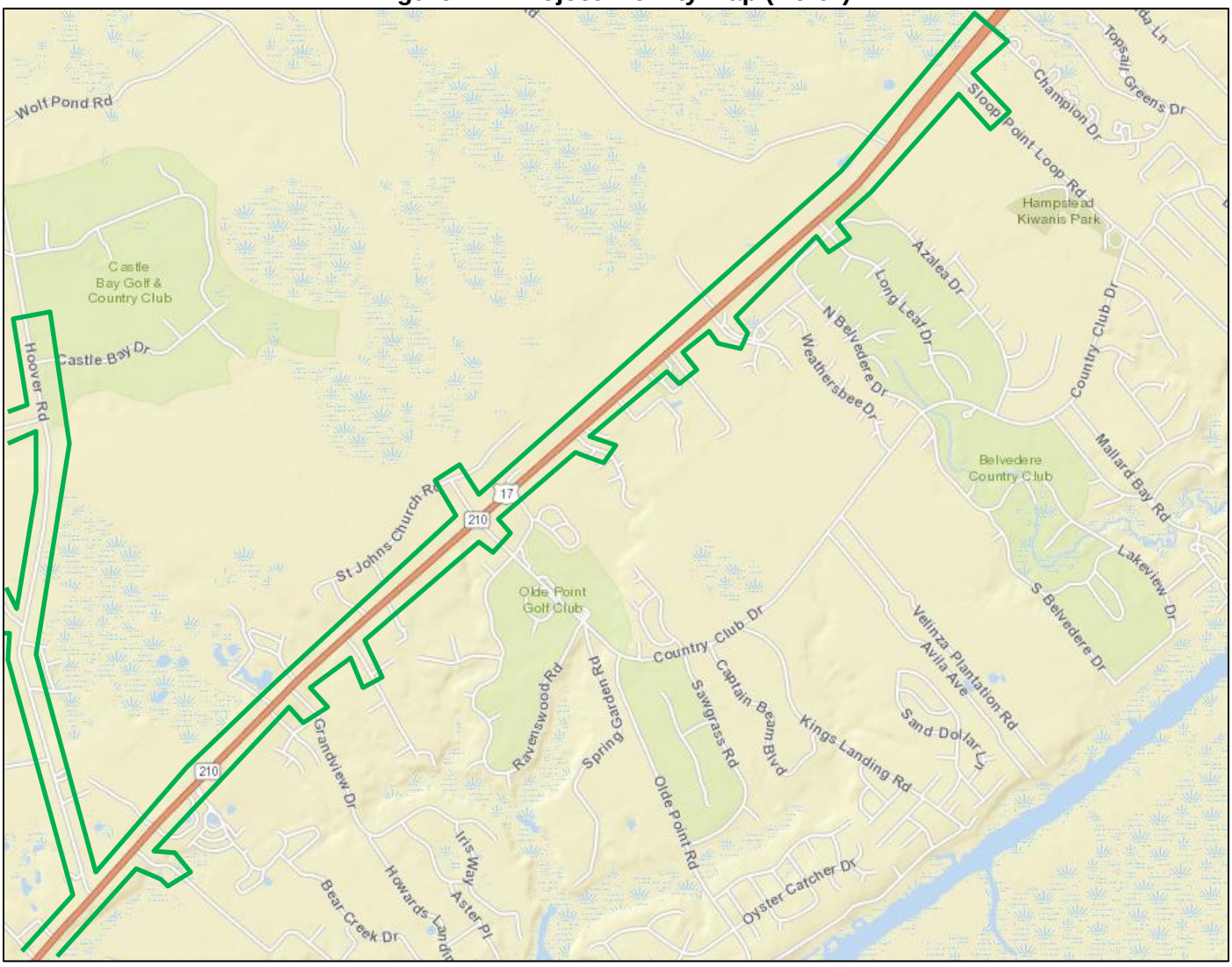


Figure 1-2: Project Vicinity Map (North)



1.5 ROUTE INFORMATION

The following roadways are classified by the Federal Highway Administration (FHWA), as designated in the 2040 Long Range Transportation Plan:

The **US 17** corridor is classified as an *Other Principal Arterial* within the traffic forecast study area and serves the inter-county travel demands between Onslow, Pender, and New Hanover Counties. The land use along the project study corridor is primarily, institutional, commercial, and undeveloped space, with most of the commercial activity centered around the intersections with NC 210 and in the vicinity of the Topsail school complex. The speed limit along US 17 is 45 mph south of Transfer Station Road and 55 mph north of Transfer Station Road. US 17 serves as the primary access to a mix of single-lot residential and residential developments along many of the side streets along the corridor.

I-140 is designated as an *Other Freeway* on the NCDOT Functional Classification mapping although it is currently designated as an Interstate. The speed limit on I-140 is 70 mph and currently includes an interchange to the west at I-40 and an interchange at its eastern terminus at US 17.

NC 210 is designated as a Minor Arterial within the project study area. The speed limit along NC 210 is 35 miles per hour in the vicinity of US 17, 45 mph from northwest of US 17 to Brickyard Road, and 55 mph west of Brickyard Road.

The alignment of NC 210 breaks at the intersection with Island Creek Road so that the north and east legs of the intersection are designated as NC 210.

Island Creek Road (SR 1002) is designated as a Minor Collector within the project study area. The speed limit along Island Creek Road is not posted within the project study area, but connects directly to a section of NC 210 that is posted at 55 mph (see above).

1.6 FUTURE AREA ROADWAY IMPROVEMENTS – FISCAL CONSTRAINT

The project is located within the boundaries of the Wilmington Metropolitan Planning Organization (WMPO); therefore, the travel demand model and traffic forecasts are fiscally constrained to match the assumptions of the corresponding Metropolitan Transportation Plan (MTP).

The *Cape Fear Transportation 2040 Metropolitan Transportation Plan* includes the proposed projects expected to be completed by 2040 and describes them as follows:

R-3300 – Hampstead Bypass from Porters Neck Road to Sloop Point Loop Road – $343,328,798

The following projects that may affect the proposed project are assumed to be constructed prior to 2040:

- STIP Project U-4751 – Military Cutoff Road Extension: US 17 Bus/Market Street to US 17/Wilmington Bypass (MTP ID R-3)
- STIP Project U-4902 – US17BUS/Market Street Access Management: Military Cutoff Road to Porters Neck Road (MPT ID R-10)
- STIP Project U-5732 – US 17 Superstreet: Washington Acres Road to Sloop Point Road (MTP ID R-12)
- NC 210 Improvements: Island Creek/NC 210 to US 17 (MPT ID R-36)
- Country Club Drive/Doral Drive and Sloop Point Loop Road: intersection project (MTP ID R-39)

2. SOURCES OF INFORMATION AND DATA

The following sections describe the various information and data sources used in the development of the traffic forecast.

2.1 RELATED FORECASTS

Past traffic forecasts in the vicinity of the proposed project were utilized as a tool when preparing the traffic forecasts. Only one past traffic forecast that included study area roadways and was less than ten years old was located. The following forecast was used in the traffic forecast development process:

- R-3300 & U-4571, US17-Hampstead Bypass & Military Cutoff Road Extension, June 2008

This forecast was an asset in determining design data and providing reasonableness checks for the traffic volumes developed in the traffic forecast for the proposed project.

2.2 HISTORIC AADT

Existing traffic count data for study area roadways from 1995 to 2015 was provided by the NCDOT Traffic Survey Group (TSG). Data sources included:

- NCDOT TSG Average Annual Daily Traffic (AADT) history from 1995 to 2015

The locations of the historic traffic data counts are shown in Figure 2-1 . The complete 20-year AADT history for each location is found in Appendix A.

2.3 FIELD DATA COLLECTION

Existing recent counts, project specific counts and those included in the NCDOT TSG count database were reviewed. It was determined that one existing turning movement count along US 17 and one existing classification count on I-140 were adequate for use in the forecast and new project specific counts would be needed for the purpose of developing the traffic forecast. A portion of the project-specific counts were taken in October and November of 2016 through the NCDOT TSG on-call contract and included eleven 13-hour turning movement counts and three 48-hour classification counts. The remaining six project-specific turning movement counts were provided by the project team and were collected in October 2016.

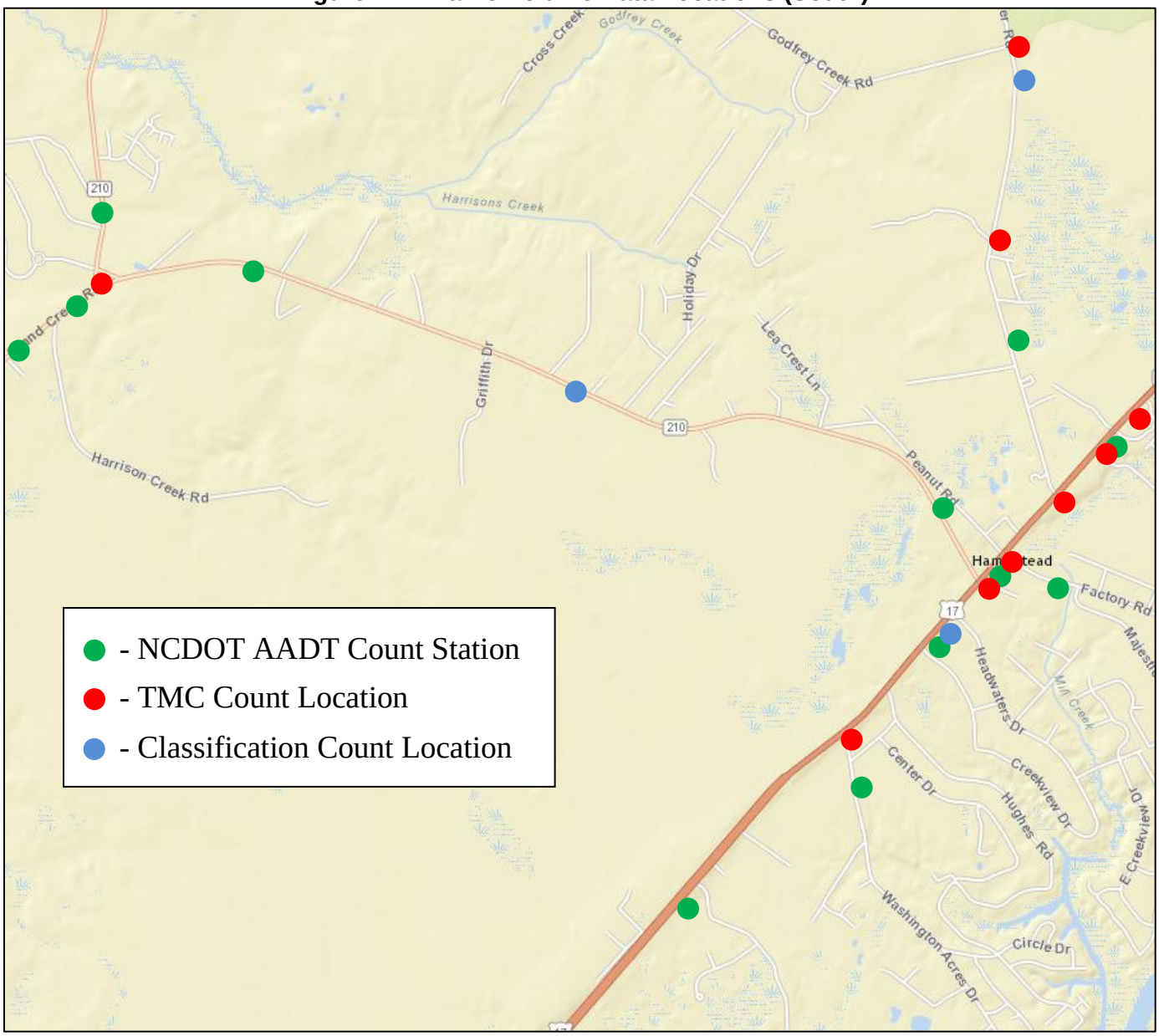
The traffic count locations fall under the TSG ATR classifications, as follows:

- ATR Group 1 (The most dominant group in the State. Mostly rural in nature and is predominantly used for count locations on nonurban primary routes and all rural and most urban secondary roads.). This ATR Group was used for all non-Interstate roadways included in the forecast.

- ATR Group 11 (Applies to urban interstate and some rural locations strongly influenced by nearby large urban areas). This ATR Group was used for I-140

The traffic count locations are listed in Table 2-2 and are displayed in Figure 2-1 and Figure 2-2.

Figure 2-1: Traffic Volume Data Locations (South)



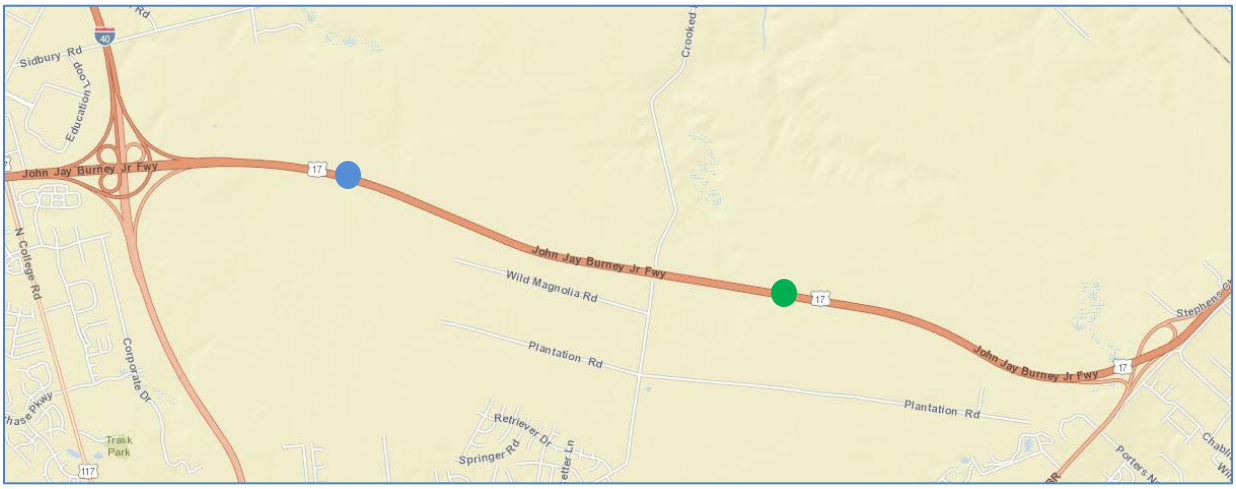
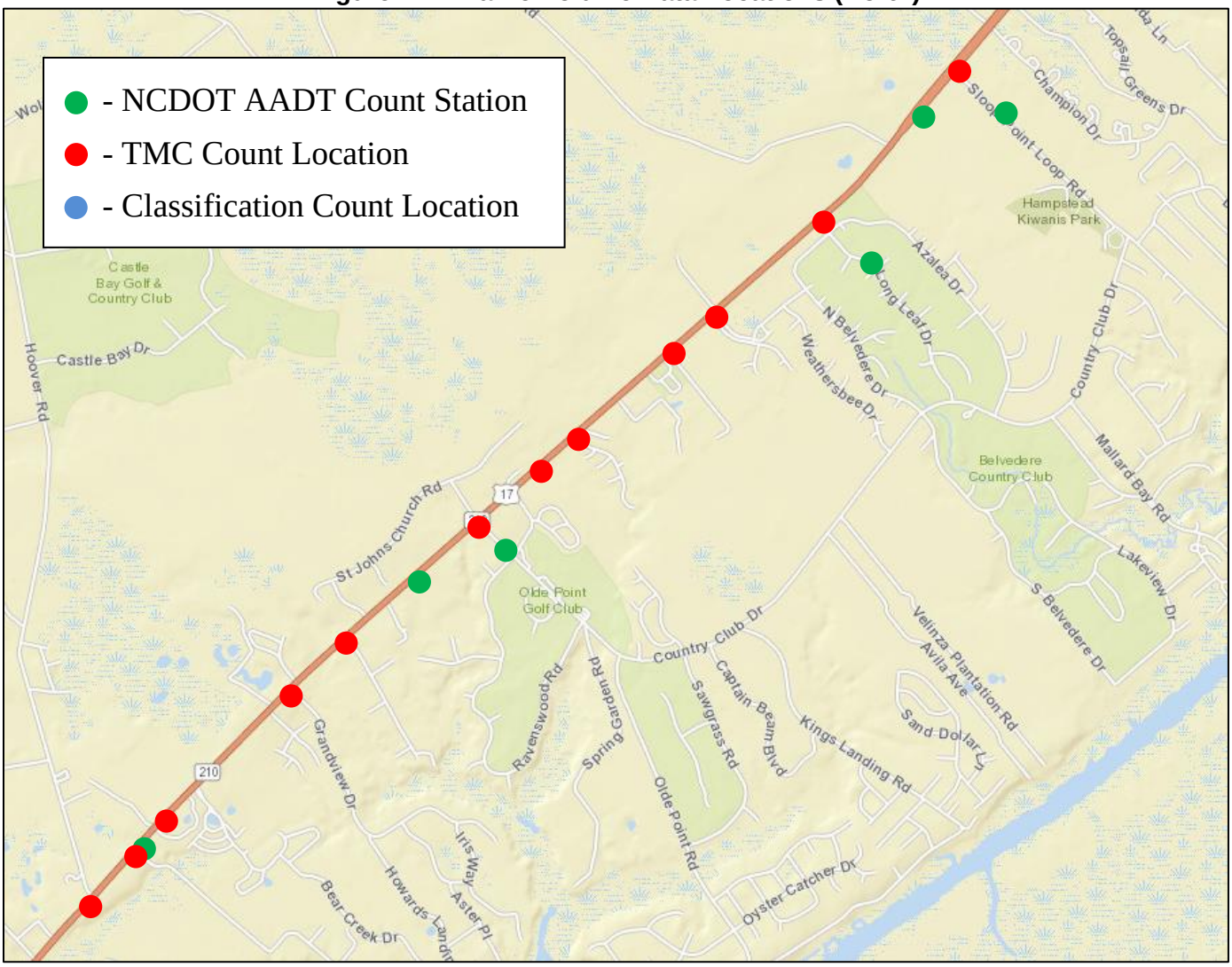


Figure 2-2: Traffic Volume Data Locations (North)



The classification counts were converted to 24-Hour volumes by dividing the 48-Hour counts by two and then applying the correct seasonal adjustment factors. The turning movement counts (TMCs) for US 17, NC 210 and Hoover Road (SR 1569) were converted to 24-Hour volumes by utilizing project specific factors based on the proportion of traffic during the 13-hour period compared to the daily volume for the 48-hour classification counts. For the remaining roadways (all local or SR routes) in the forecast, the NCDOT Traffic Survey Partial Weekday Count Expansion Factors (November 2015) was utilized to convert the counts to daily volumes. The count expansion factors were also compared to the count data from the 48-hour volume, speed, classification count and determined to be adequate. Table 2-1 includes the 13-hour to 24-hour conversion factors utilized in the forecast:

Table 2-1: 13-hour to 24-hour Conversion Factors

Roadway	Conversion Factor	Source
US 17	1.169	48-hour VSC
NC 210	1.156	48-hour VSC
Hoover Road (SR 1569)	1.153	48-hour VSC
All Other Roadways	1.228	NCDOT Traffic Survey Partial Weekday Count Expansion Factors

Table 2-2: Collected Traffic Count Locations

Location	Count Type	Date(s)	County	ATR Group	Seasonal Adjustment Factor
US 17 at Washington Acres Rd (SR 1582)	13-hour TMC	10/25/16	Pender	1	0.99
US 17 at NC 210/Dan Owen Dr	13-hour TMC	10/25/16	Pender	1	0.99
US 17 at Peanut Rd (SR 1570)/Factory Rd (SR 1570)	13-hour TMC	10/25/16	Pender	1	0.99
US 17 at Hoover Rd (SR 1569)	13-hour TMC	10/25/16	Pender	1	0.99
US 17 at Forest Sound Rd	13-hour TMC	10/25/16	Pender	1	0.99
US 17 at Arrow Wood Rd	4-hour TMC	06/07/16	Pender	1	0.96
US 17 at Grandview Dr	13-hour TMC	10/25/16	Pender	1	0.99
US 17 at Williams Store Rd (SR 1568)	13-hour TMC	11/01/16	Pender	1	0.97
US 17 at Jenkins Rd/Country Club Rd	13-hour TMC	11/01/16	Pender	1	0.97
US 17 at Hampstead Town Center	13-hour TMC	11/01/16	Pender	1	0.97
US 17 at Topsail Middle School/Vista Ln	13-hour TMC	11/01/16	Pender	1	0.97
US 17 at Transfer Station Rd	13-hour TMC	11/01/16	Pender	1	0.97
US 17 at Leeward Ln	13-hour TMC	11/01/16	Pender	1	0.97
US 17 at Long Leaf Dr	13-hour TMC	10/25/16	Pender	1	0.99
US 17 at Sloop Point Loop Rd (SR 1563)	13-hour TMC	10/25/16	Pender	1	0.99
NC 210 @ Island Creek Rd (SR 1002)	13-hour TMC	10/25/16	Pender	1	0.99
Hoover Rd (SR 1569) at South Topsail Elementary School	13-hour TMC	10/25/16	Pender	1	0.99
Hoover Rd (SR 1569) at Godfrey Creek Rd	13-hour TMC	10/25/16	Pender	1	0.99
I-140, east of I-40	48-hour VSC	4/7/15-4/8/15	New Hanover	11	0.97/0.94
US 17 south of NC 210/Dan Owen Dr	48-hour VSC	10/25/16-10/26/16	Pender	1	0.99/0.96
NC 210 west of US 17	48-hour VSC	10/25/16-10/26/16	Pender	1	0.99/0.96
Hoover Rd (SR 1569) south of Godfrey Creek Rd	48-hour VSC	10/25/16-10/26/16	Pender	1	0.99/0.96

Note: TMC = turning movement count; VSC = volumes, speed, classification count

2.4 FIELD INVESTIGATION

An orientation field trip was taken as part of the traffic forecast initiation process. The field trip was taken on January 12 and 13, 2017. The following observations were noted:

- There appears to be, in addition to the standard AM and PM peak periods, a third distinct peak period occurring in the early afternoon when the schools in the area release for the day. The AM Peak was fairly heavy as it included both commuter traffic and local trips to the schools in the area.

- The AM peak direction along US 17 was in the southbound direction with a relatively strong flow in the opposite direction. The PM peak direction along US 17 was in the northbound direction with the overall corridor seeing heavy traffic with a steady stream of traffic in the southbound direction as well. The school peak in the afternoon appeared to be pretty well balanced with the southbound direction appearing to have a slightly higher traffic flow.

- The distribution of trips during the peak hours from the side streets was highly dependent on the associated land use along the roadways. The sharpest peaks were for the schools within the study area where very high volumes occurred during arrival and dismissal times. Several of the retail properties had much higher traffic volumes during the PM as compared to the AM and most of the residential streets exhibited the normal behavior of concentrated peaks exiting in the AM and returning during the PM peak.

- The area of the corridor that had the highest levels of congestion was at the US 17/NC 210 intersection where peak hour traffic was queued back as much as 1,000 feet on US 17 and 700 feet on NC 210. It was also observed that during peak times vehicles would have to wait through multiple cycles to get through the intersection.

- There were several parcels along US 17 that were under construction and approximately 25 parcels along the corridor had for sale or for lease signs offering the property for commercial development. Several of the properties were very large tracts of land.

- There were signs of a strong residential development climate along several of the Y-lines. Several active developments were observed as well as numerous houses being constructed on individual lots outside of defined developments. Several large tracts of land were also being marketed for residential development within the forecast study area.

2.5 INFORMATION FROM LOCAL PLANNERS

The following individuals were contacted or attended meetings to assist in understanding the project and traffic forecast study area:

- Katie Hite, NCDOT Division 3 – Project Development Engineer
- Jessi Leonard, NCDOT Division 3 – Division Traffic Engineer
- Trace Howell, NCDOT Division 3 - Division Design Construct, Design Engineer
- Patrick Riddle, NCDOT Division 3 – District 1 Engineer
- Mason Herndon, NCDOT Division 3 - Environmental Program Supervisor
- Nazia Sarder, NCDOT Transportation Planning Branch
- Soon Chung, NCDOT Transportation Planning Branch
- Mike Kozlosky, Wilmington MPO – Executive Director
- Suraiya Motsinger, Wilmington MPO – Senior Transportation Planner
- Tim Lowe, Wilmington MPO – Senior Project Engineer
- Kyle Breuer, Pender County – Planning Director
- Megan Crowe, Pender County – Senior Planner
- Allen Vann, Pender County Schools - Chief Officer of Auxiliary Services
- Darren LaFon, Pender County Schools - Transportation Director
- Todd Rademacher, Town of Surf City – Planning Director

A summary of the meeting and correspondence is included in Appendix B.

2.6 OTHER SOURCES

Data sources used that are not listed in Sections 2.1 through 2.5 include:

North Carolina Department of Transportation. *State Transportation Improvement Program.* August 2016. Available: https://connect.ncdot.gov/projects/planning/STIPDocuments1/LIVE_STIP.pdf

Wilmington Urban Area Metropolitan Planning Organization. *Cape Fear Transportation 2040.* Adopted November 18, 2015. Available: http://www.transportation2040.org/PDFs/CFT2040_adoptiondate_111815.pdf

NCDOT Functional Classification Maps. Available: http://ncdot.maps.arcgis.com/home/webmap/viewer.html?layers=029a9a9fe26e43d687d30cd3c08b1792

3. BASE YEAR 2016 NO-BUILD TRAFFIC FORECAST

3.1 METHODOLOGY

A review of previous traffic forecasts, field-collected traffic counts, area AADT history, and engineering judgment serve as the basis for the 2016 Base Year No-Build traffic forecast. After careful review for reasonableness checks, the 48-Hour classification counts and 13-Hour TMCs were first converted to AADT volumes by using the appropriate NCDOT TSG seasonal adjustment factors based on the month and day of the week the counts were collected.

A variation of the NCDOT Traffic Forecast Utility (TFU) spreadsheet was also a major tool used in the determination of the traffic forecast volumes. The NCDOT TFU spreadsheet includes the calculation of a validation score that considers the approach volumes and design factors for each intersection. The score is utilized as a tool in selecting the appropriate volumes and factors with a score that is less than 2.0 being considered to be valid. All scores for the 2016 Base Year forecast were less than 1.6. Ultimately, the approach volumes and factors will be selected based on engineering judgment such that the AADTs and turning movements can be converted to peak hour volumes.

The data from the field-collected traffic counts were incorporated into the spreadsheet in order to replicate volumes as closely as possible for each intersection in the traffic forecast. The traffic forecast volumes in the 2016 Base-Year traffic forecast mimic the observed patterns as closely as possible. Once the traffic forecast volumes were determined, they were compared to historic AADT trends and interpolated model volumes for reasonableness. Table C1 found in Appendix C provides a comparison of historic AADT trends, field collected data, interpolated model volumes, and the selected traffic forecast volumes for all locations within the study area.

3.2 DESIGN FACTORS

Design factors are a very important aspect of traffic forecasting. The truck percentages, peak hour factor (or K-Factor), and directional distribution are all used along with forecasted traffic volumes when designing a roadway. For a typical traffic forecast a single set of design factors is shown for the PM peak and it is assumed that the AM peak period has the same factors with the only difference being that the peak direction is reversed. Due to the varied types of land use within the study area (especially relating to the schools) the design factors vary during different times of day.

As noted in Section 2.4, three distinct peak periods were observed within the study area; therefore, design data was developed for each of the three peak periods. The first peak period is the AM peak which includes a mix of commuter and local school traffic along with lower volumes at retail locations. The second peak is the PM peak during the early afternoon when schools are being dismissed. During this peak, the traffic on US 17 is not at its peak but still relatively high; however, the trips from the adjacent roadway (especially schools) is very high creating localized peak conditions at several intersections along the corridor. The third peak is the traditional PM peak that includes most of the commuter traffic returning during the evening. Table C3 (Directional Distribution) and C4 (Peak Hour Factor) described below may be used for the analysis of operations, or in developing design related items, depending on the goal of the analysis. For studies relating to comparing traffic operations for the various scenarios being evaluated for the Hampstead Bypass, the AM peak and PM commuter peak would likely be the most appropriate; however, if the goal is to develop designs for intersections in the vicinity of the schools, then the AM peak and PM school peak period would most likely be the most appropriate.

The methodology and chosen values for the truck percentages, peak hour factor (or K-Factor), and directional distribution are described below.

3.2.1 TRUCK PERCENTAGES

Truck Percentages were determined using the 48-Hour mainline classification count data, the 13-Hour TMC data, and previous traffic forecast listed in Section 2.1. Overall truck percentages were then separated into the two NCDOT

standard classifications: Duals (single-unit trucks with at least one dual- tire axle) and TTSTs (multi-unit trucks with single or twin trailers). Attempts were made to maintain consistent truck percentages along a roadway facility unless circumstances warranted a change. Data used to determine the truck percentages and the chosen values are found in Table C2 in Appendix C. A discussion of the truck percentages for the project is also included as follows:

- US 17 – Truck percentages were fairly consistent along US 17, ranging from three to five percent duals and one to two percent TTSTs, according to the turning movement counts. According to the vehicle classification count on US 17 the truck volumes are nine percent duals and four percent TTSTs. The previous forecast (U-4571 & R-3300, US17-Hampstead Bypass & Military Cutoff Road Extension) heavy vehicle percentages were reviewed for US 17 and were in line with the turning movement counts. The forecast utilizes four percent duals and two percent TTSTs along the entire length of the US 17 corridor.

- Interstate 140 – Truck percentages from the 2015 classification count were collected utilizing Wavetronix radar sensors resulting in 32 percent duals and 5 percent TTST. However, Wavetronix counts and are not adequate for determining truck percentages for forecasting purposes. The NCDOT TSG 2015 Traffic Segments data includes 3.4 percent duals and 1.6 percent TTST, while the previous forecast included 4 percent duals and six percent TTST. Based on the trend in the NCDOT and Wavetronix data it was determined that utilizing the 10 percent total percentage would be reasonable; however, it was divided up with six percent duals and 4 percent TTST to match the count data ratios more closely.

- NC 210 – Dual truck percentages along NC 210 ranged from four to five percent, according to the turning movement counts, and seven percent according to the classification count. The TTST percentage ranged from one to two percent, regardless of the count source. The previous forecast heavy vehicle percentages were reviewed for NC 210 and were in line with the turning movement counts. The forecast utilizes five percent duals and two percent TTSTs along NC 210.

- Hoover Road (SR 1569) – The dual truck percentage along Hoover Road varies noticeably through the study area, ranging from five to eleven percent. The TTST percentage was consistently measured as one percent of the traffic. There is a mining operation at the north end of Hoover Road that contributes trucks to the vehicle stream. Therefore, the forecast utilizes truck percentages that are larger farther away from US 17 where the overall volume is lower: seven percent duals and one percent TTSTs west of US 17, and nine percent duals and one percent TTSTs south of South Topsail Elementary School.

- Grandview Drive – the TMC truck percentages seemed relatively high considering the characteristics of the road, with duals measured at eight percent and TTSTs at two percent. It was assumed that truck traffic could be attributed to the temporary development activity in the area and that three percent duals and one percent TTSTs would be an appropriate set of truck factors based on comparisons with similar roadways in the study area.

- Transfer Station Road – the truck percentages along Transfer Station Road showed fifteen percent duals and five percent TTSTs, which reflects that most the traffic is accessing the Pender County Transfer Station and includes a higher percentage of trucks. The selected values were the same as the counted values with fifteen percent duals and 5 percent TTSTs.

- Y-lines – Along the remaining Y-line roadways, the forecast utilizes truck percentages that are generally consistent with the count percentages.

3.2.2 DIRECTIONAL DISTRIBUTION

The directional distribution (D) provides information on the direction of traffic flow in the peak period and is a percentage (rounded to the nearest 5 percent) based on the percent of traffic traveling in each direction along the roadway. In addition to the directional distribution percentage the direction of the peak travel during the PM commuter peak period is selected and included on the forecast figures. For the forecast study area, D ranged from 50% to 85%. For the traffic forecast the D values utilized typically fell within the range of 55% to 65% with the exception of some minor side streets. Table C3 in Appendix C provides the D value information used for this traffic forecast. A discussion of the D values for the project is also included as follows:

- US 17 Corridor – the directional distribution along US 17 ranged from 55 to 65 percent with a consistent PM peak period direction in the northbound direction. The average distribution was approximately 59 percent along the entire corridor, and, based on a review of the data, it was determined that a single value would be used for the entire length of the US 17 corridor. The directional distribution was determined to be 60 percent along the entire corridor with a PM peak in the northbound direction and the AM peak in the southbound direction. The count data did support that there are actually two peak periods during the PM period with one occurring around 3:30 PM and one occurring around 5:15 PM. The 3:30 PM peak was associated with the end of the school day and had a peak direction that radiated outward from the school complex (Jenkins Road to Topsail Middle School) while the 5:15 peak was consistently in the northbound direction.

- Interstate 140 – the directional distribution along I-140 was shown to be 66 percent in the eastbound direction during the PM peak; therefore, a directional distribution of 65 percent in the eastbound direction was selected.

- Hoover Road – the directional distribution on Hoover Road was substantially affected by the traffic accessing South Topsail Elementary School. There were several locations where the distribution during school drop off and pickup times was 70 percent; however, during the overall peak periods for the forecast the distributions were more balanced with a 55 percent distribution for the peak direction. The nearly balanced distribution is reflective of the roadway being a dead end with the only access being to US 17 where vehicles accessing the school frequently travel in both directions along the road in a short timeframe due to picking up or dropping of students at the school. Based on this it was determined that the directional distribution on Hoover Road would be 60 percent north of South Topsail Elementary where the land use was primarily residential and 55 percent to the south with the PM peak direction in the northbound direction.

- Roadways associated with schools – similar to the patterns discussed above for Hoover Road, the traffic accessing Topsail High School (Jenkins Road) and Topsail Middle School (Topsail Middle School Road) had different distributions during the time surrounding the beginning and ending of the school day and the overall peak periods of the day. Due to the parking and loading pattern the directional distribution for the streets accessing the schools showed directional distributions of 85 to 90 percent during arrival and dismissal times; however, during the peak hours of the overall study area, which occurred either earlier or later, the distributions were typically about 60 percent. The selected directional distribution for Topsail Middle school was 60 percent, while the selected directional distribution for Jenkins Road was 55 percent during the PM peak. The PM school peak had a 55 percent distribution due to the nature of cars picking up students and then exiting back out the same way they came in. The PM school peak for Jenkins Road that provides access to Topsail High School showed an 85 percent distribution, likely due to more students driving themselves to school.

- Other roadways – The directional distributions for most other roadways in the traffic forecast generally ranged from 55 to 75 percent and the selected directional distributions were largely in line with the turning movement count percentages.

3.2.3 PEAK HOUR FACTOR

The peak hour factor (K) is the percentage of AADT that occurs during the peak time period of the day. The K-factor is meant to approximate what percentage of daily traffic would be present during the 30th highest peak hour of a given year, which is commonly referred to as K30. To determine the K-value for the classification counts the highest hourly volume was divided by the daily average of the 48-Hour counts. For turning movement counts the K-factor was developed by dividing the peak hour of the count for each of the three peak periods by the daily volume. The K-factors in this traffic forecast range from 7% to 12%, except at those intersections where the character of travel on the intersection roadways varied by time of day (see Directional Distribution, Section 3.2.2, above). At those intersections that were the exception, the K-factor varied greatly with a low of four percent and a high of 34 percent. The K-factor information used for this forecast is found in Table C4 in Appendix C. A discussion of the K values for the project is also included as follows:

- US 17 Corridor – the peak hour factor along US 17 ranged from eight to nine percent and had relatively consistent percentages along the corridor. The southern end of the corridor showed a slightly lower K factor than the northern end of the corridor. The peak hour factor for both the AM and PM commuter peaks was determined to be eight percent, while the PM school peak had a 7 percent factor outside of the central portion of the corridor near the schools (Forest Sound Road to Leeward Lane), which had an eight percent factor.

- Hoover Road – the peak hour factor measured from the turning movement counts and the vehicle classification count taken along Hoover Road ranged from seven to ten percent, with an average of 8.3 percent during the PM commuter peak. The PM commuter peak hour factor for the Hoover Road corridor was determined to be eight percent, which is consistently maintained along the corridor during the traditional PM peak. The AM peak period showed greater variation with the section of Hoover Road between US 17 and South Topsail Elementary School having a factor between 11 and 17 percent. The PM school peak period was slightly higher than the traditional PM commuter peak with a factor of nine percent between US 17 and South Topsail Elementary School.

- Other roadways – the peak hour factors for most other roadways in the traffic forecast generally ranged from seven to twelve percent and the selected peak factors were largely in line with the turning movement count percentages for each of the three peak periods.

3.3 TRAFFIC FORECAST VOLUMES

Based on the methodology described in Section 3.1, traffic forecasts for the 2016 Base Year No-Build Scenario were calculated. Adjusted counts were compared to trend line analyses and the extrapolation of data to 2016 during the process. Utilizing the variation of the NCDOT Traffic Forecast Utility spreadsheet, bidirectional turning movements were also forecasted at intersections to replicate observed daily turning movement volumes as closely as possible. Comparisons of trend line analyses, volume extrapolation, observed counts, and selected forecast volumes are shown in Table C1 in Appendix C. A discussion of the traffic forecast volumes is included as follows:

- The traffic forecast volume relied primarily on the field collected data as compared to the historic AADT. Based on input from local planners, it was determined that utilizing the actual count data would be the most reliable method for determining the Base Year volumes as the growth along the corridor has increased due to the improving economy. The volumes derived from the 13-hour turning movement counts tended to produce volumes that were higher than the 48-hour classification counts for the locations on US 17 and NC 210. The turning count data was collected utilizing video and represents a larger sample size with 14 locations along US 17 that all produced consistent volumes along the corridor. Additionally, turning movement counts collected in the area during January 2017 also exhibited volumes that were similar to the turning movement counts

collected for this forecast. Therefore, after reviewing the count data, it was decided that relying more heavily on the turning count data was preferable.

- The traffic forecast includes break lines at two locations where it was determined that the volumes along the roadway between the subject intersections were affected substantially enough by intervening side streets or driveways that a single link volume was not representative of the volume between the two intersections.

- The "intersection" of NC 210, Island Creek Road and Royal Oak Drive is actually three separate intersections that form a triangle and have redundant locations where you can accomplish the same movement. Due to the duplicate movements, it was decided that the best way to represent this in the forecast was a single intersection that combined all of the movements into a standard four-leg intersection.

4. MODEL DATA

Patriot Transportation Engineering (PTE) has recently prepared several traffic forecasts in the Wilmington area. While performing a previous traffic forecast PTE identified several discrepancies between the 2040 MTP and the network included in the Wilmington Metropolitan Planning Organization (WMPO) Travel Demand Model (TDM). After consultation with WMPO and NCDOT, it was agreed that PTE would update the WMPO Model future network. A description of the model revisions is documented in the *Wilmington Metropolitan Planning Organization Travel Demand Model Revisions* (December 2016). A summary of how the revised model was applied to this forecast is included in Appendix E.

The study area for the forecast is included in the Wilmington Regional Travel Demand Model. The study area is located in the northeastern area of the model. This area of the model is characterized by large Traffic Analysis Zones (TAZs) with somewhat limited connectivity. Study roadways that are included in the model network are: US 17, NC 210, Island Creek Road, Washington Acres, Hoover Rd, Hampstead Bypass, Grandview Drive, and Sloop Point Loop Road (SR 1563). However, Grandview Drive and Sloop Point Loop Road are not connected to any model loading points and, therefore, do not have any traffic assigned to them.

The revised Wilmington Regional Travel Demand Model was utilized as a tool in the development of the forecast to determine the Future year scenario traffic volumes. The Wilmington model was developed in TransCAD (version 5 Build 2110) and was calibrated based on a base year of 2010, and has models for a future year of 2040. After revision, the model contains all fiscally-constrained roadway projects contained in the WMPO MTP.

Table C5 can be found in Appendix C and displays model performance for the 2010 model against 2010 NCDOT AADTs, the 2040 no-build model volumes and an extrapolated volume for 2016 based on the 2010 and 2040 model output. A discussion of the model performance for the project study area corridors is included as follows:

- US 17 Corridor – the 2010 model volumes for the corridor in the study area were generally close to the corresponding AADT, varying by 700 to 2,000 vehicles per day (vpd). There was no pattern to the variance, however, with the locations of higher model volumes interspersed with the locations of lower model volumes. The 2016 interpolated model volumes are lower than the project-specific count data by about 7,000 vpd on the southern end of the corridor and are about 2,000 vpd greater on the northern end.
- Interstate 140 – the 2010 model volumes are about 2,600 vpd lower than the 2010 count data; similarly, by 2016, the interpolated model volume is nearly 3,000 vpd lower than the 2016 AADT.
- NC 210 – the 2010 model volumes are within 600 vehicles per day, with the west end of the corridor above the AADT and the east end below the AADT count. The 2016 interpolated model volumes are consistently lower than the project count data by approximately 1,000 to 2,000 vpd.
- Hoover Road (SR 1569) – the 2010 model volumes are approximately 1,000 vehicles per day above the corresponding AADT. The 2016 AADT does not show much appreciable growth from 2010, so the growth shown in the model increases the discrepancy between the volume sets except just to the west of US 17. West of US 17 the interpolated model volumes and the project count data are similar.
- Island Creek Road (SR 1002) – the 2010 model volumes for Island Creek Road are lower than the 2010 AADT (by about 2,100 vpd) with a similar discrepancy between the interpolated volume in 2016 and the project-specific count data.
- Washington Acres Road (SR 1582) – in the model Washington Acres Road provides a connection between a centroid connector and the remainder of the network, providing a somewhat limited ability of the model to match observed volumes. (Because the roadway connects only to a centroid connector at its southern end, the only way to change the volumes on Washington Acres Road is to change the volumes coming out of the centroid.) In 2010 the model volumes are greater than the AADT by approximately 700 vpd, and in 2016 the interpolated model data is lower than the AADT by approximately 1,500 vpd.

5. FUTURE YEAR 2040 NO-BUILD TRAFFIC FORECAST

5.1 ASSUMPTIONS

A Future Year of 2040 was chosen for the R-3300 traffic volume examination as it is the latest year available in the Wilmington Travel Demand Model and to correspond with the horizon year of the MTP. All 2040 fiscally-constrained projects, with the exception of R-3300, listed in the Wilmington MPO 2040 Metropolitan Transportation Plan were included in the 2040 No-Build alternative model run.

The modeling aspects for the 2040 No-Build scenario included utilizing the Wilmington Travel Demand Model fiscally constrained model. The first step was to review the model and determine if the changes included in the fiscally constrained MTP have been properly included in the model. Based on this review, the revisions detailed in Appendix D were made to the 2040 future year model network. The model revisions were provided to NCDOT on December 15, 2016.

5.2 METHODOLOGY

Typically, model based traffic forecasts rely on the output from the travel demand model, along with other sources of data such as past trends in population and traffic volumes, population and employment projections and input from local planners.

The Wilmington Travel Demand Model was utilized as a tool in the development of the 2040 Future Year No-Build traffic volumes. A 2040 Future Year No-Build model run was completed without the proposed project in place. The Compound Annual Growth Rate (CAGR) for each traffic volume location was calculated using the following equation:

((2040 Model Value/2010 Model Value) ^1/30) -1

Based on the model data it was determined that CAGR between 2010 and 2040 along US 17 ranged from 1.10 percent to 1.36 percent, which is lower than previous rates for the study area. Based on the lower than anticipated growth rates along the corridor a meeting was held with local engineers and planners to discuss the findings.

Additionally, a review of the WMPO TDM was undertaken to determine how best to utilize the data in the model and to better understand the limitations associated with the model. The following are findings of the model review:

- The distance along US 17 from Washington Acres Road to Sloop Point Loop Road is 5.5 miles; however, the only roadways in the model that produce volumes are US 17, NC 210, Island Creek Road, Washington Acres Road and Hoover Road. Therefore, 20 roadways that are included in the forecast are not represented in the model.
- The forecast study area includes four main TAZs that have a total area of 18,500 acres (28.9 square miles). Two TAZs are located east of US 17 and each TAZ includes a single centroid connector that loads all of the trips directly onto US 17. Two TAZs are located west of US 17 with one TAZ including a centroid connector that loads all of the traffic directly onto NC 210 and one TAZ that loads all of the traffic directly onto Hoover Road. None of the development along the west side of US 17 (including the schools) has their trips loaded onto US 17; therefore, all of these trips are loaded onto either NC 210 or Hoover Road.
- The northern end of the traffic forecast study area is only 6 miles along US 17 from the edge of the model and no other roadways, apart from a stub street representing the NC 210 connection to Topsail Island, are included in the model. The process used to develop the model defines the number of trips entering US 17 at the northern edge of the model; therefore, the number of trips and paths for trips north of the project are predetermined and are identical for all scenarios for a given model year.

- Additionally, the northern extent of the model ends at an external station north of the NC 210 split, but south of the connection to NC 50. Due to the limited connectivity and difficulty in modeling the interaction of traffic within the triangle of roadways made up by US 17, NC 210 and NC 50 there appears to be limitations on how traffic is loaded onto US 17. The external station volume has a Compound Annual Growth Rate (CAGR) of 2.4 percent; however, the volumes south of the NC 210 split only show a CAGR of 1.5 percent.
- The model accurately reflects the speed limits and general capacity along US 17; however, it does not include any adjustment for the signalized intersections along the corridor or account for the delay caused by them in selecting the fastest route to take between origins and destinations.

Following the meeting on December 15, 2016 and due to these inherent limitations in the WMPO TDM it was decided that additional evaluation of the input data would be undertaken and that the determination of 2040 volumes would start with the model data, but would rely more heavily on historic trend data and input from local planners.

5.3 SOURCES OF INFORMATION

The first step in determining the 2040 future year volumes was to collect as much pertinent data, both past and future, as possible to better inform the traffic forecast development process.

Historic Data

The population growth of Pender County is shown in Table 5-1 and Table 5-2:

Table 5-1: Historic Population Data – United States Census Bureau

County	1990	2000	2010	1990-2010 CAGR	2000-2010 CAGR
Pender	28,855	41,082	52,217	3.60%	2.43%

Source: United States Census Bureau

Table 5-2: Historic Population Data – North Carolina Office of State Budget and Management

County	1995	2005	2015	1995-2015 CAGR	2005-2015 CAGR
Pender	35,288	45,368	57,941	2.51%	2.48%

Source: North Carolina Office of State Budget and Management

The historic Average Annual Daily Traffic (AADT) growth rate for roadways included in the forecast is shown Table 5-3:

Table 5-3: AADT Historic Growth Rate

Forecast Location	AADT Historic Growth Rate[1]	
	1995-2015	2005-2015
US 17 - Washington Acres Rd (SR 1582) to NC 210/Dan Owen Drive	3.50%	2.46%
US 17 - NC 210/Dan Owen Drive to Peanut Road (SR 1570)/Factory Rd (SR	3.18%	1.23%
US 17 - Forest Sound Road to Arrow Wood Road	3.05%	2.37%
US 17 - Williams Store Road (SR 1568) to Jenkins Road/Country Club Road	3.46%	1.71%
NC 210 - north of NC 210/Royal Oak Drive	2.45%	2.25%
NC 210 - east of NC 210/Island Creek Road (SR 1002)	2.25%	-1.30%
NC 210 - west of US 17	1.92%	-0.44%

1 – based on linear regression of available count data

Future Projections

The projected population growth for Pender County is shown in Table 5-4:

Table 5-4: Population Projections – North Carolina Office of State Budget and Management

County	2016	2036	2016-2036 CAGR
Pender	59,100	83,800	1.76%

Source: North Carolina Office of State Budget and Management

The *Cape Fear Transportation 2040 Metropolitan Transportation Plan* includes population and employment projections. The WMPO and NCDOT cooperatively maintain a regional travel demand model for the Wilmington Urban Area and routinely update population and employment data to ensure that the model accurately depicts current and anticipated socioeconomic conditions. NCDOT developed base year (2010) and future year (2040) household, employment and population estimates for the WMPO based on its statewide travel demand model. Using the future year projections, the WMPO worked with local land use planners and other subject matter experts to disaggregate the future year projections to smaller geographies called traffic analysis zones (TAZs).

A summary of the data included in the MTP and the WMPO TDM are shown in Table 5-5:

Table 5-5: Population Projections – Wilmington Metropolitan Planning Organization

Area	Population			Employment		
	2010	2040	2010-2040 CAGR	2010	2040	2010-2040 CAGR
WMPO Area	253,738	365,927	1.23%	109,323	150,557	1.07%
Pender County [1]	27,808	47,358	1.79%	3,707	6,637	1.96%
Coastal Pender County [2]	21,176	32,226	1.41%	2,938	3,938	0.98%
Study Area [3]	12,150	18,550	1.42%	2,533	3,078	0.65%

1 - Portion of Pender County within the WMPO Boundary
2 - Pender County east of the Northeast Cape Fear River
3 - Any portion of TAZ overlaps study area

Source: Cape Fear Transportation 2040 and WMPO Travel Demand Model

The *Wilmington MPO Travel Demand Model Final Report* (September 2015) includes a discussion of the process for developing external trips for the future year. External trips are those that begin or end outside the limits of the modeled area and are loaded and distributed onto the model at fixed entry points. The following is an excerpt from that report describing the process:

> *The future year external to external trip table was developed by frataring the base year trip table to year 2040 conditions. This frataring was set against forecast counts for the external cordon of the model. Counts were forecast by a simple process of trend extrapolation of historical count data for those external stations with historical count data. All internal-external to external-external splits were maintained from the base year.*

The report includes Table 5-6 that shows the growth of external traffic in the model:

Table 5-6: Wilmington MPO Travel Demand Model External Station Growth Rate

External Station	Description	ADT 2010	ADT 2040	CAGR[1]
801	Town Creek Rd	500	708	1.2%
802	NC 87, North	17,000	26,160	1.4%
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
804	US 17, North	15,000	30,400	2.4%
805	US 17, South	14,000	28,528	2.4%
806	Blueberry Rd	1,400	1,727	0.7%
807	US 421	4,300	4,807	0.4%
808	US 117	12,000	19,673	1.7%
809	NC 133	5,200	10,254	2.3%
810	NC 87, South	7,100	14,131	2.3%
811	Danford Rd	2,500	4,700	2.1%

[1]Compound Annual Growth Rate

Source: Wilmington MPO Travel Demand Model Final Report

As mentioned previously, the study area for this forecast is located at the edge of the WMPO TDM. The project study area is approximately 6 miles from the Pender County/Onslow County border. Transportation Planning for Onslow County is under the purview of the Jacksonville Urban Area Metropolitan Planning Organization (JUMPO). Similar to WMPO, JUMPO utilizes a travel demand model to determine the effects of future transportation improvements. The southern edge of the Jacksonville Travel Demand Model (Jacksonville TDM) includes US 17 beginning slightly south of the NC 210 split to Topsail Island and continuing north into Onslow County. Due to the proximity of the edges of both the WMPO TDM and the Jacksonville TDM to the forecast study area, the external station growth rate for the Jacksonville TDM may also provide insight into the projected future growth along the US 17 corridor. A review of the Jacksonville TDM for the southern edge of US 17 is shown in Table 5-7:

Table 5-7: Jacksonville Travel Demand Model US 17 Growth Rate

Model Link	2010	2040	2010-2040 CAGR
US 17, South of NC 210 (ID 51)	13,500	29,000	2.58%

Source: Jacksonville Travel Demand Model

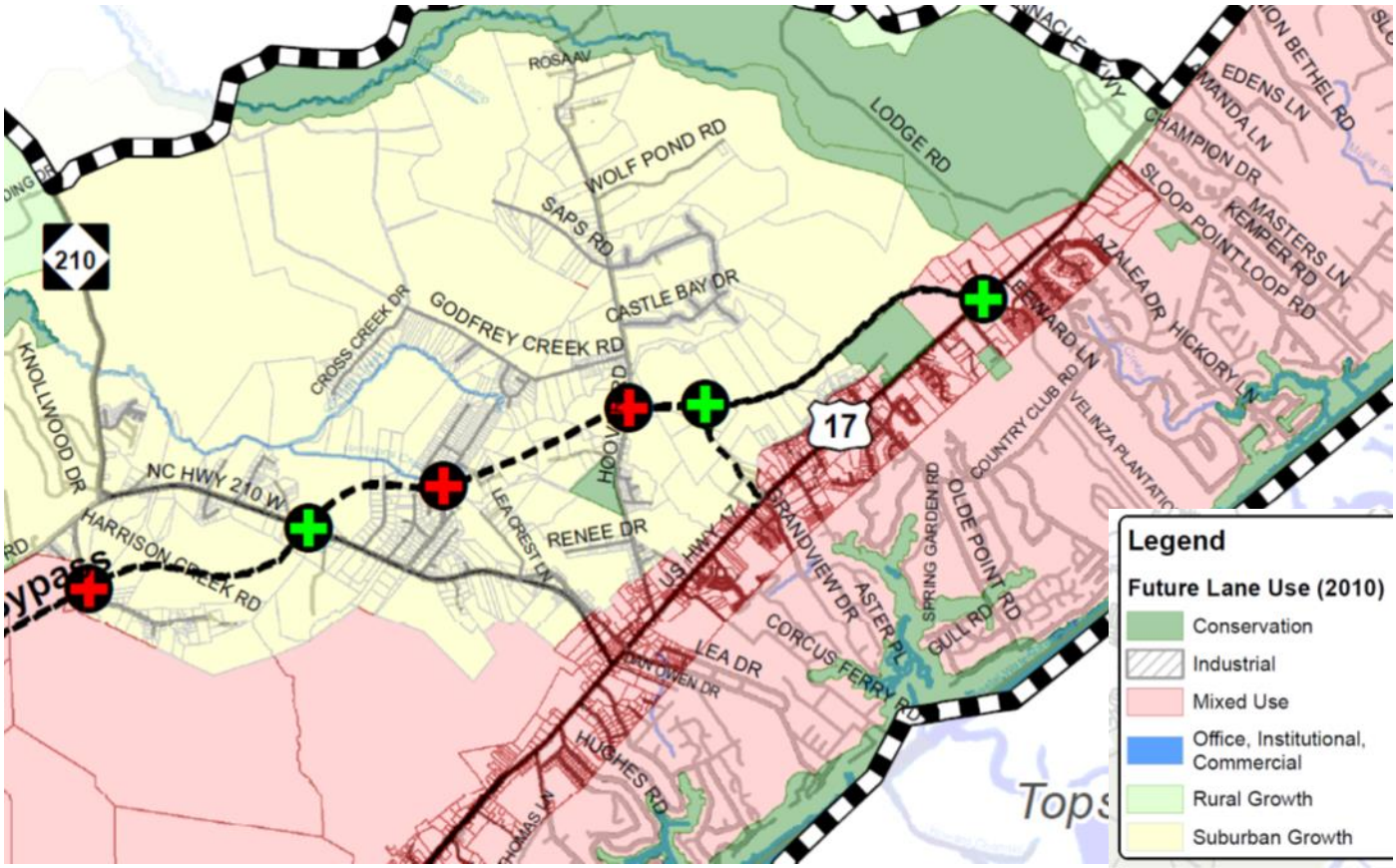
Local Plans and Development

There are several local plans that provide additional information on how the study area is anticipated to grow in the future. Additionally, ongoing development within the study area is regulated by Pender County and there are numerous potential developments in the vicinity of the study area that are either in the development approval process or have been informally discussed with local officials. The following sections summarize the data included in the local plans.

Pender County Comprehensive Land Use Plan (2010)

The plan, shown in Figure 5-1, includes future land use classifications that are intended to reflect and expand on the land use classifications used in the CAMA Land Use Plan. The comprehensive plan incorporates a Coastal Pender Small Area Plan that includes the study area from the Pender County line near Sidbury Road to Holly Shelter Game Land and Sloop Point Loop Road. The small area plan designates a Mixed-Use future land use classification from Sidbury Road to near Harrison Creek Road, between NC 210 and US 17. The Mixed-Use classification applies to locations where a mix of higher density uses is to be encouraged. The Mixed-Use classification continues along US 17 to Sloop Point Loop Road, with the exception of a few areas classified as Conservation. Conservation areas have special significance or unique characteristics that make them worthy of preservation. These areas include South Topsail Elementary School, the Topsail Schools complex, and Holly Shelter Game Land. Northwest of US 17, from Harrison Creek Road to Holly Shelter Game Land, the future land use classification is predominantly Suburban Growth. The Suburban Growth classification identifies areas where significant residential growth is expected to occur

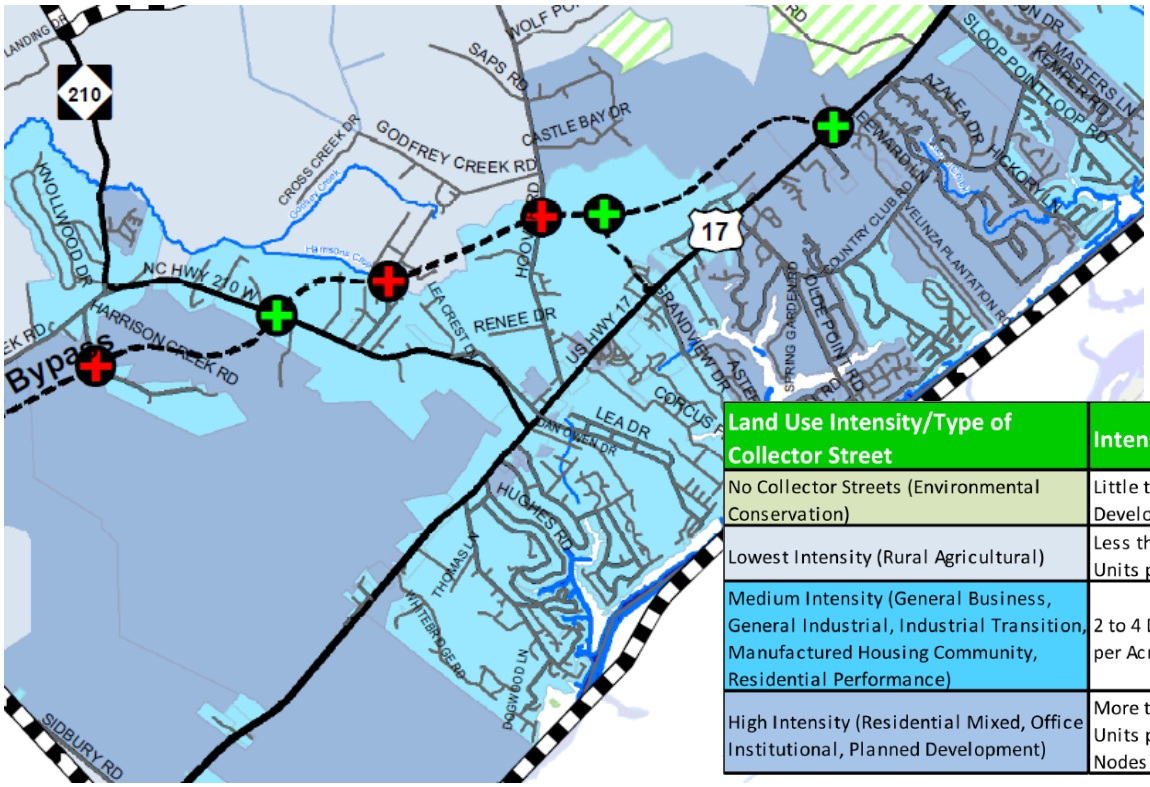
Figure 5-1: Pender County Comprehensive Land Use Plan



Pender County Collector Street Plan

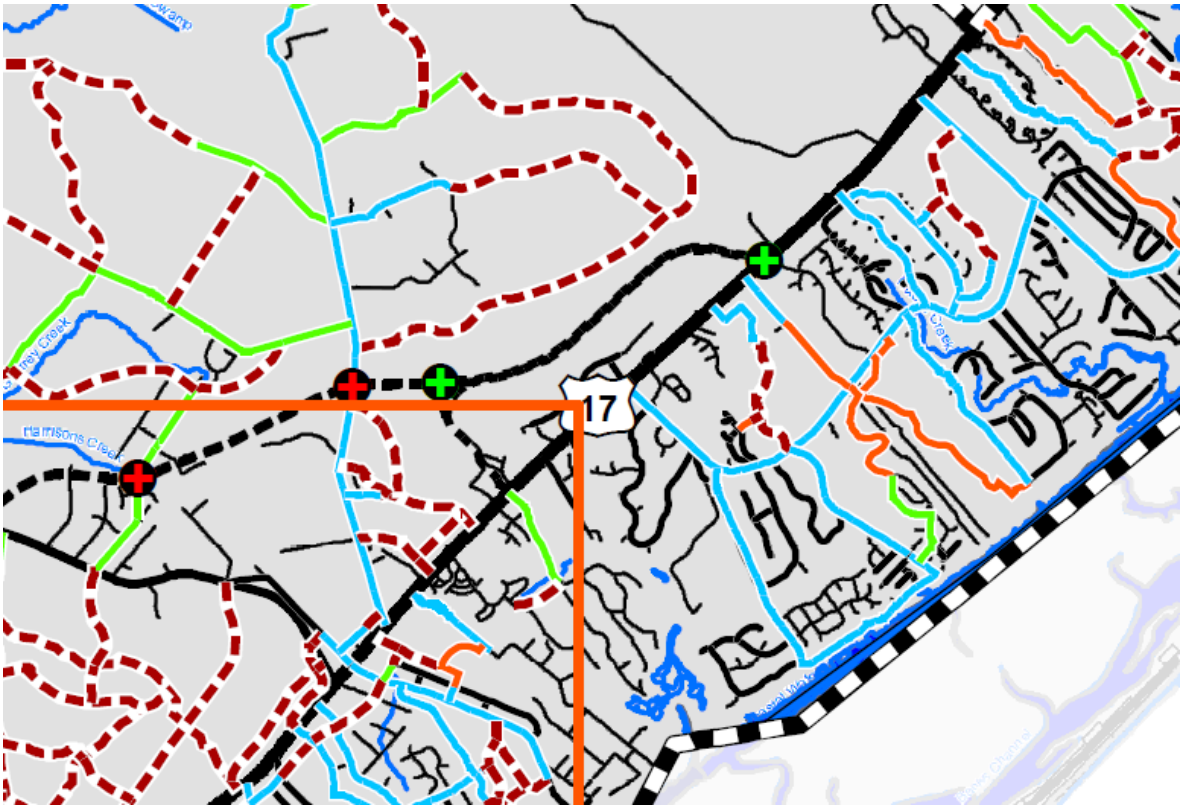
The primary goal of the Pender County Collector Street Plan is to guide investment in new collector streets with the ultimate intention of improving connectivity, focusing land development in suitable areas, encouraging all modes of transportation, maintaining levels-of-service on existing roadways, promoting safety, ensuring that significant natural areas are conserved, and providing a safe and high-quality transportation system for existing and future residents, businesses, and visitors. The Plan includes both a Land Use Intensity map and the Recommended Collector Street Plan, which are shown in Figure 5-2 and Figure 5-3:

Figure 5-2: Pender County Collector Street Plan Land Use Intensity Figure



Land Use Intensity/Type of Collector Street	Intensity
No Collector Streets (Environmental Conservation)	Little to No Development
Lowest Intensity (Rural Agricultural)	Less than 2 Dwelling Units per Acre
Medium Intensity (General Business, General Industrial, Industrial Transition, Manufactured Housing Community, Residential Performance)	2 to 4 Dwelling Units per Acre
High Intensity (Residential Mixed, Office Institutional, Planned Development)	More than 4 Dwelling Units per Acre/Activity Nodes

Figure 5-3: Pender County Collector Street Plan Recommended Collector Street Plan



Pender County Water and Wastewater Master Plan

Pender County Utilities and private utility companies provide water and wastewater services in Pender County. Existing sewer and water lines are present along US 17, NC 210, and Hoover Road. A wastewater treatment package plant is located at the northeast corner of the Topsail Schools complex. Pender County completed a Water Master Plan and Wastewater Master Plan in 2006 for the period from 2005 to 2030 to aid in planning and implementation of public water and wastewater facilities in the County. The plan included the development of population projections that first looked at traditional population projection models and resulted in a 2030 population ranging between 75,000 and 81,000. However, they also reviewed growth rates for similar areas before and after the implementation of similar facilities including nearby Brunswick County. A series of models was developed including moderate and aggressive growth models. The plan determined that the moderate growth model was the most likely and projected the 2030 population of Pender County to be 104,000 in 2030, with a corresponding CAGR of 3.4 percent.

Figure 5-4 and Figure 5-5 show the planned wastewater and water infrastructure in the vicinity of the study area:

Figure 5-4: Pender County Wastewater Master Plan

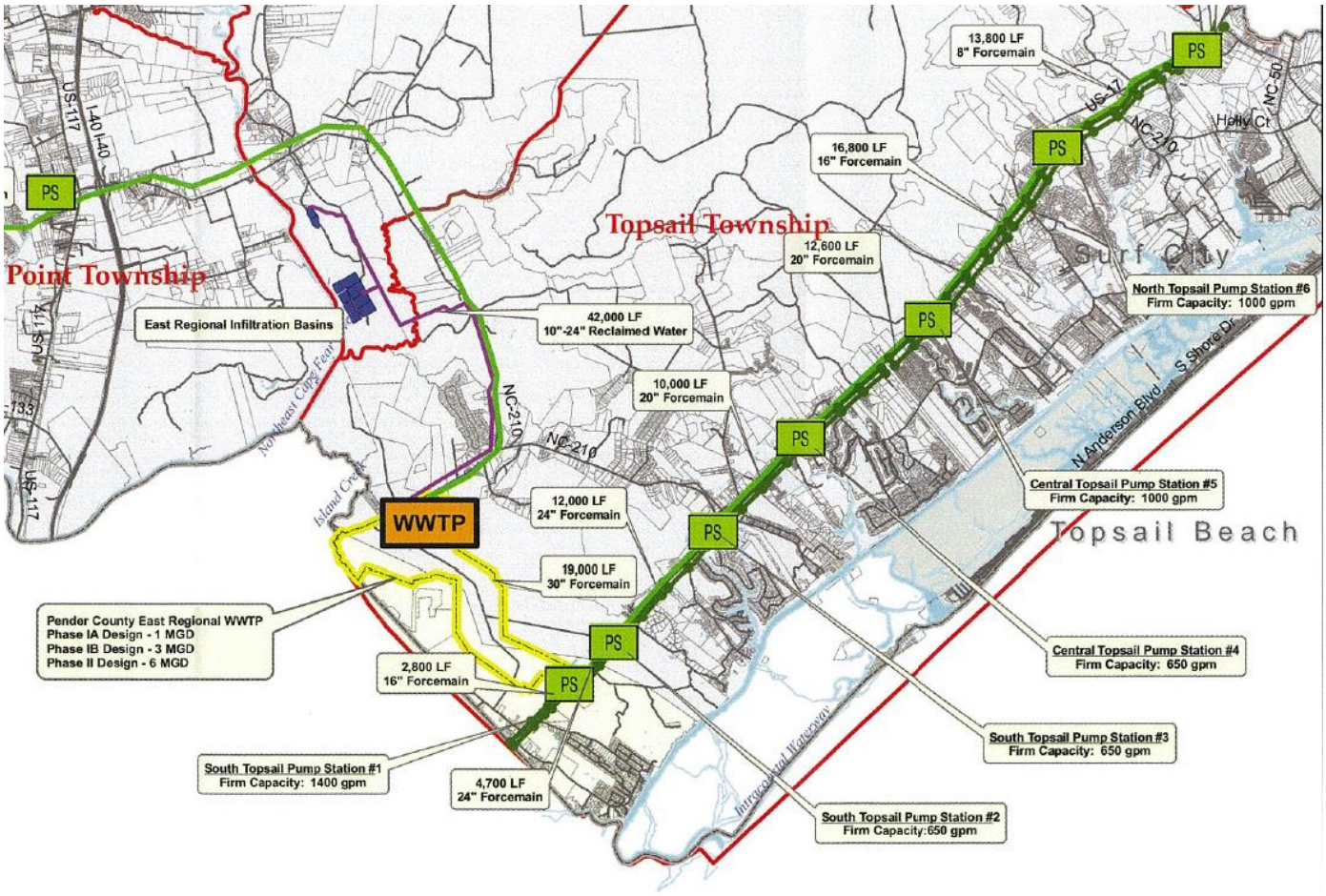
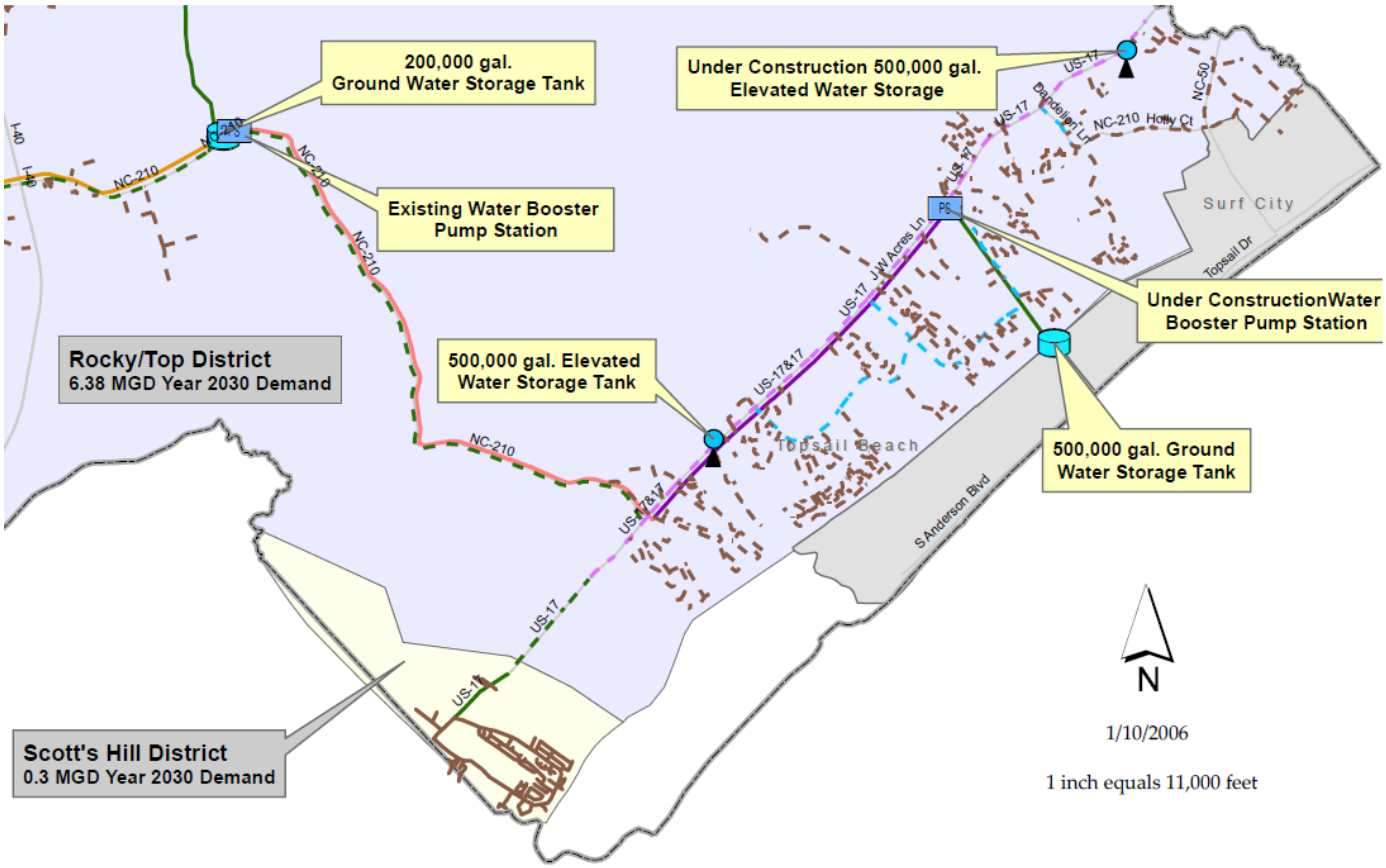


Figure 5-5: Pender County Water Master Plan



School Development

A coordination meeting was held on February 8, 2017 between Stantec and Pender County Schools (Allen Vann – Chief Officer of Auxiliary Services and Darren LaFon - Transportation Director) in Hampstead. Mr. Vann indicated that there are two schools in Surf City schools (elementary & middle) under construction that will have a capacity of 1568 students. These are slated to open in the summer of 2018. Mr. Vann stated that their opening may have a short-term effect on the numbers of students at other nearby schools but it wouldn't last long due to anticipated growth. Other Pender County schools, such as Penderlea (K-8) opening summer 2018, Cape Fear Elem/Middle (capacity increase for existing), and Pender High School were considered to have no bearing on this forecast. At this point, there is no knowledge of or long range plan for the expansion of any of the existing schools or any new schools in the area represented by the forecast.

Local Development

Based on the field visit, existing commercial and residential growth is prevalent throughout the study area and the areas that are served by US 17 and NC 210. Table 5-8 and Figure 5-6 detail the known potential developments in the study area. The local development identifies between 8,500 and 10,000 potential new residential units and numerous commercial or mixed use developments in the vicinity of the study area. While several of the identified developments are still in the speculative stage, it is likely that by 2040 development of many of these potential developments will occur.

Figure 5-6: Local Development in Vicinity of Forecast Study Area

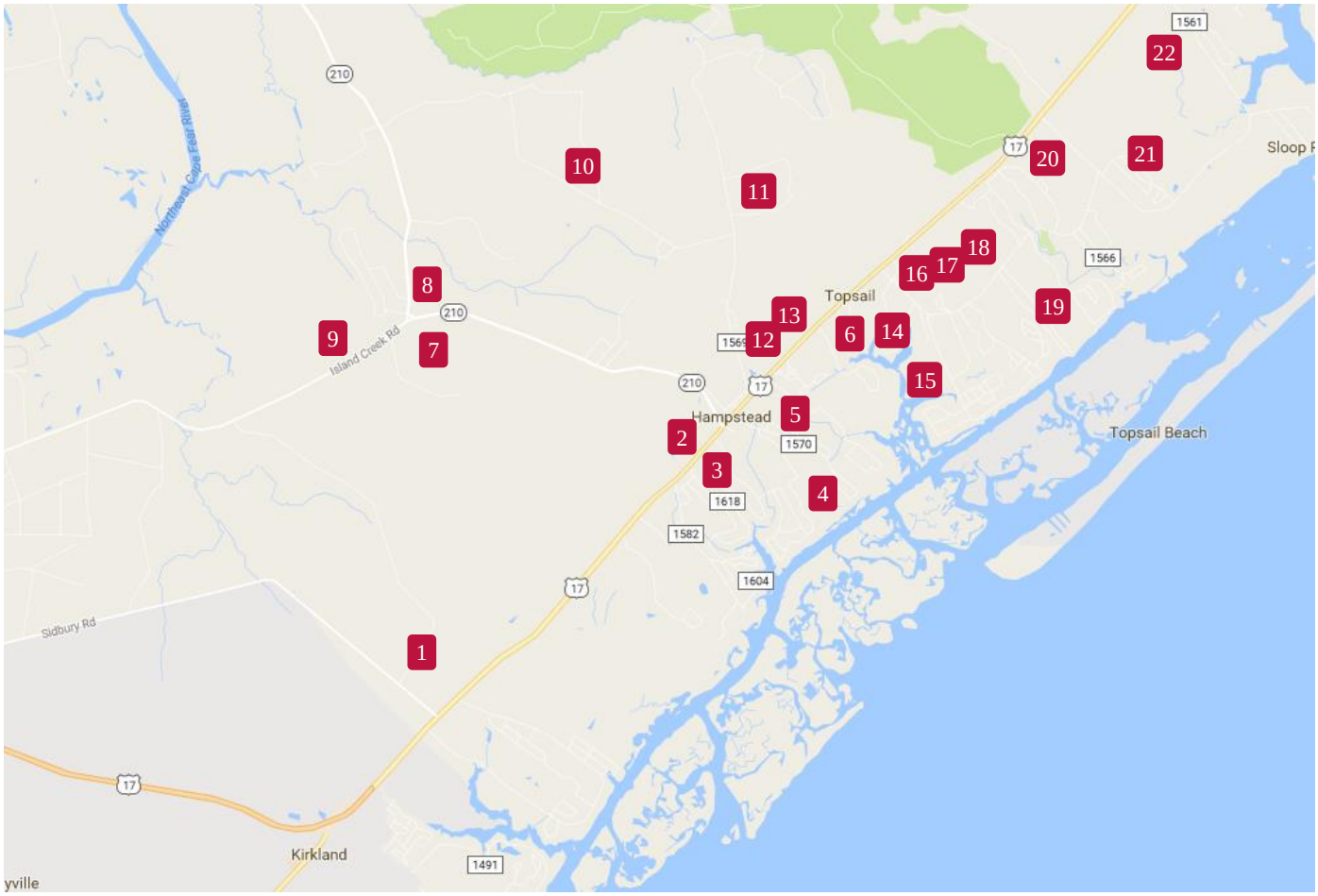


Table 5-8: Local Development in Vicinity of Forecast Study Area

ID	Development	Intensity/ Land Use	Status/Comments
1	Blake Farm	3000 residential units; 250,000 sq. ft. commercial	Phase 1 Permit Approved
2	SPOT Festival Site	Commercial	Speculative; land planning phase only; no submittal to Pender County
3	Headwaters	~100 residential units; 75,000 sq. ft. commercial; 5 outparcels	Commercial and outparcels approved; no residential component at this time.
4	Unnamed	400 residential units	Speculative; land planning phase only; no submittal to Pender County
5	Grey Bull	106 residential units	Conditional Rezoning Approved
6		~60-80 residential units	
7	Harrison Cove	90	Master Development Plan and Preliminary Plan Pending Approval
8	Avendale	211 residential units	174 Lots Recorded
9	WO Johnston	~100-200 residential units	Speculative; land planning phase only; no submittal to Pender County
10	Donald Sullivan Tract	~1000-2000 residential units	Speculative; land planning phase only; no submittal to Pender County
11	Castle Bay	364	Built Out
12	Sparrows Bend	149 SF 228 MF units	Conditional Rezoning Approved
13	Canters Crest	39 residential units	Master Development Plan and Preliminary Plan Pending Approval
14	The Point	16 residential units	Final Plat Recorded
15	Spring Garden	250-500	Speculative; land planning phase only; no submittal to Pender County
16	Villages at Olde Point	96 residential units; 15,000 sq. ft. commercial	54 of 96 Recorded
17	Donnelly Tract	135	Master Development Plan and Preliminary Plan Pending Approval
18	*No name at this time*	72	Master Development Plan and Preliminary Plan Pending Approval
19	Hawksbill Cove	1023 residential units	Master Development Plan Approved
20	Pender Land Greenway Park	281 with future development	Master Development Plan and Phase I Preliminary Plan Approved
21	Wyndwater	529 residential units	118 Lots Recorded
22	Crown Pointe	174 residential units	70 Lots Recorded

Source: Pender County Planning and Community Development (2/3/2017)

Military Growth

While there are not any military installations in Pender County, US 17 is part of the Strategic Highway Network (STRAHNET), a system of roads deemed necessary for emergency mobilization and peacetime movement of heavy armor, fuel, ammunition, repair parts, food, and other commodities to support U.S. military operations. There is a heavy military presence in Onslow County to the north with Camp Lejeune and Marine Corp Air Station (MCAS) New River while Brunswick County to the south is home to the Military Ocean Terminal Sunny Point (MOTSU). Based on discussions with local planners, military traffic does not account for a significant volume along US 17; however, there is some traffic related to commuting to and from the base by enlisted personnel or civilian contractors. Per the Jacksonville MPO's *2040 Long Range Transportation Plan* 9,900 active duty troops and civil servants were added at Camp Lejeune and MCAS New River between 2007 and 2011; however, the rate has begun to slow due to the January 2012 announcement of substantial cuts in the Defense budget with Camp Lejeune expecting to lose approximately 7,000 troops over an unspecified timeline. Also, per the Jacksonville MPO *2040 Long Range Transportation Plan*, approximately two percent of the workers within the Jacksonville MPO boundary reside in Pender County.

5.4 DETERMINATION OF 2040 GROWTH RATES AND VOLUMES

Based on the limitations of the WMPO TDM discussed in Section 5.2 and the information included in Section 5.3, engineering judgment based on the available data is the most reliable method for determining the growth rates to be utilized in developing the 2040 forecast volumes. The determination of growth rates included two separate processes, one to determine the growth along the major roadways (US 17 and NC 210) that pass through the study area and one to determine the localized growth within the study area itself.

Through Volume Growth Rates

The determination of growth rates along US 17 and NC 210 required careful review of the available data. As stated, typically the WMPO TDM would be the primary basis for determining these growth rates; however, based on the information provided previously, additional considerations are warranted. The deliberations regarding the selection of the growth rates are summarized in the following bullets:

- The WMPO TDM shows a CAGR along US 17 that ranges from 1.10 percent to 1.36 percent. Because the study area is at the very edge of the model the growth rate is heavily constrained by the growth of the external station volume entering and exiting the model. The model was developed to have a CAGR of 2.4 percent at the external station; however, due to the limited connectivity and only partial modeling of the Topsail Island area the growth rate drops to a CAGR of 1.5 percent by the time it enters the study area. This is likely due to the model limitations as the number of trips in the vicinity of Surf City have a CAGR of 2.4 percent as well; therefore, the lower growth rate does not seem reasonable and should only be given limited weight in selecting the growth rate along US 17.

- The portion of US 17 a few miles north of the study area overlaps the limits of the Jacksonville TDM, which includes a CAGR of 2.58 percent.

- The 20-year historic AADT growth rate for US 17 ranges from 3.05 percent to 3.50 percent and is roughly 0.5 to 1.0 percent higher than the 2.5 percent population CAGR over the same period for Pender County. The historic AADT CAGR for NC 210 also ranges from 1.92 to 2.45 percent over the past 20 years.

- The North Carolina Office of State Budget and Management projects a 1.76 percent CAGR for Pender County over the next 20 years. The study done in 2006 as part of the planned expansion of water and wastewater services in Pender County included a 25-year CAGR of 3.4 percent and noted that it was based on a moderate growth model derived from similar locations where major infrastructure expansions occurred.

- Based on input from local planners, the area around Surf City is growing more rapidly than was anticipated in the model socioeconomic data. A new elementary and middle school are currently under construction, the Surf City bridge replacement is currently underway and larger scale commercial developments are planned including a recently announced lease by Publix to open a shopping center at the intersection of NC 50 and NC 210. Additionally, the planning and permitting of the Magnolia-by-the-Sea development, an 1,800 to 3,000-unit development is ongoing with Phase I in progress.

- The expansion of water and wastewater facilities is allowing for higher density development and better utilization of land through the diminished use of package treatment plants.

Based on these deliberations it was determined that the most appropriate CAGR for through traffic along US 17 would be approximately 2.5 percent with slight variations along the corridor due to localized development patterns. Similarly, the growth rate for NC 210 was determined to be similar to what was included in the WMPO TDM with a CAGR between 2.0 and 2.3 percent. The primary reason that the CAGR for NC 210 was slightly lower than that for US

17 is that the historic rates were slightly lower and that the travel time to and from the coast via I-140 and US 17 is similar and may suppress the growth slightly along the corridor.

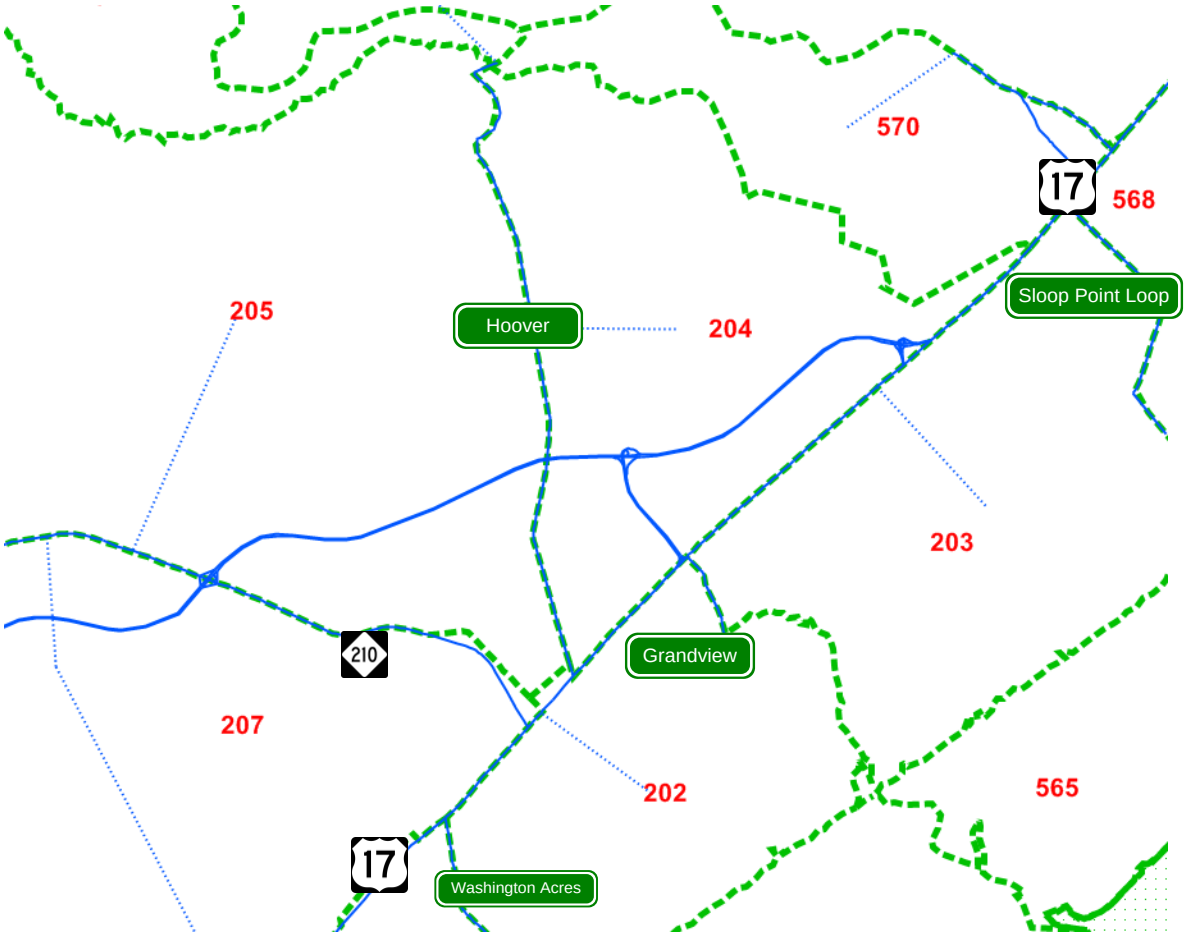
Localized Growth Rates and Trip Distribution

The process of determining the localized growth rates for the local roadways again included starting with the data in the WMPO TDM and determining growth rates based on knowledge of the local area and its development patterns. The travel demand model, shown in Figure 5-7 includes four large TAZs (202, 203, 204 and 205) that cover a majority of the study area included in this forecast. The socioeconomic data and total trips produced by the model for 2010 and 2040 are shown in Table 5-9.

Table 5-9: Study Area Traffic Analysis Zone Data

TAZ	2010				2040				2010-2040
	Households	Population	Employment	Total Trips	Households	Population	Employment	Total Trips	CAGR
202	934	2,309	643	10,540	1,217	3,009	783	14,139	0.98%
203	1,961	4,556	846	13,835	2,606	6,056	921	17,038	0.70%
204	386	9,96	435	4,916	5,41	1,396	455	6,459	0.91%
205	379	1,037	94	2,649	5,25	1,437	114	3,959	1.35%
TOTAL	**3,660**	**8,898**	**2,018**	**31,940**	**4,889**	**11,898**	**2,273**	**41,595**	**0.88%**

Figure 5-7: Wilmington MPO Travel Demand Model – Study Area Traffic Analysis Zones



Based on the field visit, local land use plans, and the ongoing and planned development in the study area, the WMPO TDM growth appears to be much lower than anticipated. The initial growth projections were completed by the WMPO in conjunction with local planners; however, they were based on a control total from the North Carolina Statewide Model developed during the economic downturn. Based on the recent economic recovery, and for many of the same reasons that the through trips in the area were considered to be under represented, the area within the project study area was reviewed in greater detail to determine a more reasonable growth rate for the purposes of this forecast. A meeting was held on January 13, 2017 with planners from NCDOT Division 3, Wilmington MPO, Pender County and the Town of Surf City to discuss the forecast and likely future growth in the area. A summary of the meeting is included in Appendix B.

In order to determine a growth rate for the 2040 scenarios, there needs to be an evaluation of the different sources of information and they need to reviewed in multiple ways to determine an appropriate growth rate for the study area. There are two main ways of developing future year growth rates, known as “bottom-up” and “top-down”.

For a bottom-up analysis, all of the likely development between the current time and the horizon year are determined and an estimate of the total number of new homes and new employments is generated. Next, the homes and employments are converted to trips based on trip generation rates. For example, an average home generates about 10 trips a day. For the forecast study area, the data in Table 5-8 identified about 10,000 new homes and a decent amount of new commercial development. Commercial property growth rates are highly variable depending on the developed land use. However, even if we ignore the commercial development, the residential aspect generates about

100,000 new trips. Based on the existing traffic volumes in the area, this would work out to being an average growth rate of about 4.4 percent per year. If we then add the commercial development back in it is likely that the growth rate would be between 5 and 6 percent per year.

For a top-down analysis, an initial projection of the socioeconomic data for a larger area is done based on past trends and anticipated future growth. The next step is to continuously break down those projections into smaller areas until you arrive at the TAZ level. For the forecast study area, the Wilmington MPO was provided a control total for their region from the North Carolina Statewide Model by NCDOT. WMPO, in conjunction with local planners took these projections and broke them it into increasingly smaller areas. WMPO began with the overall MPO total and then distributed the growth to each of the counties. It is likely that the data was then broken into subareas within the county, such as coastal Pender County and Northern Pender County. From there, each subarea total was eventually distributed down to the TAZ level. From the TAZ level, the number of new trips can be determined based on the trip generation rates in the WMPO model. When this method is used, it shows the same area as described above increasing by 1200 households and 250 jobs between 2010 and 2040. When translated to daily trips, this results in a growth rate of 0.9 percent per year and produces 9,700 new trips by 2040.

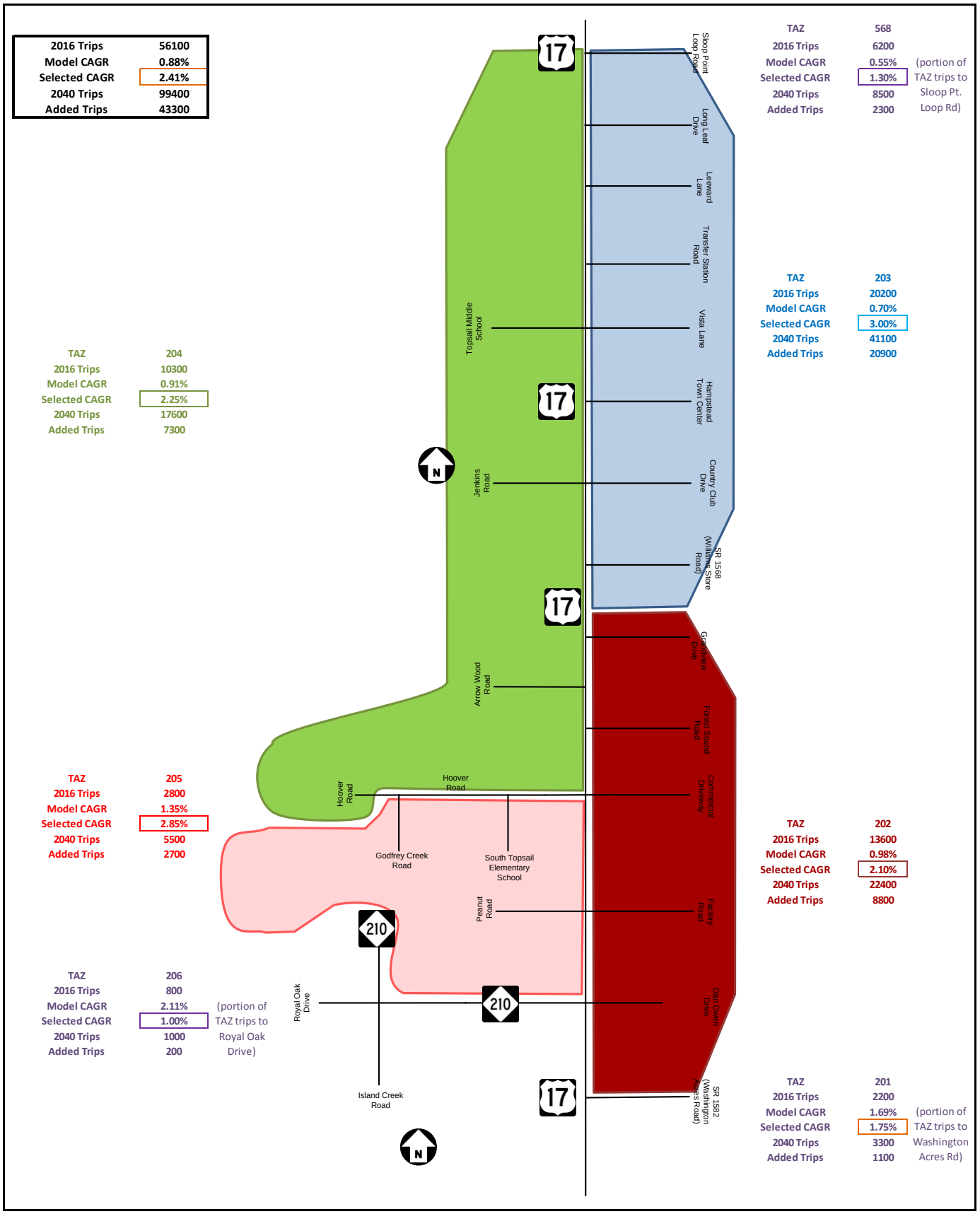
It is clear that each of these methods produces very different results with one producing a growth rate less than 1 percent and one being as high as 5-6 percent. For traffic forecasting and long range planning purposes, the top-down method is typically preferred as the reliability of population projections tends to be a more dependable method than the speculative nature of projecting development for a 30-year period. However, based on a review of the available data and the input from local planners it was determined that an overall CAGR of 2.0 to 2.5 percent was reasonable for the TAZs located within the study area.

Once it was determined that the future year growth rate would be between 2.0 and 2.5 percent then next step was to review each of the four TAZs to determined how to distribute the additional trips. Maps showing each of the study areas were reviewed by the group at the meeting and potential future development was discussed for each area with the location and intensity of potential developments being identified. Based on this review, the group ranked the TAZs, shown in Figure 5-8, in order from highest growth to lowest growth. The consensus of the group was that TAZ ID 203 (blue in Figure 5-8) would have the highest growth, followed by TAZ ID 202 (dark red). Therefore, the highest growth would be east of US 17 which is consistent with where the current Land Use Plan designates for higher intensity mixed use development. The third highest growth area was determined to be TAZ ID 205 (red) followed by TAZ 204 (green) with TAZ 204 being the most environmentally constrained and also having limited options for access due to the Holly Shelter Game Land.

In addition to the four TAZs within the study area, three additional TAZs are located along the edges of the forecast study area. TAZ ID 568 begins on the north side of Sloop Point Loop Road, TAZ ID 201 begins on the south side of Washington Acres Road and TAZ ID 206 includes the subdivision off Royal Oak Drive. Based on a review of the available land and potential development CAGRs for each of the additional TAZ were developed to account for the trips that would likely be included on the roadways listed above.

Following the meeting it was determined that an overall CAGR of 2.4 percent would be used for the area included within the study area for the forecast. The following figure shows a summary of the data for the TAZs in and around the study area, including the 2016 Base Year AADT volumes, the model and selected CAGR, the 2040 total trips and additional trips determined by applying the CAGR to the Base Year AADT. It should be noted that the selected CAGR for each TAZ does not fully align with the order discussed above. When determining the growth, it was found that the areas west of US 17 have lower existing volumes and would require slightly higher growth rates to generate the number of trips anticipated for each area. Therefore, while the CAGR is higher, the total number of trips produced by each TAZ aligns with the rankings discussed above.

Figure 5-8: 2040 Future Year Growth by Traffic Analysis Zone



The next step in developing the forecast is the distribution of growth, in the form of the additional trips, within each TAZ. At the January 13, 2017 meeting, each of the TAZs was briefly discussed by the group and the following conclusions were made:

- For TAZ ID 203 (blue) it was determined that the extension of Transfer Station Road to Country Club Road would have the largest increase in traffic with the volumes on Country Club Road and Sloop Point Loop Road increasing as well due to them providing access to US 17. The growth for Williams Store Road, Hampstead Town Center, Vista Lane, Leeward Lane and Long Leaf Drive would be lower as these areas are already mostly developed.

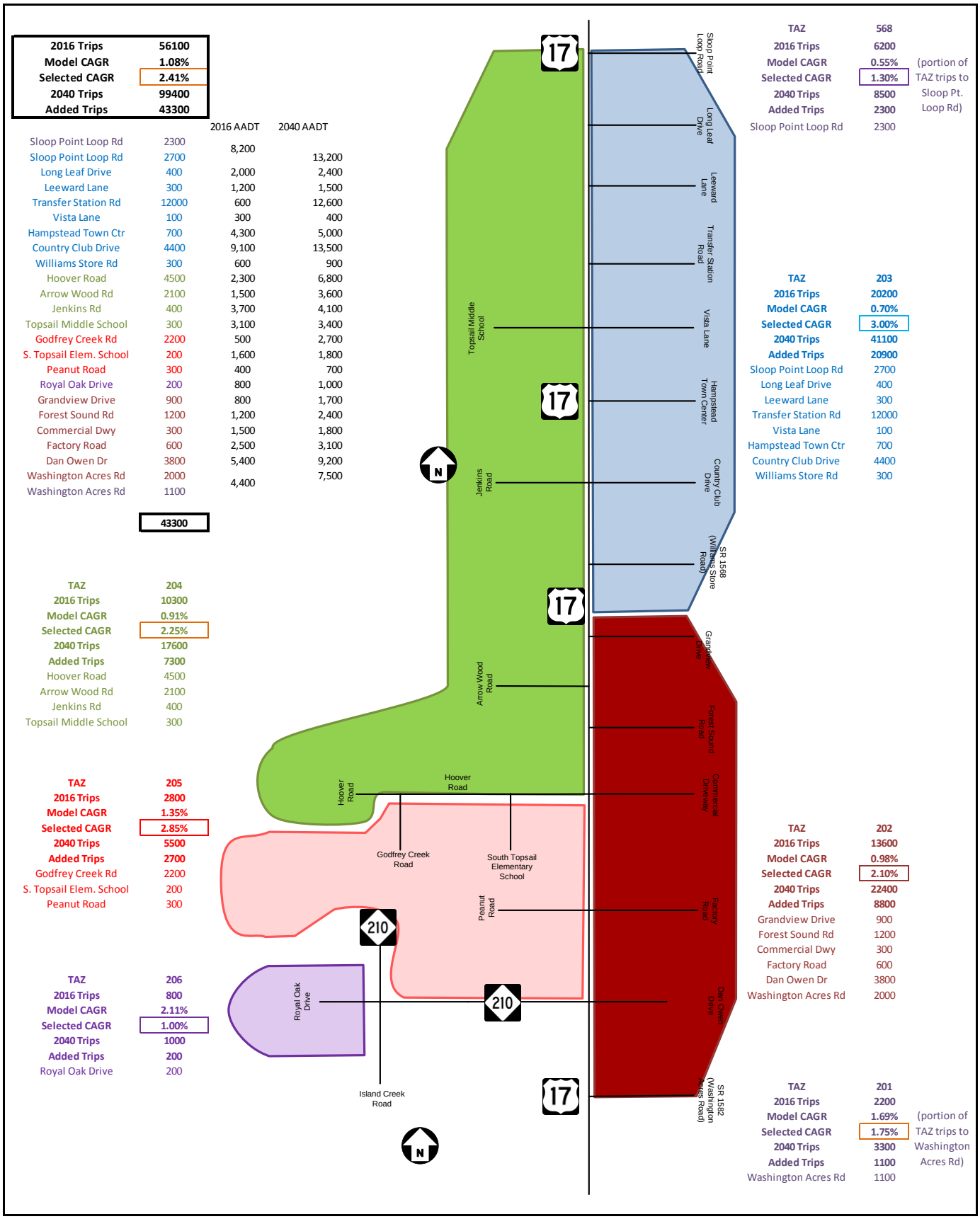
- For TAZ ID 202 (dark red) it was determined that most of the growth would be near the NC 210/Dan Owen Drive intersection. The current plan is for Dan Owen Drive to be extended to Factory Road with the US 17/Factory Road intersection being converted to right-in/right-out. The growth along Washington Acres Road was the next highest area due to several ongoing and planned developments with lower volumes for Forest Sound Road and Grandview Drive.

- For TAZ ID 205 (red) the largest increase in traffic would be in the area west of the Bypass between NC 210 and Hoover Road, which would be represented by an increase in volume at Godfrey Creek Road, the closest existing roadway that could be assigned the growth in traffic.

- For TAZ ID 204 (green) the highest growth would be at Arrow Wood Road due to the Lea Tract development and to Hoover Road west of Godfrey Creek Road which would be the closest existing roadway to capture the additional growth due to development along Hoover Road and the tract between NC 210 and Hoover Road.

Based on these conclusions the next step was to distribute the added trips to determine the likely 2040 traffic volume for each local roadway. Therefore, the additional trips for each TAZ were distributed among the individual roadways such that the growth for each TAZ matched the selected growth CAGR. Figure 5-9 shows the results of the distribution of 2040 traffic to the local roadways.

Figure 5-9: 2040 Future Year Trip Distribution by Roadway



5.5 TRAFFIC FORECAST VOLUMES

The traffic volumes for the 2040 Future Year No-Build Scenario were calculated based on the existing AADT and turn movements data in combination with the Through Volume Growth Rates, Localized Growth Rates, and Volume Distributions described in Section 5.4. Table C6 in Appendix C shows the comparisons of historic growth rates, model output, CAGRs, and selected volumes. Some of the volumes were modified slightly to allow for the development of a balanced network.

A brief summary of the key observations and considerations from the development of the 2040 No-Build volumes are as follows:

- The 2040 forecast volumes along US 17 show a CAGR ranging from 2.45 percent to 2.61 percent consistent with the decision to maintain an average rate of about 2.5 percent along the corridor. The selected growth rate is higher than the model growth rate, but lower than the 20-year historic growth rate along the corridor. The increase in CAGR from the south end to the north end matches the trend included in the model and is likely due to the largest growth occurring along US 17 north of Country Club Road.

- The growth along NC 210 is comparable to the model growth rate and the historic growth rate over the past 20 years.

- Growth along the Y-lines is largely dependent on the amount of land for development or redevelopment with most roadways that are developed having a CAGR of 0.5 to 1.5 percent. The CAGR for roadways that are expected to accommodate substantial future growth have a CAGR of 2 to 4 percent. Two roadways include a CAGR greater than 4 percent, Godfrey Creek Road and Transfer Station Road. Godfrey Creek Road has a CAGR of 5.72 percent due to the existing very small volume on the roadway and that the proposed growth represents expected growth in the area between NC 210 and Hoover Road once a connection is made. Transfer Station Road is planned to be extended to Country Club Road to accommodate planned development in the area, in accordance with the Pender County Collector Street Plan; therefore, the growth rate reflects a CAGR of 13.53 percent due to the very low existing volume and that it will provide an additional access point to US 17 for the developments along Country Club Road.

- The Military Cutoff Road Extension (STIP Project U-4751) was added to the 2040 No-Build forecast by determining the 2040 volume on I-140 based on model growth rates. Next, the proportion of forecast volume to model volume for I-140 was determined and it was applied to the model volume for the Military Cutoff Road Extension to determine the 2040 No-Build forecast volume.

5.6 DESIGN FACTORS

The 2016 Base Year design factors were reviewed against the expected growth trends in the study area to determine if they were still appropriate for the 2040 No-Build scenario. Based on this review all the 2016 Base Year factors were appropriate except for the following:

- The heavy vehicle percentages for Hoover Road were modified from the 2016 Base Year values of 7 to 9 percent duals and 1 percent TTSTs to a 2040 No-Build value of 5 percent duals and 1 percent TTST. The reduction is due to the existing percentages being a result of low volumes combined with a higher percentage of trucks due to South Topsail Elementary School and the mining operation at the end of Hoover Road. It is expected that as additional development occurs, mostly residential, the percentage of duals will be reduced by about one-third.

- The design factors for Arrow Wood Road were also reviewed based on the expected development in the area between 2016 and 2040. The existing configuration serves a small shopping center; however, the roadway will be extended further west to serve the Lea Tract development that includes 400 residential units. Due to the change in land use the 2016 Base Year D-factor of 75 percent was reduced to 65 percent to account for the likelihood that traffic will be more balanced in the future as people will be returning to the residential area in the PM peak, thus reducing the D-factor.

- All of the design factors for Transfer Station Road were reviewed as the existing traffic is primarily related to the use of the Transfer Station. Under the 2040 No-Build scenario it is expected that Transfer Station Road will be extended to Country Club Road and its use will primarily be access to existing and proposed residential areas. Due to this change the K-factor was changed to 8 percent and the D-factor was changed to 65 percent with the PM peak being reversed to be in the eastbound direction (towards the residential development). These values were selected based on a comparison with the values for Country Club Road which serves the same function that Transfer Station will serve in the future. Additionally, the truck percentages of 15 percent duals and 5 percent TTSTs was reduced to 6 percent duals and 2 percent TTSTs as their will still be a larger number of trucks due to the continued operation of Transfer Station, but a lower percentage overall due to the expected increase in residential traffic.

- The design factors for Military Cutoff Road Extension were selected to closely mirror the factors along US 17 as that is the most representative comparable facility in the study area. The selected truck percentages match the percentages used for the 2008 forecast.

A summary of the revised design factors is shown in Table 5-10.

Table 5-10: 2040 FY NB Design Factors

Forecast Location	Selected 2040 FY NB K Value [1]	Selected 2040 FY NB D Value [1]	Selected 2040 FY NB Truck Percentage
Hoover Road	No Change	No Change	5 , 1
Arrow Wood Drive – west of US 17	No Change	65 EB/65 EB/65 EB	No Change
Transfer Station Road – east of US 17	8 / 8 / 8	70 WB/60 EB/65 EB	6 , 2
Military Cutoff Road Extension – south of I-140	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 3

(1) AM Peak Hour / PM School Peak Hour / PM Commuter Peak Hour

6. FUTURE YEAR 2040 BUILD TRAFFIC FORECAST

6.1 ASSUMPTIONS

The 2040 Build traffic forecast scenarios contain all the assumptions found in the 2040 No-Build traffic volume network discussed in Section 5.1. This traffic forecast considers seven build scenarios for the Hampstead Bypass:

- Scenario 1 – includes interchanges at NC 210, Midtown and US 17 (R-3300 Preferred Alternative from NEPA)
- Scenario 2 – Includes interchanges at NC 210, Midtown, US 17 and on-ramps from Hoover Road
- Scenario 3 – Includes interchanges at NC 210 and US 17
- Scenario 4 – Includes interchanges at NC 210, US 17 and on-ramps from Hoover Road
- Scenario 5 – Includes interchanges at NC 210, Midtown, US 17, on-ramps from Hoover Road and a service road from the Midtown interchange to Hoover Road
- Scenario 6 - Includes interchanges at NC 210, Midtown, US 17 and a service road from the Midtown interchange to Hoover Road
- Scenario 7 - Includes interchanges at NC 210, Hoover Road (full movement) and US 17

The R-3300 project was coded into the model for each scenario. A detailed description of the modeling effort is included in Appendix E.

6.2 METHODOLOGY

The Wilmington Travel Demand Model, the information discussed in Section 5.3 and engineering judgment were heavily relied upon in the calculation of the 2040 Future Year Build traffic volumes. Once the travel demand model was run to include the different R-3300 build scenarios, model volumes were extracted for each location included in the evaluation.

For a typical traffic forecast, the model volumes from the 2040 No-Build and Build Model runs are compared in order to calculate a diversion percentage between the two scenarios. These diversion percentages are then applied to the 2040 No-Build traffic volumes in order to develop 2040 Build Traffic volumes for both alternatives. However, as noted in Section 5, the Wilmington Travel Demand Model includes several limitations that make developing a traffic forecast with the required level of detail difficult. The travel demand model includes four very large TAZs for the study area surrounding the proposed project. Each of these TAZs use a single connection to load all of the traffic from the TAZ onto the network in the model. The level of minor variations included in the Build scenarios would require a much more fine-grained network as it routes trips based on travel time between the origin and destination. The four TAZs (shown in Figure 5-7:) include the two TAZ on the east side of US 17 connecting to US 17 in the vicinity of Factory Road and the vicinity of Transfer Station Road. The TAZ along NC 210 that includes all of the traffic generated west of US 17 (including the businesses along US 17) connects to NC 210 three miles to the northwest of US 17, while the connection for traffic from Hoover Road to opposite Sloop Point Loop Road connects to Hoover road 2 ¼ miles north of US 17.

Due to the coarse network and limited connections, utilizing the travel demand model for local trips is not possible. For example, the trip from a house on Vista Lane to Topsail Middle School (which are across US 17 from one another) would actually be a five-mile trip in the travel demand model due to the location of the loading points for the TAZs. Based on these limitations the model data was reviewed and it was determined that it was not adequate for use on local trips. However, a review of the model data for longer distance travel within the region was reviewed and determined to a reliable method for determining the diversion of through trips through the project study area.

The limitations of the travel demand data required that a decision be made on the best method for developing the forecast. The two options were to utilize the model where it was considered to be reliable and rely on manual re-allocation and engineering judgment to develop the forecast or switch to a detailed subarea analysis that would revise

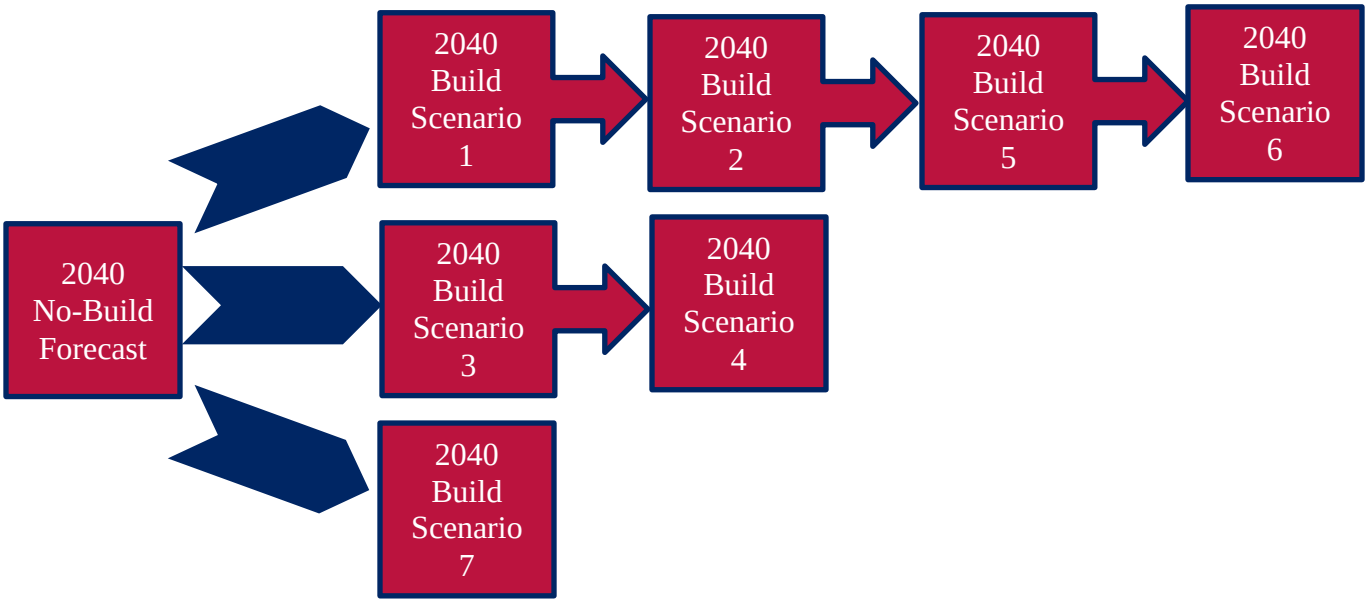
the travel demand model to provide the level of detail required. The use of manual re-allocation and engineering judgment is commonly used on traffic forecast where model data is not available or deemed unreliable. The development of a subarea model for the project study area would be an extremely expensive and time consuming endeavor and would require a great deal of additional data to break the data down to the level needed to develop this forecast. As much of the data that would be required is not currently available it would need to developed and would require either extensive study and coordination (costing time and money) or the use of assumptions, many of which are what will be utilized the process of manually re-allocating the local trips. Based on the benefits and burdens of each approach it was determined that the process would utilize the model data where it is deemed reliable and utilize manual re-allocation based on engineering judgment.

Therefore, the manual re-allocation of trips using engineering judgement was utilized during the development of the forecast. For each roadway included in the forecast, the analyst reviewed the land use and determined the likely percentage of trips that would divert their trip to an alternative path based on the likely travel time and assumed destination for trips. The travel times were determined based off aerial mapping of the existing and proposed roadway networks for the project. Additionally, the STIP Project U-5732 will make modifications to the US 17 corridor, including access management that may limit or redirect access to several of the roadways in the forecast. Nearly all the major intersections will remain full movement once the U-5732 project is completed or will be modified to allow all movements under the R-3300 project. Many of the minor roadways in the forecast will include redirected turn movements due to the addition of a median with u-turn locations being provided in close proximity to the existing intersection. The effects of the proposed access were considered during the development of the forecast; however, the revised access is not anticipated to have a substantial effect on the trips patterns in the study area as the u-turn locations are not likely to add a substantial amount of travel time to the trip, such that alternative paths become more viable.

A methodology was then developed for the development of the 2040 Future Year Build scenarios that relied on the model data for the diversion of through trips from US 17 to the Hampstead Bypass and then relied on a more manual re-allocation of trips based on the evaluation of the likely travel times between locations and engineering judgment to develop the interaction between the Bypass, US 17 and the local street network. The detailed methodology for each of the seven 2040 Future Year Build scenarios is described in the Section 6.3 with the detailed procedure included in Appendix D.

6.3 TRAFFIC FORECAST VOLUMES AND DESIGN FACTORS

Based on the methodology described in Section 6.2, traffic volumes for the 2040 Future Year Build Forecast Scenario were calculated for the seven design scenarios. Tables C7 through C13 in Appendix C show the comparisons of model output, diversion percentages, and selected volumes. The methodology presented in Section 6.2 utilizes the 2040 No-Build forecast, along with model diversion rates for the Hampstead Bypass and manual re-allocation of local trips to develop the forecast volumes. The seven design scenarios being developed have similar features and were developed by developing three base scenarios; Scenario 1 (interchanges at NC 210, Midtown and US 17), Scenario 3 (interchanges at NC 210 and US 17) and Scenario 7 (interchanges at NC 210 Hoover Road and US 17). Scenario 2 utilized Scenario 1 as the basis for developing the build volumes for the addition of the on-ramps from Hoover Road. Similarly, Scenario 4 utilized Scenario 3 as the basis for developing the build scenario that added the same on-ramps from Hoover Road. Scenario 5 was developed based on Scenario 2, and included a service road from the Midtown interchange to Hoover Road. Scenario 6 was developed based on Scenario 5, and included removing the on-ramps at Hoover Road as the movements could be accommodated at the Midtown interchange via the service road. The following is a summary of the forecast development process:



Traffic forecasts frequently include a slightly different number of total trips between the no-build and build forecasts, with the build scenarios typically having higher volumes. This is typically due to traffic modifying their desired trip paths due to high levels of congestion in the no-build scenario and then returning to their desired route once additional capacity is provided. The WMPO TDM did show some slight changes in volume between the model runs for the no-build and build scenarios; however, the difference was minimal and was due to changes in the number of trips accessing US 17 from the TAZs north of the study area. Because the project is located at the edge of the WMPO model it does not include any alternative paths for traffic to be diverted to in the no-build scenario. Therefore, the minimal change in volumes was the result of slightly fewer trips being made from each TAZ in the no-build model runs. In a practical sense, it is not likely that trips were not being made but instead were being captured within the TAZ and not accessing the roadway network. Additionally, a review of the larger roadway network was completed that looked at potential long range trip diversion (such as using I-40 to NC 24 to Jacksonville and then down to Topsail Island). Based on this review it was determined that due to the limited roadway network and large protected areas (Holly Shelter Game Land) that there really weren't any potential alternative routes that would attract traffic if US 17 was congested. Therefore, it was determined that the total volumes for all of the build scenario would match the total volume from the 2040 No-Build forecast. The following sections summarize the forecast development process for each of the seven 2040 Future Year Build scenarios with the detailed procedure included in Appendix D.

6.3.1 2040 Build Scenario 1

The development of the 2040 Build Scenario 1 forecast included eight steps that are detailed in Appendix D1.

- Step 1 began with the 2040 No-Build forecast volumes and redistributed movements to the US 17/Hampstead Bypass interchange. Due to the location of the interchange, it affected volumes (with a decreasing rate the further south you travel) as far south as the US 17 intersection with Jenkins Road/Country Club Road. Traffic that was turning left to travel south on US 17 was re-routed to the north and became the volume accessing the Hampstead Bypass from the south.

- Step 2 continued the process of re-allocating the trips to the proposed Midtown/Hampstead Bypass interchange, which is located ½ mile northwest of US 17 and connects back to US 17 in the vicinity of Grandview Drive via the Midtown Connector. A portion of the trips from as far north as the US 17 intersection with Transfer Station Road were diverted to the Midtown interchange to travel south, while a portion of trips

from as far south as the US 17/Washington Acres Road intersection were diverted to the Midtown interchange to travel north.

- Step 3 continued the process of re-allocating the trips to the proposed NC 210/Hampstead Bypass interchange, which is located 2 ½ miles northwest of US 17. A portion of the trips from as far north as the US 17/Arrow Wood Road intersection and as far south as Washington Acres Road were diverted to the NC 210 interchange. Due to the distance from US 17 the proportion of trips was lower as the only destinations that would provide a travel time savings would be those in northern New Hanover/southern Pender County.

- Step 4 utilized the diversion rate from the WMPO TDM to determine the distribution of traffic from the north onto US 17 and the Hampstead Bypass. The model volumes showed that 71.4 percent of traffic utilized the Hampstead Bypass. The model also showed that no trips would utilize the Hampstead Bypass to avoid the Topsail Middle School/High School area and then return to US 17 via the Midtown interchange. The WMPO TDM utilizes the quickest travel time to assign trips; however, it does not account for the delay associated with traffic signals. A review of the potential routes found that while the route along the Hampstead Bypass was ¾ mile longer the free flow travel time (no effect of traffic signals) difference was less than 30 seconds. Being that the route where drivers would stay on US 17 has four additional traffic signals it was determined that about 25 percent of the US 17 through trips would utilize the Hampstead Bypass to Midtown interchange route resulting in a total diversion rate of 75.4 percent to the Hampstead Bypass at the US 17 interchange.

- Step 5 again utilized data from the WMPO TDM to determine the effect on longer distance trips along NC 210 and Island Creek Road. The model showed a reduction in trips (compared with the no-build scenario) of about 23 percent on Island Creek Road, while the volumes on NC 210 showed a slight increase of about six percent. Based on a review of the data the 2040 Build volumes for the NC 210/Island Creek Road/Royal Oak Drive intersection were selected and the turning movements re-balanced.

- Step 6 included the determination of the turning volumes at the NC 210/Hampstead Bypass interchange and then rebalancing the eastern and southern link volumes. The volume in the northwest quadrant (EB→NB, SB→WB) was developed by comparing the model volumes for the ramps and the volume drop through the interchange. Model volumes for this movement showed roughly 7,000 trips which was increased proportionally based on comparing model volume to link AADT, resulting with 7,200 trips. The volume in the northeast quadrant (WB→NB, SB→EB) is largely redundant as any longer distance travel would have a shorter route elsewhere; therefore, it would only serve localized development along NC 210 and an assumed volume of 1000 was selected. The volume in the southeast quadrant (NB→EB, WB→SB) is made up of the diverted trips from Step 3. The volume in southwest quadrant is similar to those in the northeast quadrant with an assumed volume of 1000 serving local trips; however, to balance the overall network the overall change in traffic on Island Creek/NC 210 from Step 5 was also added to this quadrant. The Step 6 process concluded by re-balancing the trips to the east along NC 210 to the US 17 intersection and the south along the Hampstead Bypass.

- Step 7 included rebalancing the network from the US 17/NC 210/Dan Owen Drive intersection to the southern edge of the network based on the link volumes determined in the previous steps.

- Step 8 included a final review of the volumes for balancing and checked that the total volume for all external links matched the 2040 No-Build total volume.

Following the development of the traffic forecast for the R-3300B study area, the I-140/Military Cutoff Road Extension/Hampstead Bypass interchange was developed utilizing model diversion rates between the No-Build and Build scenarios.

A review of the design factors for the 2040 Build Scenario 1 included an evaluation of the factors for all the existing roadways and concluded with the selected values being the same as those selected for the 2040 No-Build scenario discussed in Section 5.6. The Build Scenario 1 traffic forecast included the addition of the Hampstead Bypass and the Midtown Connector to the forecast. For each of these facilities, the design factors were selected to match those on the US 17 corridor and are shown in Table 6-1. The only exception to matching the US 17 factors was for the PM School Peak where it is anticipated that the traffic on the Hampstead Bypass will be less than on US 17; therefore, the K value was reduced from 7 percent to 6 percent.

Table 6-1: 2040 FY B Scenario 1 Design Factors

Forecast Location	Selected 2040 FY B K Value [1]	Selected 2040 FY B D Value [1]	Selected 2040 FY B Truck Percentage
Hampstead Bypass – I-140 to NC 210	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Hampstead Bypass - NC 210 to Midtown Interchange	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Hampstead Bypass - Midtown Interchange to US 17	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Midtown Connector - Hampstead Bypass to US 17	8 / 6 / 8	60 EB/60 WB/60 WB	4 , 2

(1) AM Peak Hour / PM School Peak Hour / PM Commuter Peak Hour

A summary of the key observations from the development of the 2040 Build Scenario 1 volumes are as follows:

- The volumes for the Hampstead Bypass range from 48,300 to 52,000 vehicles per day
- The volumes along US 17 range from 13,100 to 25,800 vehicles per day for the portion between Washington Acres Road and the US 17/Hampstead Bypass and from 56,600 to 61,400 vehicles per day north of the Hampstead Bypass
- The volumes along NC 210 range from 7,000 to 11,900 vehicles per day
- The volumes along Hoover Road range from 6,800 to 15,000 vehicles per day
- The volume along the Midtown Connector between US 17 and the Hampstead Bypass is 11,000 vehicles per day

6.3.2 2040 Build Scenario 2

The development of the 2040 Build Scenario 2 forecast started with the final forecast for Build Scenario 1 and included 12 steps that are detailed in Appendix D2. Build Scenario 2 includes the addition of on-ramps from Hoover Road to the Hampstead Bypass. Because this scenario does not also include exit ramps it creates a unique situation from a forecast perspective as traffic forecasts typically assume that each complete trip returns on the same path it originally took. For example, a trip from home to work would include the same route, only in reverse that when returning from work to home in the evening. With the inclusion of on-ramps only this assumption is disrupted as trips entering the Hampstead Bypass from Hoover Road would need to return on US 17 to complete the trip. Therefore, several assumptions need to be made in the traffic re-allocation process and the resultant forecast will not include balanced volumes (same number of trips in each direction) along many links and several turn volumes will not have equal turn movements. Additionally, when re-allocating trips, it becomes very difficult to allocate trips to each individual destination roadway in the forecast. Because many of the re-allocated movements are relatively minor compared to the total number of trips in the forecast a simplifying assumption was made that many of the re-allocated trips would be removed from the major volume sources of US 17 and the Hampstead Bypass. This assumption will allow for a reasonable distribution of traffic along the major facilities but may not fully capture the very minor (likely to be only a few vehicles in the peak hour) changes in turning movements at intersections.

- Steps 1 and 2 – These steps re-allocated trips from Hoover Road, west of Godfrey Creek Road to the new on-ramps. It was assumed that roughly 75 percent of these trips would utilize the Hampstead Bypass with the distribution to the north and south matching the turning percentages at the US 17/Hoover Road intersection. This resulted in 1500 trips re-allocated to the south and 1000 trips re-allocated to the north along the Bypass. Of the 1000 trips to the north, it was assumed that 600 would stay on the Bypass to the north while 400 would utilize the Midtown interchange to travel north on US 17.

- Steps 3 and 4 – these steps were the same as for Steps 1 and 2 but were for the traffic from Godfrey Creek Road. The result of this step was the addition of 700 trips to the south and 400 trips (split 200 to the Bypass and 200 back to US 17 via the Midtown interchange) to the north.

- Steps 5 and 6 – these steps were similar to Steps 1 through 4 but were for trips from South Topsail Elementary School. The result of this step was the addition of 200 trips to the south and 400 trips to the north (again split 200 to the Bypass and 200 back to US 17 via the Midtown interchange). The larger percentage of trips to the north assumes that more students at the school are from the north than the south.

- Steps 7, 8 and 9 – these steps include the re-allocation of trips from Forest Sound Road (300 trips), Arrow Wood Road (100 trips) and the Commercial Driveway (200 trips) opposite Hoover Road at the US 17 intersection from the NC 210 interchange (from Build Scenario 1 redistribution) to the Hoover Road on-ramps with all trip destinations to the south as was included in the Build 1 re-allocation.

- Step 10 included the re-allocation of an assumed 400 trips from NC 210 to Godfrey Creek Road with the trips destined to the south along the Hampstead Bypass. The proposed developments between NC 210 and Hoover Road will be required to construct the collector street network included in the *Pender County Collector Street Plan* providing interconnectivity between NC 210 and Hoover Road. This step assumes that some of the development traffic destined to the south that is located closer to Hoover Road will divert its path to the Hoover Road on-ramps.

- Step 11 included the minor redistribution of link volumes and directional turning movement volumes to allow for all link flows to be in increments of 100 vehicles.

- Step 12 included a final review of the volumes for balancing and checked that the total volume for all external links matched the 2040 No-Build total volume.

Following the development of the traffic forecast for the R-3300B study area, the I-140/Military Cutoff Road Extension/Hampstead Bypass interchange was developed utilizing model diversion rates between the No-Build and Build scenarios.

A review of the design factors for the 2040 Build Scenario 2 included an evaluation of the factors for all of the existing roadways and concluded with the selected values being the same as those selected for the 2040 No-Build scenario discussed in Section 5.6. The Build Scenario 2 traffic forecast included the addition of the same roadways as Build Scenario 1 and resulted in the same design factors as Scenario 1. The addition of the on-ramps from Hoover Road split the Hoover Road link between Godfrey Creek Road and South Topsail Elementary School, with the Scenario 2 design factors maintaining the same factors as the link that was split. For each of these facilities, the design factors are shown in Table 6-2. Additionally, the Directional Distribution for I-140 was reduced from 65 percent to 60 percent. The WMPO TDM showed the percentage being reduced once the Hampstead Bypass and Military Cutoff Road Extension were completed and the validation score was greater than 2 if the 65 percent factor was maintained. With the revised factors the validation score is below 1.0.

Table 6-2: 2040 FY B Scenario 2 Design Factors

Forecast Location	Selected 2040 FY B K Value [1]	Selected 2040 FY B D Value [1]	Selected 2040 FY B Truck Percentage
Hampstead Bypass - I-140 to NC 210	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Hampstead Bypass - NC 210 to Hoover Road	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Hampstead Bypass - Hoover Road to Midtown Interchange	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Hampstead Bypass - Midtown Interchange to US 17	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Hoover Rd (SR 1569) - Godfrey Creek Rd to Hampstead Bypass	9 / 7 / 8	65 EB/55WB/60WB	5 , 1
Midtown Connector - Hampstead Bypass to US 17	8 / 6 / 8	60 EB/60 WB/60 WB	4 , 2

(1) AM Peak Hour / PM School Peak Hour / PM Commuter Peak Hour

A summary of the key observations from the development of the 2040 Build Scenario 2 volumes are as follows:

- The volumes for the Hampstead Bypass range from 51,000 to 55,400 vehicles per day
- The volumes along US 17 range from 12,100 to 23,200 vehicles per day for the portion between Washington Acres Road and the US 17/Hampstead Bypass and from 56,600 to 61,400 vehicles per day north of the Hampstead Bypass
- The volumes along NC 210 range from 6,600 to 11,400 vehicles per day
- The volumes along Hoover Road range from 6,700 to 11,400 vehicles per day
- The volume along the Midtown Connector between US 17 and the Hampstead Bypass is 11,800 vehicles per day

6.3.3 2040 Build Scenario 3

The development of the 2040 Build Scenario 3 forecast started with the 2040 No-Build forecast and followed a very similar set of steps as the development of the Build Scenario 1 forecast with seven steps that are detailed in Appendix D3.

- Step 1 began with the 2040 No-Build forecast volumes and redistributed movements to the US 17/Hampstead Bypass interchange. Due to the location of the interchange, it affected volumes (with a decreasing rate the further south you travel) as far south as the US 17 intersection with Jenkins Road/Country Club Road. Traffic that was turning left to travel south on US 17 was re-routed to the north and became the volume accessing the Hampstead Bypass from the south.
- Step 2 continued the process of re-allocating the trips to the proposed NC 210/Hampstead Bypass interchange, which is located 2 ½ miles northwest of US 17. A portion of the trips from as far north as the US 17 intersection with Jenkins Road/Country Club road were diverted to the NC 210 interchange. Due to the distance from US 17 the proportion of trips was lower as the only destinations that would provide a travel time savings would be those in northern New Hanover/southern Pender County.
- Step 3 utilized the diversion rate from the WMPO TDM to determine the distribution of traffic from the north onto US 17 and the Hampstead Bypass. The model volumes showed that 71.4 percent of traffic utilized the Hampstead Bypass.
- Step 4 again utilized data from the WMPO TDM to determine the effect on longer distance trips along NC 210 and Island Creek Road. The model showed a reduction in trips (compared with the no-build scenario) of about

23 percent on Island Creek Road, while the volumes on NC 210 showed a slight increase of about six percent. Based on a review of the data the 2040 Build volumes for the NC 210/Island Creek Road/Royal Oak Drive intersection were selected and the turning movements re-balanced.

- Step 5 included the determination of the turning volumes at the NC 210/Hampstead Bypass interchange and then rebalancing the eastern and southern link volumes. The volume in the northwest quadrant (EB→NB, SB→WB) was developed by comparing the model volumes for the ramps and the volume drop through the interchange. Model volumes for this movement showed roughly 7,000 trips which was increased proportionally based on comparing model volume to link AADT, resulting with 7,200 trips. The volume in the northeast quadrant (WB→NB, SB→EB) is largely redundant as any longer distance travel would have a shorter route elsewhere; therefore, it would only serve localized development along NC 210 and an assumed volume of 1000 was selected. The volume in the southeast quadrant (NB→EB, WB→SB) is made up of the diverted trips from Step 2. The volume in southwest quadrant is similar to those in the northeast quadrant with an assumed volume of 1000 serving local trips; however, to balance the overall network the overall change in traffic on Island Creek/NC 210 from Step 5 was also added to this quadrant. The Step 5 process concluded by re-balancing the trips to the east along NC 210 to the US 17 intersection and the south along the Hampstead Bypass.

- Step 6 included rebalancing the network from the US 17/NC 210/Dan Owen Drive intersection to the southern edge of the network based on the link volumes determined in the previous steps.

- Step 7 included a final review of the volumes for balancing and checked that the total volume for all external links matched the 2040 No-Build total volume.

Following the development of the traffic forecast for the R-3300B study area, the I-140/Military Cutoff Road Extension/Hampstead Bypass interchange was developed utilizing model diversion rates between the No-Build and Build scenarios.

A review of the design factors for the 2040 Build Scenario 3 included an evaluation of the factors for all of the existing roadways and concluded with the selected values being the same as those selected for the 2040 No-Build scenario discussed in Section 5.6. The Build Scenario 3 traffic forecast included the addition of the Hampstead Bypass to the forecast. For this facility, the design factors were selected to match those on the US 17 corridor and are shown in Table 6-3. The only exception to matching the US 17 factors was for the PM School Peak where it is anticipated that the traffic on the Hampstead Bypass will be less than on US 17; therefore, the K value was reduced from 7 percent to 6 percent. Additionally, the Directional Distribution for I-140 was reduced from 65 percent to 60 percent. The WMPO TDM showed the percentage being reduced once the Hampstead Bypass and Military Cutoff Road Extension were completed and the validation score was greater than 2 if the 65 percent factor was maintained. With the revised factors the validation score is below 1.0.

Table 6-3: 2040 FY B Scenario 3 Design Factors

Forecast Location	Selected 2040 FY B K Value [1]	Selected 2040 FY B D Value [1]	Selected 2040 FY B Truck Percentage
Hampstead Bypass - I-140 to NC 210	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Hampstead Bypass - NC 210 to US 17	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2

(1) AM Peak Hour / PM School Peak Hour / PM Commuter Peak Hour

A summary of the key observations from the development of the 2040 Build Scenario 3 volumes are as follows:

- The volumes for the Hampstead Bypass range from 47,000 to 49,600 vehicles per day

- The volumes along US 17 range from 15,500 to 28,200 vehicles per day for the portion between Washington Acres Road and the US 17/Hampstead Bypass and from 56,600 to 61,400 vehicles per day north of the Hampstead Bypass

- The volumes along NC 210 range from 8,100 to 11,900 vehicles per day

- The volumes along Hoover Road range from 6,800 to 15,000 vehicles per day

6.3.4 2040 Build Scenario 4

The development of the 2040 Build Scenario 4 forecast started with the final forecast for Build Scenario 3 and included 12 steps that are detailed in Appendix D4. Build Scenario 4 includes the addition of on-ramps from Hoover Road to the Hampstead Bypass and is very similar from a forecast development standpoint.

- Steps 1 and 2 – These steps re-allocated from Hoover Road, west of Godfrey Creek Road to the new on-ramps. It was assumed that roughly 65 percent of these trips would utilize the Hampstead Bypass. This is a slightly lower percentage than Build Scenario 2 as this scenario does not include the Midtown interchange which would provide additional destinations to northbound traffic. This resulted in 1500 trips re-allocated to the south and 600 trips re-allocated to the north along the Bypass.

- Steps 3 and 4 – these steps were the same as for Steps 1 and 2 but were for the traffic from Godfrey Creek Road and has a similar trend with a reduction in the number of trips due to it not having the Midtown interchange. The result of this step was the addition of 700 trips to the south and 200 trips to the north.

- Steps 5 and 6 – these steps were similar to Steps 1 through 4 but were for trips from South Topsail Elementary School. The result of this step was the addition of 200 trips to the south and 300 trips to the north. The larger percentage of trips to the north assumes that more students at the school are from the north than the south.

- Steps 7, 8 and 9 – these steps include the re-allocation of trips from Forest Sound Road (300 trips), Arrow Wood Road (100 trips) and the Commercial Driveway (200 trips) opposite Hoover Road at the US 17 intersection from the NC 210 interchange (from Build Scenario 1 redistribution) to the Hoover Road on-ramps with all trip destinations to the south as was included in the Build 1 re-allocation.

- Step 10 included the re-allocation of an assumed 400 trips from NC 210 to Godfrey Creek Road with the trips destined to the south along the Hampstead Bypass. The proposed developments between NC 210 and Hoover Road will be required to construct the collector street network included in the *Pender County Collector Street Plan* providing interconnectivity between NC 210 and Hoover Road. This step assumes that some of the development traffic destined to the south that is located closer to Hoover Road will divert its path the Hoover Road on-ramps.

- Step 11 included the minor redistribution of link volumes and directional turning movement volumes to allow for all link flows to be in increments of 100 vehicles.

- Step 12 included a final review of the volumes for balancing and checked that the total volume for all external links matched the 2040 No-Build total volume.

Following the development of the traffic forecast for the R-3300B study area, the I-140/Military Cutoff Road Extension/Hampstead Bypass interchange was developed utilizing model diversion rates between the No-Build and Build scenarios.

A review of the design factors for the 2040 Build Scenario 4 included an evaluation of the factors for all of the existing roadways and concluded with the selected values being the same as those selected for the 2040 No-Build scenario discussed in Section 5.6. The Build Scenario 4 traffic forecast included the addition of the same roadways as Build Scenario 2 and resulted in the same design factors as Scenario 2. The addition of the on-ramps from Hoover Road split the Hoover Road link between Godfrey Creek Road and South Topsail Elementary School, with the Scenario 4 design factors maintaining the same factors as the link that was split. For each of these facilities, the design factors are shown in Table 6-4. Additionally, the Directional Distribution for I-140 was reduced from 65 percent to 60 percent. The WMPO TDM showed the percentage being reduced once the Hampstead Bypass and Military Cutoff Road Extension were completed and the validation score was greater than 2 if the 65 percent factor was maintained. With the revised factors the validation score is below 1.0.

Table 6-4: 2040 FY B Scenario 4 Design Factors

Forecast Location	Selected 2040 FY B K Value [1]	Selected 2040 FY B D Value [1]	Selected 2040 FY B Truck Percentage
Hampstead Bypass - I-140 to NC 210	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Hampstead Bypass - NC 210 to Hoover Road	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Hampstead Bypass - Hoover Road to US 17	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Hoover Rd (SR 1569) - Godfrey Creek Rd to Hampstead Bypass	9 / 7 / 8	65 EB/55WB/60WB	5 , 1

(1) AM Peak Hour / PM School Peak Hour / PM Commuter Peak Hour

A summary of the key observations from the development of the 2040 Build Scenario 4 volumes are as follows:

- The volumes for the Hampstead Bypass range from 49,500 to 53,000 vehicles per day
- The volumes along US 17 range from 14,300 to 25,200 vehicles per day for the portion between Washington Acres Road and the US 17/Hampstead Bypass and from 56,600 to 61,400 vehicles per day north of the Hampstead Bypass
- The volumes along NC 210 range from 7,500 to 11,400 vehicles per day
- The volumes along Hoover Road range from 6,800 to 12,000 vehicles per day

6.3.5 2040 Build Scenario 5

The development of the 2040 Build Scenario 5 forecast started with the final forecast for Build Scenario 2 and included 12 steps that are detailed in Appendix D5. Build Scenario 5 includes the addition of a service road from the Midtown interchange to Hoover Road. This build scenario effectively provides the additional movements that were not included previously due to there not being off-ramps to Hoover Road. Therefore, the design allows for the reverse movement of the trips from Hoover Road, Godfrey Creek Road and South Topsail Elementary School that were not re-allocated in Build Scenario 2 to be allocated due to the change in design. The reverse trips to Forest Sound Road, Arrow Wood Road and the Commercial Driveway were not re-allocated to the proposed service road as the distance to complete these trips would still be less than utilizing the US 17 route due to the circuitous nature of the service road configuration.

- Steps 1 and 2 – These steps re-allocated trips to Hoover Road, west of Godfrey Creek Road from the new service road. It was assumed that roughly 75 percent of these trips would utilize the Hampstead Bypass with the distribution to the north and south matching the turning percentages at the US 17/Hoover Road intersection. This resulted in 1500 trips re-allocated from the south and 1000 trips re-allocated from the north along the Bypass. Of the 1000 trips from the north, it was assumed that 600 would travel on the Bypass from the north while 400 would utilize the Midtown Connector from the north on US 17.

- Steps 3 and 4 – these steps were the same as for Steps 1 and 2 but were for the traffic to Godfrey Creek Road. The result of this step was the addition of 700 trips from the south and 400 trips (split 200 from the Bypass and 200 from US 17 via the Midtown Connector) from the north.

- Steps 5 and 6 – these steps were similar to Steps 1 through 4 but were for trips to South Topsail Elementary School. The result of this step was the addition of 200 trips from the south and 400 trips from the north (again split 200 from the Bypass and 200 from US 17 via the Midtown Connector).

- Step 7 included the re-allocation of an assumed 400 trips from NC 210 to Godfrey Creek Road with the trips destined from the south along the Hampstead Bypass. The proposed developments between NC 210 and Hoover Road will be required to construct the collector street network included in the *Pender County Collector Street Plan* providing interconnectivity between NC 210 and Hoover Road. This step assumes that some of the development traffic destined from the south that is located closer to Hoover Road will divert its path to the new service road.

- Steps 8 and 9 – these steps re-allocated an assumed 800 daily trips from Hoover Road, west of Godfrey Creek Road to the north end of the new service road based on the assumption that some of the developments between Hoover Road and the Holly Shelter Game Land would have access to the new service road. The assumed number was based on data provided that said that this area would have the lowest development potential of the four TAZs in the study area due to the limited access (no direct connection to US 17 due to Game Lands) and environmental constraints.

- Step 10 included the re-allocation of 200 trips between Hoover Road and Topsail Middle School via the Bypass instead of US 17. This re-allocation allowed for the northbound service road to include at least a nominal volume for analysis and design, but also allowed the volumes along a majority of US 17 to be equal in both directions.

- Step 11 included the minor redistribution of link volumes and directional turning movement volumes to allow for all link flows to be in increments of 100 vehicles. One set of turning movements at the US 17/Topsail Middle School intersection included movements in increments of 50; however, this was the only means to achieve the balanced volumes along US 17 and would not cause any effect on the design or analysis of the project.

- Step 12 included a final review of the volumes for balancing and checked that the total volume for all external links matched the 2040 No-Build total volume.

Following the development of the traffic forecast for the R-3300B study area, the I-140/Military Cutoff Road Extension/Hampstead Bypass interchange was developed utilizing model diversion rates between the No-Build and Build scenarios.

A review of the design factors for the 2040 Build Scenario 5 included an evaluation of the factors for all of the existing roadways and concluded with the selected values being the same as those selected for the 2040 No-Build scenario discussed in Section 5.6. The Build Scenario 5 traffic forecast included the addition of a new service road that predominantly served traffic to and from the Hampstead Bypass. Therefore, the design factors were selected to match those on the Hampstead Bypass. For each of these facilities, the design factors are shown in Table 6-5. Additionally, the Directional Distribution for I-140 was reduced from 65 percent to 60 percent. The WMPO TDM showed the percentage being reduced once the Hampstead Bypass and Military Cutoff Road Extension were completed and the validation score was greater than 2 if the 65 percent factor was maintained. With the revised factors the validation score is below 1.0.

Table 6-5: 2040 FY B Scenario 5 Design Factors

Forecast Location	Selected 2040 FY B K Value [1]	Selected 2040 FY B D Value [1]	Selected 2040 FY B Truck Percentage
Hampstead Bypass - I-140 to NC 210	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Hampstead Bypass - NC 210 to Hoover Road	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Hampstead Bypass - Hoover Road to Midtown Interchange	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Hampstead Bypass - Midtown Interchange to US 17	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Midtown Connector - Service Road to Hampstead Bypass	8 / 6 / 8	60 EB/60 WB/60 WB	4 , 2
Midtown Connector - Hampstead Bypass to US 17	8 / 6 / 8	60 EB/60 WB/60 WB	4 , 2
Service Road - Hoover Road to Midtown Connector	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Service Road - North of Midtown Connector	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Hoover Rd (SR 1569) - Godfrey Creek Rd to Hampstead Bypass	9 / 7 / 8	65 EB/55WB/60WB	5 , 1

(1) AM Peak Hour / PM School Peak Hour / PM Commuter Peak Hour

A summary of the key observations from the development of the 2040 Build Scenario 5 volumes are as follows:

- The volumes for the Hampstead Bypass range from 53,400 to 58,500 vehicles per day
- The volumes along US 17 range from 10,700 to 21,800 vehicles per day for the portion between Washington Acres Road and the US 17/Hampstead Bypass and from 56,600 to 61,400 vehicles per day north of the Hampstead Bypass
- The volumes along NC 210 range from 6,600 to 11,100 vehicles per day
- The volumes along Hoover Road range from 2,000 to 8,900 vehicles per day
- The volume along the Midtown Connector between US 17 and the Hampstead Bypass is 12,600 vehicles per day

6.3.6 2040 Build Scenario 6

The development of the 2040 Build Scenario 6 forecast started with the final forecast for Build Scenario 5 and included 5 steps that are detailed in Appendix D6. Build Scenario 5 includes the addition of the service road from the Midtown interchange to Hoover Road; however, it does not include the Hoover Road on-ramps. This build scenario effectively re-allocates the volumes that were accessing the on-ramps at Hoover Road and reallocating them along the service road to the Midtown interchange. The model volumes for Scenario 6 were not re-run in the WMPO TDM as the configuration was essentially the same from a modeling perspective as Scenario 5.

- Steps 1 through 4 included re-allocating each of the turn movements from the on-ramps in Build Scenario 5 to the service road and onto the Hampstead Bypass at the Midtown interchange.
- Step 5 included a final review of the volumes for balancing and checked that the total volume for all external links matched the 2040 No-Build total volume.

Following the development of the traffic forecast for the R-3300B study area, the I-140/Military Cutoff Road Extension/Hampstead Bypass interchange was developed utilizing model diversion rates between the No-Build and Build scenarios.

A review of the design factors for the 2040 Build Scenario 6 included an evaluation of the factors for all of the existing roadways and concluded with the selected values being the same as those selected for the 2040 No-Build scenario discussed in Section 5.6. The Build Scenario 6 traffic forecast included the addition of a new service road that predominantly served traffic to and from the Hampstead Bypass. Therefore, the design factors were selected to match those on the Hampstead Bypass. For each of these facilities, the design factors are shown in Table 6-6. Additionally, the Directional Distribution for I-140 was reduced from 65 percent to 60 percent. The WMPO TDM showed the percentage being reduced once the Hampstead Bypass and Military Cutoff Road Extension were completed and the validation score was greater than 2 if the 65 percent factor was maintained. With the revised factors the validation score is below 1.0.

Table 6-6: 2040 FY B Scenario 6 Design Factors

Forecast Location	Selected 2040 FY B K Value [1]	Selected 2040 FY B D Value [1]	Selected 2040 FY B Truck Percentage
Hampstead Bypass - I-140 to NC 210	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Hampstead Bypass - NC 210 to Midtown Interchange	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Hampstead Bypass - Midtown Interchange to US 17	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Midtown Connector - Service Road to Hampstead Bypass	8 / 6 / 8	60 EB/60 WB/60 WB	4 , 2
Midtown Connector - Hampstead Bypass to US 17	8 / 6 / 8	60 EB/60 WB/60 WB	4 , 2
Service Road - Hoover Road to Midtown Connector	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Service Road - North of Midtown Connector	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2

(1) AM Peak Hour / PM School Peak Hour / PM Commuter Peak Hour

A summary of the key observations from the development of the 2040 Build Scenario 5 volumes are as follows:

- The volumes for the Hampstead Bypass range from 53,400 to 58,500 vehicles per day
- The volumes along US 17 range from 10,700 to 21,800 vehicles per day for the portion between Washington Acres Road and the US 17/Hampstead Bypass and from 56,600 to 61,400 vehicles per day north of the Hampstead Bypass
- The volumes along NC 210 range from 6,600 to 11,100 vehicles per day
- The volumes along Hoover Road range from 2,000 to 8,900 vehicles per day
- The volume along the Midtown Connector between US 17 and the Hampstead Bypass is 12,600 vehicles per day

6.3.7 2040 Build Scenario 7

The development of the 2040 Build Scenario 7 forecast started with the 2040 No-Build forecast and followed a very similar set of steps as the development of the Build Scenario 1 and Scenario 3 forecasts with nine steps that are detailed in Appendix D7.

- Step 1 began with the 2040 No-Build forecast volumes and redistributed movements to the US 17/Hampstead Bypass interchange. Due to the location of the interchange, it affected volumes (with a decreasing rate the further south you travel) as far south as the US 17 intersection with Jenkins Road/Country Club Road. Traffic that was turning left to travel south on US 17 was re-routed to the north and became the volume accessing the Hampstead Bypass from the south.

- Step 2 continued the process of re-allocating the trips to the proposed Hoover Road/Hampstead Bypass Interchange for traffic to/from the US 17 corridor. Due to the 1.1 mile distance from US 17 and the northwestward orientation of the roadway, the interchange only had a limited effect on traffic to and from US 17 as the number of trips that would have a lesser travel time was relatively limited.

- Step 3 continued the process of re-allocating the trips to the proposed NC 210/Hampstead Bypass interchange, which is located 2 ½ miles northwest of US 17. A portion of the trips from the intersections immediately north and south of NC 210 were diverted to the NC 210 interchange. Due to the distance from US 17 the proportion of trips was lower as the only destinations that would provide a travel time savings would be those in northern New Hanover/southern Pender County.

- Step 4 utilized the diversion rate from the WMPO TDM to determine the distribution of traffic from the north onto US 17 and the Hampstead Bypass. The diversion rate was reduced slightly due to the fact that it already included diverted trips for the Hoover Road interchange that were being accounted for in other steps. The model volumes showed that 70.9 percent of traffic utilized the Hampstead Bypass.

- Step 5 re-allocated the trips along Hoover Road, Godfrey Creek Road and South Topsail Elementary School to the Bypass based on engineering judgment and the turning percentages for traffic at the US 17/Hoover Road intersection.

- Step 6 again utilized data from the WMPO TDM to determine the effect on longer distance trips along NC 210 and Island Creek Road. The model showed a reduction in trips (compared with the no-build scenario) of about 23 percent on Island Creek Road, while the volumes on NC 210 showed a slight increase of about six percent. Based on a review of the data the 2040 Build volumes for the NC 210/Island Creek Road/Royal Oak Drive intersection were selected and the turning movements re-balanced.

- Step 7 included the determination of the turning volumes at the NC 210/Hampstead Bypass interchange and then rebalancing the eastern and southern link volumes. The volume in the northwest quadrant (EB→NB, SB→WB) was developed by comparing the model volumes for the ramps and the volume drop through the interchange. Model volumes for this movement showed roughly 7,000 trips which was increased proportionally based on comparing model volume to link AADT, resulting with 7,200 trips. The volume in the northeast quadrant (WB→NB, SB→EB) is largely redundant as any longer distance travel would have a shorter route elsewhere; therefore, it would only serve localized development along NC 210 and an assumed volume of 1000 was selected. The volume in the southeast quadrant (NB→EB, WB→SB) is made up of the diverted trips from Step 2. The volume in southwest quadrant is similar to those in the northeast quadrant with an assumed volume of 1000 serving local trips; however, to balance the overall network the overall change in traffic on Island Creek/NC 210 from Step 5 was also added to this quadrant. The Step 5 process concluded by re-balancing the trips to the east along NC 210 to the US 17 intersection and the south along the Hampstead Bypass.

- Step 8 included rebalancing the network from the US 17/NC 210/Dan Owen Drive intersection to the southern edge of the network based on the link volumes determined in the previous steps.

- Step 9 included a final review of the volumes for balancing and checked that the total volume for all external links matched the 2040 No-Build total volume.

Following the development of the traffic forecast for the R-3300B study area, the I-140/Military Cutoff Road Extension/Hampstead Bypass interchange was developed utilizing model diversion rates between the No-Build and Build scenarios.

A review of the design factors for the 2040 Build Scenario 7 included an evaluation of the factors for all of the existing roadways and concluded with the selected values being the same as those selected for the 2040 No-Build scenario discussed in Section 5.6. The Build Scenario 6 traffic forecast included the addition of the Hampstead Bypass to the forecast. For this facility, the design factors were selected to match those on the US 17 corridor and are shown in Table 6-3. The only exception to matching the US 17 factors was for the PM School Peak where it is anticipated that the traffic on the Hampstead Bypass will be less than on US 17; therefore, the K value was reduced from 7 percent to 6 percent. Additionally, the Directional Distribution for I-140 was reduced from 65 percent to 60 percent. The WMPO TDM showed the percentage being reduced once the Hampstead Bypass and Military Cutoff Road Extension were completed and the validation score was greater than 2 if the 65 percent factor was maintained. With the revised factors the validation score is below 1.0.

Table 6-7: 2040 FY B Scenario 7 Design Factors

Forecast Location	Selected 2040 FY B K Value [1]	Selected 2040 FY B D Value [1]	Selected 2040 FY B Truck Percentage
Hampstead Bypass - I-140 to NC 210	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Hampstead Bypass - NC 210 to Hoover Road	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2
Hampstead Bypass – Hoover Road to US 17	8 / 6 / 8	60 SB/60 NB/60 NB	4 , 2

(1) AM Peak Hour / PM School Peak Hour / PM Commuter Peak Hour

A summary of the key observations from the development of the 2040 Build Scenario 7 volumes are as follows:

- The volumes for the Hampstead Bypass range from 49,200 to 54,800 vehicles per day
- The volumes along US 17 range from 14,800 to 25,700 vehicles per day for the portion between Washington Acres Road and the US 17/Hampstead Bypass and from 56,600 to 61,400 vehicles per day north of the Hampstead Bypass
- The volumes along NC 210 range from 5,100 to 11,900 vehicles per day
- The volumes along Hoover Road range from 5,400 to 9,900 vehicles per day

APPENDIX A:

HISTORIC AADT COUNT DATA

Table A1: NCDOT Historic AADT

Location	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005
US 17 - south of NC 210/Dan Owen Dr	33,000		33,000	31,000	32,000	31,000	28,000	28,000		27,000	25,000
US 17 - NC 210/Dan Owen Dr to SR 1570 (Peanut Rd/Factory Rd)	36,000	38,000	38,000		35,000	36,000	33,000	33,000	35,000	33,000	
US 17 - north of Forest Sound Rd	36,000		37,000	41,000	34,000		31,000	31,000	36,000	32,000	28,000
US 17 - south of Jenkins Rd/Country Club Rd	35,000	37,000	37,000	34,000	34,000	34,000	29,000		34,000	32,000	30,000
I-140 - I-40 to US 17	20,000	19,000	16,000	14,000	14,000	15,000	13,000	14,000	14,000	12,000	
Washington Acres Rd (SR 1582) - east of US 17				1,900		1,800		1,700		1,700	
NC 210 - west of US 17	7,600	7,800	7,900	7,100	7,000	7,300	7,100	6,500	8,400		7,300
Factory Rd (SR 1570) - east of US 17	2,100		2,000		1,700		1,300		1,500		1,600
Country Club Rd - east of US 17		7,200		7,100		7,300		6,500		7,300	
Long Leaf Dr - east of US 17			750		680		690		830		720
Sloop Point Loop Rd (SR 1563) - east of US 17	6,000		5,700		5,000		4,900		5,400		4,400
Island Creek Rd (SR 1002) - west of NC 210				2,500		2,500		2,600		4,500	
NC 210 - east of NC 210/Island Creek Rd (SR 1002)	6,500		6,800	5,900	5,600	5,400	6,000	5,300	7,200		
NC 210 - north of Royal Oak Dr	4,400		4,400	3,400	4,300	3,100	3,500	3,000	3,900	3,700	3,500
Hoover Rd (SR 1569) - south of South Topsail Elementary School	3,800		3,700		3,500		3,900				

Location	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
US 17 - south of NC 210/Dan Owen Dr	26,000	23,000	22,000		20,000	20,000	19,000	19,000		19,000
US 17 - NC 210/Dan Owen Dr to SR 1570 (Peanut Rd/Factory Rd)	30,000	28,000	28,000		24,000	25,000	23,000			19,000
US 17 - north of Forest Sound Rd	29,000	25,000	26,000							
US 17 - south of Jenkins Rd/Country Club Rd	28,000	25,000	24,000	22,000	24,000	22,000	22,000	24,000		17,000
I-140 - I-40 to US 17										
Washington Acres Rd (SR 1582) - east of US 17			1,100	1,100		900		920		950
NC 210 - west of US 17	7,800	6,700	6,300		5,100	6,200	5,800	5,700		4,800
Factory Rd (SR 1570) - east of US 17		1,500		1,700		1,500		2,000		1,700
Country Club Rd - east of US 17	6,300		5,600	5,100		5,200		5,000		3,400
Long Leaf Dr - east of US 17		710		690		550		800		650
Sloop Point Loop Rd (SR 1563) - east of US 17		3,500								
Island Creek Rd (SR 1002) - west of NC 210	3,200		1,200							
NC 210 - east of NC 210/Island Creek Rd (SR 1002)	6,700	5,700	5,400	4,600	4,300	5,100	4,800	4,700	4,100	3,500
NC 210 - north of Royal Oak Dr	3,800	2,800	2,900							
Hoover Rd (SR 1569) - south of South Topsail Elementary School				1,600		1,300		1,000		1,100

APPENDIX B:

LOCAL REPRESENTATIVE COORDINATION

Meeting Notes

R-3300 Forecast Overview Meeting

Hampstead Bypass and US 17 Median Projects

Date/Time:	December 15, 2016 / 10:30 AM
Place:	Division 3 Conference Room
Next Meeting:	Early January, TBD
Attendees:	See Attached
Absentees:	None
Distribution:	Attendee List

Item: **Action:**

Forecast Background and Overview No Action Required

Mr. Peter Trencansky provided an overview of the forecasting process for the Hampstead Bypass and US 17 Median projects. The forecast includes 15 intersections along US 17, 1 on NC 210 and 2 on Hoover Road. The traffic forecast will be developed for the 2016 Base Year (existing conditions), the 2040 Future Year No-Build and the 2040 Future Year Build scenario for nine (9) alternatives. The counts were delayed due to the Hurricane Matthew evacuation in early October and were collected at the end of October/beginning of November.

Mr. Mike Kozlosky asked if the forecast would include the seasonal variations in traffic and it was noted that the this will be a normalized traffic volume forecast that represented the average traffic throughout the year.

Item: **Action:**

Historic Data Review No Action Required

Mr. Trencansky also provided a summary of source material that would be utilized in the development of the forecast, including but not limited to: population data for Pender County from the US Census Bureau and the NC Office of State Budget and Management (NC OSBM). Pender county had grown at a 3.6% Compound Annual Growth Rate (CAGR) from 1990-2000. From 2000-2010 it grew by a similar number of people; however, due to the higher starting population the growth rate was a 2.4% CAGR. Similarly, the NC OSBM population data showed the same 2.4% CAGR between 1996 and 2016.

The growth rate along US 17 was strong with a 1.9% CAGR for the past 10-years and a 3.3% CAGR for the past 20-years. NC 210 also maintained a relatively strong growth rate with a 0.2% CAGR over the past 10 years (which included the economic downturn) and a 2.2% CAGR over the past 20 years.

Item:	**Action:**
Future Projections	No Action Required

Mr. Trencansky also discussed the future socioeconomic projections for the area noting that the NC OSBM was projecting a population growth rate of 1.7% CAGR for Pender County, while the Wilmington MPO travel demand model included 1.8% (population) / 2.0% (employment) for the portion of Pender County within the model; however, Coastal Pender County (area east of the Northeast Cape Fear River) had a growth rate of 1.4% (population) and 1.0% (employment).

Mr. Trencansky also presented model growth rates from several sources that include portions of the model study area. The primary model for the area is the Wilmington MPO travel demand model which showed a 1.5% CAGR on US 17 between Sloop Point Road and Sloop Point Loop Road. This same section of roadway is also included in the Jacksonville MPO travel demand model and has a 2.6% CAGR. Additionally, US 17 is included in the North Carolina Statewide Travel Model (NCSTM) with a 0.3% CAGR. The growth rate for the NCSTM was discussed and there are concerns about the socioeconomic data for Onslow County; therefore, the NCSTM will not play a substantial role in determining future year volumes for the subject project.

Responding to a comment regarding how much growth in Pender County for the MTP and the Model was "allowed," WMPO pointed out that the WMPO Model had to us the socio-economic control totals from the NCSTM. WMPO then expressed some concern about their growth projections given the misgivings (discussed above) regarding Onslow County. Mr. Trencansky said that there have historically been strong growth rates in the area and that this may be an area where we can choose larger growth rates than what the State is showing.

When asked about sustained growth in Pender County, Mr. Kyle Breuer noted that it would most likely depend on the implementation of the planned Bypass and possibly any policy changes by local officials.

Mr. Trencansky asked if attendees felt that the future growth was likely to be closer to the roughly 3% experienced over the past 20 years or the roughly 1.5% projected over the next 20-years. All attendees agreed it was likely to be somewhere between the two growth rates, likely in the mid 2% range.

Item:	Action:
Local Plans	No Action Required

Mr. Trencansky next discussed the local plans including the Pender Street Collector Street Plan (2016), the Pender County Comprehensive Land Use Plan (2010) and the Pender County Water/Wastewater Master Plan.

Mr. Breuer noted that they planned to implement the collector street plan as closely as possible as the parcels within the study are developed.

It was noted that due to the game lands that none of the future development along Hoover Road would have direct access to US 17 north of where the Bypass ties to US 17, nor could any collector streets be constructed that would connect Hoover Road to US 17. Mr. Breuer also confirmed that the Land Use Intensity included in the Collector Street Plan was accurate. He also noted that the area where the Spot Festival is held may develop into a higher density mixed use development.

Mr. Breuer also noted that the Comprehensive Land Use Plan is currently being updated and are subject to change but that the overall intensity of development in the new plan would be similar to the 2010 plan; however, it was likely that there would be additional stratification of the development types with higher levels of development along the future Bypass interchanges and major intersections along US 17. Mr. Breuer also noted that the intensity of development along Hoover Road may change if direct access to the Bypass is included.

Mr. Trencansky asked about the current status of the water/wastewater facilities in the area and Mr. Breuer noted that the plan was being implemented with lines in the ground and they were seeing slightly higher intensity development, or at least higher utilization of the area now that localized wastewater treatment wasn't required. Mr. Breuer expects the current trend toward slightly higher intensity land uses to continue into the future due to the additional water/wastewater facilities. Mr. Trencansky also asked if the growth estimates for the area had taken into account the water/wastewater plan. Mr. Breuer answered that the growth estimates were made in conjunction with WMPO and all were aware of the water/wastewater plan at the time.

Item:	Action:
Local Development Plans	Mr. Trencansky and Ms. Crowe to coordinate on local development plans.
Mr. Trencansky presented a map of the study area that include data on local development from the Pender County website. Ms. Megan Crowe noted that several of the names may have changed and that locations depicted on the maps may not be completely accurate. Mr. Trencansky and Ms. Crowe will coordinate on the location and development type of the known developments in the area. Mr. Trencansky pointed out that	Mr. Trencansky to coordinate with Surf

it's most important to get outlier projects – something that was unexpectedly large or counter to the type/location of growth assumed in the Model.

City on local development plans.

Mr. Trencansky noted that based on the limited research on the local developments that the only one that looked to be under represented in the future year socioeconomic data was for Blake Farm which included 3000 residential units and 250,000 sq. ft. of commercial development. Responding to a direct question from Mr. Trencansky about the likelihood of the full Blake Farm project being completed, Mr. Breuer confirmed that something like the Blake Farm development will come to fruition by 2040.

Other potential developments that were discussed as definite possibilities include: residential development between Hoover Road and NC 210; potentially re-developing the Fishhouse location for retail use; and the potential for general in-fill development in Hampstead at the US 17 & NC 210 intersection area.

The development further north in Surf City and Topsail Island was also discussed and Mr. Breuer recommended we have additional coordination with Surf City officials as they have some relatively high density developments planned on the mainland adjacent to Topsail Island.

While there is a presence of military traffic on US 17, there is no known plans to substantially change the routes used by the military that would affect US 17.

Item **Action:**

Wilmington Travel Demand Model No Action Required

Mr. Trencansky noted that the study area for the traffic forecast was on the northern extent of the Wilmington travel demand model. Therefore, there was limited alternative routes for traffic to take. Because US 17 is an external station (edge) of the network, the volumes entering and exiting the network are fixed and therefore will not change substantially as a result of changes in the transportation network. Mr. Trencansky noted that the forecast might use different overall traffic growth (based on engineering judgment) with and without the Bypass completed even though the Model, as discussed above, will not show a significant difference.

Mr. Trencansky also noted that the model had four large Traffic Analysis Zones (TAZs) that encompassed the study area. Due to large TAZs and limited connections (only 4 y-lines are in the model) much of the allocation of traffic to individual roadways would be done manually based on engineering judgment.

Mr. Trencansky also noted that the limited number of roadways included in the model within the study area would make it more difficult to utilize the model to allocate local trips within the study area. Again, manual allocation based on engineering judgment will be required to allocate the local trips within the forecast network. The travel demand model should be able to provide a good breakdown of the major through movements (US 17 to US 17 and US 17 to the Bypass) that can be used as a basis for determining the distribution of trips utilizing the Bypass.

There was a discussion on whether or not the configuration of interchanges would affect the volumes on the Bypass. Ms. Katie Hite stated that she did not think the configurations of the interchange would affect the volumes as they were based mostly on the destinations. The group agreed with this statement and it was determined that the forecast would not differentiate between the interchange types and the only variations would be due to changes in access from different interchange scenarios (with and without Midtown interchange, with and without entrance ramps from Hoover Road, etc.).

Ms. Hite also noted that the current naming convention for the roadways was that the US 17 designation would be maintained along the existing route and that the Bypass would have a different designation.

Item: **Action:**

Draft Design Data Factors

Mr. Trencansky to review truck percentage for Grandview Drive

Mr. Trencansky noted that based on the traffic counts collected in October/November that the draft factors that are used to convert the daily volumes to peak hour volumes had been developed. Mr. Trencansky noted that the PM peak direction was shown to be northbound; however, there was also a slightly lower peak period during the mid-afternoon (during the time school dismisses) that showed a slight southbound peak. The group agreed with these conclusions. Pender County also supposed that military personnel who live in the area (and get off from work earlier) might influence a heavier-than-expected southbound volume in the PM period.

Mr. Trencansky noted that the design hourly volume (percent of daily traffic in the peak hour) ranged from 8 to 9 percent along US 17 with the y-lines ranging from 7 to 10 percent. These factors are lower than the 12% factor for US 17 and the 12-14% factors for y-lines in the previous forecast.

Mr. Trencansky also presented the truck percentages for US 17 (4% dual and 2% tractor trailer), NC 210 (5% dual/2% tractor trailer) and Hoover Road (10% dual/1% tractor trailer). It was noted that a mining operation was active at the far end of Hoover road which may be causing the higher truck percentages. Mr. Trencansky also noted that the traffic count for Grandview Drive showed almost 30% trucks and nobody in attendance was aware of any reason for such a high percentage;

therefore, the count will be reviewed more closely to determine why the percentage is so high.

Item:	Action:
Additional Coordination Mr. Trencansky and Mr. Breuer discussed plans to have a meeting in early January 2017 to update planned developments in the study area. This meeting should include representatives of Surf City. NCDOT and Wilmington MPO should also be invited.	Schedule and hold coordination meeting in January 2017

Item:	Action:
Forecast Status Mr. Trencansky noted that the 2016 Existing Forecast would be ready to submit to NCDOT for approval in early January 2017.	Submit Existing Forecast to NCDOT

The meeting adjourned at 12:15 PM
The foregoing is considered to be a true and accurate record of all items discussed. If any discrepancies or inconsistencies are noted, please contact the writer immediately.

Stantec Consulting Services Inc.

Notes by Jeff Weller and Peter Trencansky

Attachment: R-3300 Forecast Overview Meeting Sign-In Sheet

R-3360 Forecast Overview Meeting

NAME	COMPANY	EMAIL
Jeff Weller	STANTEC	JEFF.WELLER@STANTEC.COM
Peter Trencansky	PATRIOT	peter@pt-engineering.net
Mason Herndon	NCDOT	tmherndon@ncdot.gov
Kyle Breuer	Pender Co.	kbreuer@pendercountync.gov
Megan Crowe	Pender County	mcrowe@pendercountync.gov
Lee Klieman	Patriot Transportation	lee@pt-engineering.net
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Ricky Greene	STANTEC	RICKY.GREENE@STANTEC.COM

R-3300 Forecast Coordination Meeting

Hampstead Bypass and US 17 Median Projects

Date/Time:	January 13, 2017 / 1:30 PM
Place:	Division 3 Conference Room
Next Meeting:	TBD
Attendees:	Katie Hite, NCDOT Division 3 Jessi Leonard, NCDOT Division 3 Trace Howell, NCDOT Division 3 Mike Kozlosky, Wilmington MPO Kyle Breuer, Pender County Megan Crowe, Pender County Todd Rademacher, Town of Surf City Ricky Greene, Stantec Peter Trencansky, Patriot Transportation Engineering
Absentees:	None
Distribution:	Attendee List

Item: **Action:**

Forecast Background and Overview of 12/15/2016 Meeting — No Action Required

Mr. Peter Trencansky provided the background information for the forecast and an overview of the conclusions made at the last meeting. In the 12/15 meeting the growth rates along the corridor were discussed and it was determined that the future growth rate (through 2040) would most likely be higher than the 1.5 percent that is shown in the Wilmington Travel Demand Model (WMPO TDM). It was determined that a growth rate of approximately 2.5 percent would be reasonable for the US 17 corridor.

It was further explained that the forecast for this project would not follow the typical process of developing a forecast in an area that has a travel demand model. The primary reason that additional, more in depth evaluation of the traffic volumes is needed is related to the project study area being located at the edge of the model. Due to the project being in relatively rural area at the edge of the model, the level of detail included in the model is very limited. The only roadways included in the model are US 17, NC 210, Island Creek Road, Washington Acres Road and Hoover Road. Additionally, the entire study area for the forecast includes only four traffic analysis zones (TAZs) in the model.

Item: **Action:**

The purpose of the meeting was to discuss additional details with the team to gain a better understanding of the local area so the forecast could be developed.

Review of Growth to the north and south of Hampstead No Action Required

Mr. Trencansky stated that in order to determine the growth rate along US 17 (determined to be approximately 2.5 percent in the 12/15/16 meeting) that will be used in the forecast he needed to get a better idea of the planned growth so he could document the decision.

Mr. Todd Rademacher (Town of Surf City) stated that the growth in Surf City is strong. The new Surf City bridge is under construction, as are a new elementary and middle school. A large shopping center, anchored by a Publix grocery store will be breaking ground soon. Additionally, Magnolia by the Sea, a planned development with 1800-3000 units is now underway with construction on Phase I. On the island, it is anticipated to remain single family and duplex due to the 48-foot height limit, but infill and build out of vacant or under developed properties is expected. The permitting of water and sewer on the mainland is underway along NC 210 and US 17 to Shepard's Point to serve new schools and development. Mr. Rademacher also noted that there were several other pods of development in the area supporting strong growth.

Mr. Kyle Breuer and Megan Crowe (Pender County) discussed the potential growth to the south of Hampstead between New Hanover County and Washington Acres Road. It was noted that sewer was extended through this area last year and that the Blake Farms development (2000 units) has been approved. Mr. Breuer also noted that there is a large tract of land with a single landowner that the plans support development of the property. It was concluded that due to the proximity to Wilmington and I-140 it is likely that this area will have strong growth potential over the next 20 years. Ms. Crowe also noted that there was potential for development along Island Creek Road as well.

Based on the review of growth it was determined that a growth rate of approximately 2.5 percent along US 17 was well supported by the current and anticipated growth in the area.

Review of Travel Patterns No Action Required

Mr. Trencansky next discussed the overall travel patterns in the area of the forecast and how they would be affected by the Hampstead Bypass. The travel demand model showed that 65 to 70 percent of the traffic on US 17 would use the Bypass. Overall, the model, despite its limitations, can be relied upon to provide reasonable estimates of the overall travel patterns within the region and should do a pretty good job of predicting the distribution of traffic using the Bypass versus US 17.

Mr. Trencansky then discussed the local travel patterns that would use the Bypass. Following discussion, it was concluded that nearly all of the traffic with an origin or destination in New Hanover County (or Brunswick County along US 17) would take the Bypass as this would be the fastest route. It was determined that at some location along US 17, for origins or destinations south of Hampstead, that the use of US 17 would become a quicker and more efficient trip. Following the discussion, it was determined that area near Scotts Hill Loop Road would be the dividing line with trips to/from locations to the south utilizing the Bypass and trips to/from the north utilizing US 17. There was also a discussion about whether trips that are destined for origins/destinations along US 17 between Scotts Hill Loop Road and Grandview Road would use the Bypass and get off at the Midtown interchange to continue to the south. The consensus from the group is that few people would use the Bypass to Midtown except possibly when traffic around the schools was letting out. Generally, it was felt that most drivers with local (within Pender County) origins and destinations would continue to use US 17. It was also concluded by the group that nobody would take the Bypass to NC 210 and then come back to US 17 to go south as the interchange is 2.5 miles away from US 17.

Mr. Trencansky next discussed the travel pattern to/from I-40 and points to the west. Mr. Trencansky asked the group if they felt that traffic to/from the Surf City and Topsail Island would use 1) NC 210, 2) Island Creek Road/Holly Shelter Road, or 3) I-40 to I-140 to the Bypass. Mr. Breuer and Mr. Rademacher both stated that it was likely that option 3 may be the most likely as the existing I-40 to I-140 to US 17 route is about the same travel time as the other options and the construction of the Bypass would reduce the travel time for Option 3. Ms. Crowe also noted that future development along Island Creek Road and NC 210 may degrade travel times along those routes in the future. Based on this it was determined that the highest percentage of traffic would use Option 3 with a lesser volume using Option 1 and even fewer using Option 2.

The final item relating to travel patterns was a discussion of the portions of the study area that would be served by each of the potential interchanges along the Bypass. The group agreed that it would vary based on the different alternatives being considered and would depend heavily on the travel times for each potential route.

Item: **Action:**

Localized Growth and Distribution of Future Year Traffic No Action Required

Mr. Trencansky next discussed that due to the limitation of the model having only four TAZs for the entire study area that the process of developing the future year traffic volumes would require an alternative approach. Mr. Trencansky stated that with such large TAZs and only a few of the roadways in the model that the forecast would be developed by growing the existing traffic volumes for all of the side streets and distributing the growth based on likely development patterns. Mr. Trencansky noted that the process for developing traffic forecasts dictates that unless a future roadway is reasonably foreseeable (as defined in the Metropolitan Transportation Plan (MTP) that the future growth would be distributed to the existing roadway connections in the model.

Mr. Trencansky discussed the growth rates for each of the four TAZs within the study area and referenced the attached figure. TAZ ID 202 (dark red) includes the area east of US 17 from Washington Acres Road to Grandview Road and the WMPO TDM includes a growth rate of 0.98%. TAZ ID 203 (blue) includes the area east of US 17 from Grandview Road to Sloop Point Loop Road and the WMPO TDM includes a growth rate of 0.70%. TAZ ID 204 (green) includes the area west of US 17 from Hoover Road to the Holly Shelter Game Land and the WMPO TDM includes a growth rate of 0.91%. TAZ Id 205 (red) includes the area west of US 17 from NC 210 to Hoover Road and the WMPO TDM includes a growth rate of 1.35%. Overall, the four TAZs have a growth rate of 0.88% between 2010 and 2040. The growth rate for the area was discussed with group and it was determined that the model most likely underrepresented the growth in the area. Based on the discussion it was determined that the likely growth rate in the study area would be between 2.0 and 2.5 percent. Mr. Mike Kozlosky asked if the TAZ data in the WMPO TDM would be modified as part of the forecast development process. Mr. Trencansky noted that the utilization of a growth rate that is different that the TDM would be project level decision for the forecast and that the WMPO TDM would not be modified in any way to reflect the decision.

Once it was determined that the future year growth rate would be between 2.0 and 2.5 percent then next step was to review each of the four TAZs to determined how to distribute the additional trips. Maps showing each of the study areas were reviewed by the group and potential future development was discussed for each area with the location and intensity of potential developments being identified. Based on this review of the TAZs Mr. Trencansky asked the group to rank the TAZ in order from highest growth to lowest growth. The consensus of the group was that TAZ ID 203 (blue) would have the highest growth, followed by TAZ ID 202 (dark red). Therefore, the highest growth would be east of US 17 which is consistent with where the current Land Use Plan

Item:	Action:
designates for mixed use development. The third highest growth area was determined to be TAZ ID 205 (red) followed by TAZ 204 (green). Next the distribution of growth within each TAZ was briefly discussed by the group. For TAZ ID 203 (blue) it was determined that the extension of Transfer Station Road to Country Club Road would have the largest increase in traffic with the volumes on Country Club Road and Sloop Point Loop Road increasing as well since they provide access to US 17. The growth for Williams Store Road, Hampstead Town Center, Vista Lane, Leeward Lane and Long Leaf Drive would be lower as these areas are already mostly developed. For TAZ ID 202 (dark red) it was determined that most of the growth would be near the NC 210/Dan Owen Drive intersection. The current plan is for Dan Owen Drive to be extended to Factory Road with the US 17/Factory Road intersection being converted to right-in/right-out. The growth along Washington Acres was the next highest area due to several ongoing and planned developments with lower volumes for Forest Sound Road and Grandview Drive. For TAZ ID 205 (red) the largest increase in traffic would be the area west of the Bypass between NC 210 and Hoover Road, which would be represented by an increase in volume at Godfrey Creek Road which would be the closest existing roadway that could be assigned the growth in traffic. For TAZ Id 204 (green) the highest growth would be at Arrow Wood Road due to the Lea Tract development and to Hoover Road west of Godfrey Creek Road which would be the closest existing roadway to capture the additional growth due to development along Hoover Road and the tract between NC 210 and Hoover Road.	
Additional Coordination Mr. Trencansky noted that additional coordination through phone calls to members of the group may be needed during the development of the forecast and he may be reaching out to clarify any items as the forecast is developed.	No Action Required
Item:	**Action:**
Forecast Status Mr. Trencansky noted that the 2016 Existing Forecast and 2040 No-Build Forecast would be ready to submit to NCDOT for an interim review in the next few weeks with the submittal of the full Draft Traffic Forecast scheduled for February 10, 2017. Following the initial review of the forecast by NCDOT the revised forecast will be shared with the group	Submit Draft Forecast to NCDOT and send Revised Draft to Attendees prior to finalizing

Item:	Action:
prior to be being finalized so that any concerns or oversights can be reviewed prior to the forecast being finalized. It is anticipated that the forecast will be completed in early March 2017.	

The meeting adjourned at 3:30 PM

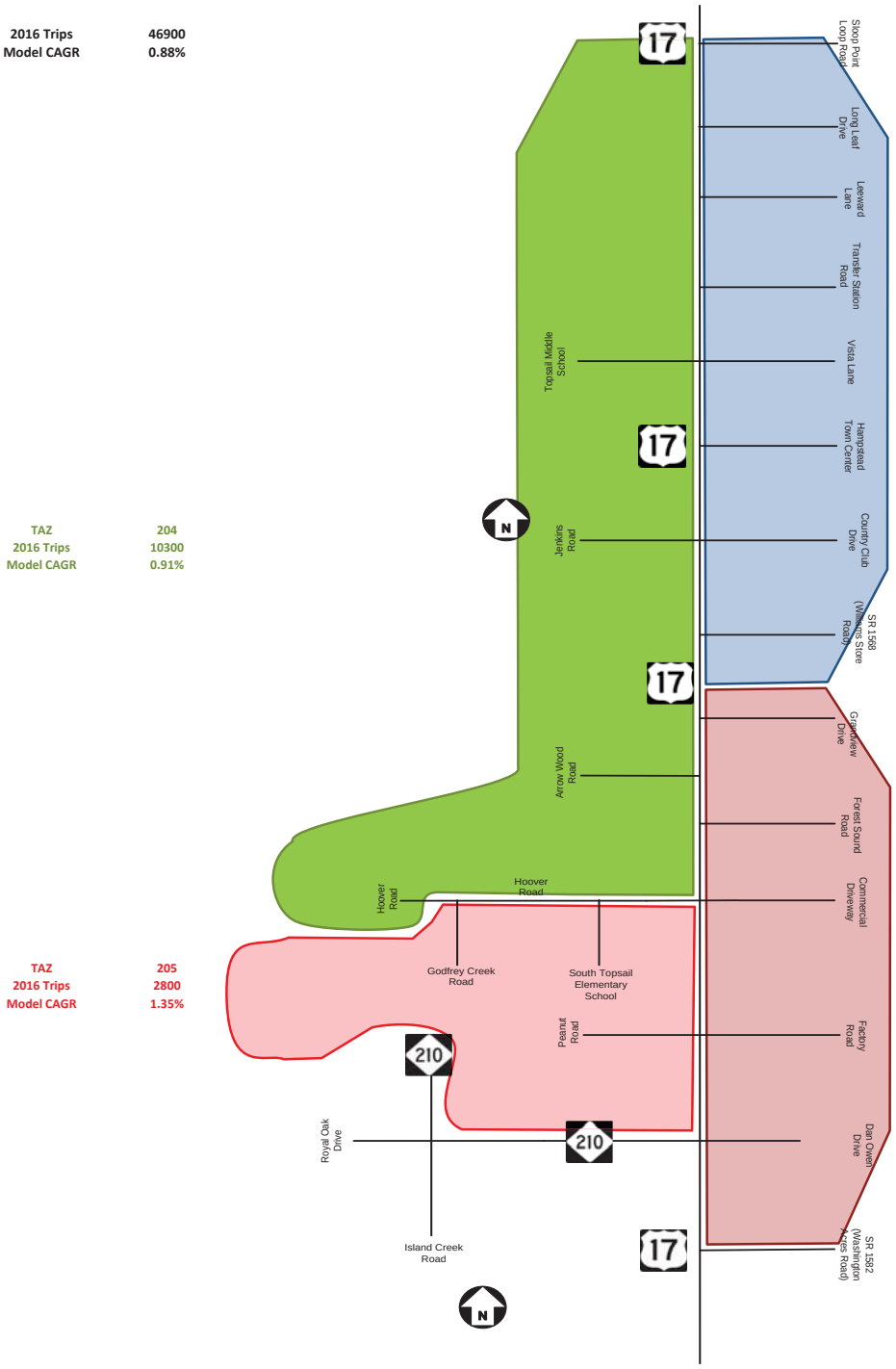
The foregoing is considered a true and accurate record of all items discussed. If any discrepancies or inconsistencies are noted, please contact the writer immediately. *(Note: No corrections or revisions were provided as of February 1, 2017.)*

Stantec Consulting Services Inc.

Ricky Greene, PE
Project Manager
Phone: 919.865.7562
Ricky.Greene@Stantec.com

Attachment: R-3300 Traffic Analysis Zone 2040 Growth

c. Attendees



TAZ	2010				2040				2010-2040	2016
	Households	Population	Employment	Total Trips	Households	Population	Employment	Total Trips	CAGR	Total Trips
202	934	2309	643	10540	1217	3009	783	14139	0.98%	11260
203	1961	4556	846	13835	2606	6056	921	17038	0.70%	14476
204	386	996	435	4916	541	1396	455	6459	0.91%	5225
205	379	1037	94	2649	525	1437	114	3959	1.35%	2911
TOTAL	3660	8898	2018	31940	4889	11898	2273	41595	0.88%	33871

Peter Trencansky

Subject: FW: R-3300B Traffic Forecast - Follow-up Questions

From: Kyle Breuer [mailto:kbreuer@pendercountync.gov]
Sent: Thursday, February 02, 2017 3:33 PM
To: Peter Trencansky <peter@pt-engineering.net>; Megan Crowe <mcrowe@pendercountync.gov>
Cc: Hite, Katie E (kehite@ncdot.gov) <kehite@ncdot.gov>; jleonard6@ncdot.gov; mike.kozlosky@wilmingtonnc.gov; Howell, Trace R <trhowell1@ncdot.gov>; Greene, Ricky <Ricky.Greene@stantec.com>
Subject: RE: R-3300B Traffic Forecast - Follow-up Questions

The entire county, I have no way of isolating locations for historic building permits which is why I applied the BP count to the forecast year and that remained conservative.

KB

From: Peter Trencansky [mailto:peter@pt-engineering.net]
Sent: Thursday, February 02, 2017 3:26 PM
To: Kyle Breuer <kbreuer@pendercountync.gov>; Megan Crowe <mcrowe@pendercountync.gov>
Cc: Hite, Katie E (kehite@ncdot.gov) <kehite@ncdot.gov>; jleonard6@ncdot.gov; mike.kozlosky@wilmingtonnc.gov; Howell, Trace R <trhowell1@ncdot.gov>; Greene, Ricky <Ricky.Greene@stantec.com>
Subject: RE: R-3300B Traffic Forecast - Follow-up Questions

Kyle,

Is the historic growth rate of 363 units/year and the 11,000 unit projection for the entire county or just for the area we are looking at in this forecast?

Thanks,
Peter

From: Kyle Breuer [mailto:kbreuer@pendercountync.gov]
Sent: Thursday, February 02, 2017 2:52 PM
To: Peter Trencansky <peter@pt-engineering.net>; Megan Crowe <mcrowe@pendercountync.gov>
Cc: Hite, Katie E (kehite@ncdot.gov) <kehite@ncdot.gov>; jleonard6@ncdot.gov; mike.kozlosky@wilmingtonnc.gov; Howell, Trace R <trhowell1@ncdot.gov>; Greene, Ricky <Ricky.Greene@stantec.com>
Subject: RE: R-3300B Traffic Forecast - Follow-up Questions

Peter,

In regards to the question about the Hoover Road tract, we feel that this project could come to fruition by 2040. Documentation regarding previous year building permit issuance, which has averaged approximately 363 units/year and future population projections, there may be a need for approximately 11,000 new units by that time. Obviously it's difficult to predict future markets and absorption but feel comfortable that recent and projected transportation and infrastructure investment, this project and others will come to fruition and would not have an impact on other TAZ's represented in the Travel Demand Model.

I hope this helps and please, if you need sources, etc. I'll be more than happy to provide.

Regards,

Kyle

From: Peter Trencansky [mailto:peter@pt-engineering.net]
Sent: Friday, January 27, 2017 1:36 PM
To: Megan Crowe <mcrowe@pendercountync.gov>; Kyle Breuer <kbreuer@pendercountync.gov>
Cc: Hite, Katie E (kehite@ncdot.gov) <kehite@ncdot.gov>; jleonard6@ncdot.gov; mike.kozlosky@wilmingtonnc.gov; Howell, Trace R <trhowell1@ncdot.gov>; Greene, Ricky <Ricky.Greene@stantec.com>
Subject: R-3300B Traffic Forecast - Follow-up Questions

Kyle/Megan,

I wanted to follow-up with you on a couple items from the meeting on 1/13. I understand the potential for the development between NC 210 and Hoover Road (I believe it was called the Donald Sullivan tract) may be moving forward towards being a reality. In the meeting the TAZ that included that development was the third highest (of the four) TAZs as far as likely growth (with the two TAZs east of US 17 as being the highest for likely growth). In the meeting, you wrote 1000-2000 lots on the map. We are trying to balance the low growth rate in the regional model with the high growth we would get if every potential development came to fruition. How likely do you think this development is to end up being 1000-2000 homes by 2040? Also, would making this development more likely make any of the other development in the area less likely?

The second item is that NCDOT Transportation Planning Branch has asked me to get some more information on development in the Hampstead as part of justifying the growth rate we are using in the forecast. I have attached a map with a table that includes the locations that were identified on the paper maps at the 1/13 meeting. In the table I have columns for the development name, the intensity of the development and for its status. For the intensity of development I realize some of these a speculative and have not submitted formally, so any estimated ranges would be fine. Also, this is intended to support likely development between now and 2040 so it should include anything you think has a reasonable chance of being developed by 2040. If a development is speculative it is fine to include it and note it in the comment Status/Comments field. Also, feel free to add any additional developments that haven't been included thus far.

Please feel free to call me if you have any questions. Would it be possible to get this back by 2/3/17? With the forecast being due on 2/10/17 we are starting to get close to the deadline.

Thanks,
Peter

Peter Trencansky

Subject: FW: R-3300B Pender Co. School Plans & Next Forecast Meeting

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From: Greene, Ricky [Ricky.Greene@stantec.com]
Sent: Wednesday, February 08, 2017 6:12 PM
To: Peter Trencansky <peter@pt-engineering.net>
Cc: Lindgren, Mike <Michael.Lindgren@stantec.com>
Subject: R-3300B Pender Co. School Plans & Next Forecast Meeting

Peter,
Allen Vann (COO) and Darren LaFon (Transportation Director) were at the meeting today in Hampstead. Allen indicated that the Surf City schools (elementary & middle) under construction would have a capacity of 1568 students. These are slated to open in the summer of 2018. Their opening may have a short term effect on the numbers of students at other nearby schools but it wouldn't last long due to anticipated growth.

The other schools they mentioned such as Pender-Lee (K-8) opening summer 2018, Cape Fear Elem/Middle (capacity increase for existing), and Pender High School were considered by Megan, Kyle, and others to have no bearing on our forecast. Megan made a point of saying that Pender Lee specifically should not be included in the forecast – I got the sense that it had perhaps been mentioned to you already? A potential school along Hoover for the newest development under discussion (1000-2000 homes) was not on the radar screen for the school folks. Kyle mentioned that any school there would have access to NC 210 as well as Hoover so it didn't seem to be a big deal for our forecast. At this point no know knowledge or long range plan for another school in the area represented by the forecast.

Ricky

APPENDIX C:

TRAFFIC FORECAST TABLES

Table C1: 2016 Base Year No-Build Traffic Volumes

Forecast Location	NCDOT Historic Count Data								AADT Exptrapolated to 2016[1]	Project Specific Count Data[2]		2016 No-Build Traffic Forecast
	2008	2009	2010	2011	2012	2013	2014	2015		TMC	Mainline [6]	
US 17 - south of Washington Acres Rd (SR 1582)										37,400 (3)		**37,000**
US 17 - Washington Acres Rd (SR 1582) to NC 210/Dan Owen Dr	28,000	28,000	31,000	32,000	31,000	33,000		33,000	34,800	37,800 (3) 37,200 (3)	33,400	**37,400**
US 17 - NC 210/Dan Owen Dr to Peanut Rd (SR 1570)/Factory Rd (SR 1570)	33,000	33,000	36,000	35,000		38,000	38,000	36,000	40,400	43,100 (3) 43,200 (3)		**43,200**
US 17 - Peanut Rd (SR 1570)/Factory Rd (SR 1570) to Hoover Rd (SR 1569)/Comm Dwy										43,400 (3) 43,600 (3)		**43,500**
US 17 - Hoover Rd (SR 1569)/Comm Dwy to Forest Sound Rd										42,400 (3) 42,100 (3)		**42,500**
US 17 - Forest Sound Rd to Arrow Wood Road	31,000	31,000		34,000	41,000	37,000		36,000	40,000	42,200 (3) 37,300 (5)		**42,500**
US 17 - Arrow Wood Road to Grandview Dr										36,800 (5) 41,600 (3)		**41,800**
US 17 - Grandview Dr to Williams Store Rd (SR 1568)										41,600 (3) 41,100 (3)		**41,600**
US 17 - Williams Store Rd (SR 1568) to Jenkins Rd/Country Club Rd		29,000	34,000	34,000	34,000	37,000	37,000	35,000	38,500	41,000 (3) 41,400 (3)		**41,400**
US 17 - Jenkins Rd/Country Club Rd to Hampstead Town Center										35,400 (3) 35,500 (3)		**34,600**
US 17 - Hampstead Town Center to Topsail Middle School/Vista Ln										36,200 (3) 36,900 (3)		**34,900**
US 17 - Topsail Middle School/Vista Ln to Transfer Station Rd										36,400 (3) 32,900 (3)		**34,300**
US 17 - north of Transfer Station Rd to Leeward Ln										32,700 (3) 33,000 (3)		**34,100**
US 17 - Leeward Ln to Long Leaf Dr										32,500 (3) 33,100 (3)		**33,500**
US 17 - Long Leaf Dr to Sloop Point Loop Rd (SR 1563)										32,700 (3) 32,300 (3)		**32,700**

Table C1: 2016 Base Year No-Build Traffic Volumes

Forecast Location	NCDOT Historic Count Data								AADT Exptrapolated to 2016[1]	Project Specific Count Data[2]		2016 No-Build Traffic Forecast
	2008	2009	2010	2011	2012	2013	2014	2015		TMC	Mainline [6]	
US 17 - north of Sloop Point Loop Rd (SR 1563)										30,400 (3)		**30,500**
I-140 - from I-40 to US 17	14,000	13,000	15,000	14,000	14,000	16,000	19,000	20,000	19,100		20,200 (7)	**20,200**
Washington Acres Rd (SR 1582) - east of US 17	1,700		1,800		1,900				2,300	4,400 (3)		**4,400**
Royal Oak Dr - west of NC 210										1,000 (3)		**800**
Island Creek Rd (SR 1002) - south of NC 210/Royal Oak Dr	2,600		2,500		2,500			2,600	2,800	3,700 (3)		**3,700**
NC 210 - north of NC 210/Royal Oak Dr	3,000	3,500	3,100	4,300	3,400	4,400		4,400	4,300	4,800 (3)		**5,100**
NC 210 - east of NC 210/Island Creek Rd (SR 1002)	5,300	6,000	5,400	5,600	5,900	6,800		6,500	6,800	7,200 (3)		**7,200**
NC 210 - west of US 17	6,500	7,100	7,300	7,000	7,100	7,900	7,800	7,600	8,100	8,900 (3)	7,500 (4)	**9,000**
Dan Owen Dr - east of US 17										5,400 (3)		**5,400**
Peanut Rd (SR 1570) - west of US 17										400 (3)		**400**
Factory Rd (SR 1570) - east of US 17		1,300		1,700		2,000		2,100	1,800	2,500 (3)		**2,500**
Hoover Rd (SR 1569) - west of Godfrey Creek Rd										2,100 (3)		**2,300**
Hoover Rd (SR 1569) - South Topsail Elementary School to Godfrey Creek Rd										2,500 (3) 2,700 (3)	2,400	**2,800**
Hoover Rd (SR 1569) - south of South Topsail Elementary School		3,900		3,500		3,700		3,800	4,300	3,900 (3)		**4,000**
Hoover Rd (SR 1569) - west of US 17										5,800 (3)		**5,700**
Commercial Dwy - east of US 17										1,600 (3)		**1,500**
Godfrey Creek Rd - west of Hoover Rd (SR 1569)										500 (3)		**500**
South Topsail Elementary School - west of Hoover Rd (SR 1569)										1,600 (3)		**1,600**
Forest Sound Rd - east of US 17										1,100 (3)		**1,200**
Arrow Wood Road - west of US 17										*1,500* (5)		**1,500**
Grandview Dr - east of US 17										800 (3)		**800**
Williams Store Rd (SR 1568) - east of US 17										600 (3)		**600**
Jenkins Rd - west of US 17										3,600 (3)		**3,700**

Table C1: 2016 Base Year No-Build Traffic Volumes

Forecast Location	NCDOT Historic Count Data								AADT Exptrapolated to 2016[1]	Project Specific Count Data[2]		2016 No-Build Traffic Forecast
	2008	2009	2010	2011	2012	2013	2014	2015		TMC	Mainline [6]	
Country Club Rd - east of US 17	6,500		7,300		7,100		7,200			9,100 (3)		**9,100**
Hampstead Town Center - east of US 17										4,200 (3)		**4,300**
Topsail Middle School - west of US 17										3,000 (3)		**3,100**
Vista Ln - east of US 17										300 (3)		**300**
Transfer Station Rd - east of US 17										600 (3)		**600**
Leeward Ln - east of US 17										1,200 (3)		**1,200**
Long Leaf Dr - east of US 17										1,900 (3)		**2,000**
Sloop Point Loop Rd (SR 1563) - east of US 17		4,900		5,000		5,700		6,000	6,200	8,100 (3)		**8,200**

Notes:

(1) Data extrapolated to 2016 based on linear regression of 1995-2015 data.

(2) All Project Specific Counts were converted to AADT based on the NCDOT Traffic Survey Unit ATR Seasonal Factors as described in Section 2.3

(3) 2016 13-hour Turning Movement Count - factored to 24-hour volumes, adjusted to AADT.

(4) 2016 Project Specific Mainline Count - Adjusted to AADT.

(5) 2016 4-hour Turning Movement Count - factored to 24-hour volumes, adjusted to AADT.

(6) Mainline counts were lower than the turning movement counts. It was determined that turning movement count data would be utilized as the primary source of data for developing the forecast volumes. See Section 3.3 for additional information.

(7) 2015 Mainline Count - factored to 2016 (assumed 4% growth based on historic AADT growth), adjusted to AADT.

Table C2: 2016 Base Year No-Build Design Data - Truck Percentages

Forecast Location	Previous Forecast		Project Specific Count Data		Selected 2016 BY NB Value
	Truck Percentage	TIP Project	TMC	Mainline	
US 17 - south of Washington Acres Rd (SR 1582)			3 , 1 (1)		**4 , 2**
US 17 - Washington Acres Rd (SR 1582) to NC 210/Dan Owen Dr	5 , 3	U-4751/R-3300	3 , 1 (1) 4 , 2 (1)	9 , 4	**4 , 2**
US 17 - NC 210/Dan Owen Dr to Peanut Rd (SR 1570)/Factory Rd (SR 1570)	5 , 3	U-4751/R-3300	3 , 1 (1) 3 , 1 (1)		**4 , 2**
US 17 - Peanut Rd (SR 1570)/Factory Rd (SR 1570) to Hoover Rd (SR 1569)/Comm Dwy	5 , 3	U-4751/R-3300	3 , 1 (1) 3 , 1 (1)		**4 , 2**
US 17 - Hoover Rd (SR 1569)/Comm Dwy to Forest Sound Rd	5 , 3	U-4751/R-3300	3 , 1 (1) 3 , 1 (1)		**4 , 2**
US 17 - Forest Sound Rd to Arrow Wood Road	5 , 3	U-4751/R-3300	3 , 1 (1)		**4 , 2**
US 17 - Arrow Wood Road to Grandview Dr			3 , 1 (1)		**4 , 2**
US 17 - Grandview Dr to Williams Store Rd (SR 1568)			3 , 1 (1) 4 , 1 (1)		**4 , 2**
US 17 - Williams Store Rd (SR 1568) to Jenkins Rd/Country Club Rd	5 , 3	U-4751/R-3300	4 , 1 (1) 5 , 1 (1)		**4 , 2**
US 17 - Jenkins Rd/Country Club Rd to Hampstead Town Center	5 , 3	U-4751/R-3300	4 , 1 (1) 4 , 1 (1)		**4 , 2**
US 17 - Hampstead Town Center to Topsail Middle School/Vista Ln			4 , 1 (1) 4 , 1 (1)		**4 , 2**
US 17 - Topsail Middle School/Vista Ln to Transfer Station Rd			4 , 1 (1) 4 , 1 (1)		**4 , 2**
US 17 - north of Transfer Station Rd to Leeward Ln	5 , 3	U-4751/R-3300	4 , 1 (1) 4 , 2 (1)		**4 , 2**
US 17 - Leeward Ln to Long Leaf Dr	5 , 3	U-4751/R-3300	4 , 1 (1) 4 , 2 (1)		**4 , 2**
US 17 - Long Leaf Dr to Sloop Point Loop Rd (SR 1563)	5 , 3	U-4751/R-3300	4 , 2 (1) 4 , 2 (1)		**4 , 2**

Table C2: 2016 Base Year No-Build Design Data - Truck Percentages

Forecast Location	Previous Forecast		Project Specific Count Data		Selected 2016 BY NB Value
	Truck Percentage	TIP Project	TMC	Mainline	
US 17 - north of Sloop Point Loop Rd (SR 1563)	5 , 3	U-4751/R-3300	4 , 2 (1)		**4 , 2**
I-140 - from I-40 to US 17	4 , 6	U-4751/R-3300		32 , 5 (4)	**6 , 4**
Washington Acres Rd (SR 1582) - east of US 17			2 , 1 (1)		**2 ,1**
Royal Oak Dr - west of NC 210			4 , 0 (1)		**3 , 1**
Island Creek Rd (SR 1002) - south of NC 210/Royal Oak Dr	3 , 1	U-4751/R-3300	5 , 1 (1)		**5 , 1**
NC 210 - north of NC 210/Royal Oak Dr	3 , 1		5 , 2 (1)		**5 , 2**
NC 210 - east of NC 210/Island Creek Rd (SR 1002)	3 , 1	U-4751/R-3300	5 , 1 (1)		**5 , 2**
NC 210 - west of US 17	4 , 1		4 , 1 (1)	7 , 2 (2)	**5 , 2**
Dan Owen Dr - east of US 17	2 , 1	U-4751/R-3300	1 , 1 (1)		**2 , 1**
Peanut Rd (SR 1570) - west of US 17	3, 1		3 , 1 (1)		**3 , 1**
Factory Rd (SR 1570) - east of US 17	2 , 1	U-4751/R-3300	2 , 1 (1)		**2 , 1**
Hoover Rd (SR 1569) - west of Godfrey Creek Rd			11 , 1 (1)		**9 , 1**
Hoover Rd (SR 1569) - South Topsail Elementary School to Godfrey Creek Rd			9 , 1 (1) 9 , 1 (1)	10 , 1 (2)	**9 , 1**
Hoover Rd (SR 1569) - south of South Topsail Elementary School			7 , 1 (1)		**7 , 1**
Hoover Rd (SR 1569) - west of US 17	3 , 1	U-4751/R-3300	5 , 1 (1)		**7 , 1**
Commercial Dwy - east of US 17			1 , 1 (1)		**2 , 1**
Godfrey Creek Rd - west of Hoover Rd (SR 1569)			2 , 0 (1)		**2 , 1**
South Topsail Elementary School - west of Hoover Rd (SR 1569)			7 , 1 (1)		**7 , 1**
Forest Sound Rd - east of US 17	2 , 1	U-4751/R-3300	3 , 0 (1)		**2 , 1**
Arrow Wood Road - west of US 17			(1)		**2 , 1**
Grandview Dr - east of US 17			8 , 2 (1)		**3 , 1**
Williams Store Rd (SR 1568) - east of US 17			4 , 0 (1)		**3 , 1**
Jenkins Rd - west of US 17	2 , 1	U-4751/R-3300	3 , 1 (1)		**3 , 1**
Country Club Rd - east of US 17	2 , 1		3 , 1 (1)		**3 , 1**
Hampstead Town Center - east of US 17			2 , 1 (1)		**2 , 1**
Topsail Middle School - west of US 17			6 , 0 (1)		**5 , 1**
Vista Ln - east of US 17			6 , 0 (1)		**5 , 1**
Transfer Station Rd - east of US 17			15,5 (1)		**15, 5**

Table C2: 2016 Base Year No-Build Design Data - Truck Percentages

Forecast Location	Previous Forecast		Project Specific Count Data		Selected 2016 BY NB Value
	Truck Percentage	TIP Project	TMC	Mainline	
Leeward Ln - east of US 17	2 , 1	U-4751/R-3300	3 , 0 (1)		**2 , 1**
Long Leaf Dr - east of US 17	2 , 1		3 , 1 (1)		**3 , 1**
Sloop Point Loop Rd (SR 1563) - east of US 17	2 , 1	U-4751/R-3300	5 , 1 (1)		**5 , 1**

Notes:

(1) 2016 13-hour Turning Movement Count

(2) 2016 Volume, Speed, Class Mainline Count

(3) 2016 4-hour Turning Movement Count

(4) 2015 Volume, Speed, Class Mainline Count (Wavetronix)

Table C3: 2016 Base Year No-Build No-Build Data - Directional Distribution

Forecast Location	Previous Forecast		Project Specific Count Data		Selected 2016 BY NB Value [4]
	Directional Distribution	TIP Project	TMC [4]	Mainline [4]	
US 17 - south of Washington Acres Rd (SR 1582)			68 SB/54 NB/61 NB (1)		*65 SB/55NB/* **60NB**
US 17 - Washington Acres Rd (SR 1582) to NC 210/Dan Owen Dr	65	U-4751/R-3300	65 SB/52 NB/58 NB (1) 65 SB/53 NB/58 NB (1)	60 SB/59 NB/53 NB (2)	*65 SB/55 NB/* **60 NB**
US 17 - NC 210/Dan Owen Dr to Peanut Rd (SR 1570)/Factory Rd (SR 1570)	60	U-4751/R-3300	62 SB/52 NB/59 NB (1) 62 SB/52 NB/59 NB (1)		*60 SB/55 NB/* **60 NB**
US 17 - Peanut Rd (SR 1570)/Factory Rd (SR 1570) to Hoover Rd (SR 1569)/Comm Dwy	60	U-4751/R-3300	61 SB/51 NB/58 NB (1) 62 SB/52 NB/58 NB (1)		*60 SB/55 NB/* **60 NB**
US 17 - Hoover Rd (SR 1569)/Comm Dwy to Forest Sound Rd	60	U-4751/R-3300	60 SB/52 NB/57 NB (1) 57 SB/51 NB/57 NB (1)		*60 SB/55 NB/* **60 NB**
US 17 - Forest Sound Rd to Arrow Wood Road	60	U-4751/R-3300	57 SB/51 NB/57 NB (1) 61 SB/53 NB/57 NB (3)		*60 SB/55 NB/* **60 NB**
US 17 - Arrow Wood Road to Grandview Dr			60 SB/54 NB/58 NB (3) 61 SB/51 NB/57 NB (1)		*60 SB/55 NB/* **60 NB**
US 17 - Grandview Dr to Williams Store Rd (SR 1568)			60 SB/50 NB/57 NB (1) 62 SB/55 SB/62 NB (1)		*60 SB/55 NB/* **60 NB**
US 17 - Williams Store Rd (SR 1568) to Jenkins Rd/Country Club Rd	60	U-4751/R-3300	63 SB/55 SB/62 NB (1) 58 SB/54 SB/63 NB (1)		*60 SB/55 NB/* **60 NB**
US 17 - Jenkins Rd/Country Club Rd to Hampstead Town Center	60	U-4751/R-3300	57 SB/50 SB/61 NB (1) 57 SB/57 NB/62 NB (1)		*60 SB/55 NB/* **60 NB**
US 17 - Hampstead Town Center to Topsail Middle School/Vista Ln			57 SB/57 NB/63 NB (1) 55 SB/58 NB/64 NB (1)		*60 SB/60 NB/* **60 NB**
US 17 - Topsail Middle School/Vista Ln to Transfer Station Rd			57 SB/63 NB/64 NB (1) 64 SB/60 NB/62 NB (1)		*60 SB/60 NB/* **60 NB**
US 17 - north of Transfer Station Rd to Leeward Ln	60	U-4751/R-3300	64 SB/60 NB/62 NB (1) 63 SB/61 NB/63 NB (1)		*60 SB/60 NB/* **60 NB**
US 17 - Leeward Ln to Long Leaf Dr	60	U-4751/R-3300	63 SB/61 NB/62 NB (1) 62 SB/56 NB/56 NB (1)		*60 SB/60 NB/* **60 NB**
US 17 - Long Leaf Dr to Sloop Point Loop Rd (SR 1563)	60	U-4751/R-3300	61 SB/55 NB/56 NB (1) 62 SB/54 NB/54 NB (1)		*60 SB/55 NB/* **60 NB**
US 17 - north of Sloop Point Loop Rd (SR 1563)	60	U-4751/R-3300	60 SB/54 NB/52 NB (1)		*60 SB/55 NB/* **60 NB**

Table C3: 2016 Base Year No-Build No-Build Data - Directional Distribution

Forecast Location	Previous Forecast		Project Specific Count Data		Selected 2016 BY NB Value [4]
	Directional Distribution	TIP Project	TMC [4]	Mainline [4]	
I-140 - from I-40 to US 17	65	U-4751/R-3300		69 WB/60 EB/66 EB (5)	*70 WB/60 EB/* ***65 EB***
Washington Acres Rd (SR 1582) - east of US 17			70 WB/65 EB/69 EB (1)		*70 WB/65 EB/* **70 EB**
Royal Oak Dr - west of NC 210			89 EB/64 WB/66 WB (1)		*85 EB/65 EB/* **65 WB**
Island Creek Rd (SR 1002) - south of NC 210/Royal Oak Dr	55	U-4751/R-3300	69 SB/59 NB/73 NB (1)		*70 SB/60 NB/* **75 NB**
NC 210 - north of NC 210/Royal Oak Dr	55		56 SB/50 SB/53 NB (1)		*55 SB/55 SB/* **55 NB**
NC 210 - east of NC 210/Island Creek Rd (SR 1002)	55	U-4751/R-3300	50 EB/53 EB/60 EB (1)		*55 WB/55 EB/* **60 EB**
NC 210 - west of US 17	55		55 EB/52 EB/56 EB (1)	52 EB/51 EB/60 EB (2)	*55 WB/55 EB/* **55 EB**
Dan Owen Dr - east of US 17	55	U-4751/R-3300	52 EB/54 WB/57 WB (1)		*55 EB/55 WB/* **55 WB**
Peanut Rd (SR 1570) - west of US 17	65		85 EB/86 EB/86 EB (1)		*80 EB/80 EB/* **80 EB**
Factory Rd (SR 1570) - east of US 17	60	U-4751/R-3300	79 WB/59 EB/65 EB (1)		*75 WB/60 EB/* **65 EB**
Hoover Rd (SR 1569) - west of Godfrey Creek Rd			63 EB/62 WB/56 WB (1)		*65 EB/60 WB/* **60 WB**
Hoover Rd (SR 1569) - South Topsail Elementary School to Godfrey Creek Rd			64 EB/63 WB/56 WB (1) 71 EB/51 WB/57 WB (1)	72 EB/52 WB/59 WB (2)	*65 EB/55 WB/* **60 WB**
Hoover Rd (SR 1569) - south of South Topsail Elementary School			55 EB/53 EB/52 WB (1)		*55 EB/55 EB/* **55 WB**
Hoover Rd (SR 1569) - west of US 17	55	U-4751/R-3300	62 EB/51 EB/56 WB (1)		*55 EB/55 EB/* **55 WB**
Commercial Dwy - east of US 17			64 WB/53 WB/57 WB (1)		*60 WB/55 WB/* **55 WB**
Godfrey Creek Rd - west of Hoover Rd (SR 1569)			70 NB/66 SB/57 SB (1)		*65 NB/ 65 SB/* **55 SB**
South Topsail Elementary School - west of Hoover Rd (SR 1569)			53 SB/56 SB/64 SB (1)		*55 SB/55 NB/* **65 SB**
Forest Sound Rd - east of US 17	65	U-4751/R-3300	54 WB/54 EB/55 WB (1)		*55 WB/55 EB/* **55 WB**
Arrow Wood Road - west of US 17			64 EB/69 EB/74 EB (1)		*65 EB/70 EB/* **75 EB**
Grandview Dr - east of US 17			69 WB/57 EB/66 EB (1)		*65 WB/60 EB/* **65 EB**
Williams Store Rd (SR 1568) - east of US 17			52 EB/54 WB/57 WB (1)		*55 EB/55 WB/* **55 WB**
Jenkins Rd - west of US 17	60	U-4751/R-3300	63 WB/88 EB/57 EB (1)		*63 WB/85 EB/* **55 EB**
Country Club Rd - east of US 17	60		74 WB/62 EB/66 EB (1)		*70 WB/60 EB/* **65 EB**
Hampstead Town Center - east of US 17			51 EB/50 EB/56 WB (1)		*55 EB/55 WB/* **55 WB**
Topsail Middle School - west of US 17			59 WB/86 EB/59 EB (1)		*60 WB/85 EB/* **60 EB**
Vista Ln - east of US 17			71 WB/61 EB/65 EB (1)		*70 WB/60 EB/* **65 EB**
Transfer Station Rd - east of US 17			59 EB/54 EB/85 WB (1)		*60 EB/55 EB/* **80 WB**
Leeward Ln - east of US 17	65	U-4751/R-3300	73 WB/62 EB/62 EB (1)		*70 WB/60 EB/* **60 EB**

Table C3: 2016 Base Year No-Build No-Build Data - Directional Distribution

Forecast Location	Previous Forecast		Project Specific Count Data		Selected 2016 BY NB Value [4]
	Directional Distribution	TIP Project	TMC [4]	Mainline [4]	
Long Leaf Dr - east of US 17	65		68 WB/69 EB/67 EB (1)		*65 WB/65 EB/* **65 EB**
Sloop Point Loop Rd (SR 1563) - east of US 17	60	U-4751/R-3300	55 WB/53 EB/57 EB (1)		*55 WB/55 EB/* **55 EB**

Notes:

(1) 2016 13-hour Turning Movement Count

(2) 2016 Volume, Speed, Class Mainline Count

(3) 2016 4-hour Turning Movement Count

(4) AM Peak Hour / PM School Peak Hour / PM Commuter Peak Hour

(5) 2015 Volume, Speed, Class Mainline Count

Table C4: 2016 Base Year No-Build Design Data - Peak Hour Factor

Forecast Location	Previous Forecast		Project Specific Count Data		Selected 2016 BY NB Value [4]
	Peak Hour Factor	TIP Project	TMC [4]	Mainline [4]	
US 17 - south of Washington Acres Rd (SR 1582)			8 / 7 / 8 (1)		*8 / 7 /* **8**
US 17 - Washington Acres Rd (SR 1582) to NC 210/Dan Owen Dr	12	U-4751/R-3300	8 / 7 / 8 (1) 8 / 7 / 8 (1)	8 / 7 / 8 (2)	*8 / 7 /* **8**
US 17 - NC 210/Dan Owen Dr to Peanut Rd (SR 1570)/Factory Rd (SR 1570)	12	U-4751/R-3300	8 / 7 / 8 (1) 8 / 7 / 8 (1)		*8 / 7 /* **8**
US 17 - Peanut Rd (SR 1570)/Factory Rd (SR 1570) to Hoover Rd (SR 1569)/Comm Dwy	12	U-4751/R-3300	8 / 7 / 8 (1) 8 / 7 / 8 (1)		*8 / 7 /* **8**
US 17 - Hoover Rd (SR 1569)/Comm Dwy to Forest Sound Rd	12	U-4751/R-3300	8 / 7 / 8 (1) 8 / 7 / 8 (1)		*8 / 7 /* **8**
US 17 - Forest Sound Rd to Arrow Wood Road	12	U-4751/R-3300	8 / 8 / 8 (1) 6 / 8 / 9 (3)		*8 / 8 /* **8**
US 17 - Arrow Wood Road to Grandview Dr			6 / 8 / 9 (3) 8 / 8 / 8 (1)		*8 / 8 /* **8**
US 17 - Grandview Dr to Williams Store Rd (SR 1568)			8 / 8 / 8 (1) 8 / 8 / 8 (1)		*8 / 8 /* **8**
US 17 - Williams Store Rd (SR 1568) to Jenkins Rd/Country Club Rd	12	U-4751/R-3300	8 / 8 / 8 (1) 8 / 8 / 8 (1)		*8 / 8 /* **8**
US 17 - Jenkins Rd/Country Club Rd to Hampstead Town Center	12	U-4751/R-3300	8 / 8 / 8 (1) 8 / 8 / 8 (1)		*8 / 8 /* **8**
US 17 - Hampstead Town Center to Topsail Middle School/Vista Ln			8 / 8 / 8 (1) 9 / 8 / 8 (1)		*8 / 8 /* **8**
US 17 - Topsail Middle School/Vista Ln to Transfer Station Rd			9 / 8 / 8 (1) 8 / 8 / 8 (1)		*8 / 8 /* **8**
US 17 - north of Transfer Station Rd to Leeward Ln	12	U-4751/R-3300	8 / 8 / 8 (1) 8 / 8 / 9 (1)		*8 / 8 /* **8**
US 17 - Leeward Ln to Long Leaf Dr	12	U-4751/R-3300	8 / 8 / 9 (1) 8 / 7 / 9 (1)		*8 / 7 /* **8**
US 17 - Long Leaf Dr to Sloop Point Loop Rd (SR 1563)	12	U-4751/R-3300	8 / 7 / 9 (1) 8 / 7 / 9 (1)		*8 / 7 /* **8**

Table C4: 2016 Base Year No-Build Design Data - Peak Hour Factor

Forecast Location	Previous Forecast		Project Specific Count Data		Selected 2016 BY NB Value [4]
	Peak Hour Factor	TIP Project	TMC [4]	Mainline [4]	
US 17 - north of Sloop Point Loop Rd (SR 1563)	12	U-4751/R-3300	8 / 7 / 8 (1)		*8 / 7 /* **8**
I-140 - from I-40 to US 17	12	U-4751/R-3300		9 / 8 / 10 (5)	9 / 8 / **10**
Washington Acres Rd (SR 1582) - east of US 17			8 / 6 / 8		*8 / 6 /* **8**
Royal Oak Dr - west of NC 210			10 / 7 / 9 (1)		*10 / 7 /* **9**
Island Creek Rd (SR 1002) - south of NC 210/Royal Oak Dr	12	U-4751/R-3300	9 / 6 / 12 (1)		*9 / 6 /* **12**
NC 210 - north of NC 210/Royal Oak Dr	12		9 / 7 / 9 (1)		*9 / 7 /* **9**
NC 210 - east of NC 210/Island Creek Rd (SR 1002)	12	U-4751/R-3300	9 / 7 / 11 (1)		*9 / 7 /* **10**
NC 210 - west of US 17	14		8 / 8 / 9 (1)	9 / 7 / 10 (2)	*9 / 7 /* **9**
Dan Owen Dr - east of US 17	14	U-4751/R-3300	2 / 9 / 8 (1)		*2 / 9 /* **9**
Peanut Rd (SR 1570) - west of US 17	15		10 / 7 / 8 (1)		*10 / 7 /* **8**
Factory Rd (SR 1570) - east of US 17	12	U-4751/R-3300	7 / 7 / 8 (1)		*7 / 7 /* **9**
Hoover Rd (SR 1569) - west of Godfrey Creek Rd			9 / 7 / 8 (1)		*9 / 7 /* **8**
Hoover Rd (SR 1569) - South Topsail Elementary School to Godfrey Creek Rd			9 / 7 / 9 (1) 9 / 7 / 8 (1)	9 / 8 / 9 (2)	*9 / 7 /* **8**
Hoover Rd (SR 1569) - south of South Topsail Elementary School			17 / 10 / 7 (1)		*14 / 9 /* **8**
Hoover Rd (SR 1569) - west of US 17	18	U-4751/R-3300	11 / 6 / 7 (1)		*14 / 9 /* **8**
Commercial Dwy - east of US 17			4 / 7 / 7 (1)		*4 / 7 /* **7**
Godfrey Creek Rd - west of Hoover Rd (SR 1569)			11 / 8 / 8 (1)		*11 / 8 /* **8**
South Topsail Elementary School - west of Hoover Rd (SR 1569)			34 / 16 / 4 (1)		*34 / 16 /* **4**
Forest Sound Rd - east of US 17	14	U-4751/R-3300	7 / 8 / 7 (1)		*7 / 8 /* **7**
Arrow Wood Road - west of US 17			8 / 5 / 8 (1)		*8 / 5 /* **8**
Grandview Dr - east of US 17			8 / 8 / 7 (1)		*8 / 8 /* **8**
Williams Store Rd (SR 1568) - east of US 17			5 / 10 / 6 (1)		*6 / 9 /* **7**
Jenkins Rd - west of US 17	15	U-4751/R-3300	23 / 18 / 4 (1)		*22 / 18 /* **4**
Country Club Rd - east of US 17	13	U-4751/R-3300	8 / 8 / 8 (1)		*8 / 8 /* **8**
Hampstead Town Center - east of US 17			3 / 10 / 10 (1)		*3 / 10 /* **10**
Topsail Middle School - west of US 17			23 / 17 / 5 (1)		*22 / 16 /* **6**
Vista Ln - east of US 17			7 / 9 / 9 (1)		*7 / 9 /* **10**
Transfer Station Rd - east of US 17			7 / 6 / 2 (1)		*7 / 6 /* **2**

Table C4: 2016 Base Year No-Build Design Data - Peak Hour Factor

Forecast Location	Previous Forecast		Project Specific Count Data			Selected 2016 BY NB Value [4]
	Peak Hour Factor	TIP Project	TMC [4]		Mainline [4]	
Leeward Ln - east of US 17	14	U-4751/R-3300	8 / 7 / 12	(1)		*8 / 7 /* **12**
Long Leaf Dr - east of US 17	14		9 / 7 / 8	(1)		*9 / 7 /* **8**
Sloop Point Loop Rd (SR 1563) - east of US 17	13	U-4751/R-3300	9 / 6 / 9	(1)		*9 / 6 /* **9**

Notes:

(1) 2016 13-hour Turning Movement Count

(2) 2016 Volume, Speed, Class Mainline Count

(3) 2016 4-hour Turning Movement Count

(4) AM Peak Hour / PM School Peak Hour / PM Commuter Peak Hour

(5) 2015 Volume, Speed, Class Mainline Count

Table C5: Model Validation

Forecast Location	Model Calibration 2010		Interpolated Model [3]	Forecast Volume	FY NB Volumes	
	Model	AADT [1]	2016	2016 NB	2040 Model	2040 Forecast
US 17 - south of Washington Acres Rd (SR 1582)	27,697		29,800	37,000	38,227	66,200
US 17 - Washington Acres Rd (SR 1582) to NC 210/Dan Owen Dr	30,198	31,000 [2]	32,700	37,400	42,482	66,900
US 17 - NC 210/Dan Owen Dr to Peanut Rd (SR 1570)/Factory Rd (SR 1570)	35,335	36,000 [2]	38,600	43,200	51,621	77,200
US 17 - Peanut Rd (SR 1570)/Factory Rd (SR 1570) to Hoover Rd (SR 1569)/Comm Dwy	33,699		36,900	43,500	49,478	77,800
US 17 - Hoover Rd (SR 1569)/Comm Dwy to Forest Sound Rd	32,001	35,400 [2]	34,900	42,500	46,683	76,000
US 17 - Forest Sound Rd to Arrow Wood Road	32,001	31,000 [1]	34,900	42,500	46,683	75,800
US 17 - Arrow Wood Road to Grandview Dr	32,001		34,900	41,800	46,683	74,800
US 17 - Grandview Dr to Williams Store Rd (SR 1568)	32,001		34,900	41,600	46,683	74,400
US 17 - Williams Store Rd (SR 1568) to Jenkins Rd/Country Club Rd	32,001	34,000 [2]	34,900	41,400	46,683	74,100
US 17 - Jenkins Rd/Country Club Rd to Hampstead Town Center	32,001		34,900	34,600	46,683	63,500
US 17 - Hampstead Town Center to Topsail Middle School/Vista Ln	32,001		34,900	34,900	46,683	64,100
US 17 - Topsail Middle School/Vista Ln to Transfer Station Rd	30,606		33,600	34,300	45,802	63,100
US 17 - Transfer Station Rd to Leeward Ln	30,606		33,600	34,100	45,802	62,300
US 17 - Leeward Ln to Long Leaf Dr	30,606		33,600	33,500	45,802	61,400
US 17 - Long Leaf Dr to Sloop Point Loop Rd (SR 1563)	30,606		33,600	32,700	45,802	60,600
US 17 - north of Sloop Point Loop Rd (SR 1563)	30,606		33,600	30,500	45,802	56,600
Washington Acres Rd (SR 1582) - east of US 17	2,501	1,800 [2]	2,900	4,400	4,465	7,500
Island Creek Rd (SR 1002) - south of NC 210/Royal Oak Dr	4,620	2,500 [2]	5,500	3,700	8,833	6,200
NC 210 - north of NC 210/Royal Oak Dr	3,657	3,000 [2]	4,200	5,100	6,495	8,200
NC 210 - east of NC 210/Island Creek Rd (SR 1002)	6,364		7,600	7,200	12,343	12,300
NC 210 - west of US 17	6,699	7,300 [2]	7,700	9,000	11,529	15,100
Factory Rd (SR 1570) - east of US 17	10,540		11,200	2,500	13,719	3,100
Hoover Rd (SR 1569) - north of Godfrey Creek Rd	4,929		5,400	2,300	7,073	6,800
Hoover Rd (SR 1569) - South Topsail Elementary School to Godfrey Creek Rd	4,929		5,400	2,800	7,073	9,100
Hoover Rd (SR 1569) - south of South Topsail Elementary School	4,929	3,900 [1]	5,400	4,000	7,073	10,500
Hoover Rd (SR 1569) - west of US 17	4,929	3,700 [2]	5,400	5,700	7,073	15,000
I-140 - I-40 to US 17	12,377	15,000 [2]	17,300	20,200	37,103	48,500

Notes:

Table C6: 2040 No-Build Traffic Volumes

Forecast Location	Forecast 2016 BY NB	Historic Growth Rate		Model Growth Rate [1]	Chosen Growth Rate [1]	Future Year No-Build Volumes	
	AADT	2005-2015	1995-2015	2010-2040	2016-2040	2040 Model	2040 Forecast
US 17 - south of Washington Acres Rd (SR 1582)	37,000			1.08%	2.45%	38,227	**66,200**
US 17 - Washington Acres Rd (SR 1582) to NC 210/Dan Owen Dr	37,400	2.46%	3.50%	1.14%	2.45%	42,482	**66,900**
US 17 - NC 210/Dan Owen Dr to Peanut Rd (SR 1570)/Factory Rd (SR 1570)	43,200	1.23%	3.18%	1.27%	2.45%	51,621	**77,200**
US 17 - Peanut Rd (SR 1570)/Factory Rd (SR 1570) to Hoover Rd (SR 1569)/Comm Dwy	43,500			1.29%	2.45%	49,478	**77,800**
US 17 - Hoover Rd (SR 1569)/Comm Dwy to Forest Sound Rd	42,500			1.27%	2.45%	46,683	**76,000**
US 17 - Forest Sound Rd to Arrow Wood Road	42,500	2.37%	3.05%	1.27%	2.44%	46,683	**75,800**
US 17 - Arrow Wood Road to Grandview Dr	41,800			1.27%	2.45%	46,683	**74,800**
US 17 - Grandview Dr to Williams Store Rd (SR 1568)	41,600			1.27%	2.45%	46,683	**74,400**
US 17 - Williams Store Rd (SR 1568) to Jenkins Rd/Country Club Rd	41,400	1.71%	3.46%	1.27%	2.46%	46,683	**74,100**
US 17 - Jenkins Rd/Country Club Rd to Hampstead Town Center	34,600			1.27%	2.56%	46,683	**63,500**
US 17 - Hampstead Town Center to Topsail Middle School/Vista Ln	34,900			1.27%	2.57%	46,683	**64,100**
US 17 - Topsail Middle School/Vista Ln to Transfer Station Rd	34,300			1.35%	2.57%	45,802	**63,100**
US 17 - north of Transfer Station Rd to Leeward Ln	34,100			1.35%	2.54%	45,802	**62,300**
US 17 - Leeward Ln to Long Leaf Dr	33,500			1.35%	2.56%	45,802	**61,400**
US 17 - Long Leaf Dr to Sloop Point Loop Rd (SR 1563)	32,700			1.35%	2.60%	45,802	**60,600**
US 17 - north of Sloop Point Loop Rd (SR 1563)	30,500			1.35%	2.61%	45,802	**56,600**
I-140 - I-40 to Military Cutoff Road Extension	20,200	4.97%		3.73%	3.72%	37,103	**48,500**
I-140 - Military Cutoff Road Extension to US 17	20,200	4.97%		3.82%	3.81%	38,085	**49,600**
Military Cutoff Road Extension - South of I-140	0			n/a	n/a	18,008	**23,500**
Washington Acres Rd (SR 1582) - east of US 17	4,400	1.99%	5.34%	1.95%	2.25%	4,465	**7,500**
Royal Oak Dr - west of NC 210	800	-5.74%	0.43%	n/a	0.49%	n/a	**900**
Island Creek Rd (SR 1002) - south of NC 210/Royal Oak Dr	3,700			2.18%	2.17%	8,833	**6,200**
NC 210 - north of NC 210/Royal Oak Dr	5,100	2.25%	2.45%	1.93%	2.00%	6,495	**8,200**
NC 210 - east of NC 210/Island Creek Rd (SR 1002)	7,200	-1.30%	2.25%	2.23%	2.26%	12,343	**12,300**
NC 210 - west of US 17	9,000	-0.44%	1.92%	1.83%	2.18%	11,529	**15,100**
Dan Owen Dr - east of US 17	5,400			n/a	2.24%	n/a	**9,200**
Peanut Rd (SR 1570) - west of US 17	400			n/a	2.36%	n/a	**700**
Factory Rd (SR 1570) - east of US 17	2,500	3.81%	0.49%	0.88%	0.90%	13,719	**3,100**

Table C6: 2040 No-Build Traffic Volumes

Forecast Location	Forecast 2016 BY NB	Historic Growth Rate		Model Growth Rate [1]	Chosen Growth Rate [1]	Future Year No-Build Volumes	
	AADT	2005-2015	1995-2015	2010-2040	2016-2040	2040 Model	2040 Forecast
Hoover Rd (SR 1569) - west of Godfrey Creek Rd	2,300			1.21%	4.62%	7,073	**6,800**
Hoover Rd (SR 1569) - South Topsail Elementary School to Godfrey Creek Rd	2,800			1.21%	5.03%	7,073	**9,100**
Hoover Rd (SR 1569) - south of South Topsail Elementary School	4,000	-0.13%	8.26%	1.21%	4.10%	7,073	**10,500**
Hoover Rd (SR 1569) - west of US 17	5,700			1.21%	4.11%	7,073	**15,000**
Commercial Dwy - east of US 17	1,500			n/a	0.76%	n/a	**1,800**
Godfrey Creek Rd - west of Hoover Rd (SR 1569)	500			n/a	7.28%	n/a	**2,700**
South Topsail Elementary School - west of Hoover Rd (SR 1569)	1,600			n/a	0.49%	n/a	**1,800**
Forest Sound Rd - east of US 17	1,200			n/a	2.93%	n/a	**2,400**
Arrow Wood Road - west of US 17	1,500			n/a	3.47%	n/a	**3,400**
Grandview Dr - east of US 17	800			n/a	3.44%	n/a	**1,800**
Williams Store Rd (SR 1568) - east of US 17	600			n/a	1.70%	n/a	**900**
Jenkins Rd - west of US 17	3,700			n/a	0.43%	n/a	**4,100**
Country Club Rd - east of US 17	9,100			n/a	1.66%	n/a	**13,500**
Hampstead Town Center - east of US 17	4,300			n/a	0.63%	n/a	**5,000**
Topsail Middle School - west of US 17	3,100			n/a	0.39%	n/a	**3,400**
Vista Ln - east of US 17	300			n/a	1.21%	n/a	**400**
Transfer Station Rd - east of US 17	600			n/a	13.53%	n/a	**12,600**
Leeward Ln - east of US 17	1,200			n/a	0.93%	n/a	**1,500**
Long Leaf Dr - east of US 17	2,000	-1.70%	0.04%	n/a	0.76%	n/a	**2,400**
Sloop Point Loop Rd (SR 1563) - east of US 17	8,200	2.50%	3.59%	n/a	2.00%	n/a	**13,200**

Notes:

(1) Growth rate shown is the Compound Annual Growth Rate (CAGR).

Table C7: 2040 Build Scenario 1 Traffic Volumes

Forecast Location	2040 Model Volumes, Daily		Model Diversion Rate	Chosen Diversion Rate	Future Year Build Volumes	
	No-Build	Build - Scenario 1	2010-2040	2016-2040	2040 No-Build	2040 Build - Scenario 1
US 17 - south of Washington Acres Rd (SR 1582)	38,227	12,780	-66.57%	-72.05%	66,200	**18,500**
US 17 - Washington Acres Rd (SR 1582) to NC 210/Dan Owen Dr	42,482	16,862	-60.31%	-70.10%	66,900	**20,000**
US 17 - NC 210/Dan Owen Dr to Peanut Rd (SR 1570)/Factory Rd (SR 1570)	51,621	18,957	-63.28%	-67.36%	77,200	**25,200**
US 17 - Peanut Rd (SR 1570)/Factory Rd (SR 1570) to Hoover Rd (SR 1569)/Comm Dwy	49,478	16,190	-67.28%	-66.84%	77,800	**25,800**
US 17 - Hoover Rd (SR 1569)/Comm Dwy to Forest Sound Rd	46,683	13,100	-71.94%	-68.42%	76,000	**24,000**
US 17 - Forest Sound Rd to Arrow Wood Road	46,683	13,100	-71.94%	-67.81%	75,800	**24,400**
US 17 - Arrow Wood Road to Midtown Connector	46,683	13,100	-71.94%	-67.91%	74,800	**24,000**
US 17 - Midtown Connector to Grandview Dr	46,683	13,100	-71.94%	-67.65%	74,800	**24,200**
US 17 - Grandview Dr to Williams Store Rd (SR 1568)	46,683	13,100	-71.94%	-68.55%	74,400	**23,400**
US 17 - Williams Store Rd (SR 1568) to Jenkins Rd/Country Club Rd	46,683	13,100	-71.94%	-68.83%	74,100	**23,100**
US 17 - Jenkins Rd/Country Club Rd to Hampstead Town Center	46,683	13,100	-71.94%	-79.37%	63,500	**13,100**
US 17 - Hampstead Town Center to Topsail Middle School/Vista Ln	46,683	13,100	-71.94%	-78.00%	64,100	**14,100**
US 17 - Topsail Middle School/Vista Ln to Transfer Station Rd	45,802	18,803	-58.95%	-78.61%	63,100	**13,500**
US 17 - north of Transfer Station Rd to Leeward Ln	45,802	18,803	-58.95%	-69.02%	62,300	**19,300**
US 17 - Leeward Ln to Hampstead Bypass	45,802	18,803	-58.95%	-67.75%	61,400	**19,800**
US 17 - Hampstead Bypass to Long Leaf Dr	45,802	47,476	3.65%	0.00%	61,400	**61,400**
US 17 - Long Leaf Dr to Sloop Point Loop Rd (SR 1563)	45,802	47,476	3.65%	0.00%	60,600	**60,600**
US 17 - north of Sloop Point Loop Rd (SR 1563)	45,802	47,476	3.65%	0.00%	56,600	**56,600**
I-140 - I-40 to Military Cutoff Road Extension	37,103	40,311	8.65%	8.66%	48,500	**52,700**
I-140 - Military Cutoff Road Extension to US 17	38,085	15,036	-60.52%	-60.48%	49,600	**19,600**
Military Cutoff Road Extension - South of I-140	18,008	24,095	33.80%	33.62%	23,500	**31,400**
Hampstead Bypass - I-140 of NC 210		34,496	n/a	n/a	n/a	**48,300**
Hampstead Bypass - NC 210 to Midtown Interchange		39,169	n/a	n/a	n/a	**52,000**
Hampstead Bypass - Midtown Interchange to US 17		39,169	n/a	n/a	n/a	**51,000**
Midtown Connector - Hampstead Bypass to US 17		0	n/a	n/a	n/a	**11,000**
Washington Acres Rd (SR 1582) - east of US 17	4,465	4,319	-3.27%	0.00%	7,500	**7,500**
Royal Oak Dr - west of NC 210			n/a	0.00%	900	**900**
Island Creek Rd (SR 1002) - south of NC 210/Royal Oak Dr	8,833	6,809	-22.91%	-19.35%	6,200	**5,000**
NC 210 - north of NC 210/Royal Oak Dr	6,495	6,966	7.25%	7.32%	8,200	**8,800**

Table C7: 2040 Build Scenario 1 Traffic Volumes

Forecast Location	2040 Model Volumes, Daily		Model Diversion Rate	Chosen Diversion Rate	Future Year Build Volumes	
	No-Build	Build - Scenario 1	2010-2040	2016-2040	2040 No-Build	2040 Build - Scenario 1
NC 210 - NC 210/Island Creek Rd (SR 1002) to Hampstead Bypass	12,343	11,200	-9.26%	-3.25%	12,300	**11,900**
NC 210 - east of Hampstead Bypass	11,529	4,045	-64.91%	-43.09%	12,300	**7,000**
NC 210 - west of US 17	11,529	4,045	-64.91%	-28.48%	15,100	**10,800**
Dan Owen Dr - east of US 17			n/a	0.00%	9,200	**9,200**
Peanut Rd (SR 1570) - west of US 17			n/a	0.00%	700	**700**
Factory Rd (SR 1570) - east of US 17			n/a	0.00%	3,100	**3,100**
Hoover Rd (SR 1569) - west of Godfrey Creek Rd	7,073	7,088	0.21%	0.00%	6,800	**6,800**
Hoover Rd (SR 1569) - South Topsail Elementary School to Godfrey Creek Rd	7,073	7,088	0.21%	0.00%	9,100	**9,100**
Hoover Rd (SR 1569) - south of South Topsail Elementary School	7,073	7,088	0.21%	0.00%	10,500	**10,500**
Hoover Rd (SR 1569) - west of US 17	7,073	7,088	0.21%	0.00%	15,000	**15,000**
Commercial Dwy - east of US 17			n/a	0.00%	1,800	**1,800**
Godfrey Creek Rd - west of Hoover Rd (SR 1569)			n/a	0.00%	2,700	**2,700**
South Topsail Elementary School - west of Hoover Rd (SR 1569)			n/a	0.00%	1,800	**1,800**
Forest Sound Rd - east of US 17			n/a	0.00%	2,400	**2,400**
Arrow Wood Road - west of US 17			n/a	0.00%	3,400	**3,400**
Grandview Dr - east of US 17			n/a	0.00%	1,800	**1,800**
Williams Store Rd (SR 1568) - east of US 17			n/a	0.00%	900	**900**
Jenkins Rd - west of US 17			n/a	0.00%	4,100	**4,100**
Country Club Rd - east of US 17			n/a	0.00%	13,500	**13,500**
Hampstead Town Center - east of US 17			n/a	0.00%	5,000	**5,000**
Topsail Middle School - west of US 17			n/a	0.00%	3,400	**3,400**
Vista Ln - east of US 17			n/a	0.00%	400	**400**
Transfer Station Rd - east of US 17			n/a	0.00%	12,600	**12,600**
Leeward Ln - east of US 17			n/a	0.00%	1,500	**1,500**
Long Leaf Dr - east of US 17			n/a	0.00%	2,400	**2,400**
Sloop Point Loop Rd (SR 1563) - east of US 17			n/a	0.00%	13,200	**13,200**

Notes:

Table C8: 2040 Build Scenario 2 Traffic Volumes

Forecast Location	2040 Model Volumes, Daily		Model Diversion Rate	Chosen Diversion Rate	Future Year Build Volumes		
	No-Build	Build - Scenario 2	2010-2040	2016-2040	2040 No-Build	2040 Build - Scenario 2	
US 17 - south of Washington Acres Rd (SR 1582)	38,227	11,852	-69.00%	-75.98%	66,200	**15,900**	(1)
US 17 - Washington Acres Rd (SR 1582) to NC 210/Dan Owen Dr	42,482	15,894	-62.59%	-73.99%	66,900	**17,400**	(1)
US 17 - NC 210/Dan Owen Dr to Peanut Rd (SR 1570)/Factory Rd (SR 1570)	51,621	17,625	-65.86%	-71.24%	77,200	**22,200**	(1)
US 17 - Peanut Rd (SR 1570)/Factory Rd (SR 1570) to Hoover Rd (SR 1569)/Comm Dwy	49,478	14,738	-70.21%	-70.69%	77,800	**22,800**	(1)
US 17 - Hoover Rd (SR 1569)/Comm Dwy to Forest Sound Rd	46,683	12,295	-73.66%	-70.79%	76,000	**22,200**	(1)
US 17 - Forest Sound Rd to Arrow Wood Road	46,683	12,295	-73.66%	-70.18%	75,800	**22,600**	(1)
US 17 - Arrow Wood Road to Midtown Connector	46,683	12,295	-73.66%	-70.32%	74,800	**22,200**	(1)
US 17 - Midtown Connector to Grandview Dr	46,683	12,295	-73.66%	-68.98%	74,800	**23,200**	(1)
US 17 - Grandview Dr to Williams Store Rd (SR 1568)	46,683	12,295	-73.66%	-69.89%	74,400	**22,400**	(1)
US 17 - Williams Store Rd (SR 1568) to Jenkins Rd/Country Club Rd	46,683	12,295	-73.66%	-70.18%	74,100	**22,100**	(1)
US 17 - Jenkins Rd/Country Club Rd to Hampstead Town Center	46,683	12,295	-73.66%	-80.94%	63,500	**12,100**	(1)
US 17 - Hampstead Town Center to Topsail Middle School/Vista Ln	46,683	12,295	-73.66%	-79.56%	64,100	**13,100**	(1)
US 17 - Topsail Middle School/Vista Ln to Transfer Station Rd	45,802	18,843	-58.86%	-80.19%	63,100	**12,500**	(1)
US 17 - Transfer Station Rd to Leeward Ln	45,802	18,843	-58.86%	-70.63%	62,300	**18,300**	(1)
US 17 - Leeward Ln to Hampstead Bypass	45,802	18,843	-58.86%	-69.38%	61,400	**18,800**	(1)
US 17 - Hampstead Bypass to Long Leaf Dr	45,802	47,508	3.72%	0.00%	61,400	**61,400**	
US 17 - Long Leaf Dr to Sloop Point Loop Rd (SR 1563)	45,802	47,508	3.72%	0.00%	60,600	**60,600**	
US 17 - north of Sloop Point Loop Rd (SR 1563)	45,802	47,508	3.72%	0.00%	56,600	**56,600**	
I-140 - I-40 to Military Cutoff Road Extension	37,103	40,146	8.20%	8.04%	48,500	**52,400**	
I-140 - Military Cutoff Road Extension to US 17	38,085	14,287	-62.49%	-62.50%	49,600	**18,600**	
Military Cutoff Road Extension - South of I-140	18,008	24,226	34.53%	34.47%	23,500	**31,600**	(1)
Hampstead Bypass - I-140 of NC 210		24,226	n/a	n/a	n/a	**51,000**	(1)
Hampstead Bypass - NC 210 to Hoover Road		35,319	n/a	n/a	n/a	**55,400**	(1)
Hampstead Bypass - Hoover Road to Midtown Interchange		40,571	n/a	n/a	n/a	**53,800**	(1)
Hampstead Bypass - Midtown Interchange to US 17		40,057	n/a	n/a	n/a	**52,000**	(1)
Midtown Connector - Hampstead Bypass to US 17		0	n/a	n/a	n/a	**11,800**	(1)
Washington Acres Rd (SR 1582) - east of US 17	4,465	4,279	-4.17%	0.00%	7,500	**7,500**	
Royal Oak Dr - west of NC 210			n/a	-11.11%	900	**800**	
Island Creek Rd (SR 1002) - south of NC 210/Royal Oak Dr	8,833	6,901	-21.87%	-19.35%	6,200	**5,000**	
NC 210 - north of NC 210/Royal Oak Dr	6,495	6,976	7.41%	2.44%	8,200	**8,400**	(1)

Table C8: 2040 Build Scenario 2 Traffic Volumes

Forecast Location	2040 Model Volumes, Daily		Model Diversion Rate	Chosen Diversion Rate	Future Year Build Volumes		
	No-Build	Build - Scenario 2	2010-2040	2016-2040	2040 No-Build	2040 Build - Scenario 2	
NC 210 - NC 210/Island Creek Rd (SR 1002) to Hampstead Bypass	12,343	11,299	-8.46%	-7.32%	12,300	**11,400**	(1)
NC 210 - east of Hampstead Bypass	11,529	3,677	-68.11%	-46.34%	12,300	**6,600**	(1)
NC 210 - west of US 17	11,529	3,677	-68.11%	-31.13%	15,100	**10,400**	(1)
Dan Owen Dr - east of US 17			n/a	0.00%	9,200	**9,200**	
Peanut Rd (SR 1570) - west of US 17			n/a	0.00%	700	**700**	
Factory Rd (SR 1570) - east of US 17			n/a	0.00%	3,100	**3,100**	
Hoover Rd (SR 1569) - west of Godfrey Creek Rd	7,073	7,289	3.05%	0.00%	6,800	**6,800**	
Hoover Rd (SR 1569) - Godfrey Creek Rd to Hampstead Bypass	7,073	7,289	3.05%	4.40%	9,100	**9,500**	(1)
Hoover Rd (SR 1569) - Hampstead Bypass to South Topsail Elementary School	7,073	4,609	-34.84%	-26.37%	9,100	**6,700**	(1)
Hoover Rd (SR 1569) - south of South Topsail Elementary School	7,073	4,609	-34.84%	-34.29%	10,500	**6,900**	(1)
Hoover Rd (SR 1569) - west of US 17	7,073	4,609	-34.84%	-24.00%	15,000	**11,400**	(1)
Commercial Dwy - east of US 17			n/a	0.00%	1,800	**1,800**	
Godfrey Creek Rd - west of Hoover Rd (SR 1569)			n/a	14.81%	2,700	**3,100**	(1)
South Topsail Elementary School - west of Hoover Rd (SR 1569)			n/a	0.00%	1,800	**1,800**	
Forest Sound Rd - east of US 17			n/a	0.00%	2,400	**2,400**	
Arrow Wood Road - west of US 17			n/a	0.00%	3,400	**3,400**	
Grandview Dr - east of US 17			n/a	0.00%	1,800	**1,800**	
Williams Store Rd (SR 1568) - east of US 17			n/a	0.00%	900	**900**	
Jenkins Rd - west of US 17			n/a	0.00%	4,100	**4,100**	
Country Club Rd - east of US 17			n/a	0.00%	13,500	**13,500**	
Hampstead Town Center - east of US 17			n/a	0.00%	5,000	**5,000**	
Topsail Middle School - west of US 17			n/a	0.00%	3,400	**3,400**	
Vista Ln - east of US 17			n/a	0.00%	400	**400**	
Transfer Station Rd - east of US 17			n/a	0.00%	12,600	**12,600**	
Leeward Ln - east of US 17			n/a	0.00%	1,500	**1,500**	
Long Leaf Dr - east of US 17			n/a	0.00%	2,400	**2,400**	
Sloop Point Loop Rd (SR 1563) - east of US 17			n/a	0.00%	13,200	**13,200**	

Notes:

1 - Link has an unbalanced AADT volume. See Forecast Figures for directional AADT.

Table C9: 2040 Build Scenario 3 Traffic Volumes

Forecast Location	2040 Model Volumes, Daily		Model Diversion Rate	Chosen Diversion Rate	Future Year Build Volumes	
	No-Build	Build - Scenario 3	2010-2040	2016-2040	2040 No-Build	2040 Build - Scenario 3
US 17 - south of Washington Acres Rd (SR 1582)	38,227	12,781	-66.57%	-70.09%	66,200	**19,800**
US 17 - Washington Acres Rd (SR 1582) to NC 210/Dan Owen Dr	42,482	16,863	-60.31%	-68.16%	66,900	**21,300**
US 17 - NC 210/Dan Owen Dr to Peanut Rd (SR 1570)/Factory Rd (SR 1570)	51,621	18,959	-63.27%	-64.25%	77,200	**27,600**
US 17 - Peanut Rd (SR 1570)/Factory Rd (SR 1570) to Hoover Rd (SR 1569)/Comm Dwy	49,478	16,191	-67.28%	-63.75%	77,800	**28,200**
US 17 - Hoover Rd (SR 1569)/Comm Dwy to Forest Sound Rd	46,683	13,101	-71.94%	-65.26%	76,000	**26,400**
US 17 - Forest Sound Rd to Arrow Wood Road	46,683	13,101	-71.94%	-65.44%	75,800	**26,200**
US 17 - Arrow Wood Road to Grandview Dr	46,683	13,101	-71.94%	-66.31%	74,800	**25,200**
US 17 - Grandview Dr to Williams Store Rd (SR 1568)	46,683	13,101	-71.94%	-66.67%	74,400	**24,800**
US 17 - Williams Store Rd (SR 1568) to Jenkins Rd/Country Club Rd	46,683	13,101	-71.94%	-66.94%	74,100	**24,500**
US 17 - Jenkins Rd/Country Club Rd to Hampstead Town Center	46,683	13,101	-71.94%	-75.59%	63,500	**15,500**
US 17 - Hampstead Town Center to Topsail Middle School/Vista Ln	46,683	13,101	-71.94%	-73.32%	64,100	**17,100**
US 17 - Topsail Middle School/Vista Ln to Transfer Station Rd	45,802	18,802	-58.95%	-73.22%	63,100	**16,900**
US 17 - Transfer Station Rd to Leeward Ln	45,802	18,802	-58.95%	-63.56%	62,300	**22,700**
US 17 - Leeward Ln to Hampstead Bypass	45,802	18,802	-58.95%	-62.21%	61,400	**23,200**
US 17 - Hampstead Bypass to Long Leaf Dr	45,802	47,476	3.65%	0.00%	61,400	**61,400**
US 17 - Long Leaf Dr to Sloop Point Loop Rd (SR 1563)	45,802	47,476	3.65%	0.00%	60,600	**60,600**
US 17 - north of Sloop Point Loop Rd (SR 1563)	45,802	47,476	3.65%	0.00%	56,600	**56,600**
I-140 - I-40 to Military Cutoff Road Extension	37,103	40,320	8.67%	8.45%	48,500	**52,600**
I-140 - Military Cutoff Road Extension to US 17	38,085	15,032	-60.53%	-60.48%	49,600	**19,600**
Military Cutoff Road Extension - South of I-140	18,008	24,083	33.74%	33.62%	23,500	**31,400**
Hampstead Bypass - I-140 of NC 210		34,495	n/a	n/a	n/a	**47,000**
Hampstead Bypass - NC 210 to US 17		39,168	n/a	n/a	n/a	**49,600**
Washington Acres Rd (SR 1582) - east of US 17	4,465	4,319	-3.27%	0.00%	7,500	**7,500**
Royal Oak Dr - west of NC 210			n/a	0.00%	900	**900**
Island Creek Rd (SR 1002) - south of NC 210/Royal Oak Dr	8,833	6,807	-22.94%	-19.35%	6,200	**5,000**
NC 210 - north of NC 210/Royal Oak Dr	6,495	6,966	7.25%	7.32%	8,200	**8,800**
NC 210 - NC 210/Island Creek Rd (SR 1002) to Hampstead Bypass	12,343	11,199	-9.27%	-3.25%	12,300	**11,900**
NC 210 - east of Hampstead Bypass	12,343	4,045	-67.23%	-34.15%	12,300	**8,100**
NC 210 - west of US 17	11,529	4,045	-64.91%	-21.19%	15,100	**11,900**
Dan Owen Dr - east of US 17			n/a	0.00%	9,200	**9,200**

Table C9: 2040 Build Scenario 3 Traffic Volumes

Forecast Location	2040 Model Volumes, Daily		Model Diversion Rate	Chosen Diversion Rate	Future Year Build Volumes	
	No-Build	Build - Scenario 3	2010-2040	2016-2040	2040 No-Build	2040 Build - Scenario 3
Peanut Rd (SR 1570) - west of US 17			n/a	0.00%	700	**700**
Factory Rd (SR 1570) - east of US 17			n/a	0.00%	3,100	**3,100**
Hoover Rd (SR 1569) - west of Godfrey Creek Rd	7,073	7,088	0.21%	0.00%	6,800	**6,800**
Hoover Rd (SR 1569) - Godfrey Creek Rd to South Topsail Elementary School	7,073	7,088	0.21%	0.00%	9,100	**9,100**
Hoover Rd (SR 1569) - south of South Topsail Elementary School	7,073	7,088	0.21%	0.00%	10,500	**10,500**
Hoover Rd (SR 1569) - west of US 17	7,073	7,088	0.21%	0.00%	15,000	**15,000**
Commercial Dwy - east of US 17			n/a	0.00%	1,800	**1,800**
Godfrey Creek Rd - west of Hoover Rd (SR 1569)			n/a	0.00%	2,700	**2,700**
South Topsail Elementary School - west of Hoover Rd (SR 1569)			n/a	0.00%	1,800	**1,800**
Forest Sound Rd - east of US 17			n/a	0.00%	2,400	**2,400**
Arrow Wood Road - west of US 17			n/a	0.00%	3,400	**3,400**
Grandview Dr - east of US 17			n/a	0.00%	1,800	**1,800**
Williams Store Rd (SR 1568) - east of US 17			n/a	0.00%	900	**900**
Jenkins Rd - west of US 17			n/a	0.00%	4,100	**4,100**
Country Club Rd - east of US 17			n/a	0.00%	13,500	**13,500**
Hampstead Town Center - east of US 17			n/a	0.00%	5,000	**5,000**
Topsail Middle School - west of US 17			n/a	0.00%	3,400	**3,400**
Vista Ln - east of US 17			n/a	0.00%	400	**400**
Transfer Station Rd - east of US 17			n/a	0.00%	12,600	**12,600**
Leeward Ln - east of US 17			n/a	0.00%	1,500	**1,500**
Long Leaf Dr - east of US 17			n/a	0.00%	2,400	**2,400**
Sloop Point Loop Rd (SR 1563) - east of US 17			n/a	0.00%	13,200	**13,200**

Notes:

Table C10: 2040 Build Scenario 4 Traffic Volumes

Forecast Location	2040 Model Volumes, Daily		Model Diversion Rate	Chosen Diversion Rate	Future Year Build Volumes		
	No-Build	Build - Scenario 4	2010-2040	2016-2040	2040 No-Build	2040 Build - Scenario 4	
US 17 - south of Washington Acres Rd (SR 1582)	38,227	11,850	-69.00%	-73.87%	66,200	**17,300**	(1)
US 17 - Washington Acres Rd (SR 1582) to NC 210/Dan Owen Dr	42,482	15,892	-62.59%	-71.90%	66,900	**18,800**	(1)
US 17 - NC 210/Dan Owen Dr to Peanut Rd (SR 1570)/Factory Rd (SR 1570)	51,621	17,624	-65.86%	-68.13%	77,200	**24,600**	(1)
US 17 - Peanut Rd (SR 1570)/Factory Rd (SR 1570) to Hoover Rd (SR 1569)/Comm Dwy	49,478	14,736	-70.22%	-67.61%	77,800	**25,200**	(1)
US 17 - Hoover Rd (SR 1569)/Comm Dwy to Forest Sound Rd	46,683	12,293	-73.67%	-66.84%	76,000	**25,200**	(1)
US 17 - Forest Sound Rd to Arrow Wood Road	46,683	12,293	-73.67%	-67.02%	75,800	**25,000**	(1)
US 17 - Arrow Wood Road to Grandview Dr	46,683	12,293	-73.67%	-67.91%	74,800	**24,000**	(1)
US 17 - Grandview Dr to Williams Store Rd (SR 1568)	46,683	12,293	-73.67%	-68.28%	74,400	**23,600**	(1)
US 17 - Williams Store Rd (SR 1568) to Jenkins Rd/Country Club Rd	46,683	12,293	-73.67%	-68.56%	74,100	**23,300**	(1)
US 17 - Jenkins Rd/Country Club Rd to Hampstead Town Center	46,683	12,293	-73.67%	-77.48%	63,500	**14,300**	(1)
US 17 - Hampstead Town Center to Topsail Middle School/Vista Ln	46,683	12,293	-73.67%	-75.20%	64,100	**15,900**	(1)
US 17 - Topsail Middle School/Vista Ln to Transfer Station Rd	45,802	18,840	-58.87%	-75.12%	63,100	**15,700**	(1)
US 17 - Transfer Station Rd to Leeward Ln	45,802	18,840	-58.87%	-65.49%	62,300	**21,500**	(1)
US 17 - Leeward Ln to Hampstead Bypass	45,802	18,840	-58.87%	-64.17%	61,400	**22,000**	(1)
US 17 - Hampstead Bypass to Long Leaf Dr	45,802	47,510	3.73%	0.00%	61,400	**61,400**	
US 17 - Long Leaf Dr to Sloop Point Loop Rd (SR 1563)	45,802	47,510	3.73%	0.00%	60,600	**60,600**	
US 17 - north of Sloop Point Loop Rd (SR 1563)	45,802	47,510	3.73%	0.00%	56,600	**56,600**	
I-140 - I-40 to Military Cutoff Road Extension	37,103	40,153	8.22%	8.25%	48,500	**52,500**	
I-140 - Military Cutoff Road Extension to US 17	38,085	14,264	-62.55%	-62.30%	49,600	**18,700**	
Military Cutoff Road Extension - South of I-140	18,008	24,236	34.58%	34.89%	23,500	**31,700**	(1)
Hampstead Bypass - I-140 of NC 210		35,324	n/a	n/a	n/a	**49,500**	(1)
Hampstead Bypass - NC 210 to Hoover Road		40,577	n/a	n/a	n/a	**53,000**	(1)
Hampstead Bypass - Hoover Road to US 17		40,063	n/a	n/a	n/a	**50,800**	(1)
Washington Acres Rd (SR 1582) - east of US 17	4,465	4,279	-4.17%	0.00%	7,500	**7,500**	
Royal Oak Dr - west of NC 210			n/a	-11.11%	900	**800**	
Island Creek Rd (SR 1002) - south of NC 210/Royal Oak Dr	8,833	6,902	-21.86%	-19.35%	6,200	**5,000**	
NC 210 - north of NC 210/Royal Oak Dr	6,495	6,977	7.42%	2.44%	8,200	**8,400**	
NC 210 - NC 210/Island Creek Rd (SR 1002) to Hampstead Bypass	12,343	11,300	-8.45%	-7.32%	12,300	**11,400**	(1)
NC 210 - east of Hampstead Bypass	11,529	3,678	-68.10%	-39.02%	12,300	**7,500**	(1)
NC 210 - west of US 17	11,529	3,678	-68.10%	-24.50%	15,100	**11,400**	(1)

Table C10: 2040 Build Scenario 4 Traffic Volumes

Forecast Location	2040 Model Volumes, Daily		Model Diversion Rate	Chosen Diversion Rate	Future Year Build Volumes		
	No-Build	Build - Scenario 4	2010-2040	2016-2040	2040 No-Build	2040 Build - Scenario 4	
Dan Owen Dr - east of US 17			n/a	0.00%	9,200	**9,200**	
Peanut Rd (SR 1570) - west of US 17			n/a	0.00%	700	**700**	
Factory Rd (SR 1570) - east of US 17			n/a	0.00%	3,100	**3,100**	
Hoover Rd (SR 1569) - west of Godfrey Creek Rd	7,073	7,289	3.05%	0.00%	6,800	**6,800**	
Hoover Rd (SR 1569) - Godfrey Creek Rd to Hampstead Bypass	7,073	7,289	3.05%	4.40%	9,100	**9,500**	(1)
Hoover Rd (SR 1569) - Hampstead Bypass to South Topsail Elementary School	7,073	4,609	-34.84%	-21.98%	9,100	**7,100**	(1)
Hoover Rd (SR 1569) - south of South Topsail Elementary School	7,073	4,609	-34.84%	-28.57%	10,500	**7,500**	(1)
Hoover Rd (SR 1569) - west of US 17	7,073	4,609	-34.84%	-20.00%	15,000	**12,000**	(1)
Commercial Dwy - east of US 17			n/a	0.00%	1,800	**1,800**	
Godfrey Creek Rd - west of Hoover Rd (SR 1569)			n/a	14.81%	2,700	**3,100**	(1)
South Topsail Elementary School - west of Hoover Rd (SR 1569)			n/a	0.00%	1,800	**1,800**	
Forest Sound Rd - east of US 17			n/a	0.00%	2,400	**2,400**	
Arrow Wood Road - west of US 17			n/a	0.00%	3,400	**3,400**	
Grandview Dr - east of US 17			n/a	0.00%	1,800	**1,800**	
Williams Store Rd (SR 1568) - east of US 17			n/a	0.00%	900	**900**	
Jenkins Rd - west of US 17			n/a	0.00%	4,100	**4,100**	
Country Club Rd - east of US 17			n/a	0.00%	13,500	**13,500**	
Hampstead Town Center - east of US 17			n/a	0.00%	5,000	**5,000**	
Topsail Middle School - west of US 17			n/a	0.00%	3,400	**3,400**	
Vista Ln - east of US 17			n/a	0.00%	400	**400**	
Transfer Station Rd - east of US 17			n/a	0.00%	12,600	**12,600**	
Leeward Ln - east of US 17			n/a	0.00%	1,500	**1,500**	
Long Leaf Dr - east of US 17			n/a	0.00%	2,400	**2,400**	
Sloop Point Loop Rd (SR 1563) - east of US 17			n/a	0.00%	13,200	**13,200**	

Notes:

1 - Link has an unbalanced AADT volume. See Forecast Figures for directional AADT.

Table C11: 2040 Build Scenario 5 Traffic Volumes

Forecast Location	2040 Model Volumes, Daily		Model Diversion Rate	Chosen Diversion Rate	Future Year Build Volumes		
	No-Build	Build - Scenario 5	2010-2040	2016-2040	2040 No-Build	2040 Build - Scenario 5	
US 17 - south of Washington Acres Rd (SR 1582)	38,227	11,766	-69.22%	-80.06%	66,200	**13,200**	
US 17 - Washington Acres Rd (SR 1582) to NC 210/Dan Owen Dr	42,482	15,804	-62.80%	-78.03%	66,900	**14,700**	(1)
US 17 - NC 210/Dan Owen Dr to Peanut Rd (SR 1570)/Factory Rd (SR 1570)	51,621	17,532	-66.04%	-74.74%	77,200	**19,500**	(1)
US 17 - Peanut Rd (SR 1570)/Factory Rd (SR 1570) to Hoover Rd (SR 1569)/Comm Dwy	49,478	14,584	-70.52%	-74.16%	77,800	**20,100**	(1)
US 17 - Hoover Rd (SR 1569)/Comm Dwy to Forest Sound Rd	46,683	11,090	-76.24%	-73.68%	76,000	**20,000**	
US 17 - Forest Sound Rd to Arrow Wood Road	46,683	11,090	-76.24%	-73.09%	75,800	**20,400**	
US 17 - Arrow Wood Road to Midtown Connector	46,683	11,090	-76.24%	-73.26%	74,800	**20,000**	
US 17 - Midtown Connector to Grandview Dr	46,683	11,090	-76.24%	-70.70%	74,400	**21,800**	
US 17 - Grandview Dr to Williams Store Rd (SR 1568)	46,683	11,090	-76.24%	-71.77%	74,400	**21,000**	
US 17 - Williams Store Rd (SR 1568) to Jenkins Rd/Country Club Rd	46,683	11,090	-76.24%	-72.06%	74,100	**20,700**	
US 17 - Jenkins Rd/Country Club Rd to Hampstead Town Center	46,683	11,090	-76.24%	-83.15%	63,500	**10,700**	
US 17 - Hampstead Town Center to Topsail Middle School/Vista Ln	46,683	11,090	-76.24%	-81.75%	64,100	**11,700**	
US 17 - Topsail Middle School/Vista Ln to Transfer Station Rd	46,683	18,815	-59.70%	-81.77%	63,100	**11,500**	
US 17 - Transfer Station Rd to Leeward Ln	46,683	18,815	-59.70%	-72.23%	62,300	**17,300**	
US 17 - Leeward Ln to Hampstead Bypass	46,683	18,815	-59.70%	-71.01%	61,400	**17,800**	
US 17 - Hampstead Bypass to Long Leaf Dr	45,802	47,727	4.20%	0.00%	61,400	**61,400**	
US 17 - Long Leaf Dr to Sloop Point Loop Rd (SR 1563)	45,802	47,727	4.20%	0.00%	60,600	**60,600**	
US 17 - north of Sloop Point Loop Rd (SR 1563)	45,802	47,727	4.20%	0.00%	56,600	**56,600**	
I-140 - I-40 to Military Cutoff Road Extension	37,103	39,903	7.55%	7.63%	48,500	**52,200**	
I-140 - Military Cutoff Road Extension to US 17	38,085	14,282	-62.50%	-62.50%	49,600	**18,600**	
Military Cutoff Road Extension - South of I-140	18,008	24,236	34.58%	36.17%	23,500	**32,000**	
Hampstead Bypass - I-140 of NC 210		35,081	n/a	n/a	n/a	**53,600**	
Hampstead Bypass - NC 210 to Hoover Road		40,239	n/a	n/a	n/a	**58,500**	(1)
Hampstead Bypass - Hoover Road to Midtown Interchange		40,193	n/a	n/a	n/a	**57,000**	(1)
Hampstead Bypass - Midtown Interchange to US 17		41,716	n/a	n/a	n/a	**53,400**	
Midtown Connector - Service Road to Hampstead Bypass			n/a	n/a	n/a	**5,600**	(1)
Midtown Connector - Hampstead Bypass to US 17		0	n/a	n/a	n/a	**12,600**	
Service Road - Hoover Road to Midtown Connector		1,524	n/a	n/a	n/a	**5,000**	(1)
Service Road - North of Midtown Connector			n/a	n/a	n/a	**1,000**	
Washington Acres Rd (SR 1582) - east of US 17	4,465	4,275	-4.26%	0.00%	7,500	**7,500**	
Royal Oak Dr - west of NC 210			n/a	0.00%	900	**900**	

Table C11: 2040 Build Scenario 5 Traffic Volumes

Forecast Location	2040 Model Volumes, Daily		Model Diversion Rate	Chosen Diversion Rate	Future Year Build Volumes		
	No-Build	Build - Scenario 5	2010-2040	2016-2040	2040 No-Build	2040 Build - Scenario 5	
Island Creek Rd (SR 1002) - south of NC 210/Royal Oak Dr	8,833	6,870	-22.22%	-19.35%	6,200	**5,000**	
NC 210 - north of NC 210/Royal Oak Dr	6,495	6,938	6.82%	-2.44%	8,200	**8,000**	
NC 210 - east of NC 210/Island Creek Rd (SR 1002)	12,343	11,226	-9.05%	-9.76%	12,300	**11,100**	(1)
NC 210 - east of Hampstead Bypass			n/a	-46.34%	12,300	**6,600**	(1)
NC 210 - west of US 17	11,529	3,653	-68.31%	-31.13%	15,100	**10,400**	(1)
Dan Owen Dr - east of US 17			n/a	0.00%	9,200	**9,200**	
Peanut Rd (SR 1570) - west of US 17			n/a	0.00%	700	**700**	
Factory Rd (SR 1570) - east of US 17			n/a	0.00%	3,100	**3,100**	
Hoover Rd (SR 1569) - west of Godfrey Creek Rd	7,073	8,110	14.66%	-14.71%	6,800	**5,800**	
Hoover Rd (SR 1569) - Godfrey Creek Rd to Service Road	7,073	8,110	14.66%	-2.20%	9,100	**8,900**	(1)
Hoover Rd (SR 1569) - Service Road to Hampstead Bypass	7,073	6,586	-6.89%	-39.56%	9,100	**5,500**	(1)
Hoover Rd (SR 1569) - Hampstead Bypass to South Topsail Elementary School	7,073	3,493	-50.62%	-67.03%	9,100	**3,000**	(1)
Hoover Rd (SR 1569) - south of South Topsail Elementary School	7,073	3,493	-50.62%	-80.95%	10,500	**2,000**	(1)
Hoover Rd (SR 1569) - west of US 17	7,073	3,493	-50.62%	-56.67%	15,000	**6,500**	(1)
Commercial Dwy - east of US 17			n/a	0.00%	1,800	**1,800**	
Godfrey Creek Rd - west of Hoover Rd (SR 1569)			n/a	29.63%	2,700	**3,500**	
South Topsail Elementary School - west of Hoover Rd (SR 1569)			n/a	0.00%	1,800	**1,800**	
Forest Sound Rd - east of US 17			n/a	0.00%	2,400	**2,400**	
Arrow Wood Road - west of US 17			n/a	0.00%	3,400	**3,400**	
Grandview Dr - east of US 17			n/a	0.00%	1,800	**1,800**	
Williams Store Rd (SR 1568) - east of US 17			n/a	0.00%	900	**900**	
Jenkins Rd - west of US 17			n/a	0.00%	4,100	**4,100**	
Country Club Rd - east of US 17			n/a	0.00%	13,500	**13,500**	
Hampstead Town Center - east of US 17			n/a	0.00%	5,000	**5,000**	
Topsail Middle School - west of US 17			n/a	0.00%	3,400	**3,400**	
Vista Ln - east of US 17			n/a	0.00%	400	**400**	
Transfer Station Rd - east of US 17			n/a	0.00%	12,600	**12,600**	
Leeward Ln - east of US 17			n/a	0.00%	1,500	**1,500**	
Long Leaf Dr - east of US 17			n/a	0.00%	2,400	**2,400**	
Sloop Point Loop Rd (SR 1563) - east of US 17			n/a	0.00%	13,200	**13,200**	

Notes:

1 - Link has an unbalanced AADT volume. See Forecast Figures for directional AADT.

Table C12: 2040 Build Scenario 6 Traffic Volumes

Forecast Location	2040 Model Volumes, Daily		Model Diversion Rate	Chosen Diversion Rate	Future Year Build Volumes		
	No-Build	Build - Scenario 6	2010-2040	2016-2040	2040 No-Build	2040 Build - Scenario 6	
US 17 - south of Washington Acres Rd (SR 1582)	38,227	11,766	-69.22%	-80.06%	66,200	**13,200**	
US 17 - Washington Acres Rd (SR 1582) to NC 210/Dan Owen Dr	42,482	15,804	-62.80%	-78.03%	66,900	**14,700**	(1)
US 17 - NC 210/Dan Owen Dr to Peanut Rd (SR 1570)/Factory Rd (SR 1570)	51,621	17,532	-66.04%	-74.74%	77,200	**19,500**	(1)
US 17 - Peanut Rd (SR 1570)/Factory Rd (SR 1570) to Hoover Rd (SR 1569)/Comm Dwy	49,478	14,584	-70.52%	-74.16%	77,800	**20,100**	(1)
US 17 - Hoover Rd (SR 1569)/Comm Dwy to Forest Sound Rd	46,683	11,090	-76.24%	-73.68%	76,000	**20,000**	
US 17 - Forest Sound Rd to Arrow Wood Road	46,683	11,090	-76.24%	-73.09%	75,800	**20,400**	
US 17 - Arrow Wood Road to Midtown Connector	46,683	11,090	-76.24%	-73.26%	74,800	**20,000**	
US 17 - Midtown Connector to Grandview Dr	46,683	11,090	-76.24%	-70.70%	74,400	**21,800**	
US 17 - Grandview Dr to Williams Store Rd (SR 1568)	46,683	11,090	-76.24%	-71.77%	74,400	**21,000**	
US 17 - Williams Store Rd (SR 1568) to Jenkins Rd/Country Club Rd	46,683	11,090	-76.24%	-72.06%	74,100	**20,700**	
US 17 - Jenkins Rd/Country Club Rd to Hampstead Town Center	46,683	11,090	-76.24%	-83.15%	63,500	**10,700**	
US 17 - Hampstead Town Center to Topsail Middle School/Vista Ln	46,683	11,090	-76.24%	-81.75%	64,100	**11,700**	
US 17 - Topsail Middle School/Vista Ln to Transfer Station Rd	45,802	18,815	-58.92%	-81.77%	63,100	**11,500**	
US 17 - north of Transfer Station Rd to Leeward Ln	45,802	18,815	-58.92%	-72.23%	62,300	**17,300**	
US 17 - Leeward Ln to Hampstead Bypass	45,802	18,815	-58.92%	-71.01%	61,400	**17,800**	
US 17 - Hampstead Bypass to Long Leaf Dr	45,802	47,727	4.20%	0.00%	61,400	**61,400**	
US 17 - Long Leaf Dr to Sloop Point Loop Rd (SR 1563)	45,802	47,727	4.20%	0.00%	60,600	**60,600**	
US 17 - north of Sloop Point Loop Rd (SR 1563)	45,802	47,727	4.20%	0.00%	56,600	**56,600**	
I-140 - I-40 to Military Cutoff Road Extension	37,103	39,903	7.55%	7.63%	48,500	**52,200**	
I-140 - Military Cutoff Road Extension to US 17	38,085	14,282	-62.50%	-62.50%	49,600	**18,600**	
Military Cutoff Road Extension - South of I-140	18,008	24,236	34.58%	36.17%	23,500	**32,000**	
Hampstead Bypass - I-140 of NC 210		35,081	n/a	n/a	n/a	**53,600**	
Hampstead Bypass - NC 210 to Midtown Interchange		40,239	n/a	n/a	n/a	**58,500**	(1)
Hampstead Bypass -Midtown Interchange to US 17		41,716	n/a	n/a	n/a	**53,400**	
Midtown Connector - Service Road to Hampstead Bypass			n/a	n/a	n/a	**10,500**	(1)
Midtown Connector - Hampstead Bypass to US 17		0	n/a	n/a	n/a	**12,600**	
Service Road - Hoover Road to Midtown Connector		4,617	n/a	n/a	n/a	**9,900**	(1)
Service Road - North of Midtown Connector			n/a	n/a	n/a	**1,000**	
Washington Acres Rd (SR 1582) - east of US 17	4,465	4,275	-4.26%	0.00%	7,500	**7,500**	
Royal Oak Dr - west of NC 210			n/a	0.00%	900	**900**	

Table C12: 2040 Build Scenario 6 Traffic Volumes

Forecast Location	2040 Model Volumes, Daily		Model Diversion Rate	Chosen Diversion Rate	Future Year Build Volumes		
	No-Build	Build - Scenario 6	2010-2040	2016-2040	2040 No-Build	2040 Build - Scenario 6	
Island Creek Rd (SR 1002) - south of NC 210/Royal Oak Dr	8,833	6,870	-22.22%	-19.35%	6,200	**5,000**	
NC 210 - north of NC 210/Royal Oak Dr	6,495	6,938	6.82%	-2.44%	8,200	**8,000**	
NC 210 - east of NC 210/Island Creek Rd (SR 1002)	12,343	11,226	-9.05%	-9.76%	12,300	**11,100**	(1)
NC 210 - east of Hampstead Bypass			n/a	-46.34%	12,300	**6,600**	(1)
NC 210 - west of US 17	11,529	3,653	-68.31%	-31.13%	15,100	**10,400**	(1)
Dan Owen Dr - east of US 17			n/a	0.00%	9,200	**9,200**	
Peanut Rd (SR 1570) - west of US 17			n/a	0.00%	700	**700**	
Factory Rd (SR 1570) - east of US 17			n/a	0.00%	3,100	**3,100**	
Hoover Rd (SR 1569) - west of Godfrey Creek Rd	7,073	8,110	14.66%	-14.71%	6,800	**5,800**	
Hoover Rd (SR 1569) - Godfrey Creek Rd to Service Road	7,073	8,110	14.66%	30.88%	6,800	**8,900**	(1)
Hoover Rd (SR 1569) - Service Road to South Topsail Elementary School	7,073	3,493	-50.62%	-67.03%	9,100	**3,000**	(1)
Hoover Rd (SR 1569) - south of South Topsail Elementary School	7,073	3,493	-50.62%	-80.95%	10,500	**2,000**	(1)
Hoover Rd (SR 1569) - west of US 17	7,073	3,493	-50.62%	-56.67%	15,000	**6,500**	(1)
Commercial Dwy - east of US 17			n/a	0.00%	1,800	**1,800**	
Godfrey Creek Rd - west of Hoover Rd (SR 1569)			n/a	29.63%	2,700	**3,500**	
South Topsail Elementary School - west of Hoover Rd (SR 1569)			n/a	0.00%	1,800	**1,800**	
Forest Sound Rd - east of US 17			n/a	0.00%	2,400	**2,400**	
Arrow Wood Road - west of US 17			n/a	0.00%	3,400	**3,400**	
Grandview Dr - east of US 17			n/a	0.00%	1,800	**1,800**	
Williams Store Rd (SR 1568) - east of US 17			n/a	0.00%	900	**900**	
Jenkins Rd - west of US 17			n/a	0.00%	4,100	**4,100**	
Country Club Rd - east of US 17			n/a	0.00%	13,500	**13,500**	
Hampstead Town Center - east of US 17			n/a	0.00%	5,000	**5,000**	
Topsail Middle School - west of US 17			n/a	0.00%	3,400	**3,400**	
Vista Ln - east of US 17			n/a	0.00%	400	**400**	
Transfer Station Rd - east of US 17			n/a	0.00%	12,600	**12,600**	
Leeward Ln - east of US 17			n/a	0.00%	1,500	**1,500**	
Long Leaf Dr - east of US 17			n/a	0.00%	2,400	**2,400**	
Sloop Point Loop Rd (SR 1563) - east of US 17			n/a	0.00%	13,200	**13,200**	

Notes:

1 - Link has an unbalanced AADT volume. See Forecast Figures for directional AADT.

Table C13: 2040 Build Scenario 7 Traffic Volumes

Forecast Location	2040 Model Volumes, Daily		Model Diversion Rate	Chosen Diversion Rate	Future Year Build Volumes	
	No-Build	Build - Scenario 7	2010-2040	2016-2040	2040 No-Build	2040 Build - Scenario 7
US 17 - south of Washington Acres Rd (SR 1582)	38,227	10,848	-71.62%	-73.41%	66,200	**17,600**
US 17 - Washington Acres Rd (SR 1582) to NC 210/Dan Owen Dr	42,482	14,883	-64.97%	-71.45%	66,900	**19,100**
US 17 - NC 210/Dan Owen Dr to Peanut Rd (SR 1570)/Factory Rd (SR 1570)	51,621	16,058	-68.89%	-70.98%	77,200	**22,400**
US 17 - Peanut Rd (SR 1570)/Factory Rd (SR 1570) to Hoover Rd (SR 1569)/Comm Dwy	49,478	13,117	-73.49%	-70.44%	77,800	**23,000**
US 17 - Hoover Rd (SR 1569)/Comm Dwy to Forest Sound Rd	46,683	11,213	-75.98%	-66.18%	76,000	**25,700**
US 17 - Forest Sound Rd to Arrow Wood Road	46,683	11,213	-75.98%	-66.36%	75,800	**25,500**
US 17 - Arrow Wood Road to Grandview Dr	46,683	11,213	-75.98%	-67.25%	74,800	**24,500**
US 17 - Grandview Dr to Williams Store Rd (SR 1568)	46,683	11,213	-75.98%	-67.61%	74,400	**24,100**
US 17 - Williams Store Rd (SR 1568) to Jenkins Rd/Country Club Rd	46,683	11,213	-75.98%	-67.88%	74,100	**23,800**
US 17 - Jenkins Rd/Country Club Rd to Hampstead Town Center	46,683	11,213	-75.98%	-76.69%	63,500	**14,800**
US 17 - Hampstead Town Center to Topsail Middle School/Vista Ln	46,683	11,213	-75.98%	-74.41%	64,100	**16,400**
US 17 - Topsail Middle School/Vista Ln to Transfer Station Rd	45,802	18,852	-58.84%	-74.33%	63,100	**16,200**
US 17 - Transfer Station Rd to Leeward Ln	45,802	18,852	-58.84%	-64.69%	62,300	**22,000**
US 17 - Leeward Ln to Hampstead Bypass	45,802	18,852	-58.84%	-63.36%	61,400	**22,500**
US 17 - Hampstead Bypass to Long Leaf Dr	45,802	47,718	4.18%	0.00%	61,400	**61,400**
US 17 - Long Leaf Dr to Sloop Point Loop Rd (SR 1563)	45,802	47,718	4.18%	0.00%	60,600	**60,600**
US 17 - north of Sloop Point Loop Rd (SR 1563)	45,802	47,718	4.18%	0.00%	56,600	**56,600**
I-140 - I-40 to Military Cutoff Road Extension	37,103	39,890	7.51%	7.63%	48,500	**52,200**
I-140 - Military Cutoff Road Extension to US 17	38,085	13,468	-64.64%	-64.52%	49,600	**17,600**
Military Cutoff Road Extension - South of I-140	18,008	24,312	35.01%	35.32%	23,500	**31,800**
Hampstead Bypass - I-140 of NC 210		35,948	n/a	n/a	n/a	**49,200**
Hampstead Bypass - NC 210 to Hoover Road		41,875	n/a	n/a	n/a	**54,800**
Hampstead Bypass - Hoover Road to US 17		41,572	n/a	n/a	n/a	**50,300**
Washington Acres Rd (SR 1582) - east of US 17	4,465	4,272	-4.32%	0.00%	7,500	**7,500**
Royal Oak Dr - west of NC 210			n/a	0.00%	900	**900**
Island Creek Rd (SR 1002) - south of NC 210/Royal Oak Dr	8,833	6,885	-22.05%	-19.35%	6,200	**5,000**
NC 210 - north of NC 210/Royal Oak Dr	6,495	6,957	7.11%	7.32%	8,200	**8,800**
NC 210 - NC 210/Island Creek Rd (SR 1002) to Hampstead Bypass	12,343	11,285	-8.57%	-3.25%	12,300	**11,900**
NC 210 - east of Hampstead Bypass	12,343	3,091	-74.96%	-58.54%	12,300	**5,100**
NC 210 - west of US 17	11,529	3,091	-73.19%	-41.06%	15,100	**8,900**

Table C13: 2040 Build Scenario 7 Traffic Volumes

Forecast Location	2040 Model Volumes, Daily		Model Diversion Rate	Chosen Diversion Rate	Future Year Build Volumes	
	No-Build	Build - Scenario 7	2010-2040	2016-2040	2040 No-Build	2040 Build - Scenario 7
Dan Owen Dr - east of US 17			n/a	0.00%	9,200	**9,200**
Peanut Rd (SR 1570) - west of US 17			n/a	0.00%	700	**700**
Factory Rd (SR 1570) - east of US 17			n/a	0.00%	3,100	**3,100**
Hoover Rd (SR 1569) - west of Godfrey Creek Rd	7,073	8,268	16.90%	0.00%	6,800	**6,800**
Hoover Rd (SR 1569) - Godfrey Creek Rd to Hampstead Bypass	7,073	8,268	16.90%	0.00%	9,100	**9,100**
Hoover Rd (SR 1569) - Hampstead Bypass to South Topsail Elementary School	7,073	1,904	-73.08%	-34.07%	9,100	**6,000**
Hoover Rd (SR 1569) - south of South Topsail Elementary School	7,073	1,904	-73.08%	-48.57%	10,500	**5,400**
Hoover Rd (SR 1569) - west of US 17	7,073	1,904	-73.08%	-34.00%	15,000	**9,900**
Commercial Dwy - east of US 17			n/a	0.00%	1,800	**1,800**
Godfrey Creek Rd - west of Hoover Rd (SR 1569)			n/a	0.00%	2,700	**2,700**
South Topsail Elementary School - west of Hoover Rd (SR 1569)			n/a	0.00%	1,800	**1,800**
Forest Sound Rd - east of US 17			n/a	0.00%	2,400	**2,400**
Arrow Wood Road - west of US 17			n/a	0.00%	3,400	**3,400**
Grandview Dr - east of US 17			n/a	0.00%	1,800	**1,800**
Williams Store Rd (SR 1568) - east of US 17			n/a	0.00%	900	**900**
Jenkins Rd - west of US 17			n/a	0.00%	4,100	**4,100**
Country Club Rd - east of US 17			n/a	0.00%	13,500	**13,500**
Hampstead Town Center - east of US 17			n/a	0.00%	5,000	**5,000**
Topsail Middle School - west of US 17			n/a	0.00%	3,400	**3,400**
Vista Ln - east of US 17			n/a	0.00%	400	**400**
Transfer Station Rd - east of US 17			n/a	0.00%	12,600	**12,600**
Leeward Ln - east of US 17			n/a	0.00%	1,500	**1,500**
Long Leaf Dr - east of US 17			n/a	0.00%	2,400	**2,400**
Sloop Point Loop Rd (SR 1563) - east of US 17			n/a	0.00%	13,200	**13,200**

Notes:

APPENDIX D:

2040 FUTURE YEAR VOLUME DEVELOPMENT

APPENDIX D1:

2040 FUTURE YEAR VOLUME DEVELOPMENT

BUILD SCENARIO 1

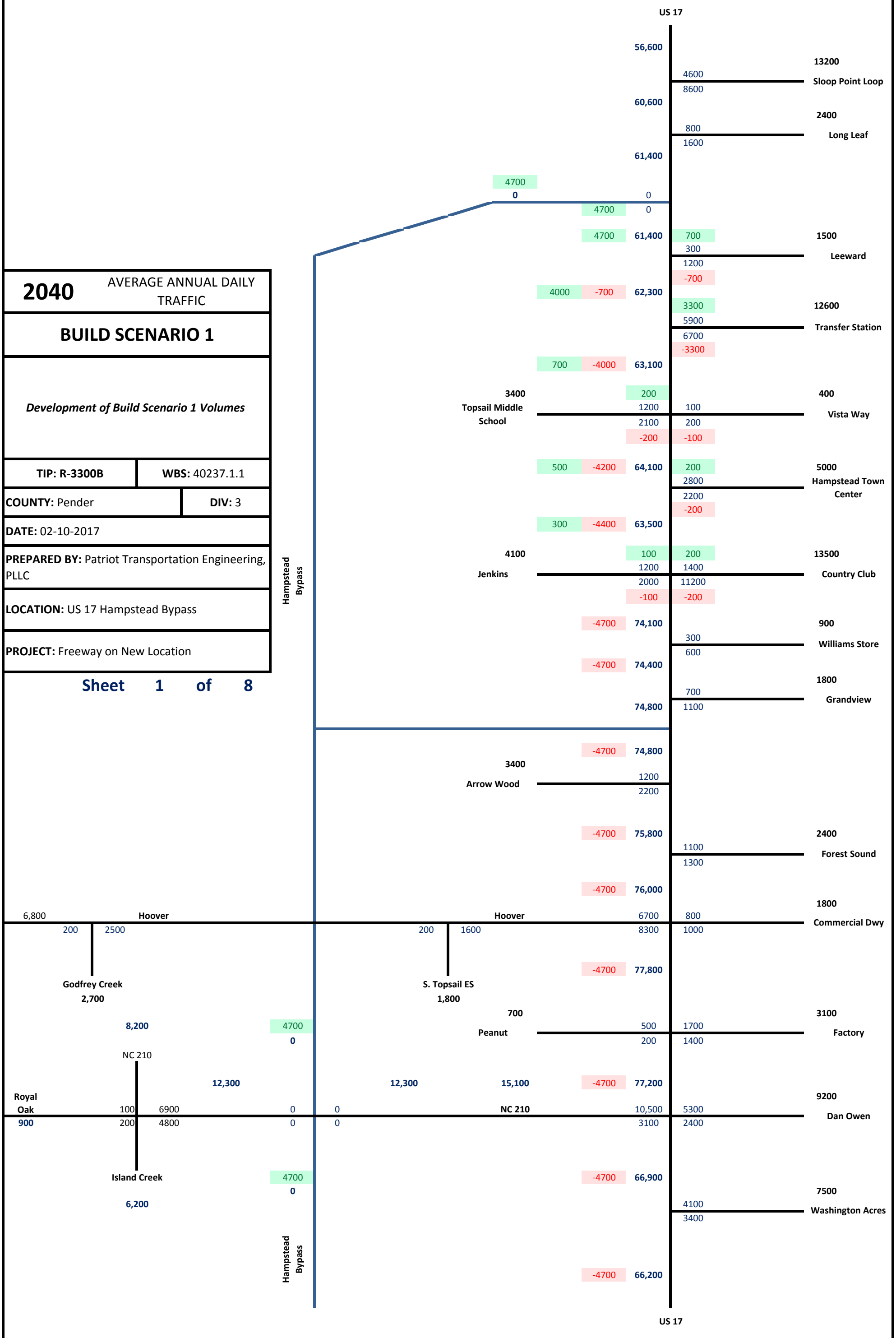
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 1

Development of Build Scenario 1 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 1 of 8



STEP 1: START WITH 2040 NO-BUILD VOLUMES AND RE-ROUTE VOLUMES TO US 17/HAMPSTEAD INTERCHANGE

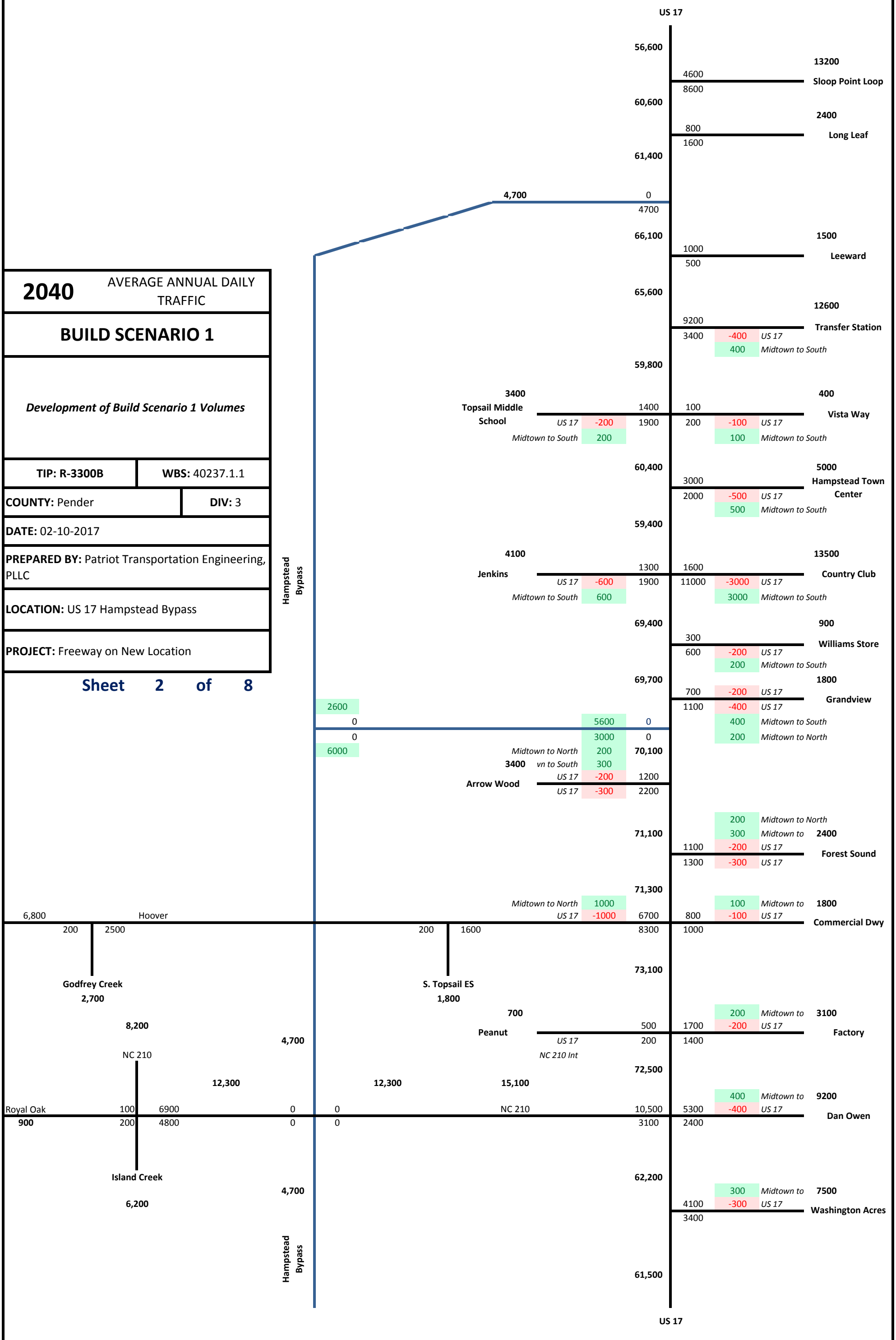
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 1

Development of Build Scenario 1 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 2 of 8



STEP 2: SPLIT OUT VOLUMES TO US 17/MIDTOWN INTERCHANGE

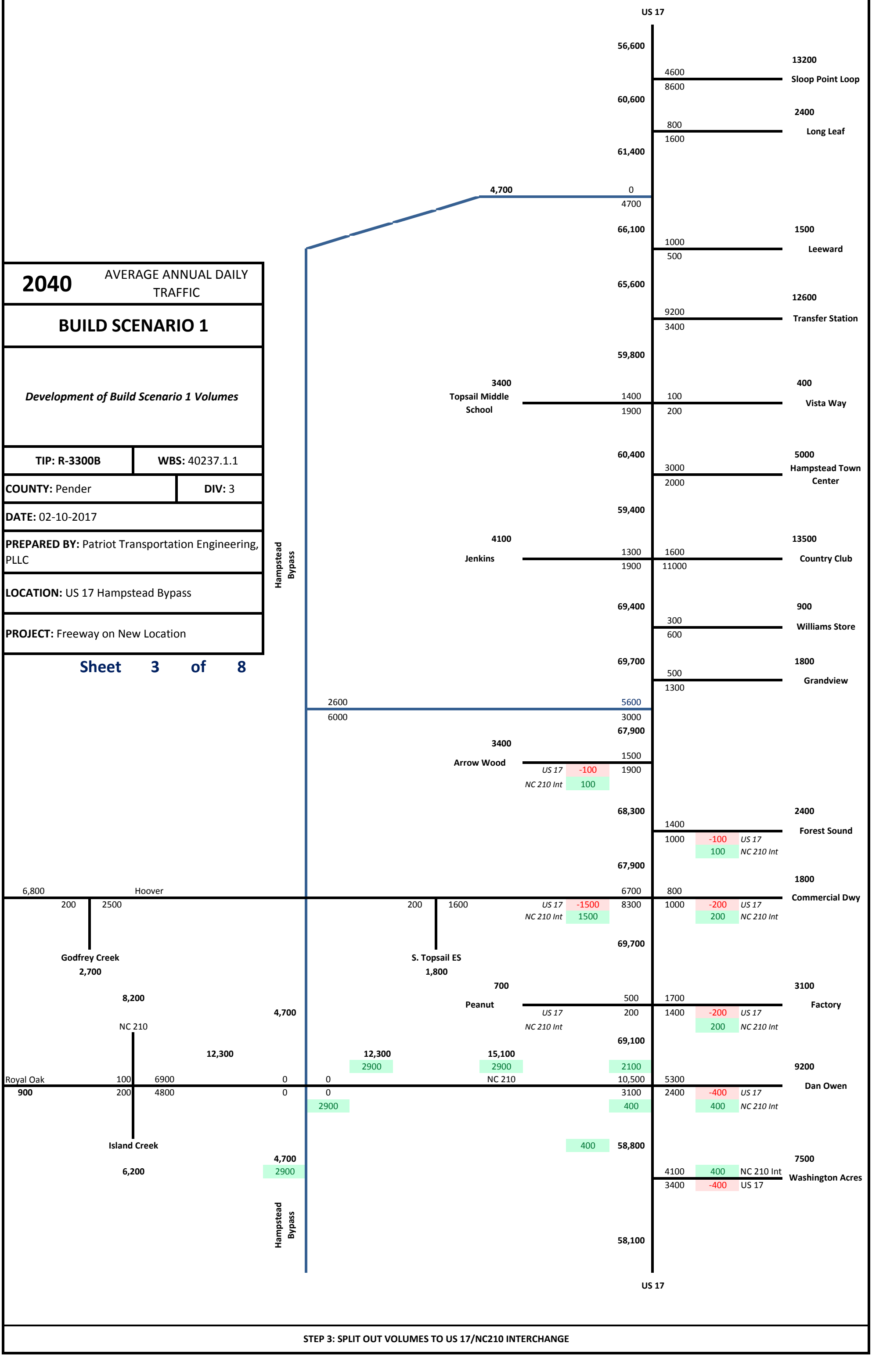
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 1

Development of Build Scenario 1 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 3 of 8



STEP 3: SPLIT OUT VOLUMES TO US 17/NC210 INTERCHANGE

2040 Build Scenario 1 Model Volumes

US 17 - North of Bypass	47,476
Bypass - West of US 17	39,169
US 17 - South of Bypass	18,803
Percent Diversion to Bypass	**71.4%**
Additional Percent Diversion to Bypass	**4.0%**
Total Percent Diversion to Bypass	**75.4%**
Volume to Bypass	**46,300**

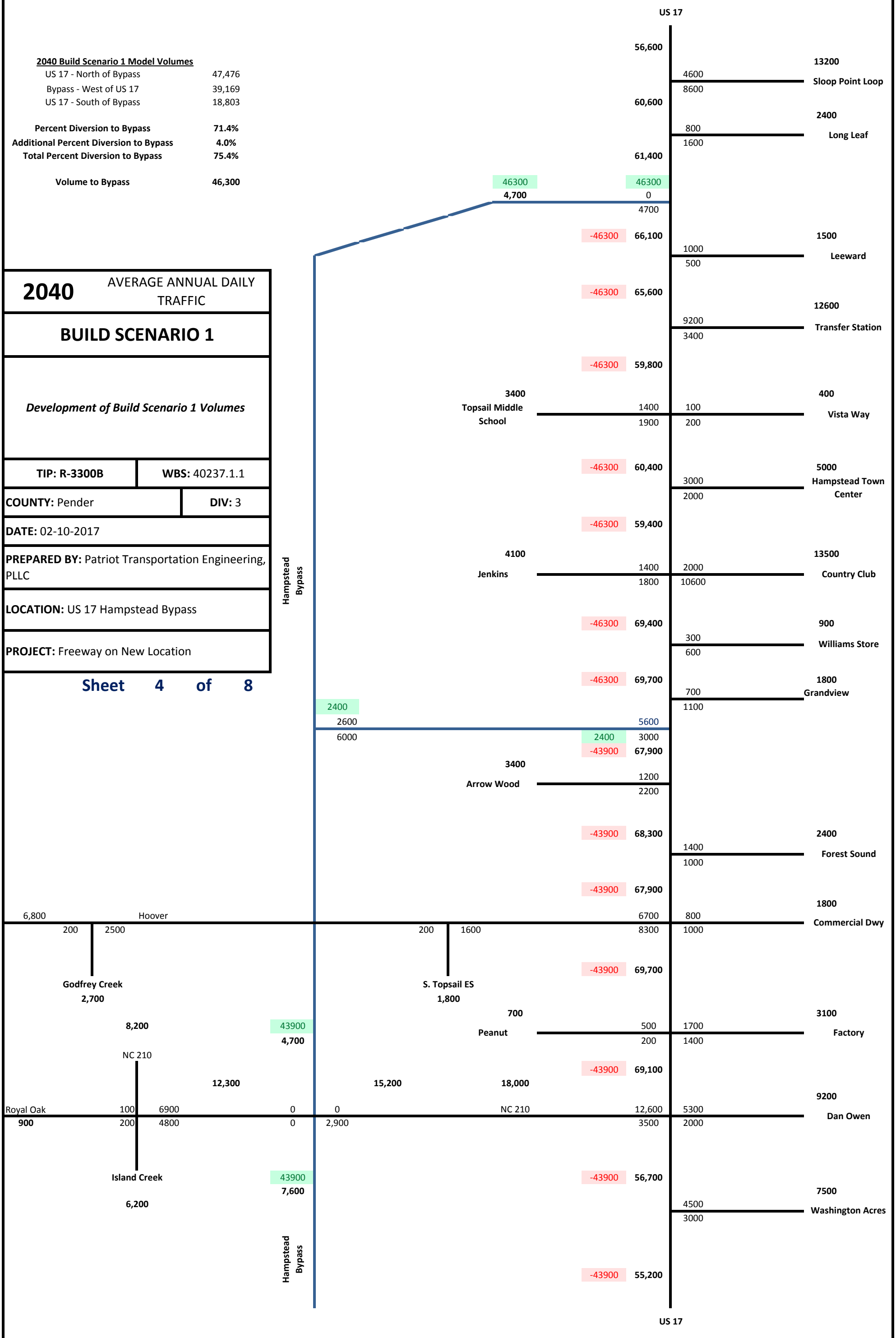
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 1

Development of Build Scenario 1 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 4 of 8



STEP 4: DETERMINE DIVERSION TO BYPASS FROM NORTH BY USING TRAVEL DEMAND MODEL DIVERSION RATE

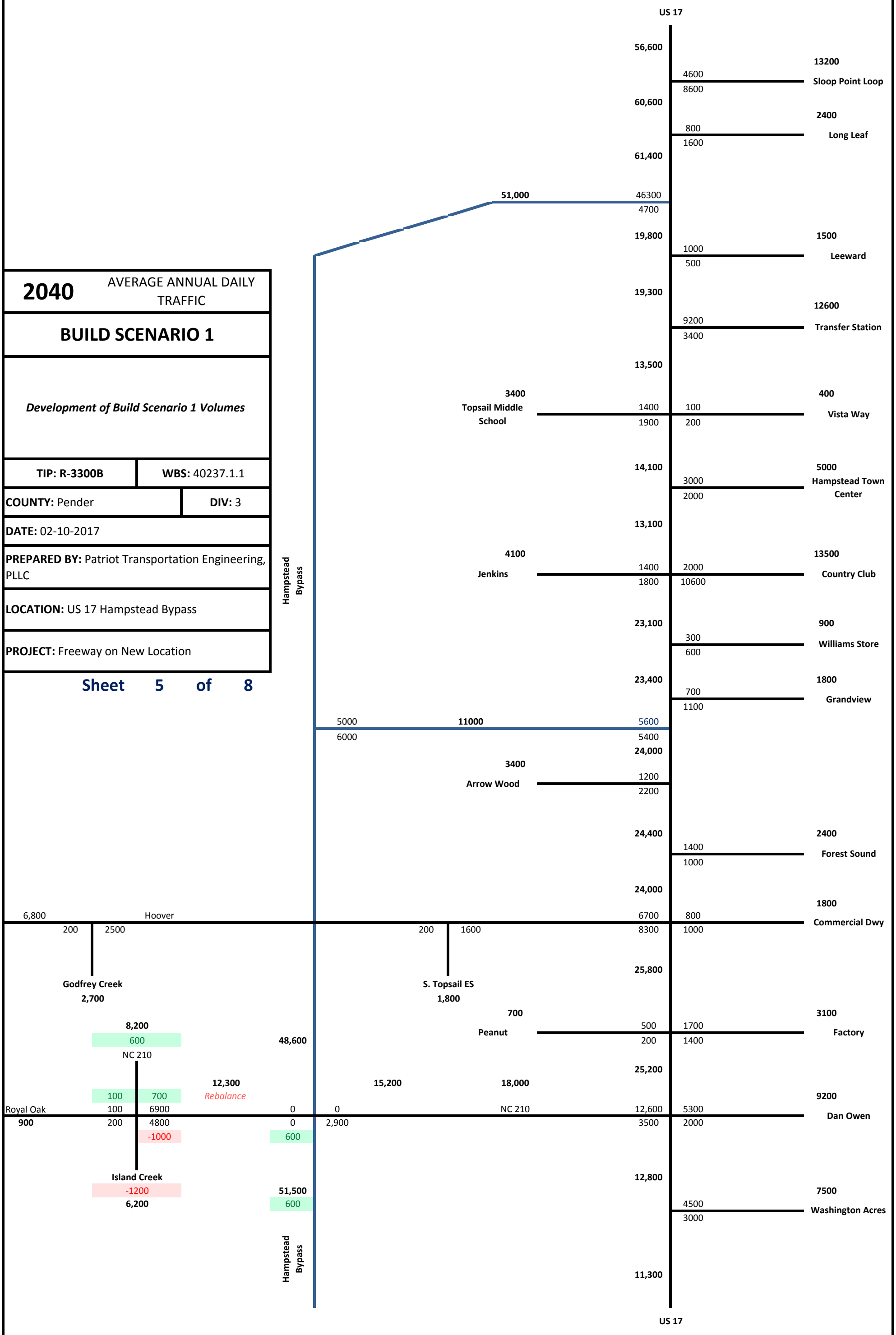
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 1

Development of Build Scenario 1 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 5 of 8



STEP 5: DETERMINE DIVERSION FROM NC 210 AND ISLAND CREEK ROAD USING TRAVEL DEMAND MODEL DIVERSION RATE AND REBALANCE TO EAST

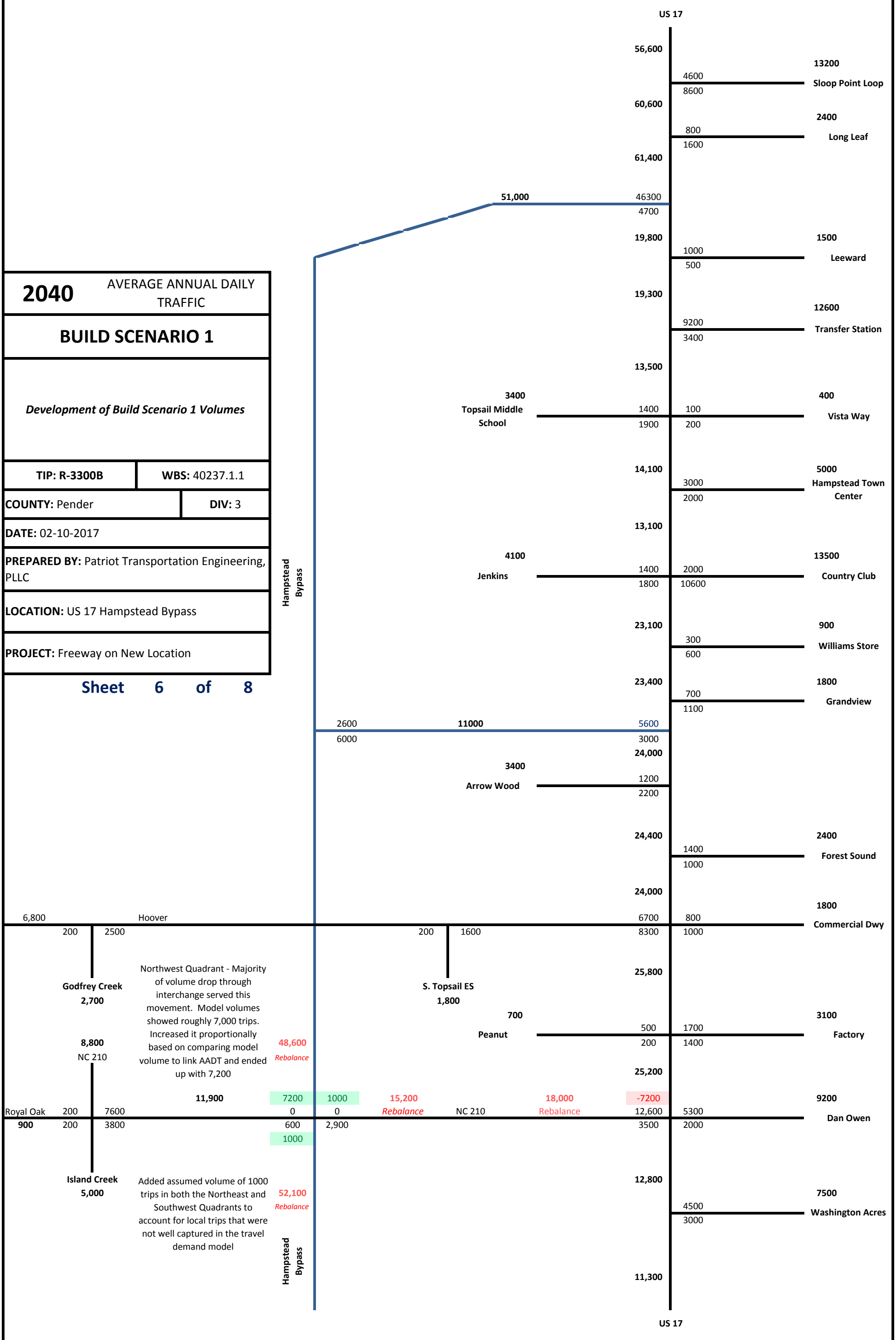
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 1

Development of Build Scenario 1 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 6 of 8



Northwest Quadrant - Majority of volume drop through interchange served this movement. Model volumes showed roughly 7,000 trips. Increased it proportionally based on comparing model volume to link AADT and ended up with 7,200

Added assumed volume of 1000 trips in both the Northeast and Southwest Quadrants to account for local trips that were not well captured in the travel demand model

STEP 6: DETERMINE DIVERSION AT BYPASS/NC 210 INTERCHANGE AND REBALANCE NETWORK TO SOUTH AND EAST

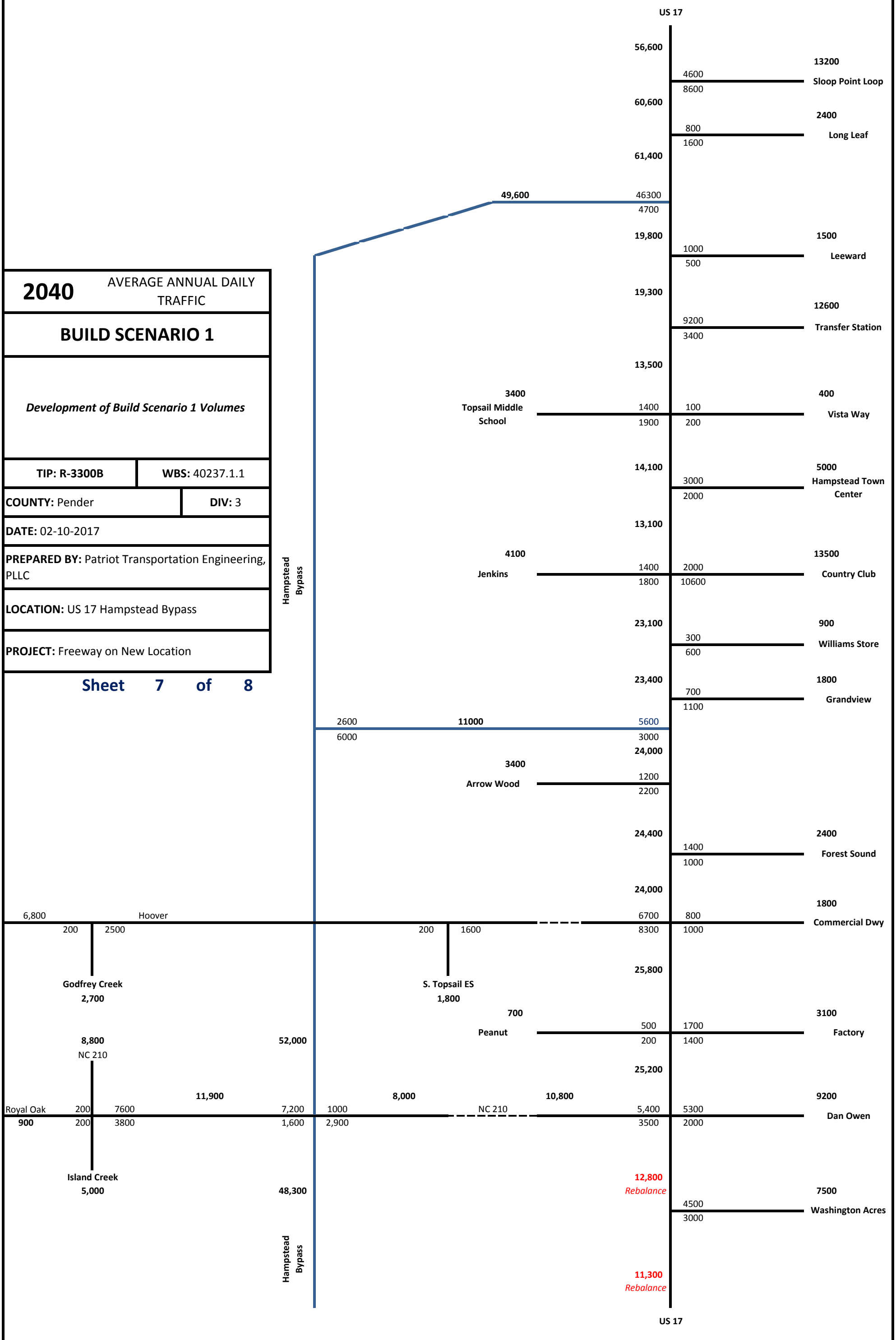
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 1

Development of Build Scenario 1 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 7 of 8



STEP 7: DETERMINE DIVERSION AT BYPASS/NC 210 INTERCHANGE AND REBALANCE NETWORK TO SOUTH AND EAST

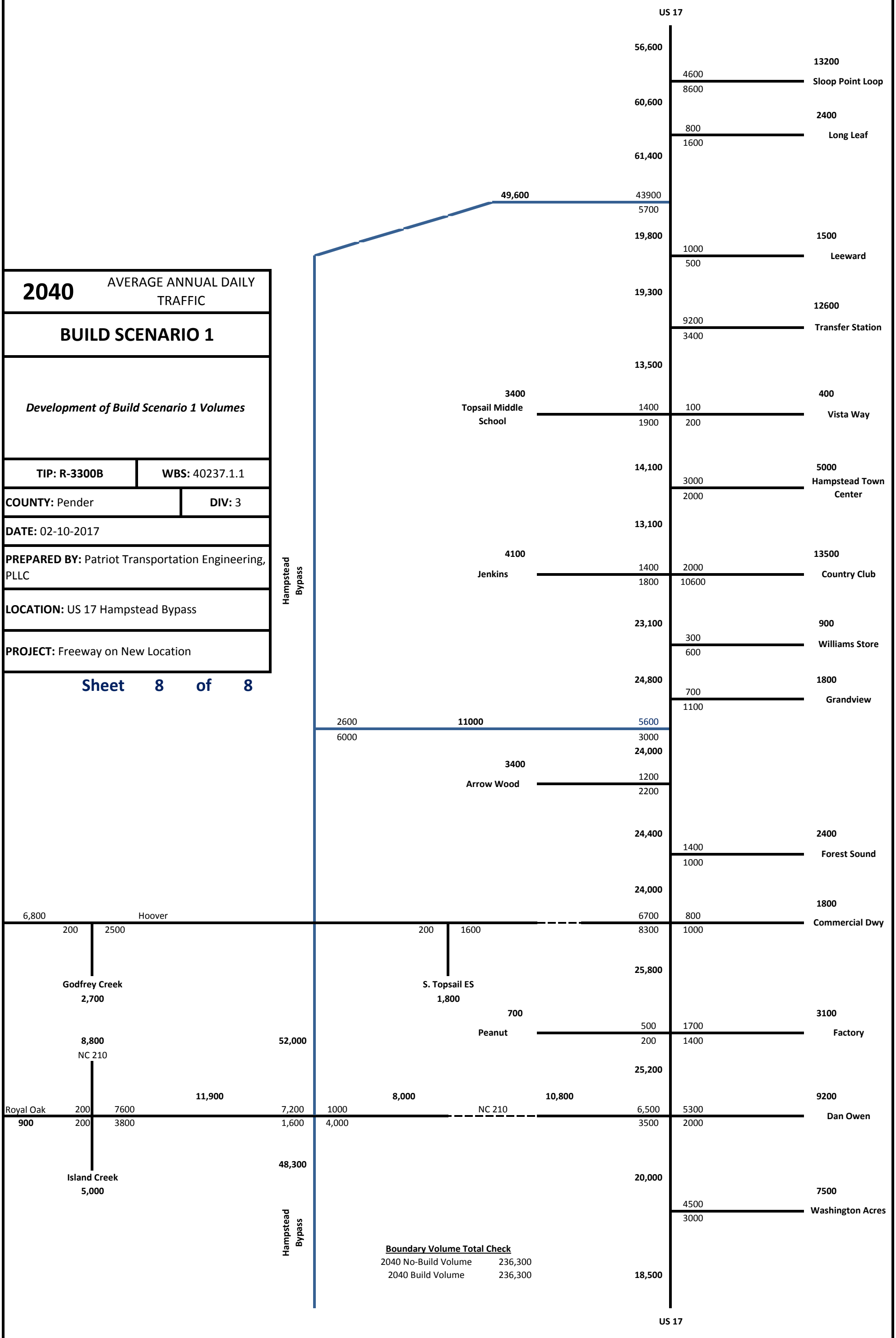
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 1

Development of Build Scenario 1 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 8 of 8



STEP 8: CHECK BOUNDARY VOLUMES AND FINALIZE

APPENDIX D2:

2040 FUTURE YEAR VOLUME DEVELOPMENT

BUILD SCENARIO 2

SUMMARY OF DIVERTED TRIPS TO HOOVER ROAD ON-RAMPS

1	Percent to Bypass	75%	
	Total Volume to Bypass	2500	
	Volume to Bypass (North)	1000	40%
	Volume to Bypass (South)	1500	60%
	Assumes 75% of trips from Hoover Road to Bypass		
2	Percent to Bypass	75%	
	Total Volume to Bypass	1100	
	Volume to Bypass (North)	400	40%
	Volume to Bypass (South)	700	60%
	Assumes 75% of trips from Godfrey Creek Road to Bypass		
3	Percent to Bypass	70%	
	Total Volume to Bypass	600	
	Volume to Bypass (North)	400	65%
	Volume to Bypass (South)	200	35%
	Assumes 70% of trips from school to Bypass		
4	Percent to Bypass	n/a	
	Total Volume to Bypass	300	
	Volume to Bypass (North)	0	0%
	Volume to Bypass (South)	300	100%
	Assumes 300 trips from Forest Sound Road to Bypass. 100 trips to NC 210 interchange in Build 1 diverted plus additional 200 new trips		
5	Percent to Bypass	n/a	
	Total Volume to Bypass	100	
	Volume to Bypass (North)	0	0%
	Volume to Bypass (South)	100	100%
	Assumes the 100 trips to NC 210 interchange in Build 1 are diverted to Hoover Road		
6	Percent to Bypass	n/a	
	Total Volume to Bypass	200	
	Volume to Bypass (North)	0	0%
	Volume to Bypass (South)	200	100%
	Assumes the 200 trips to NC 210 interchange in Build 1 are diverted to Hoover Road		
7	Percent to Bypass	n/a	
	Total Volume to Bypass	400	
	Volume to Bypass (North)	0	0%
	Volume to Bypass (South)	400	100%
	Assumes 400 trips to NC 210 interchange in Build 1 are diverted to Hoover Road due to collector connection and development being closer to Hoover Road		

2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 2

Redistriubtion of Build Scenario 1 traffic volumes for addition of Hoover Road On-ramps

TIP: R-3300B | **WBS:** 40237.1.1

COUNTY: Pender | **DIV:** 3

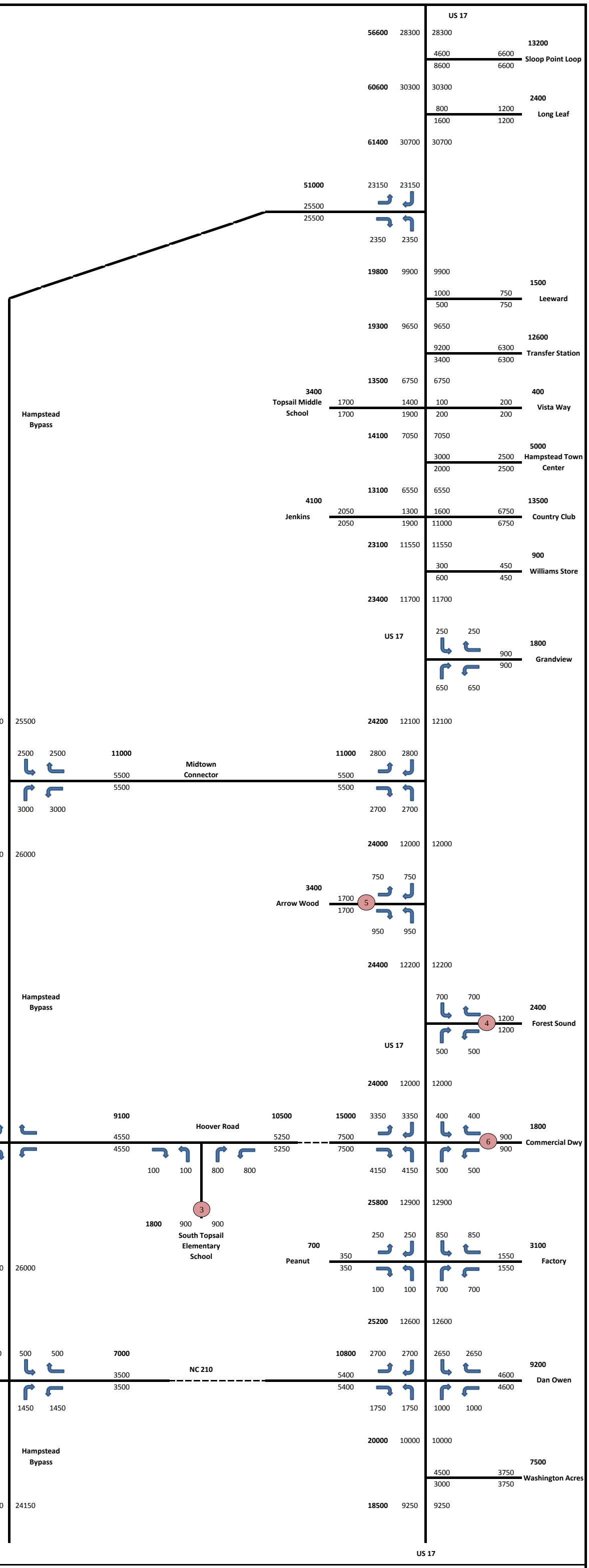
DATE: 02-10-2017

PREPARED BY: Patriot Transportation Engineering, PLLC

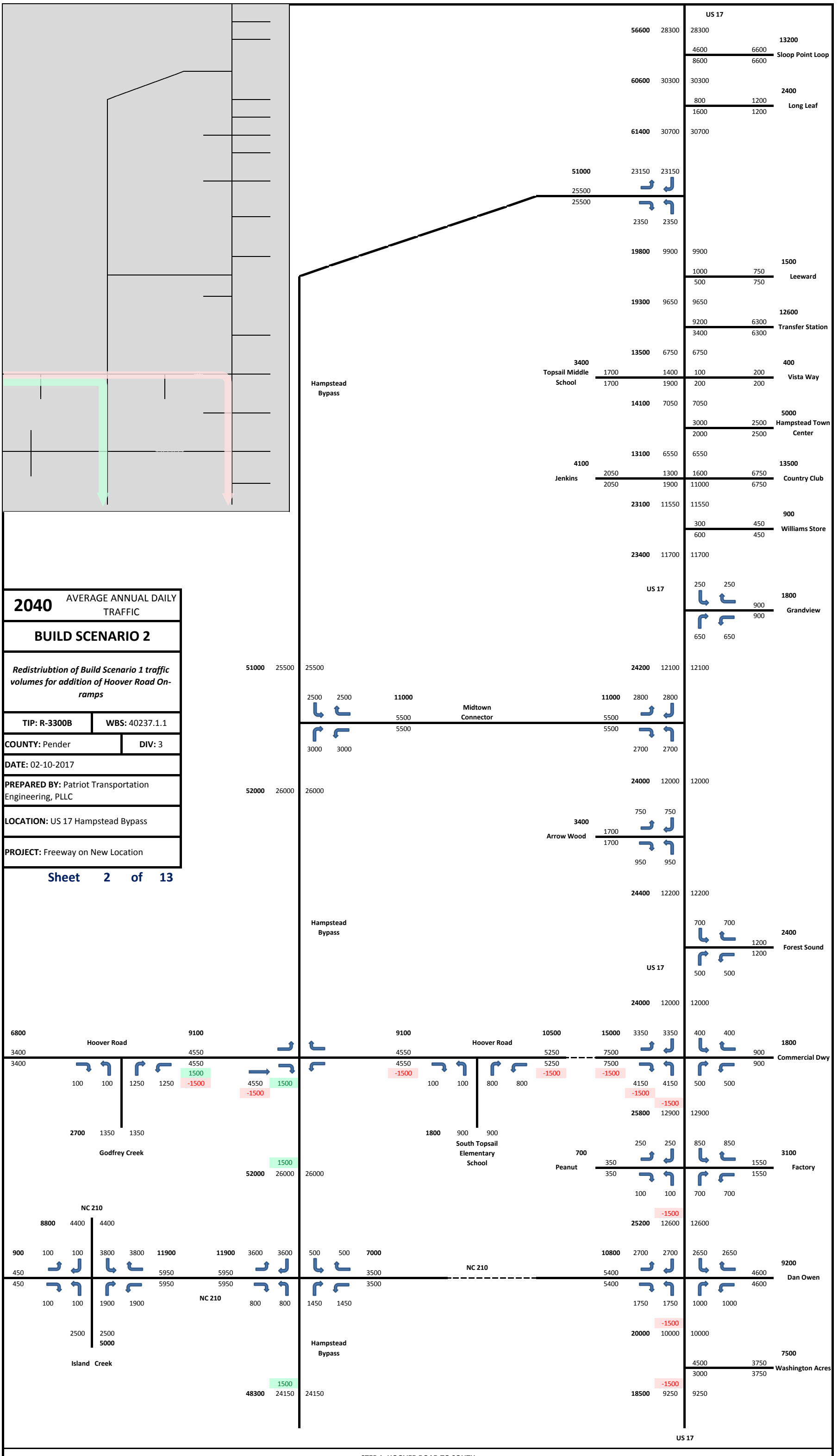
LOCATION: US 17 Hampstead Bypass

PROJECT: Freeway on New Location

Sheet 1 of 13

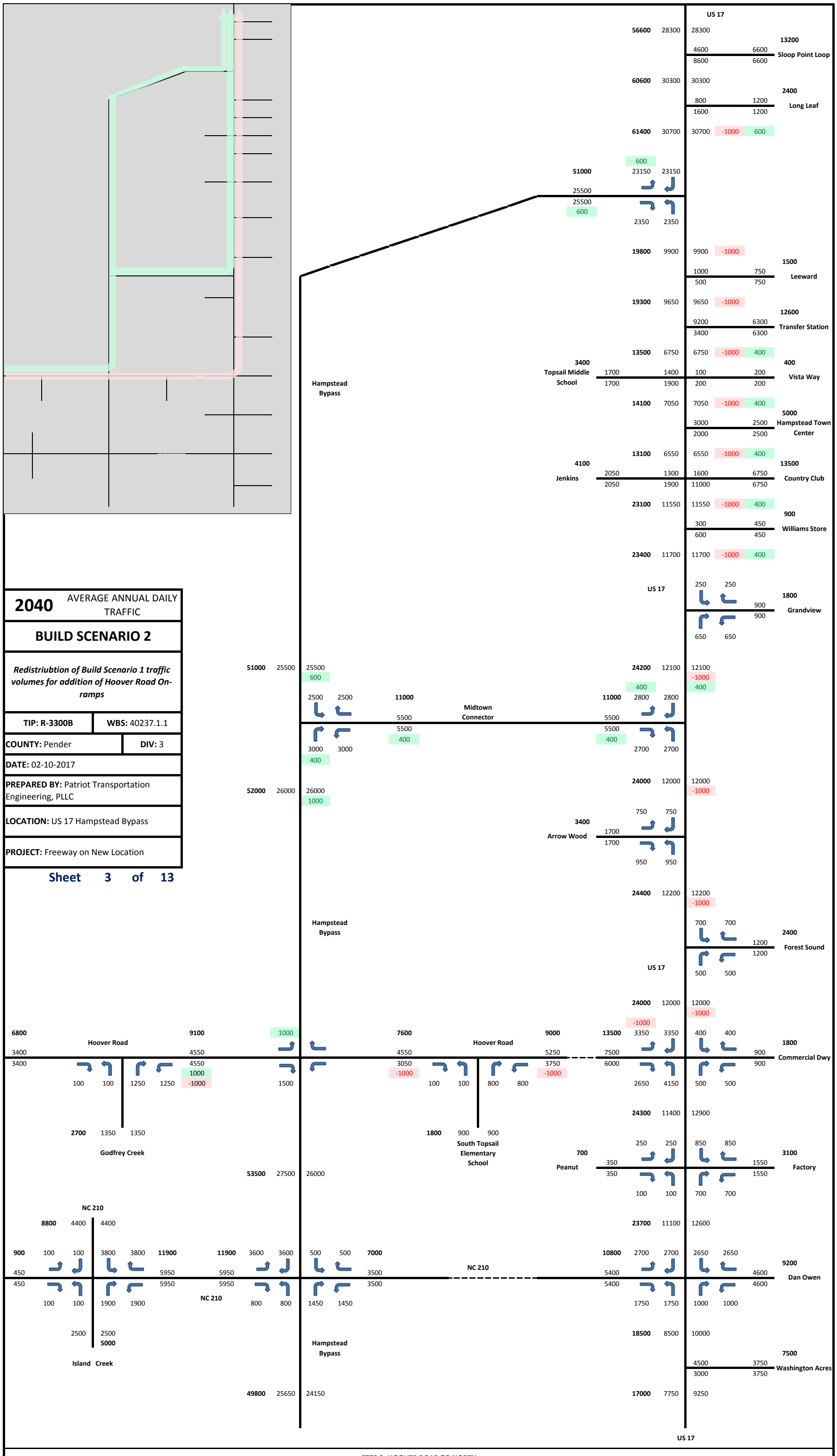


FINAL VOLUME - BUILD SCENARIO 1



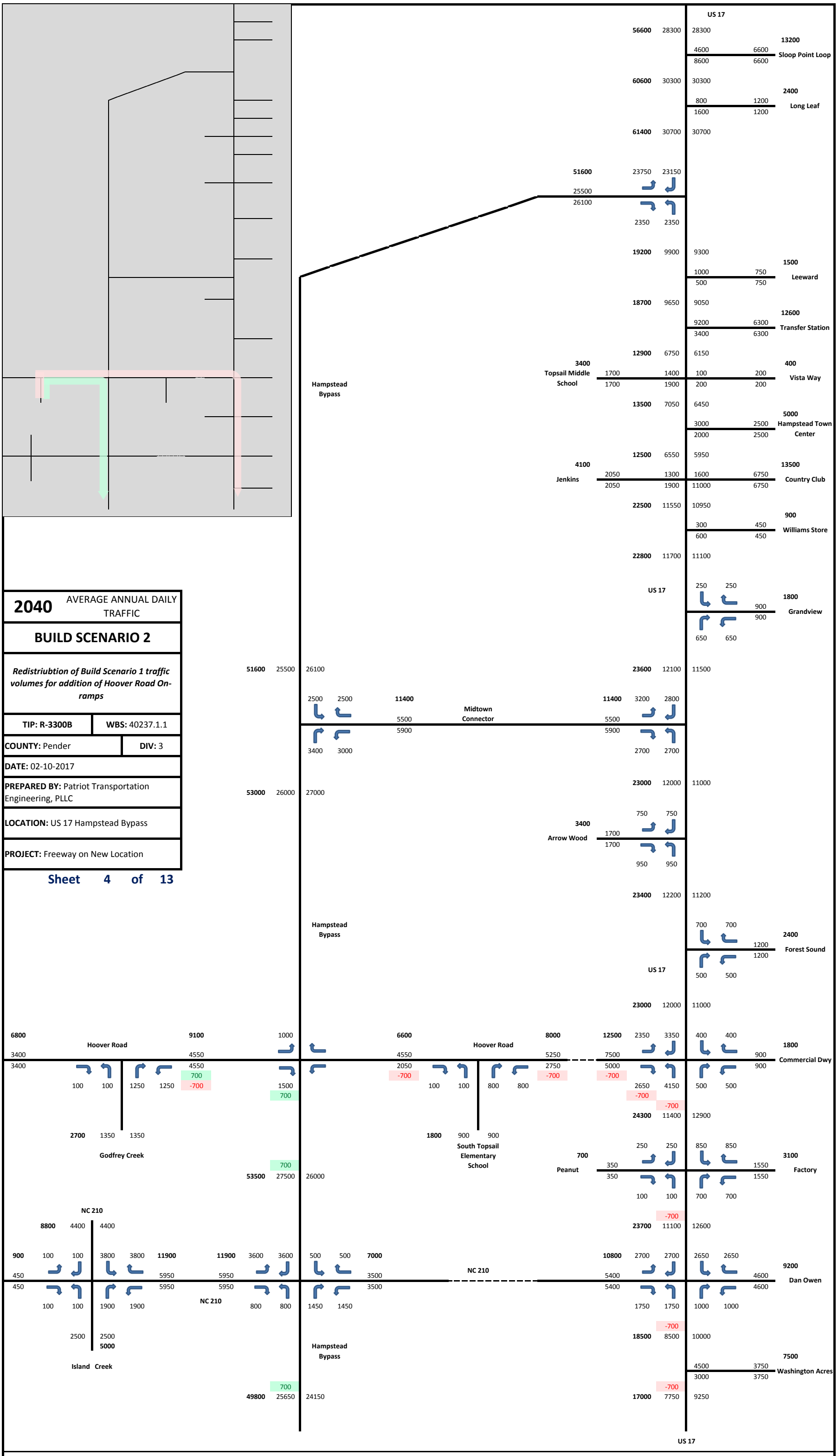
2040	AVERAGE ANNUAL DAILY TRAFFIC
BUILD SCENARIO 2	
Redistriubtion of Build Scenario 1 traffic volumes for addition of Hoover Road On-ramps	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

STEP 1: HOOVER ROAD TO SOUTH



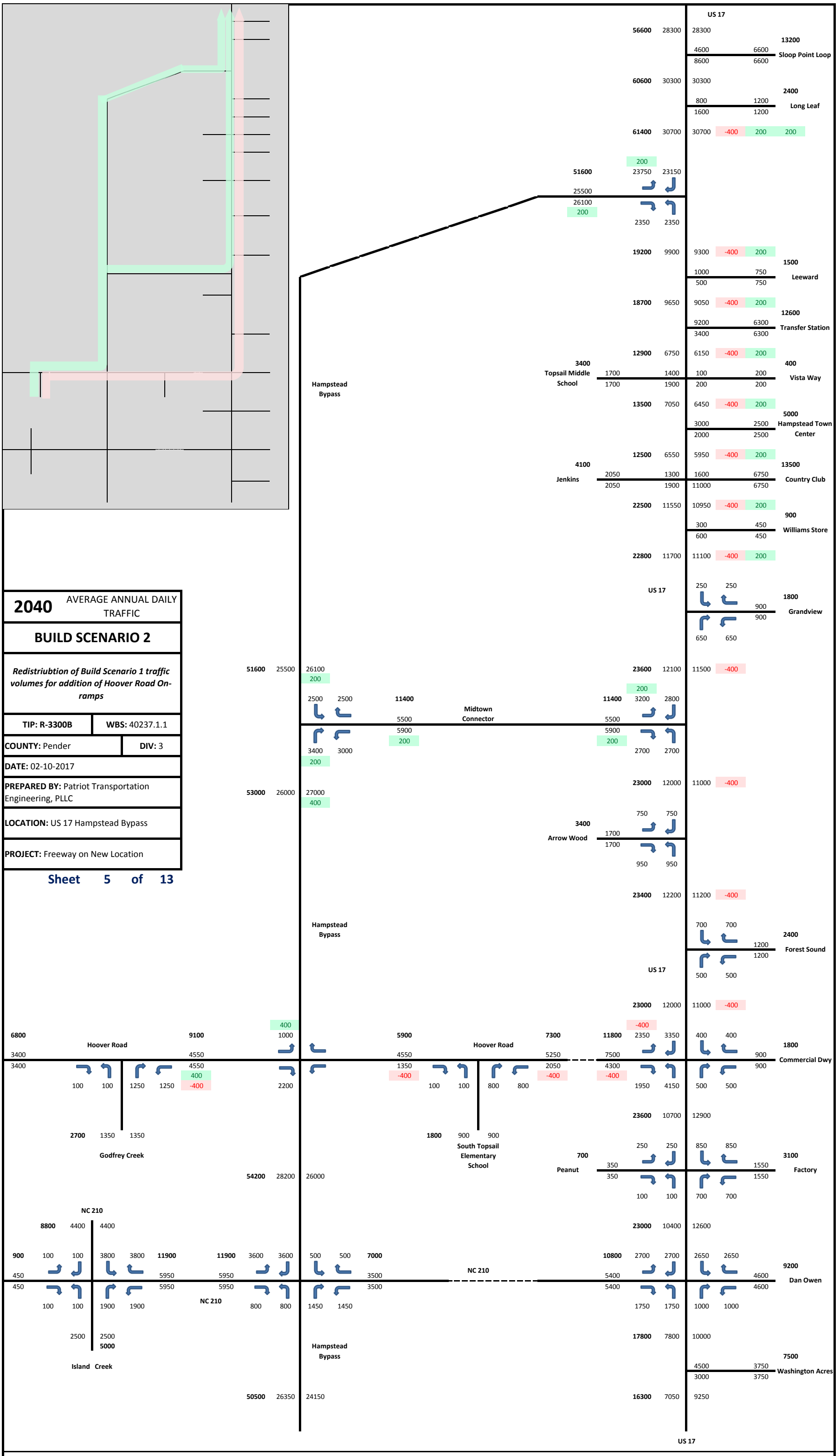
2040	AVERAGE ANNUAL DAILY TRAFFIC
BUILD SCENARIO 2	
Redistriubtion of Build Scenario 1 traffic volumes for addition of Hoover Road On-ramps	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

STEP 2: HOOVER ROAD TO NORTH



2040	AVERAGE ANNUAL DAILY TRAFFIC
BUILD SCENARIO 2	
Redistriubtion of Build Scenario 1 traffic volumes for addition of Hoover Road On-ramps	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

STEP 3: GODFREY CREEK ROAD TO SOUTH



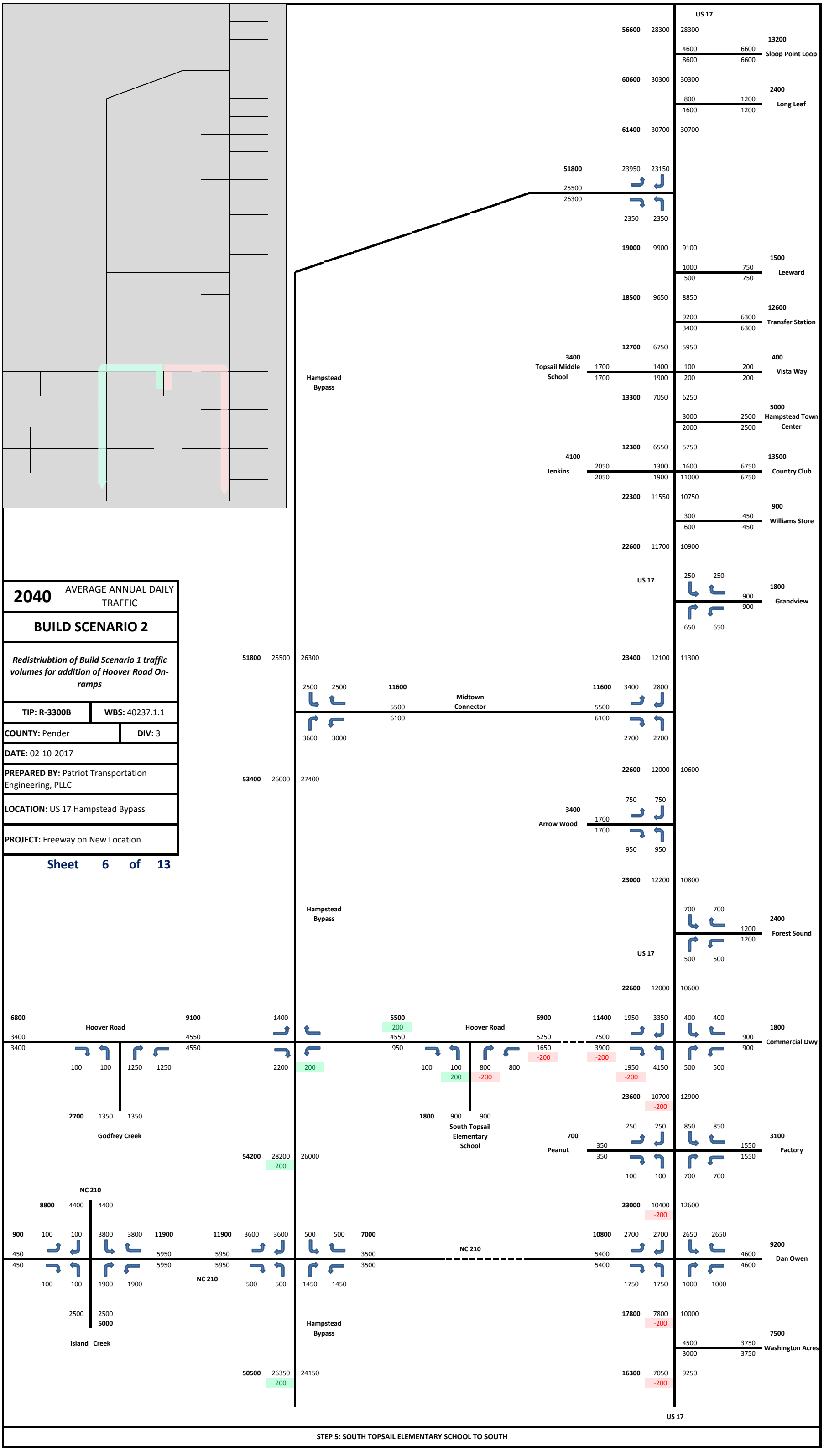
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 2

Redistriubtion of Build Scenario 1 traffic volumes for addition of Hoover Road On-ramps

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

STEP 4: GODFREY CREEK ROAD TO NORTH



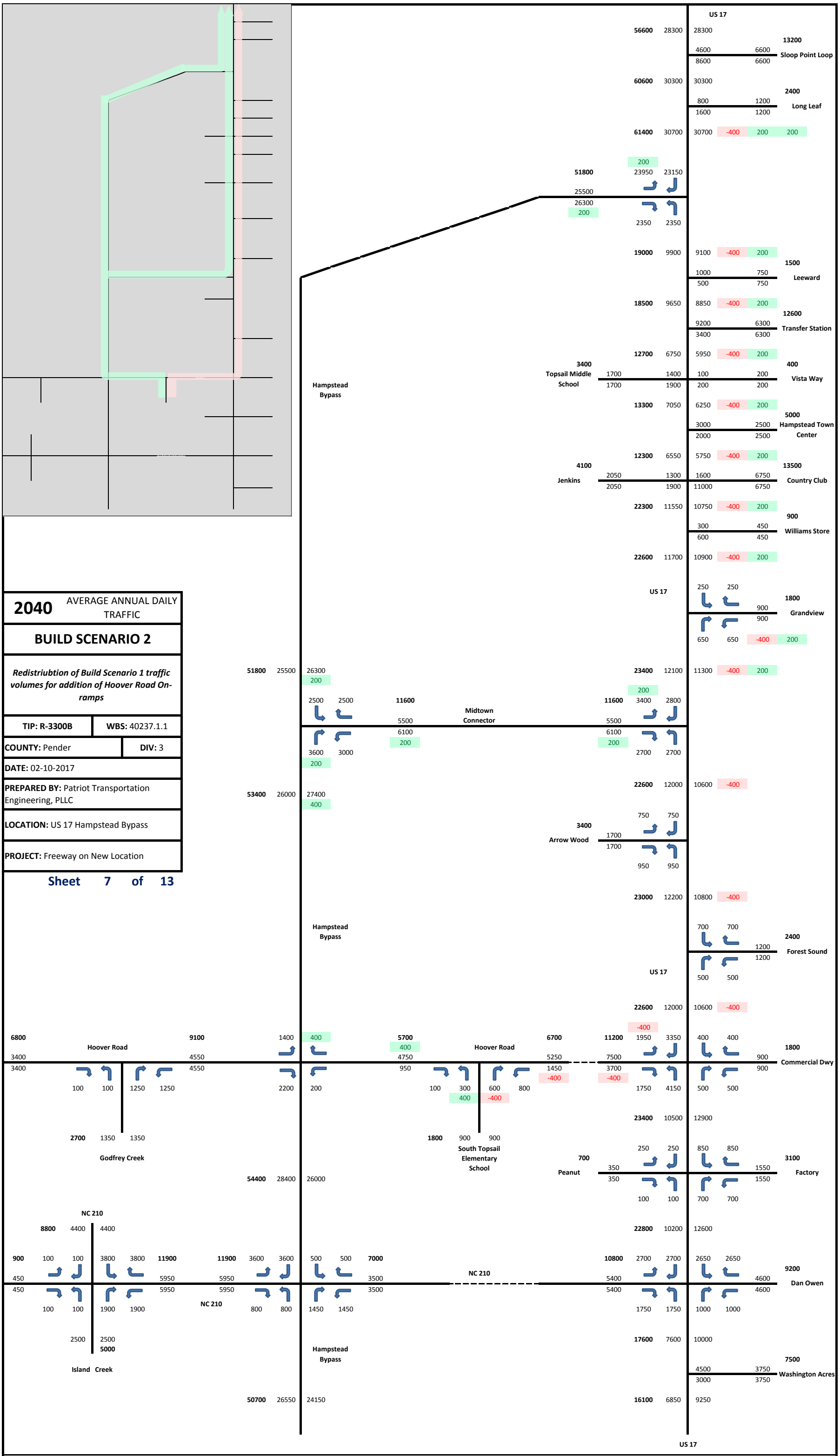
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 2

Redistriubtion of Build Scenario 1 traffic volumes for addition of Hoover Road On-ramps

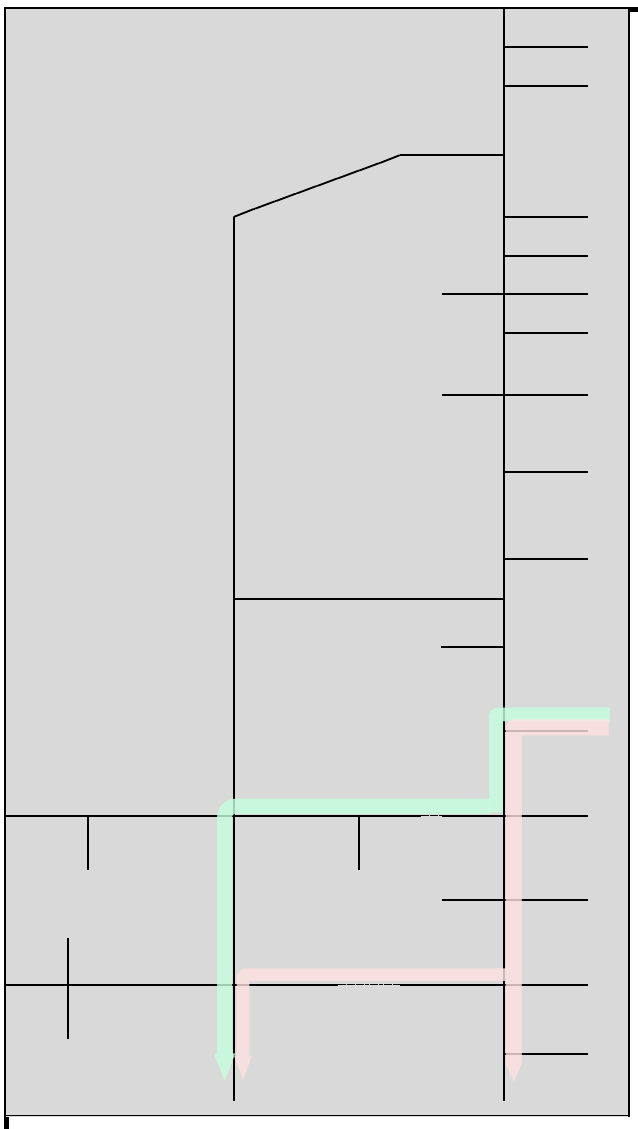
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

STEP 5: SOUTH TOPSAIL ELEMENTARY SCHOOL TO SOUTH



2040	AVERAGE ANNUAL DAILY TRAFFIC
BUILD SCENARIO 2	
Redistriubtion of Build Scenario 1 traffic volumes for addition of Hoover Road On-ramps	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

STEP 6: SOUTH TOPSAIL ELEMENTARY SCHOOL TO NORTH



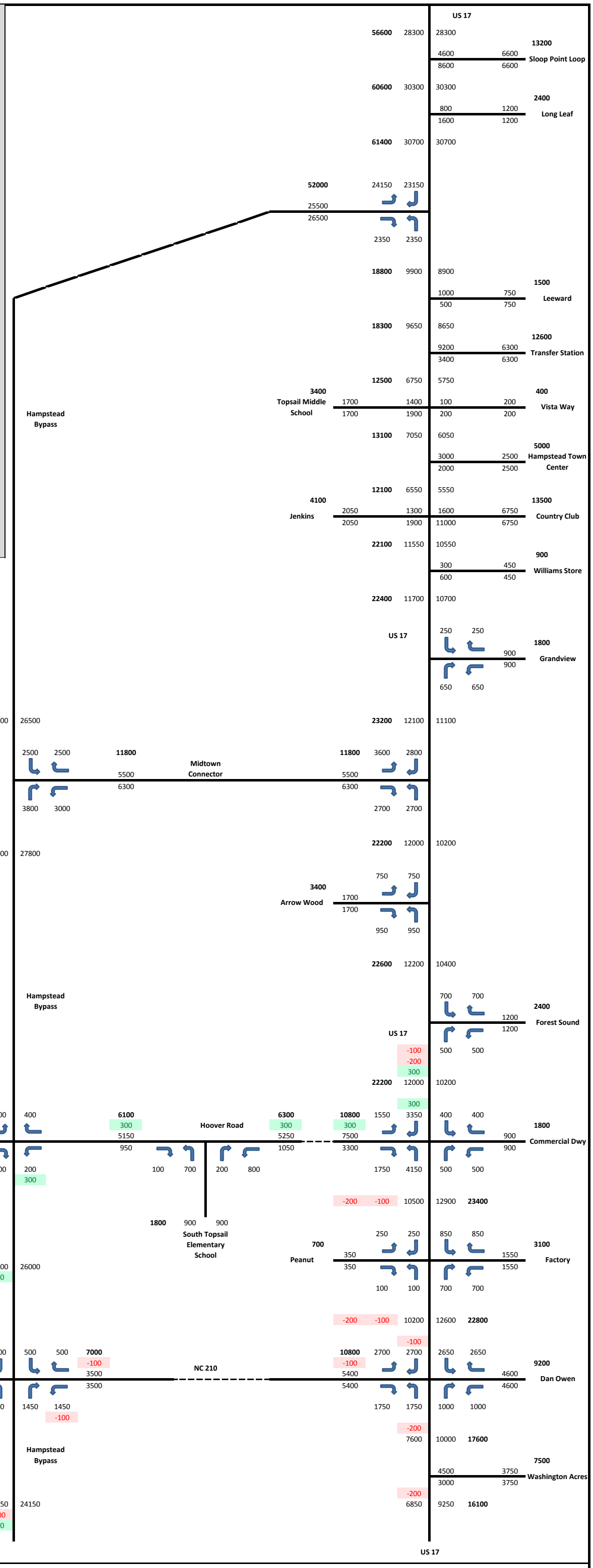
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 2

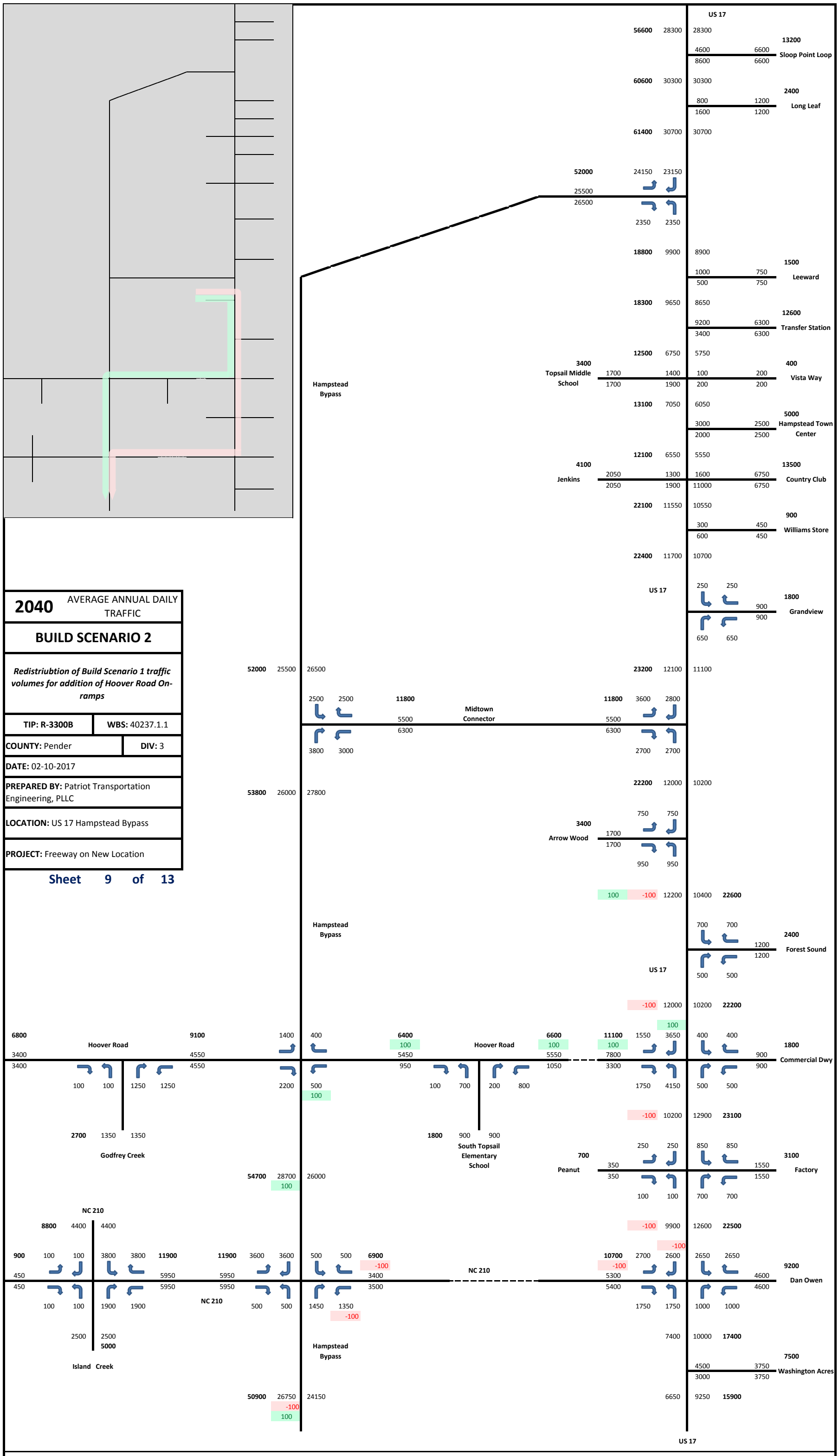
Redistriubtion of Build Scenario 1 traffic volumes for addition of Hoover Road On-ramps

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 8 of 13

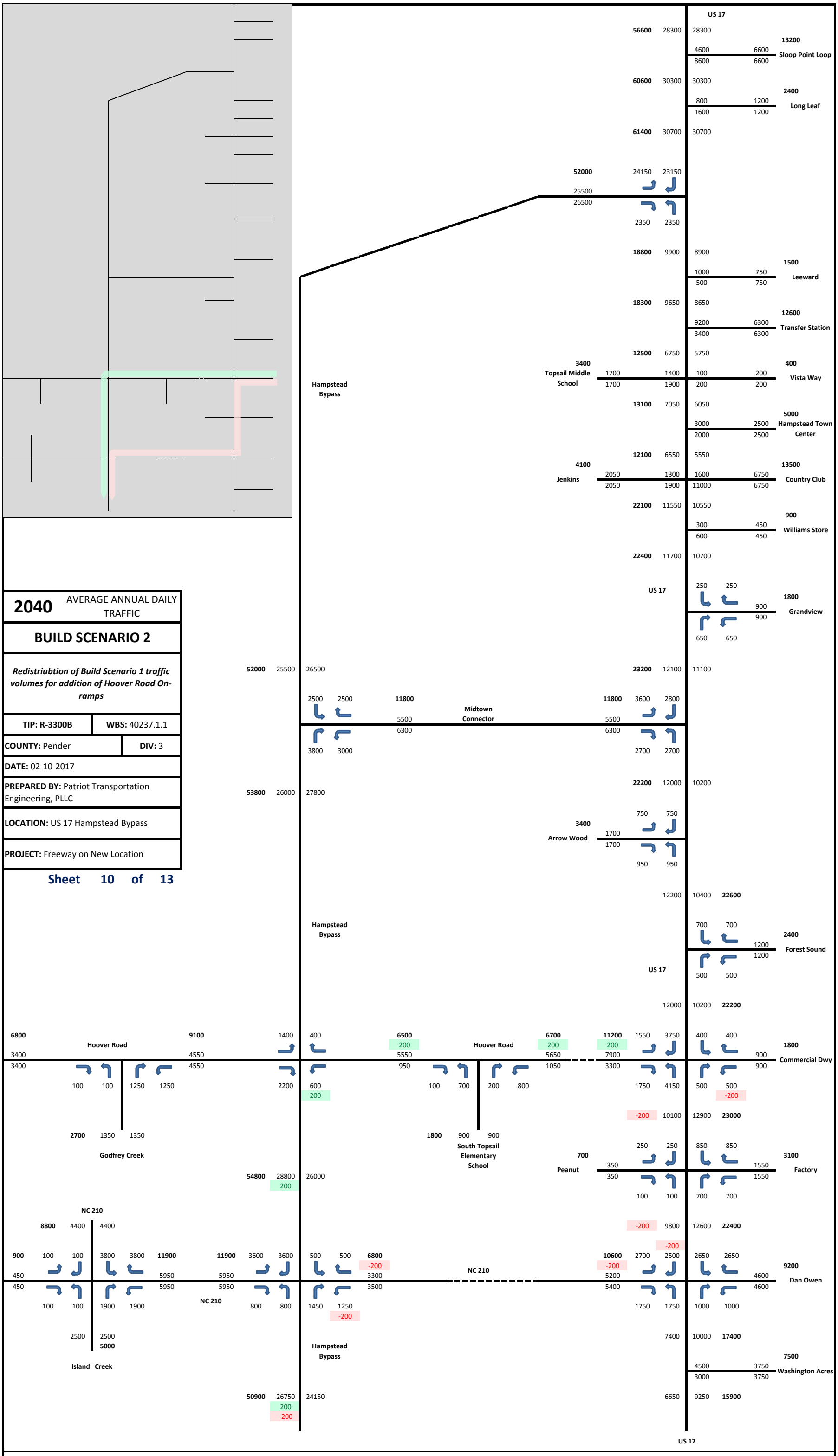


STEP 7: FOREST SOUND ROAD TO SOUTH



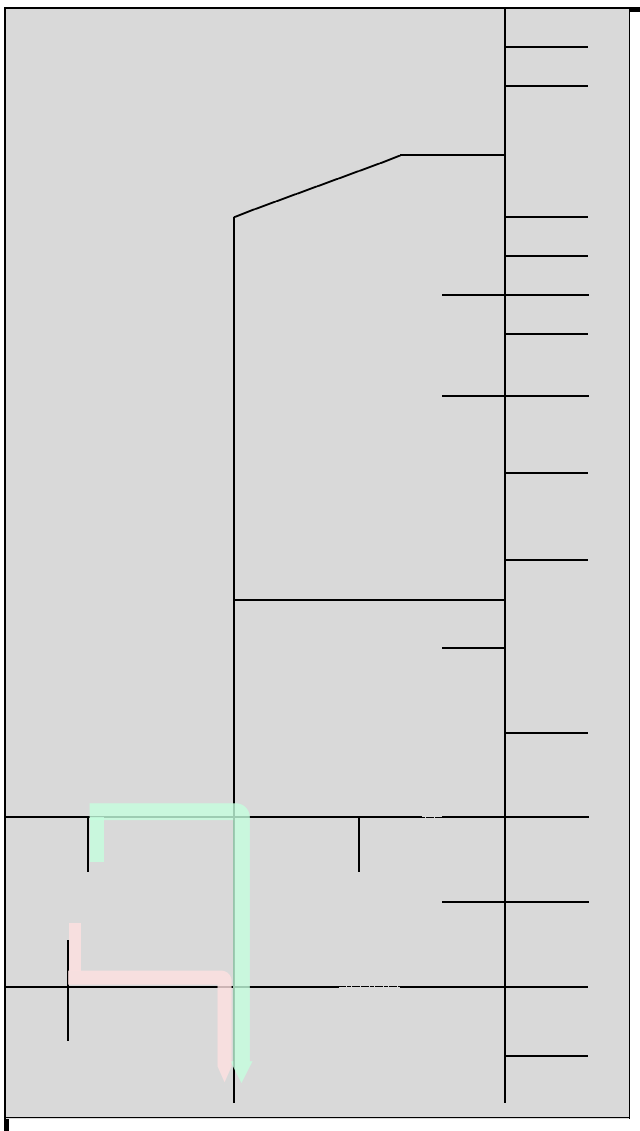
2040 AVERAGE ANNUAL DAILY TRAFFIC	
BUILD SCENARIO 2	
Redistriubtion of Build Scenario 1 traffic volumes for addition of Hoover Road On-ramps	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

STEP 8: ARROW WOOD ROAD TO SOUTH



2040	AVERAGE ANNUAL DAILY TRAFFIC
BUILD SCENARIO 2	
Redistriubtion of Build Scenario 1 traffic volumes for addition of Hoover Road On-ramps	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

STEP 9: COMMERCIAL DRIVEWAY TO SOUTH



2040	AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 2

Redistriubtion of Build Scenario 1 traffic volumes for addition of Hoover Road On-ramps

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 11 of 13

STEP 10: REDISTIRUBUTE DIVERTED TRIPS FROM NC 210 TO HOOVER ROAD

2040	AVERAGE ANNUAL DAILY TRAFFIC
BUILD SCENARIO 2	
Redistriubtion of Build Scenario 1 traffic volumes for addition of Hoover Road On-ramps	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
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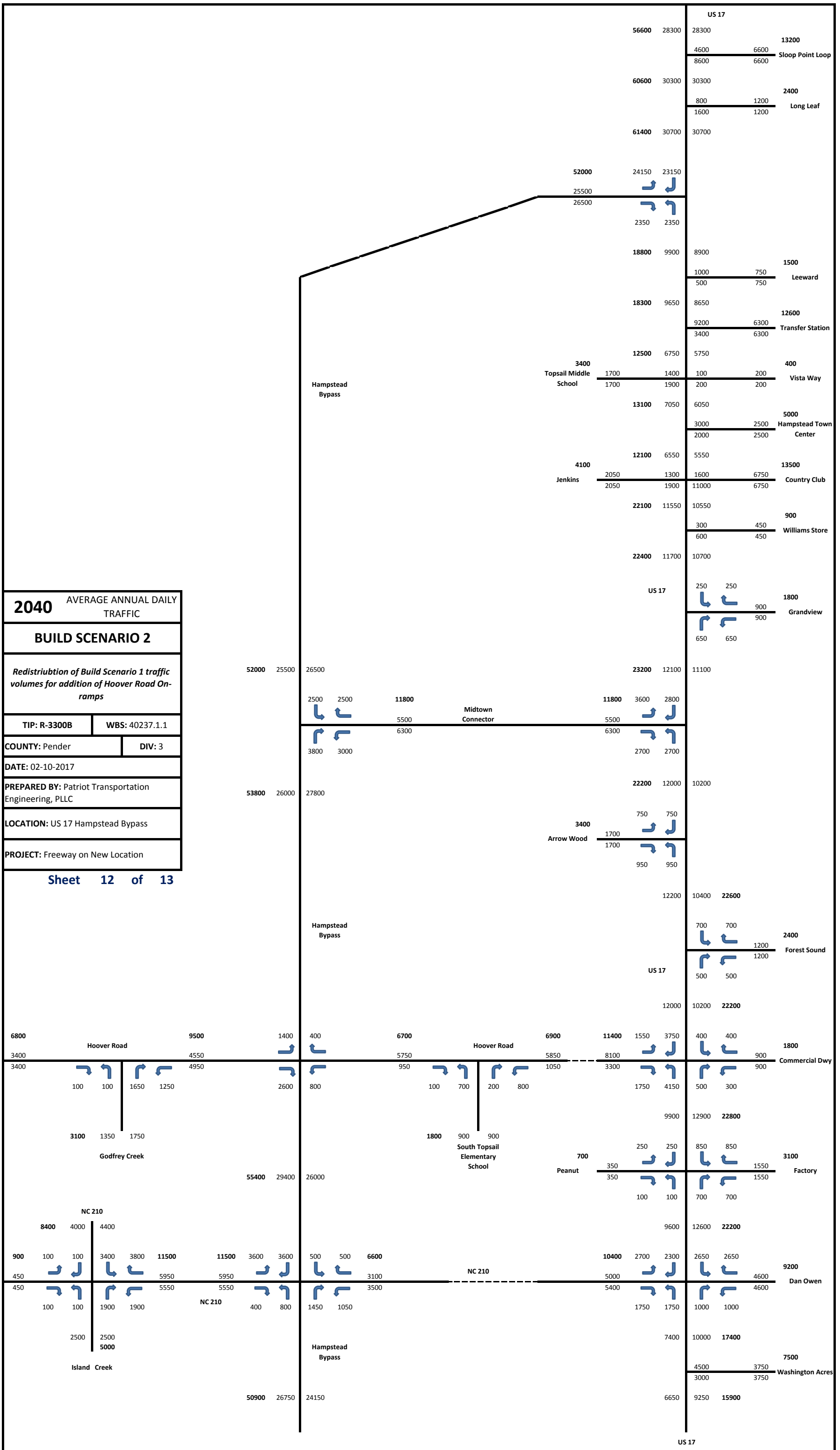
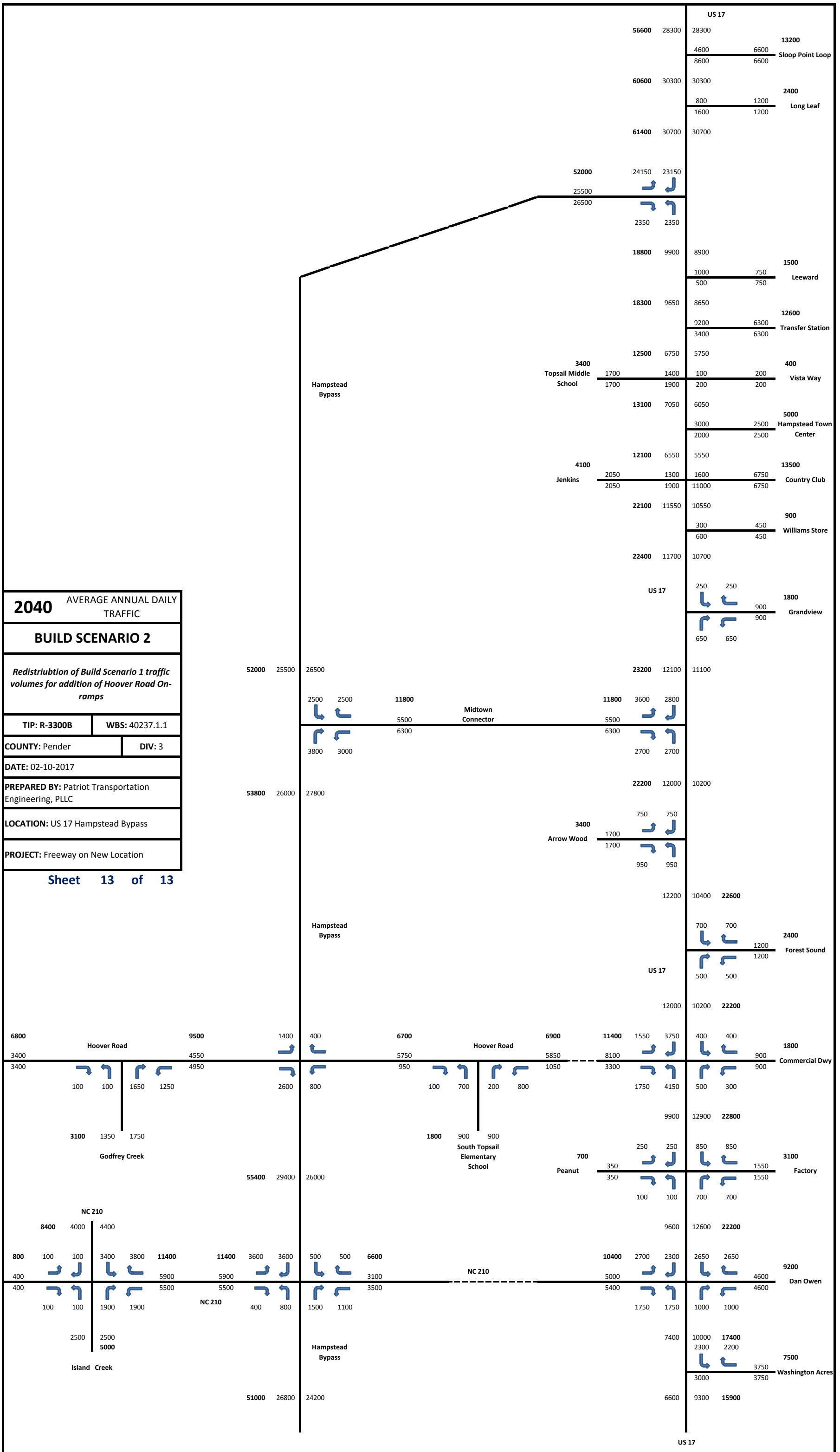
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	



STEP 11: REDISTRIBUTED VOLUMES BEFORE MINOR REBALANCING



2040 AVERAGE ANNUAL DAILY TRAFFIC	
BUILD SCENARIO 2	
Redistriubtion of Build Scenario 1 traffic volumes for addition of Hoover Road On-ramps	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

STEP 12: FINAL VOLUMES AFTER MINOR REBALANCING

APPENDIX D3:

2040 FUTURE YEAR VOLUME DEVELOPMENT

BUILD SCENARIO 3

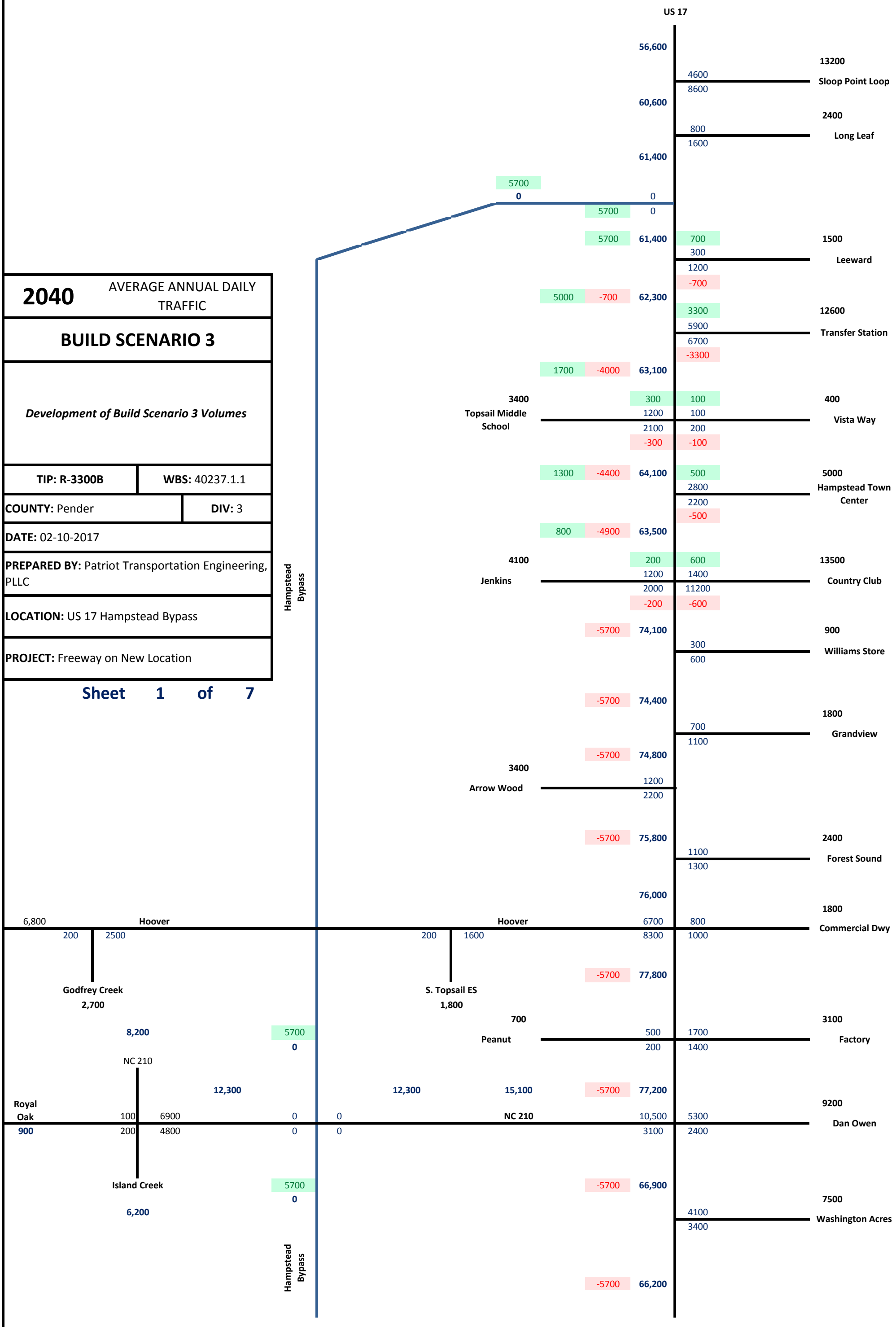
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 3

Development of Build Scenario 3 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 1 of 7



STEP 1: START WITH 2040 NO-BUILD VOLUMES AND RE-ROUTE VOLUMES TO US 17/HAMPSTEAD INTERCHANGE

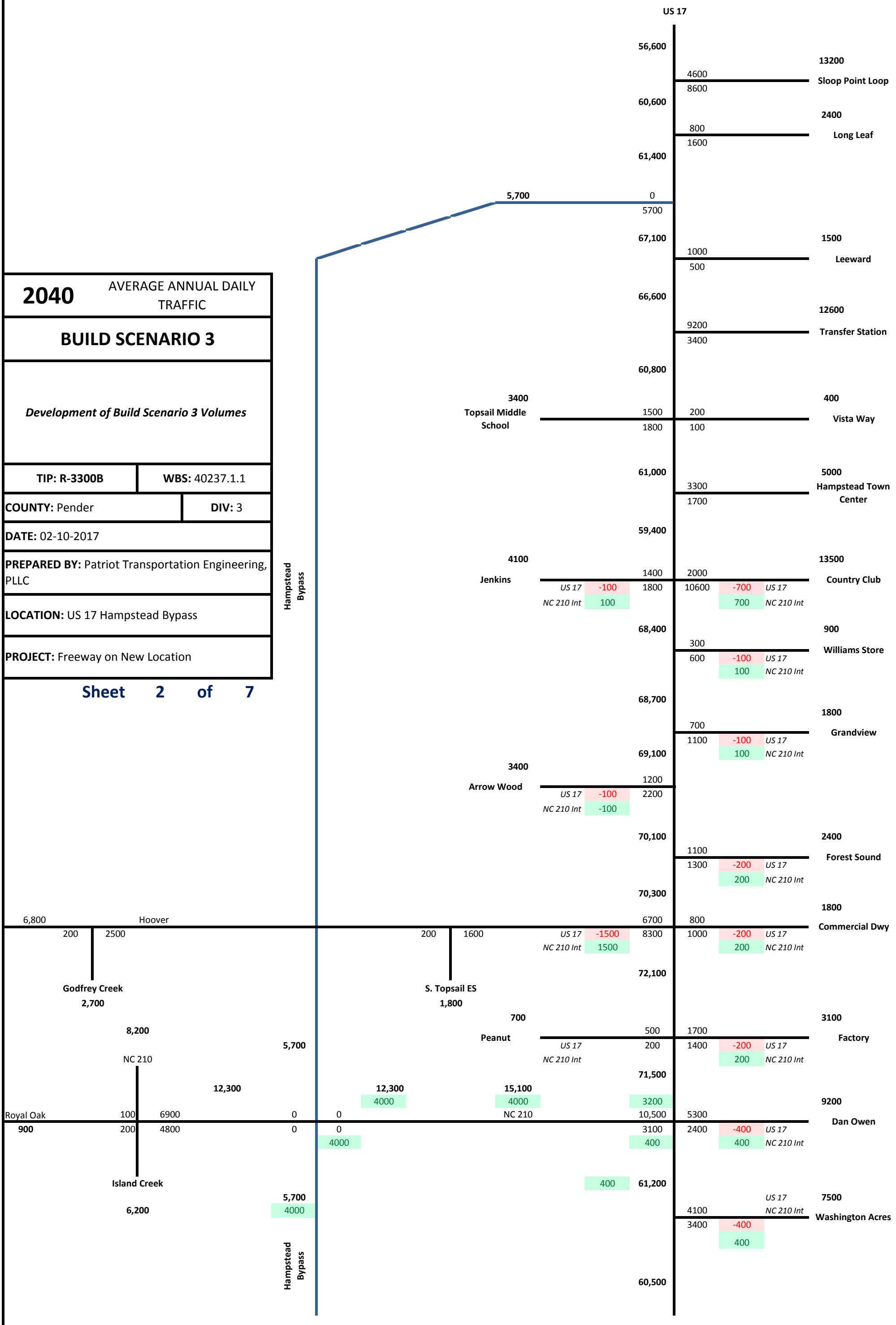
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 3

Development of Build Scenario 3 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 2 of 7



STEP 2: SPLIT OUT VOLUMES TO US 17/NC210 INTERCHANGE

2040 Build Scenario 3 Model Volumes

US 17 - North of Bypass	47,476
Bypass - West of US 17	39,168
US 17 - South of Bypass	18,802
Percent Diversion to Bypass	**71.4%**
Volume to Bypass	**43,900**

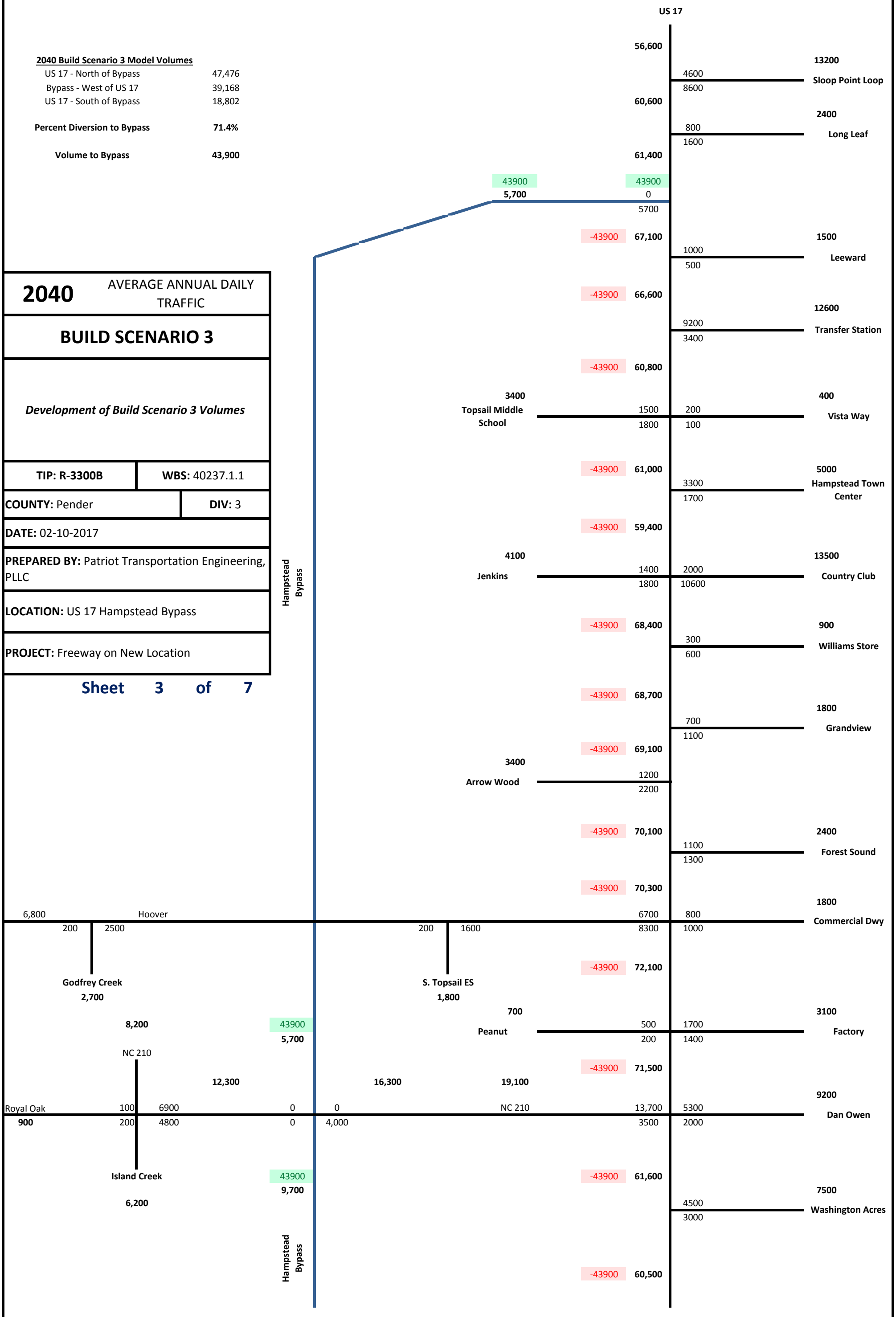
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 3

Development of Build Scenario 3 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 3 of 7



STEP 3: DETERMINE DIVERSION TO BYPASS FROM NORTH BY USING TRAVEL DEMAND MODEL DIVERSION RATE

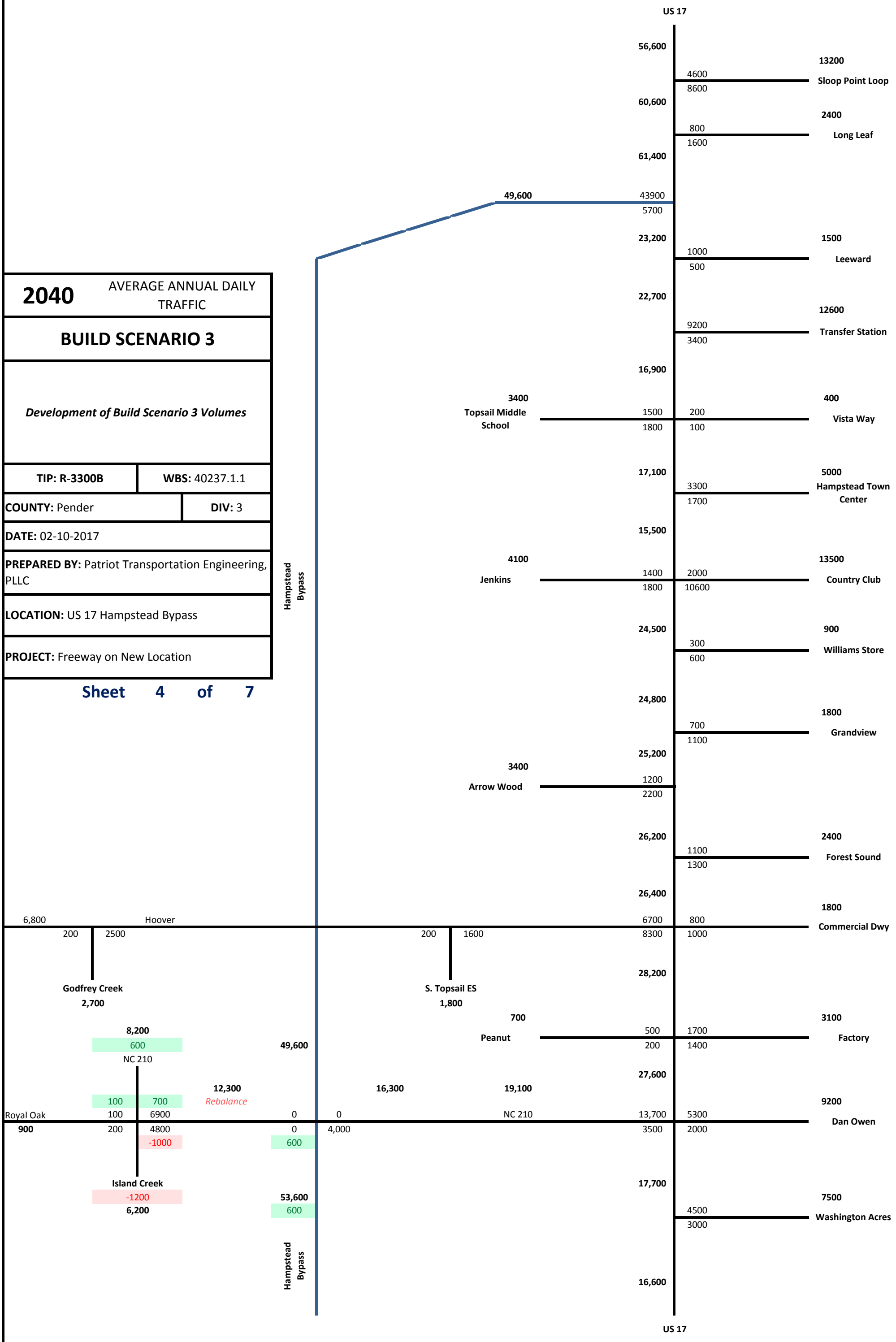
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 3

Development of Build Scenario 3 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 4 of 7



STEP 4: DETERMINE DIVERSION FROM NC 210 AND ISLAND CREEK ROAD USING TRAVEL DEMAND MODEL DIVERSION RATE AND REBALANCE TO EAST

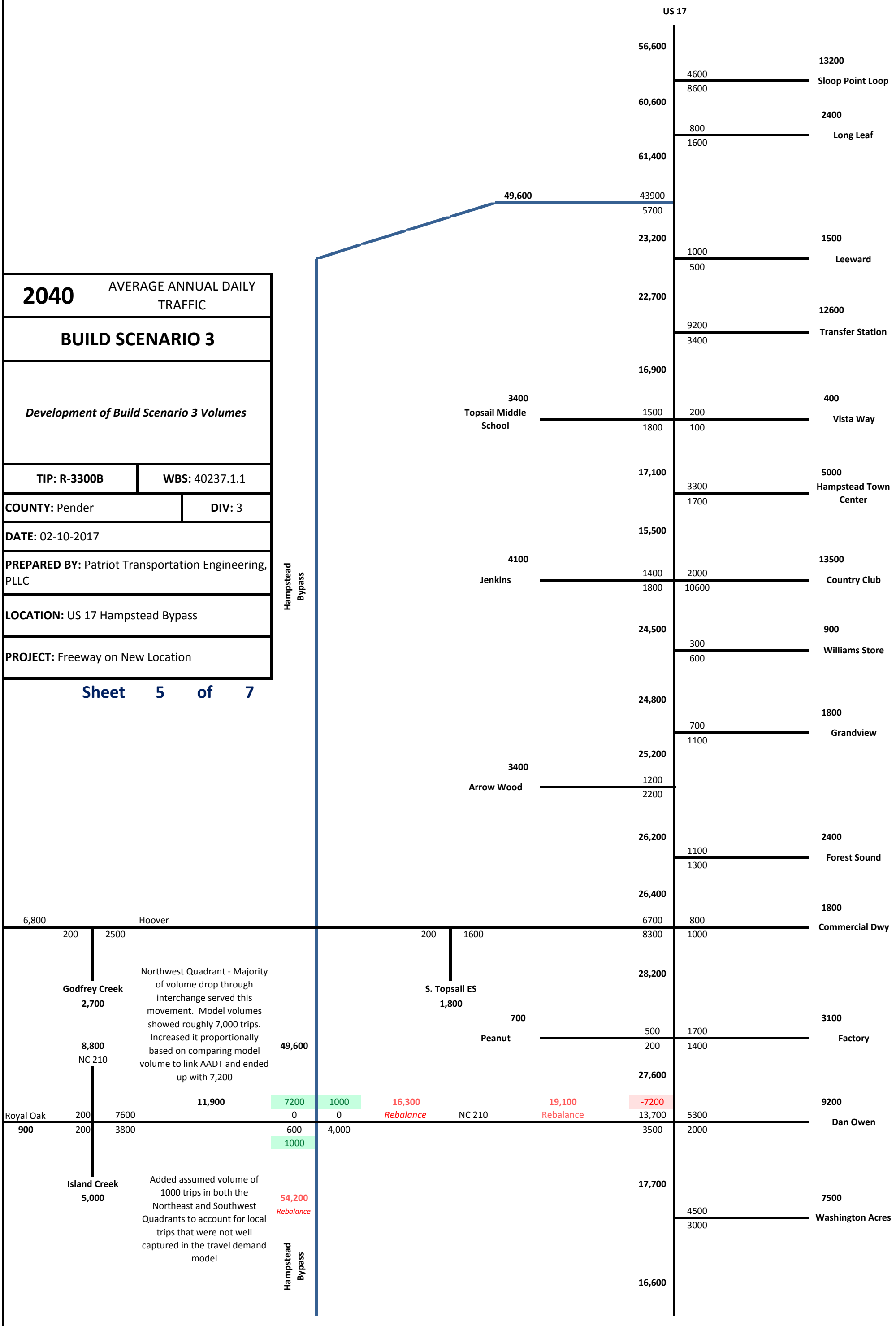
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 3

Development of Build Scenario 3 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 5 of 7



STEP 5: DETERMINE DIVERSION AT BYPASS/NC 210 INTERCHANGE AND REBALANCE NETWORK TO SOUTH AND EAST

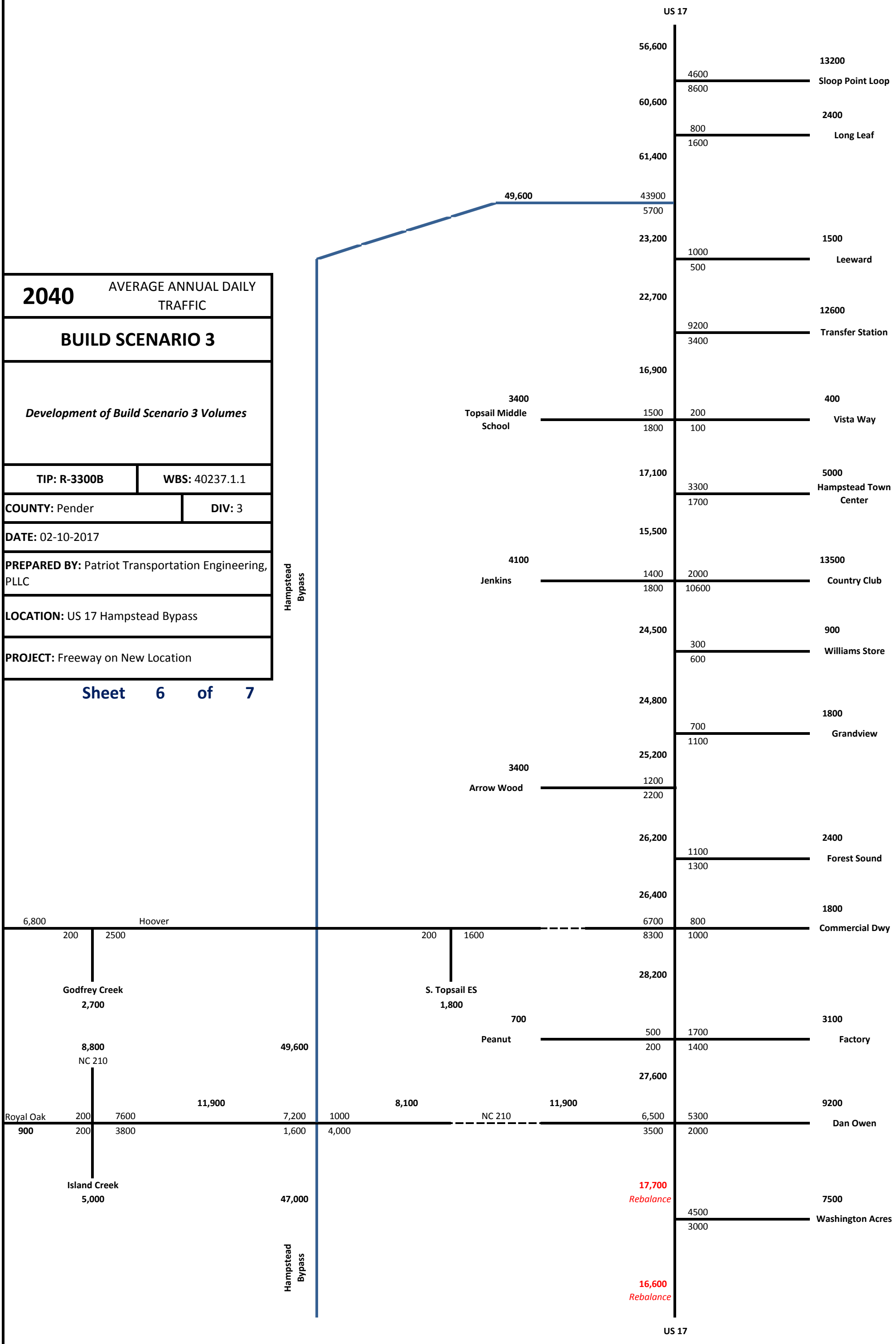
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 3

Development of Build Scenario 3 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 6 of 7



STEP 7: DETERMINE DIVERSION AT BYPASS/NC 210 INTERCHANGE AND REBALANCE NETWORK TO SOUTH AND EAST

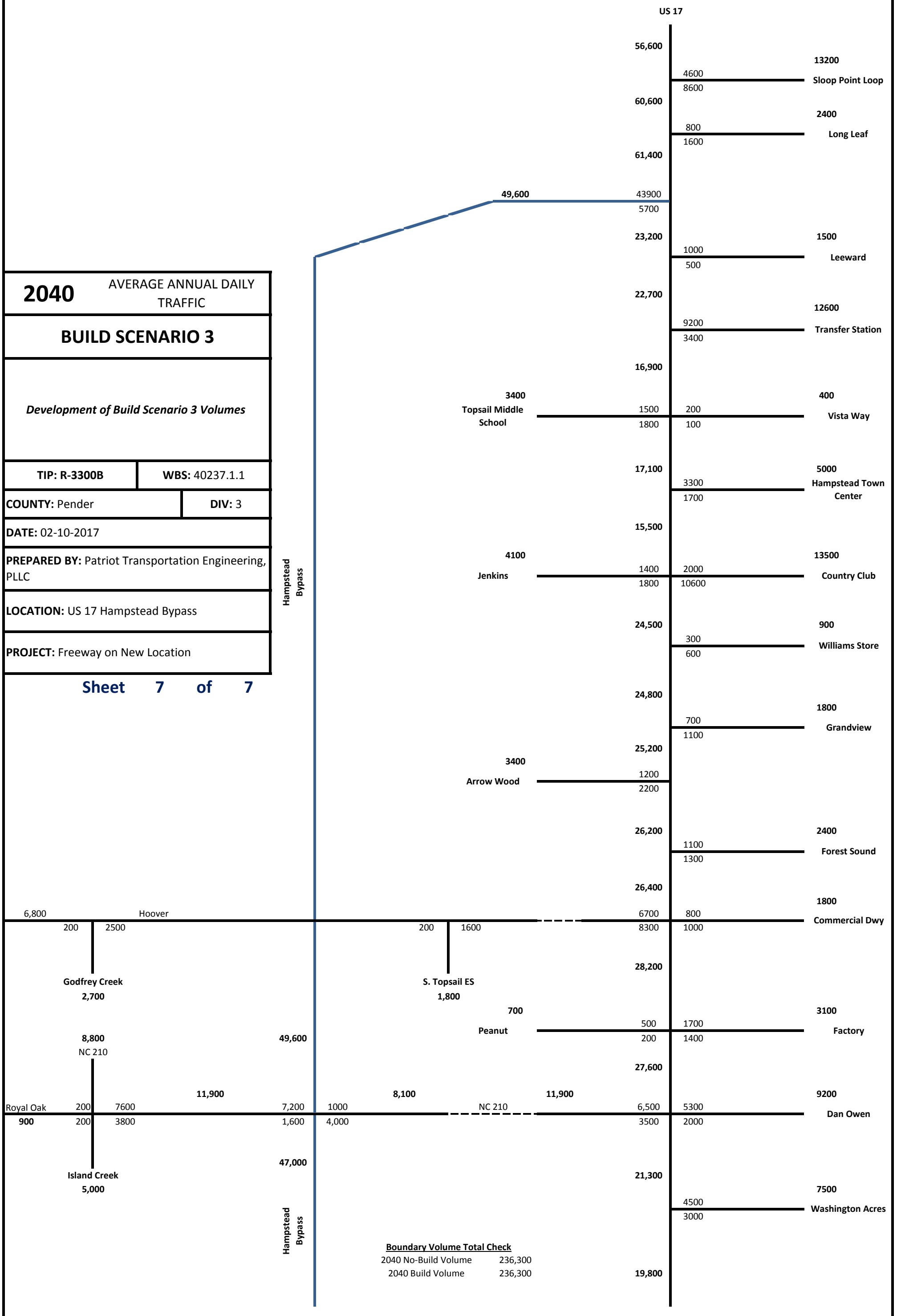
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 3

Development of Build Scenario 3 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 7 of 7



STEP 8: CHECK BOUNDARY VOLUMES AND FINALIZE

APPENDIX D4:

2040 FUTURE YEAR VOLUME DEVELOPMENT

BUILD SCENARIO 4

SUMMARY OF DIVERTED TRIPS TO HOOVER ROAD ON-RAMPS	
1	*Same assumption as Build Scenario 2 for trips to Bypass (South). Assumed reduction from 1000 to 600 for Bypass (North) due to not having Midtown Interchange to provide access for local trips along*
2	*Same assumption as Build Scenario 2 for trips to Bypass (South). Assumed reduction from 400 to 300 for Bypass (North) due to not having Midtown Interchange to provide access for local trips along*
3	*Same assumption as Build Scenario 2 for trips to Bypass (South). Assumed reduction from 400 to 300 for Bypass (North) due to not having Midtown Interchange to provide access for local trips along US 17*
4	*Same assumption as Build Scenario 2*
5	*Same assumption as Build Scenario 2*
6	*Same assumption as Build Scenario 2*
7	*Same assumption as Build Scenario 2*

2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 4

Redistriubtion of Build Scenario 3 traffic volumes for addition of Hoover Road On-ramps

TIP: R-3300B | **WBS:** 40237.1.1

COUNTY: Pender | **DIV:** 3

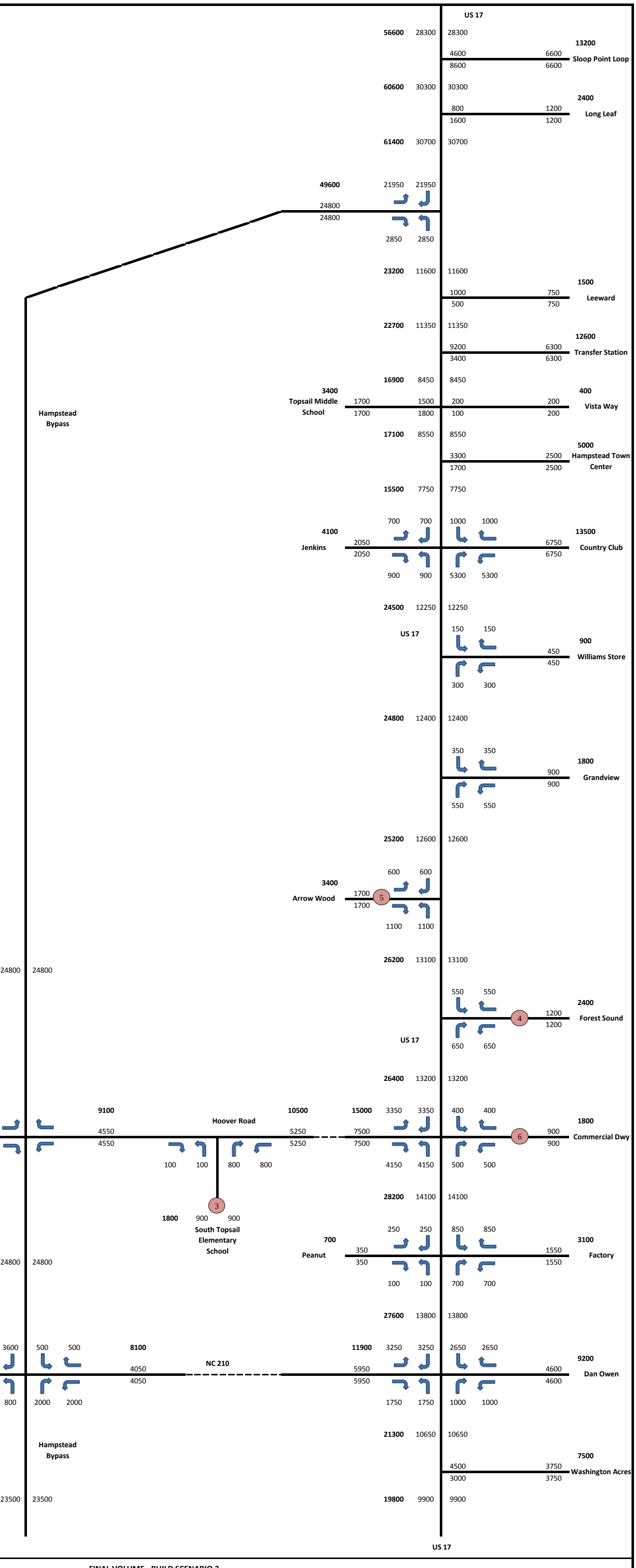
DATE: 02-10-2017

PREPARED BY: Patriot Transportation Engineering, PLLC

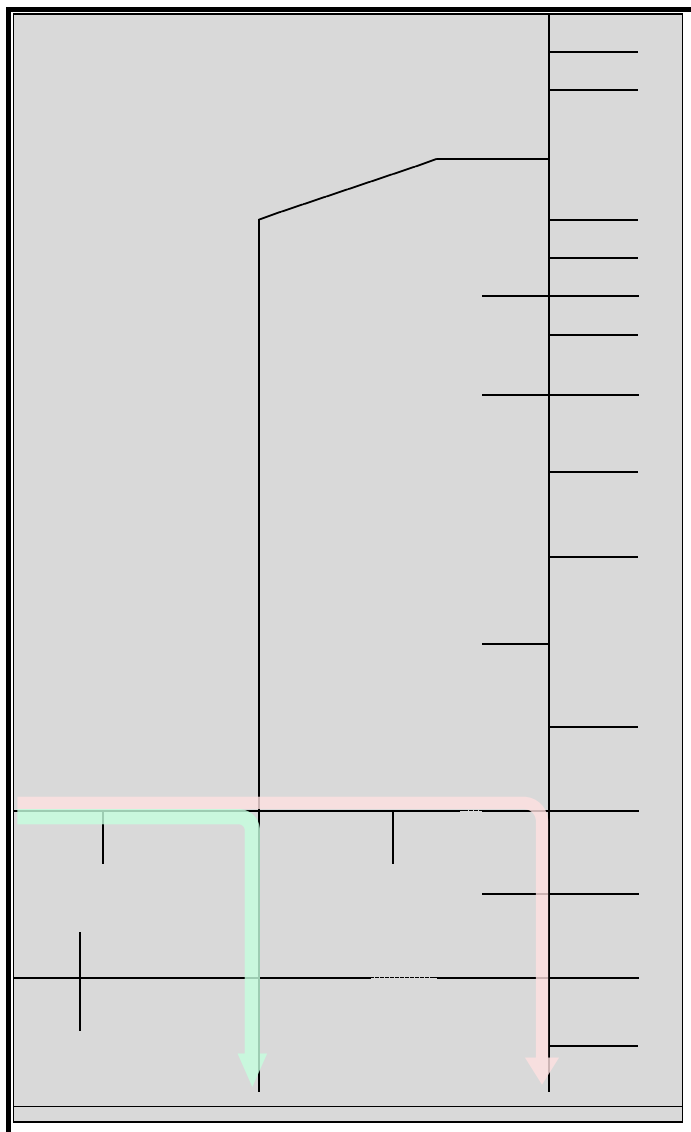
LOCATION: US 17 Hampstead Bypass

PROJECT: Freeway on New Location

Sheet 1 of 13



FINAL VOLUME - BUILD SCENARIO 3



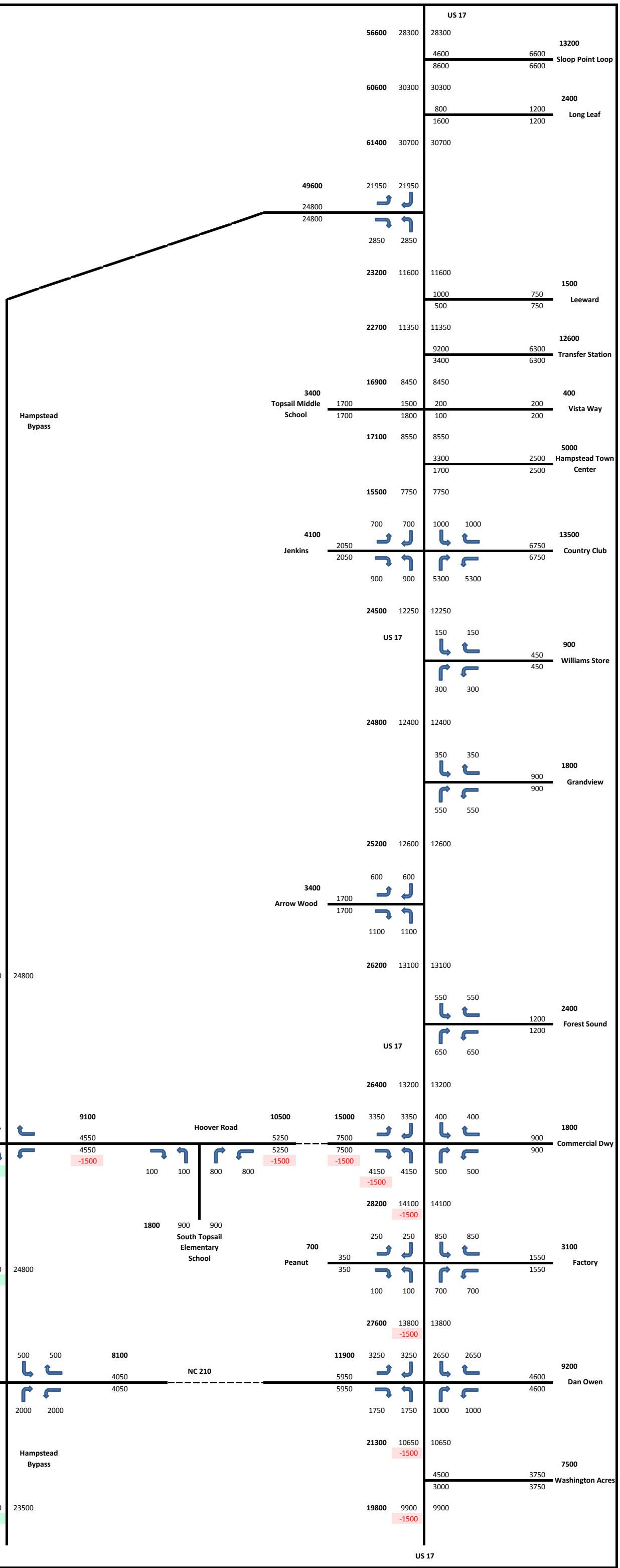
2040	AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 4

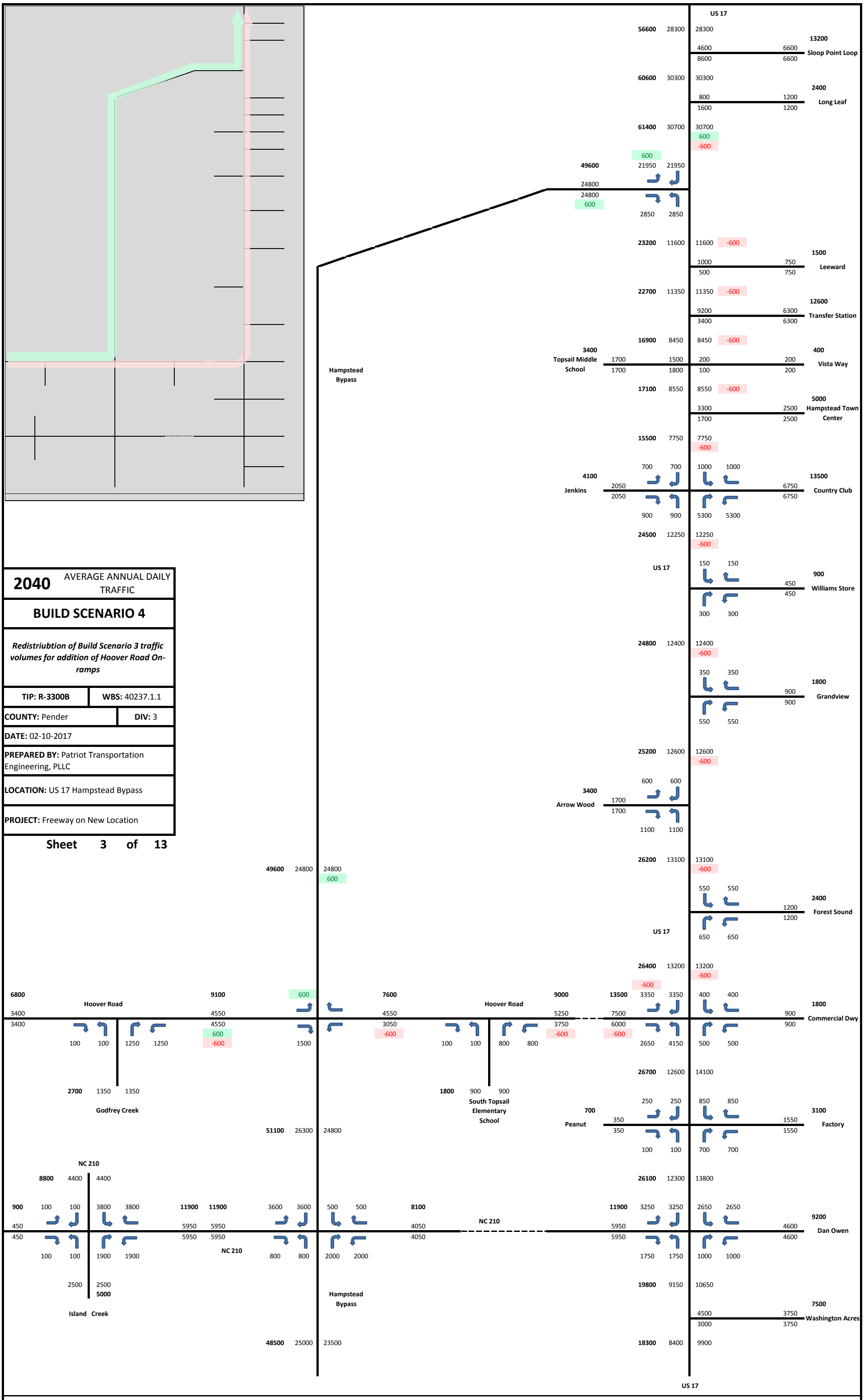
Redistriubtion of Build Scenario 3 traffic volumes for addition of Hoover Road On-ramps

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 2 of 13

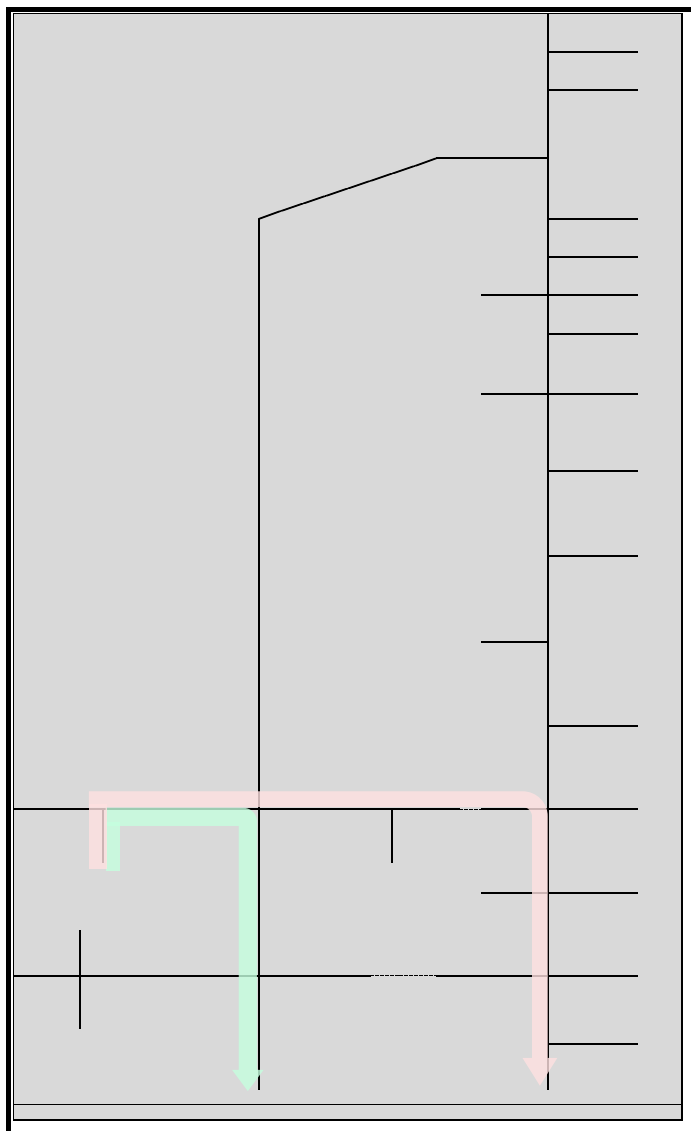


STEP 1: HOOVER ROAD TO SOUTH



2040	AVERAGE ANNUAL DAILY TRAFFIC
BUILD SCENARIO 4	
Redistriubtion of Build Scenario 3 traffic volumes for addition of Hoover Road On-ramps	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

STEP 2: HOOVER ROAD TO NORTH



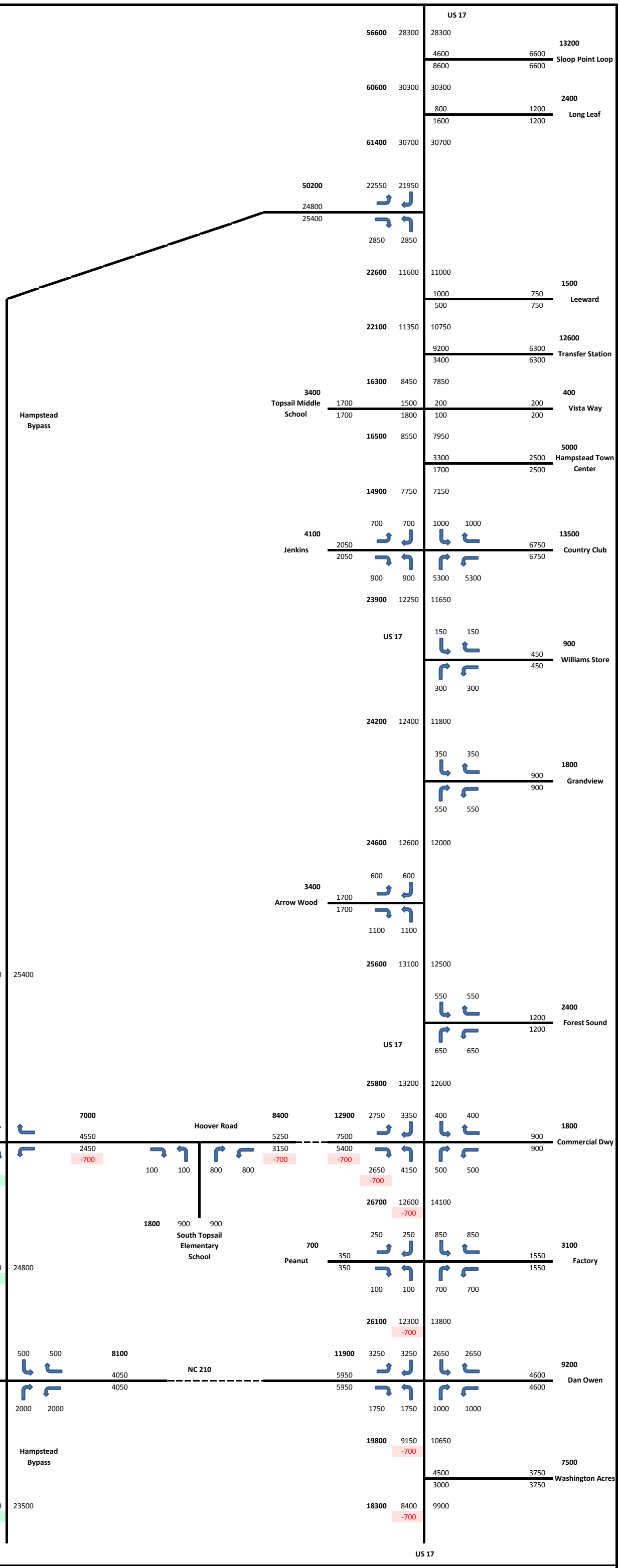
2040	AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 4

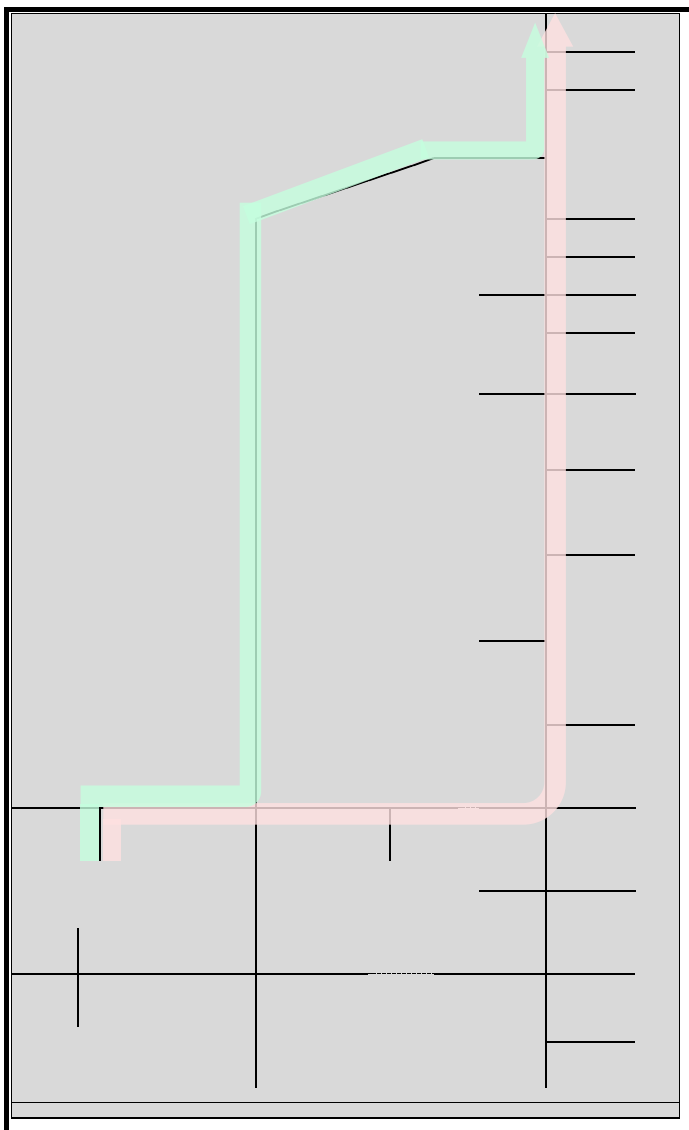
Redistriubtion of Build Scenario 3 traffic volumes for addition of Hoover Road On-ramps

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 4 of 13



STEP 3: GODFREY CREEK ROAD TO SOUTH



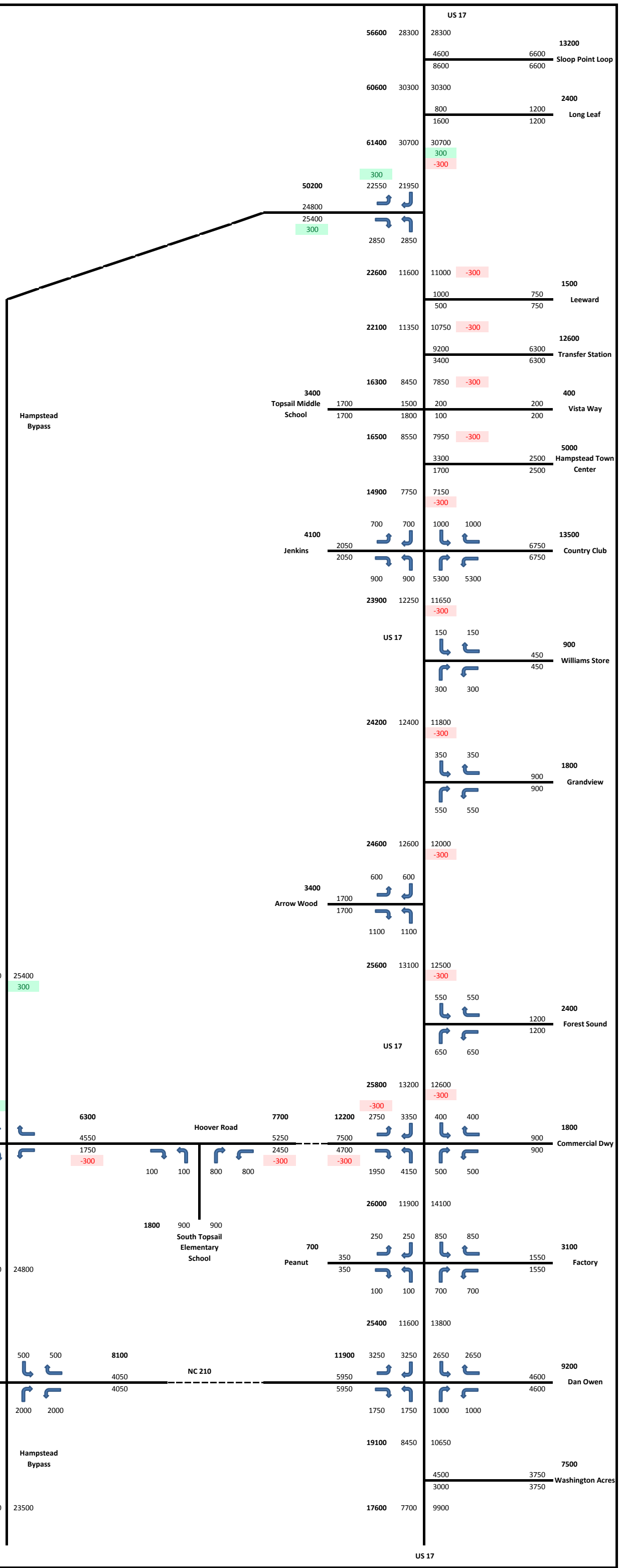
2040	AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 4

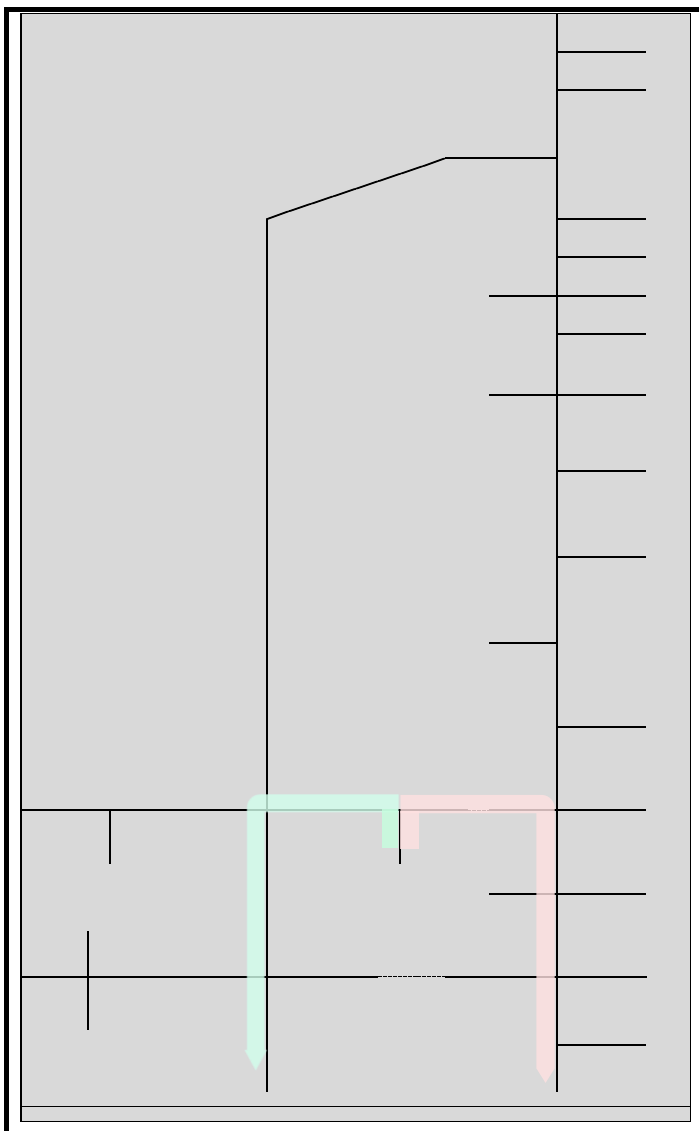
Redistriubtion of Build Scenario 3 traffic volumes for addition of Hoover Road On-ramps

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 5 of 13

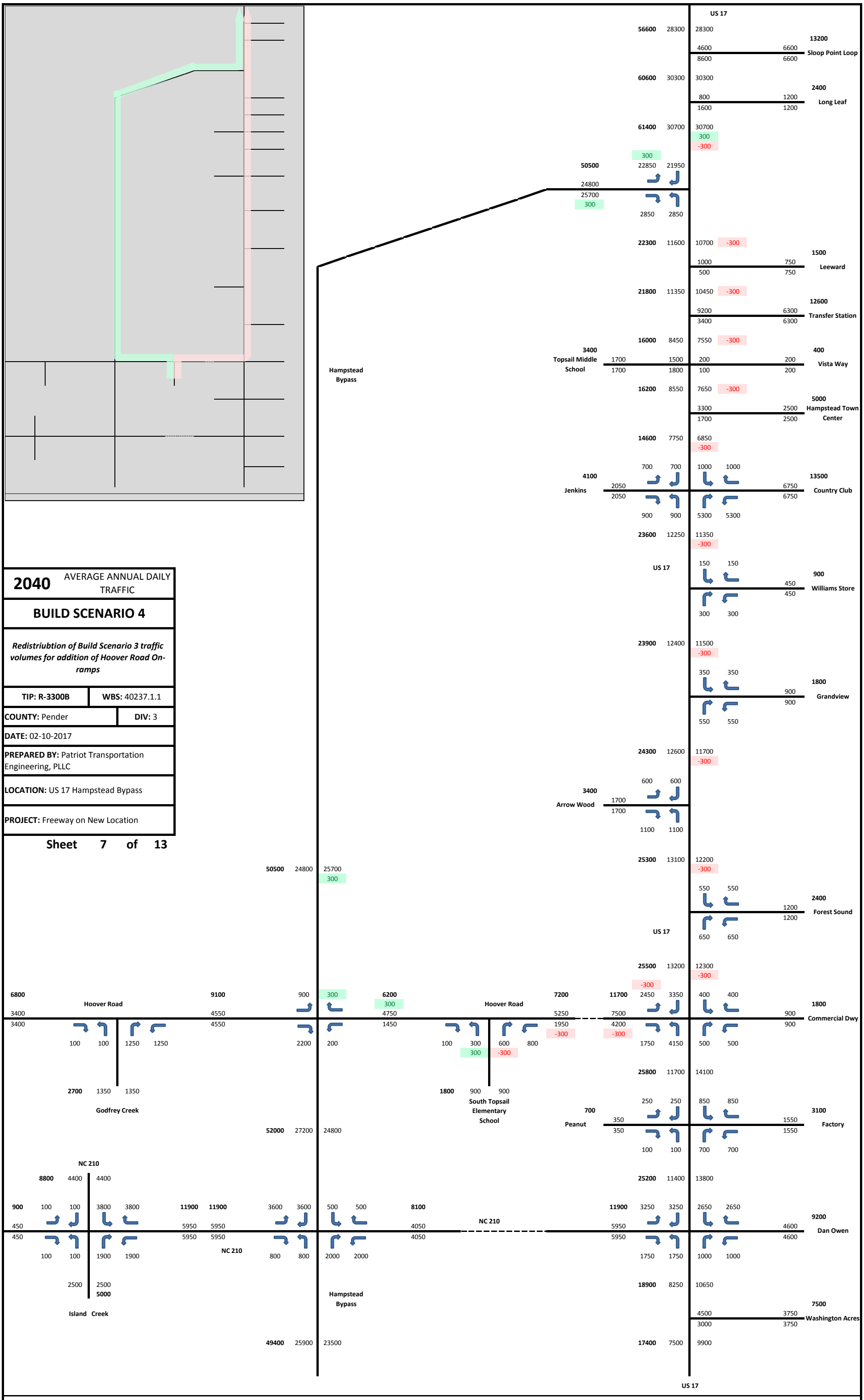


STEP 4: GODFREY CREEK ROAD TO NORTH



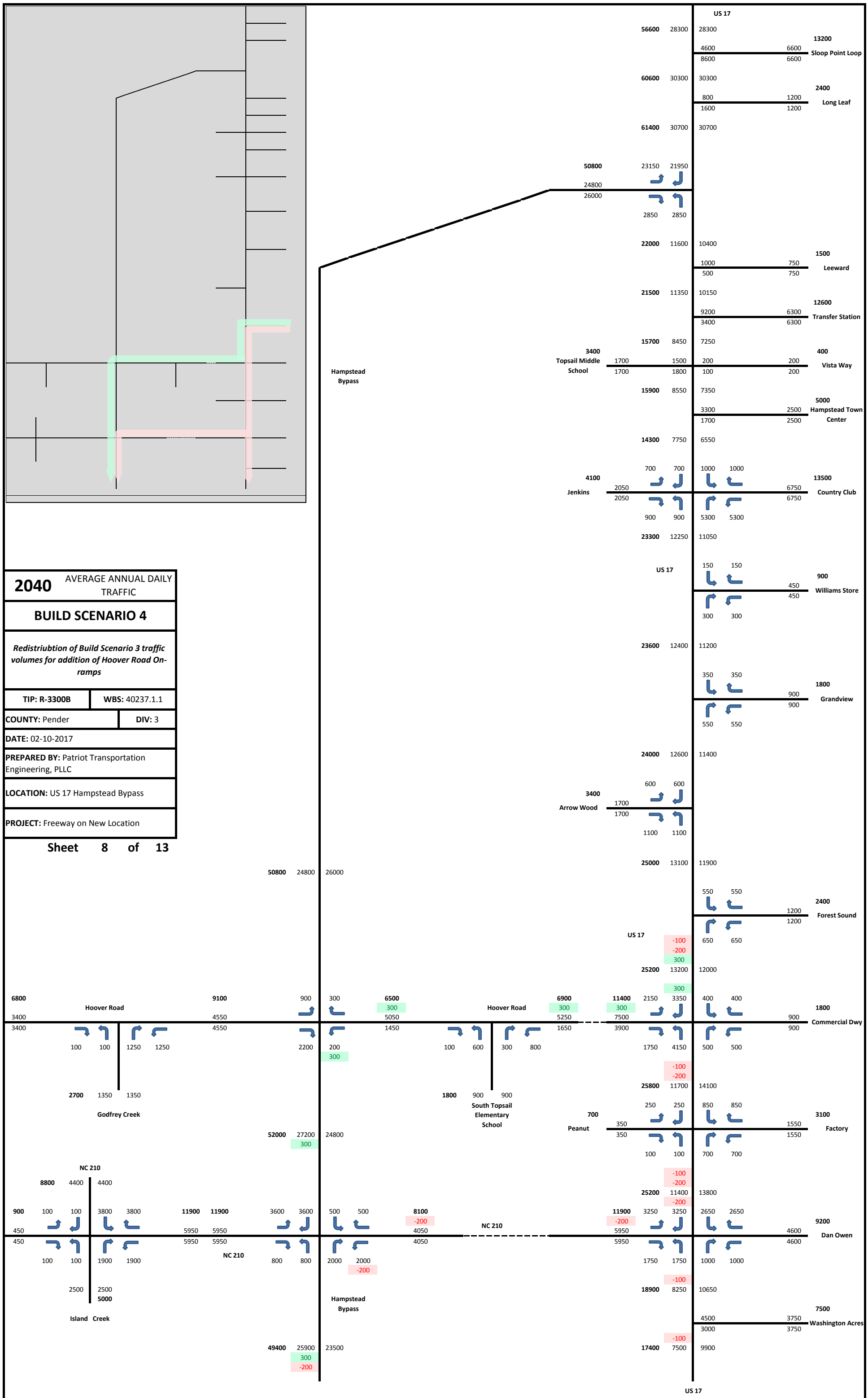
2040	AVERAGE ANNUAL DAILY TRAFFIC
BUILD SCENARIO 4	
Redistriubtion of Build Scenario 3 traffic volumes for addition of Hoover Road On-ramps	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 6 of 13



2040	AVERAGE ANNUAL DAILY TRAFFIC
BUILD SCENARIO 4	
Redistriubtion of Build Scenario 3 traffic volumes for addition of Hoover Road On-ramps	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

STEP 6: SOUTH TOPSAIL ELEMENTARY SCHOOL TO NORTH



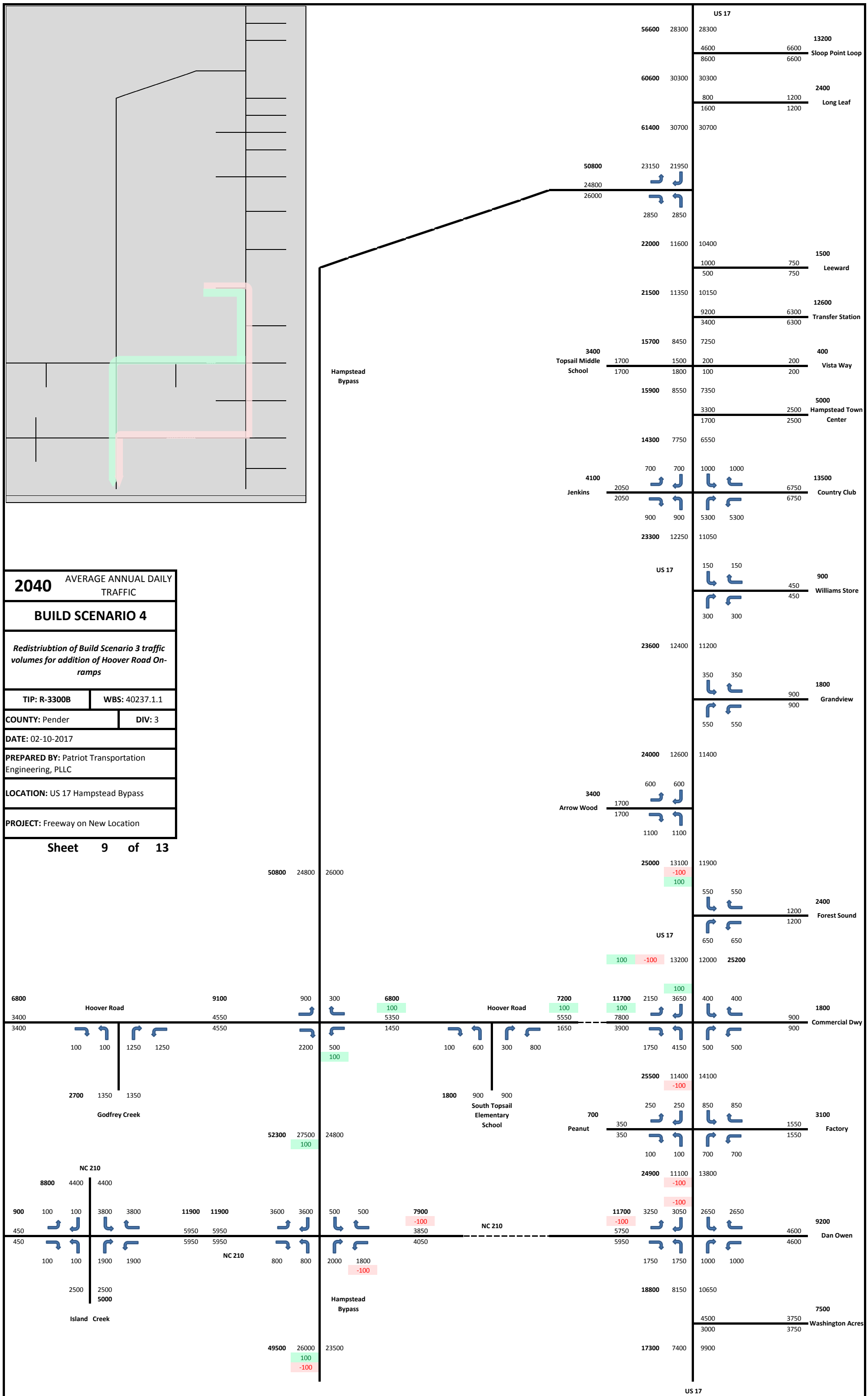
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 4

Redistriubtion of Build Scenario 3 traffic volumes for addition of Hoover Road On-ramps

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

STEP 7: FOREST SOUND ROAD TO SOUTH



2040 AVERAGE ANNUAL DAILY TRAFFIC

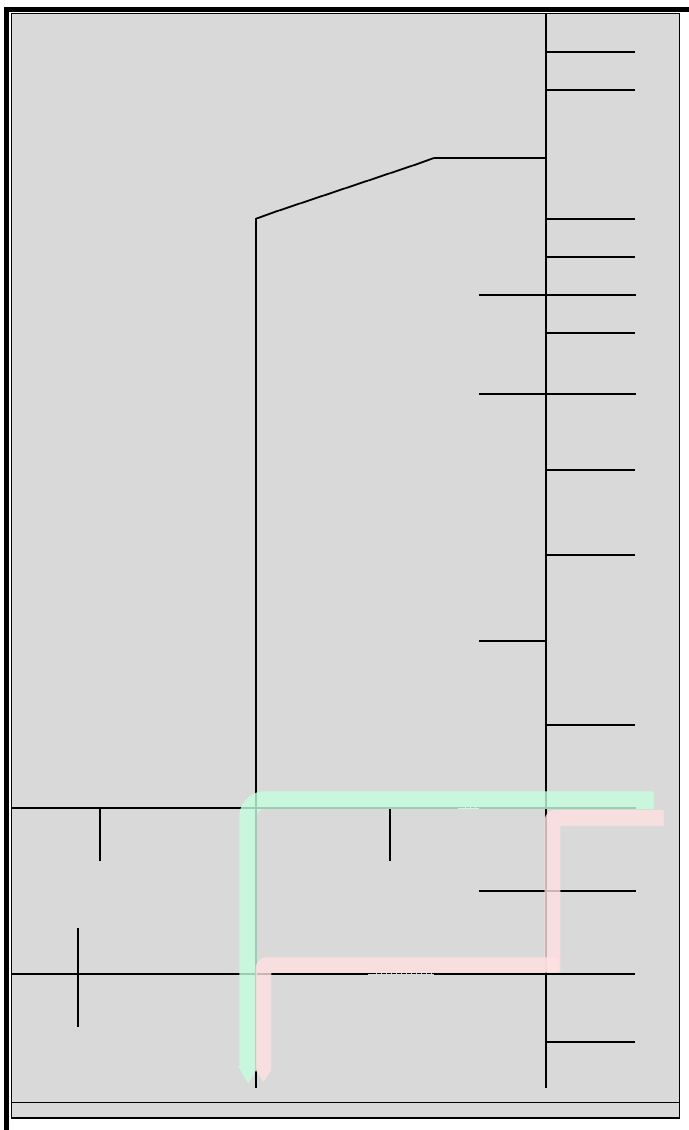
BUILD SCENARIO 4

Redistriubtion of Build Scenario 3 traffic volumes for addition of Hoover Road On-ramps

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 9 of 13

STEP 8: ARROW WOOD ROAD TO SOUTH



2040	AVERAGE ANNUAL DAILY TRAFFIC

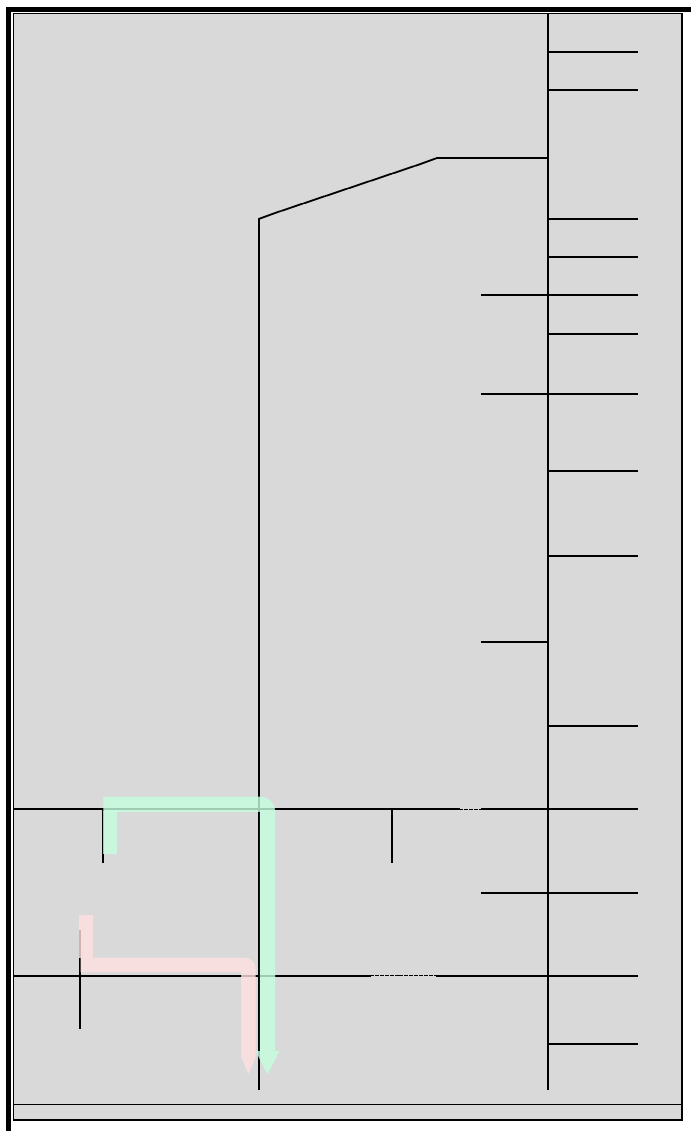
BUILD SCENARIO 4

Redistriubtion of Build Scenario 3 traffic volumes for addition of Hoover Road On-ramps

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 10 of 13

STEP 9: COMMERCIAL DRIVEWAY TO SOUTH



2040	AVERAGE ANNUAL DAILY TRAFFIC
BUILD SCENARIO 4	
Redistriubtion of Build Scenario 3 traffic volumes for addition of Hoover Road On-ramps	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 11 of 13

STEP 10: REDISTIRUBUTE DIVERTED TRIPS FROM NC 210 TO HOOVER ROAD

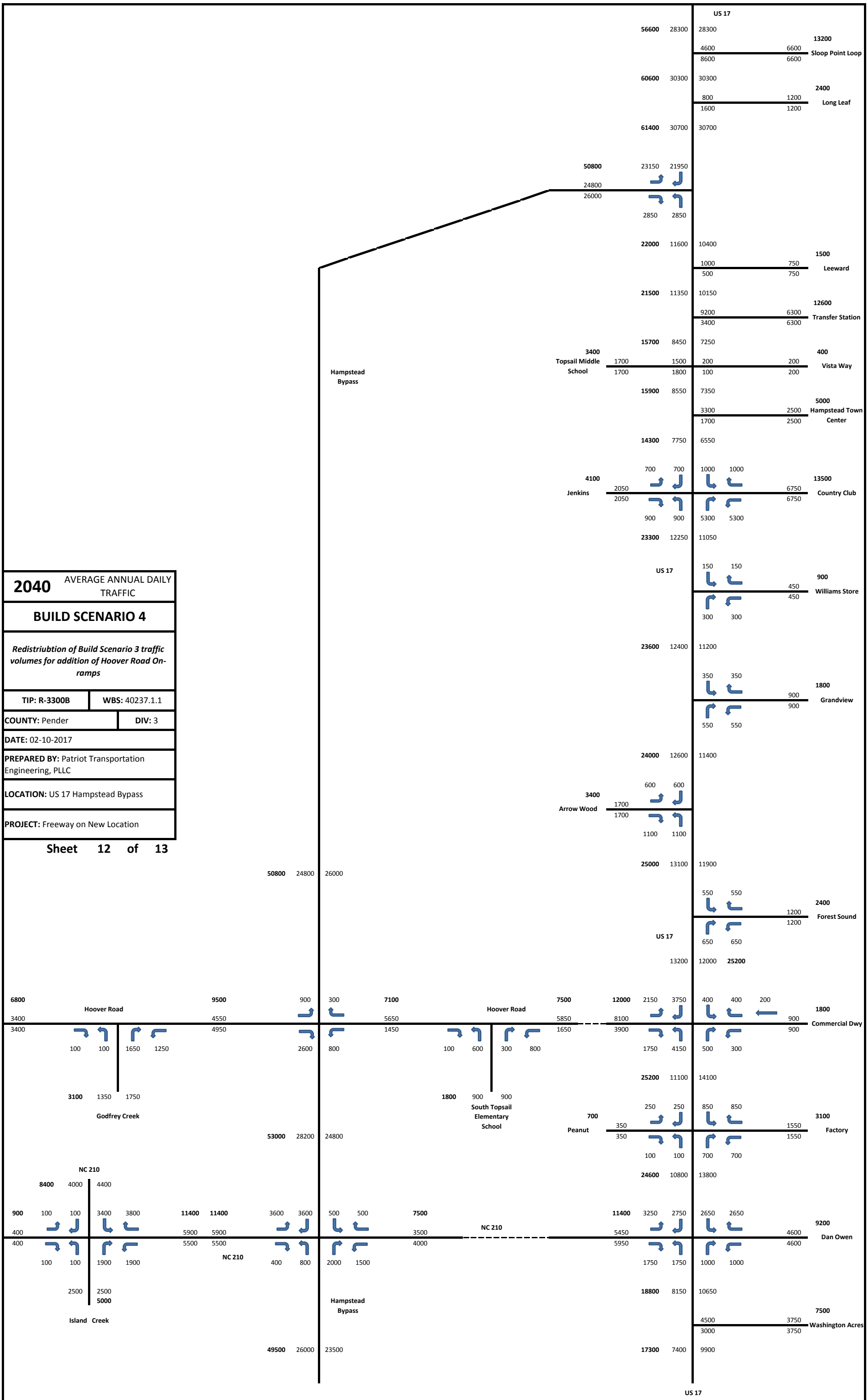
2040	AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 4

Redistriubtion of Build Scenario 3 traffic volumes for addition of Hoover Road On-ramps

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

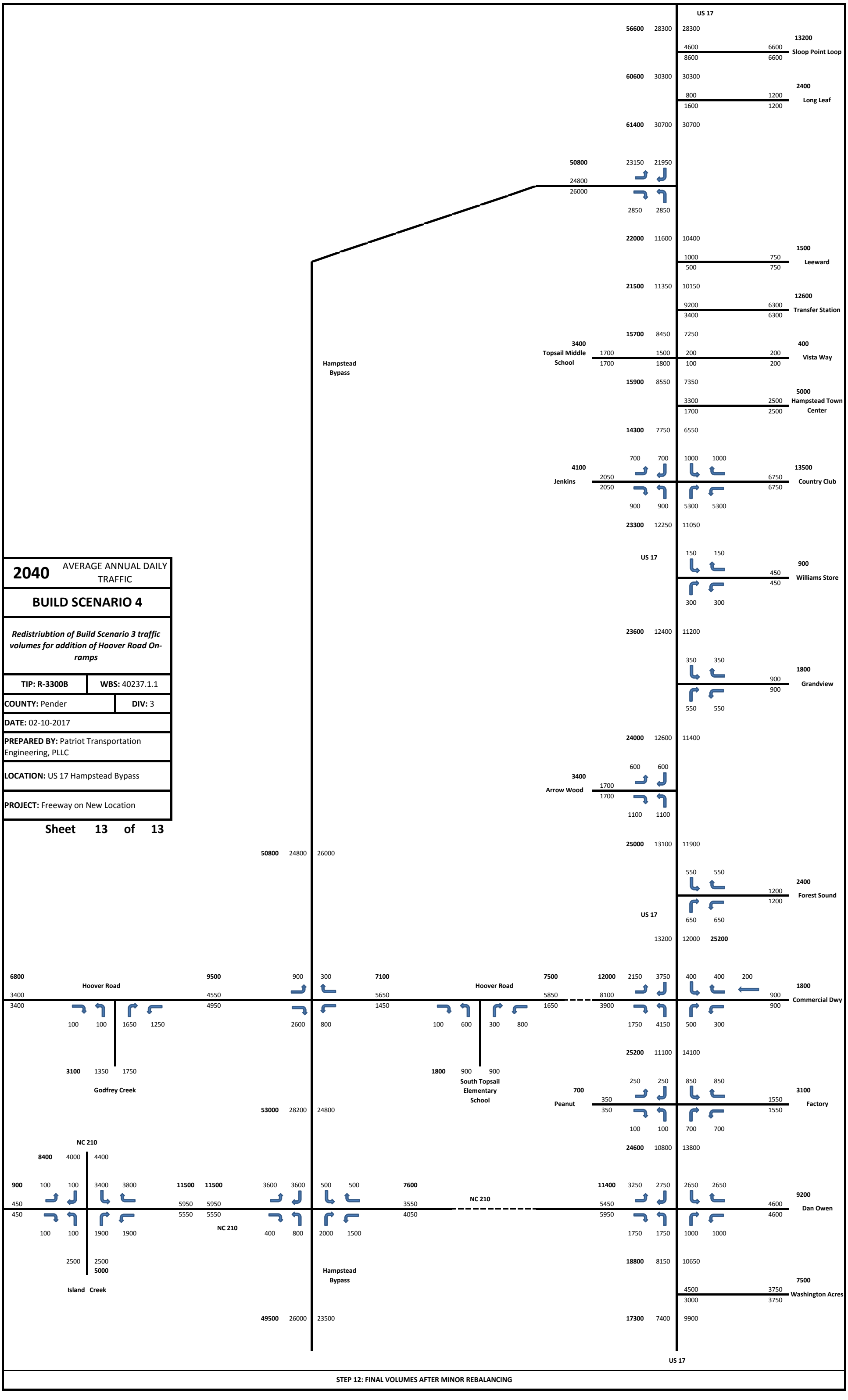
Sheet 12 of 13



STEP 11: REDISTRIBUTED VOLUMES BEFORE MINOR REBALANCING

2040	AVERAGE ANNUAL DAILY TRAFFIC
BUILD SCENARIO 4	
Redistriubtion of Build Scenario 3 traffic volumes for addition of Hoover Road On-ramps	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 13 of 13



STEP 12: FINAL VOLUMES AFTER MINOR REBALANCING

APPENDIX D5:

2040 FUTURE YEAR VOLUME DEVELOPMENT

BUILD SCENARIO 5

SUMMARY OF DIVERTED TRIPS TO HOOVER ROAD VIA SERVICE ROAD	
1	*Assumed same volumes diverted as Build 2; however, assumed path was reversed to include the traffic destined for Hoover Road*
2	*Assumed same volumes diverted as Build 2; however, assumed path was reversed to include the traffic destined for Godfrey Creek Road*
3	*Assumed same volumes diverted as Build 2; however, assumed path was reversed to include the traffic destined for S. Topsail Elementary School*
4	*Assumed same volumes diverted as Build 2; however, assumed path was reversed to include the traffic destined for Hoover Road*
5	*Assumed 200 trips between Hoover Road to Topsail Middle School, which provide nominal volume on service road northbound and allowed US 17 to have balanced directional link volumes*

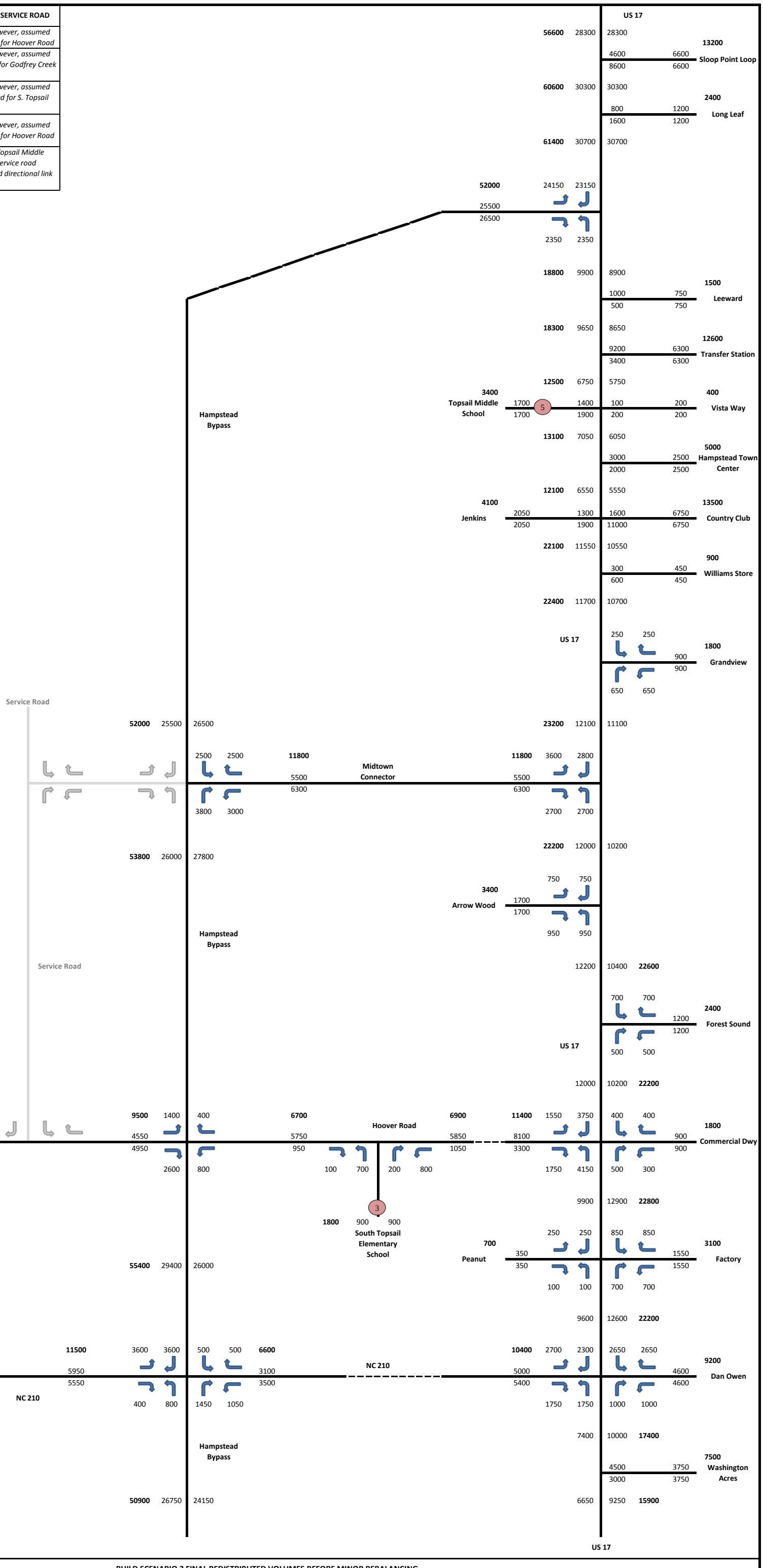
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 5

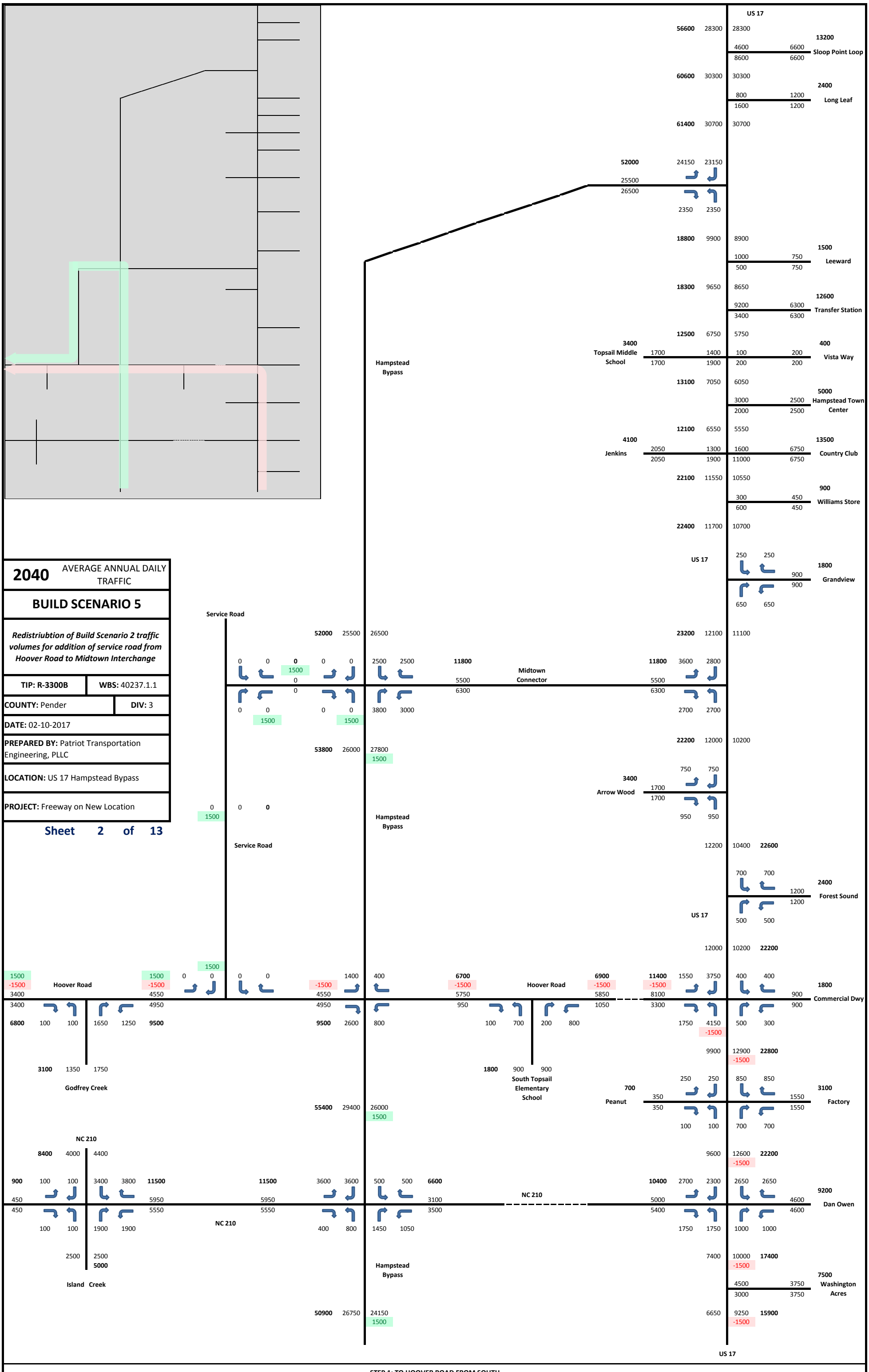
Redistriubtion of Build Scenario 2 traffic volumes for addition of service road from Hoover Road to Midtown Interchange

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 1 of 13



BUILD SCENARIO 2 FINAL REDISTRIBUTED VOLUMES BEFORE MINOR REBALANCING



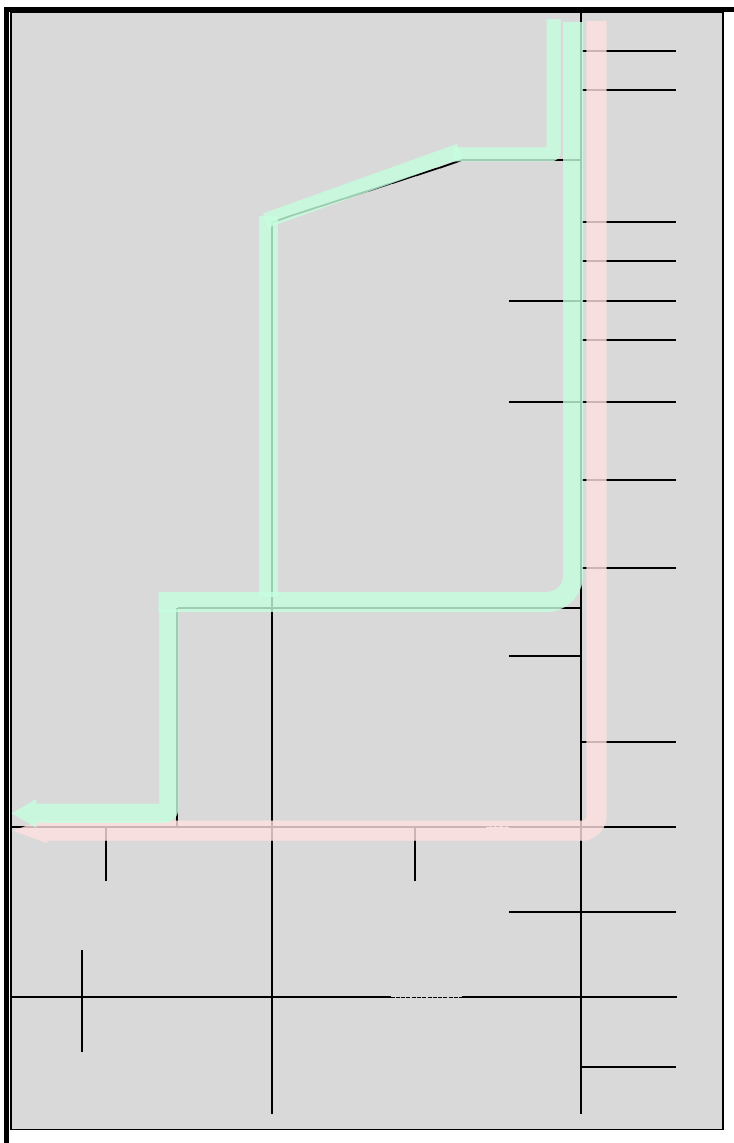
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 5

Redistriubtion of Build Scenario 2 traffic volumes for addition of service road from Hoover Road to Midtown Interchange

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

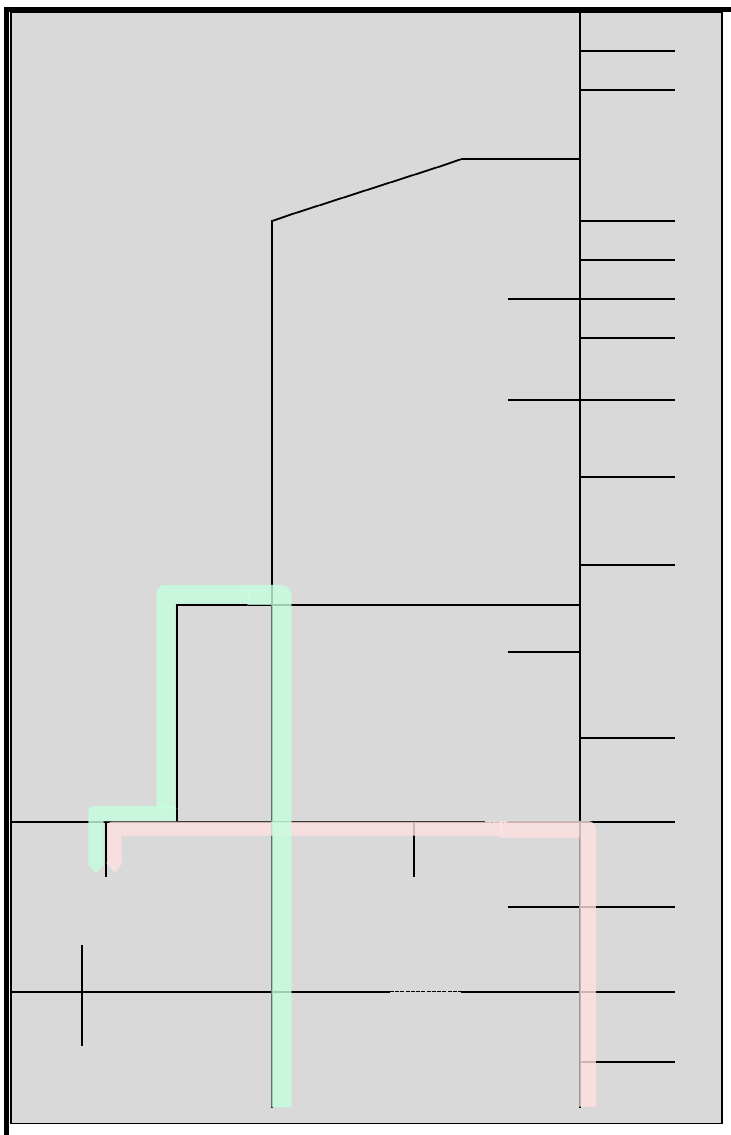
STEP 1: TO HOOVER ROAD FROM SOUTH



2040	AVERAGE ANNUAL DAILY TRAFFIC
BUILD SCENARIO 5	
Redistriubtion of Build Scenario 2 traffic volumes for addition of service road from Hoover Road to Midtown Interchange	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

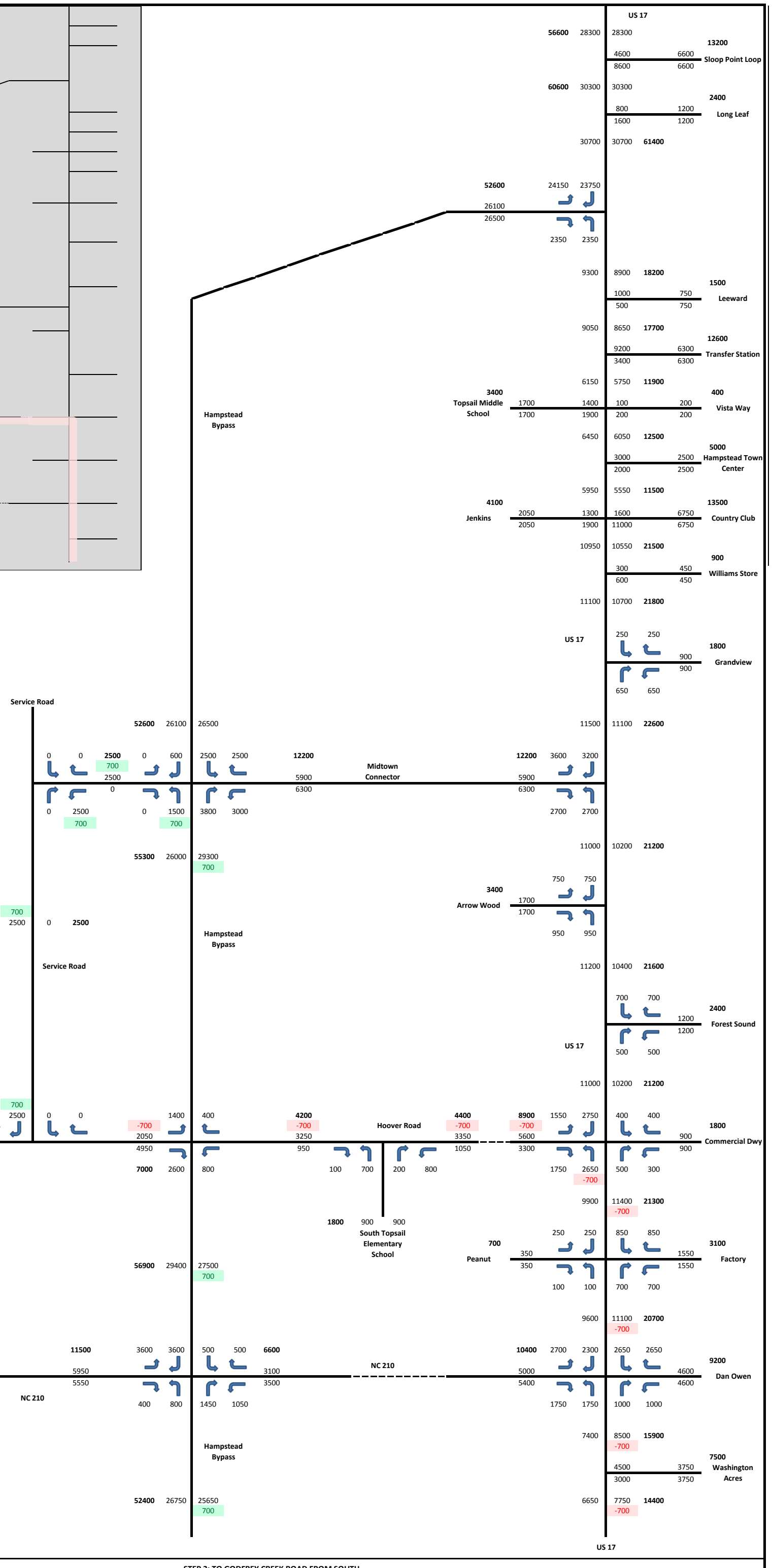
Sheet 3 of 13

STEP 2: TO HOOVER ROAD FROM NORTH

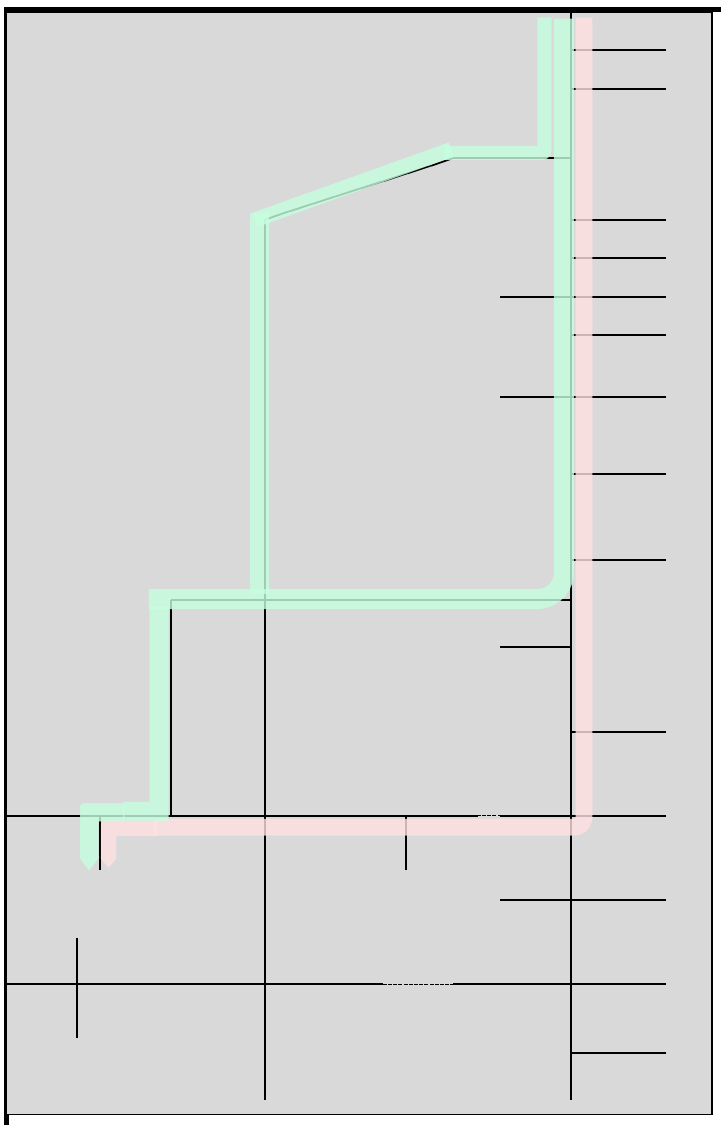


2040	AVERAGE ANNUAL DAILY TRAFFIC
BUILD SCENARIO 5	
Redistriubtion of Build Scenario 2 traffic volumes for addition of service road from Hoover Road to Midtown Interchange	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 4 of 13



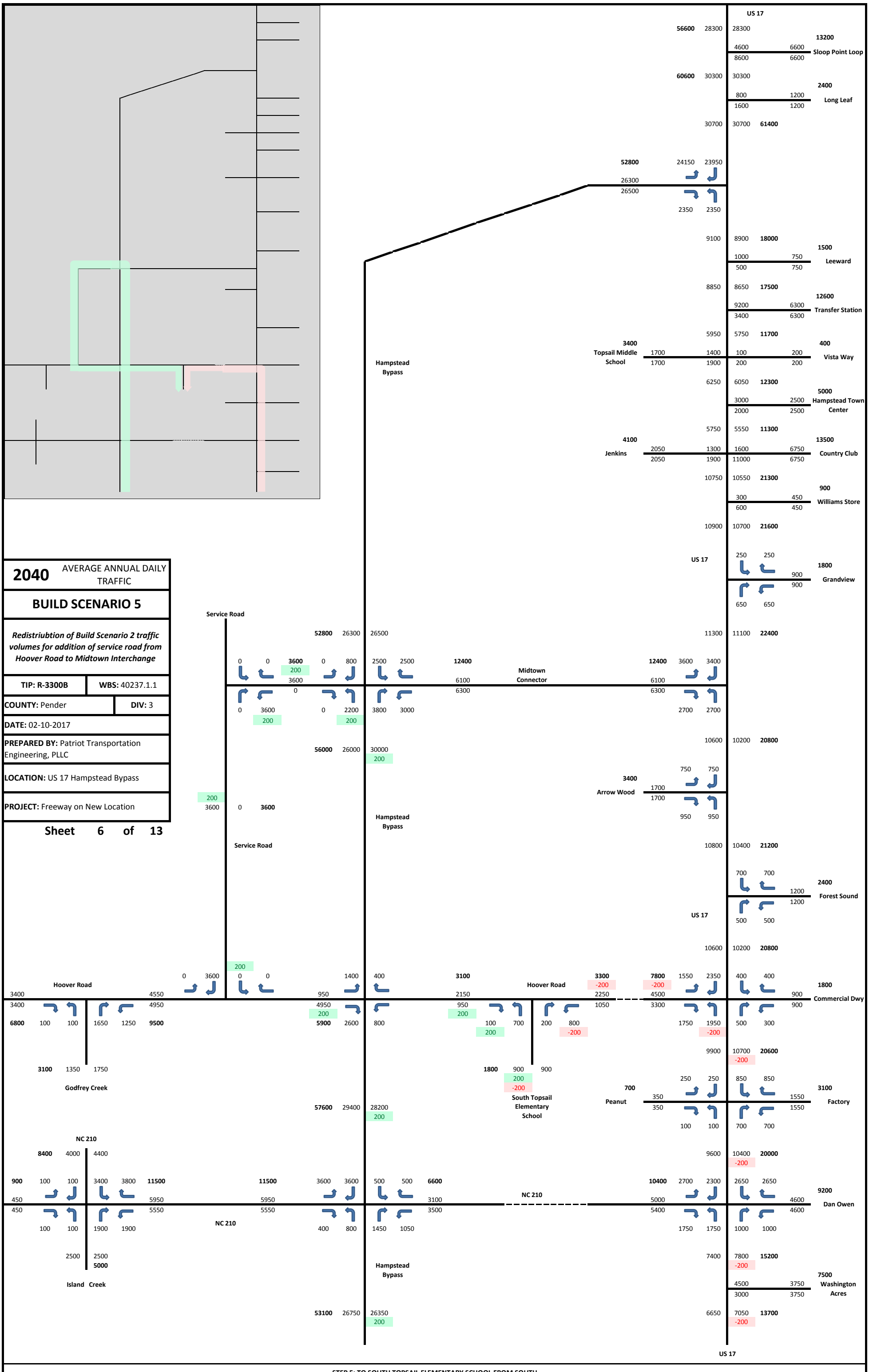
STEP 3: TO GODFREY CREEK ROAD FROM SOUTH



2040	AVERAGE ANNUAL DAILY TRAFFIC
BUILD SCENARIO 5	
Redistriubtion of Build Scenario 2 traffic volumes for addition of service road from Hoover Road to Midtown Interchange	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 5 of 13

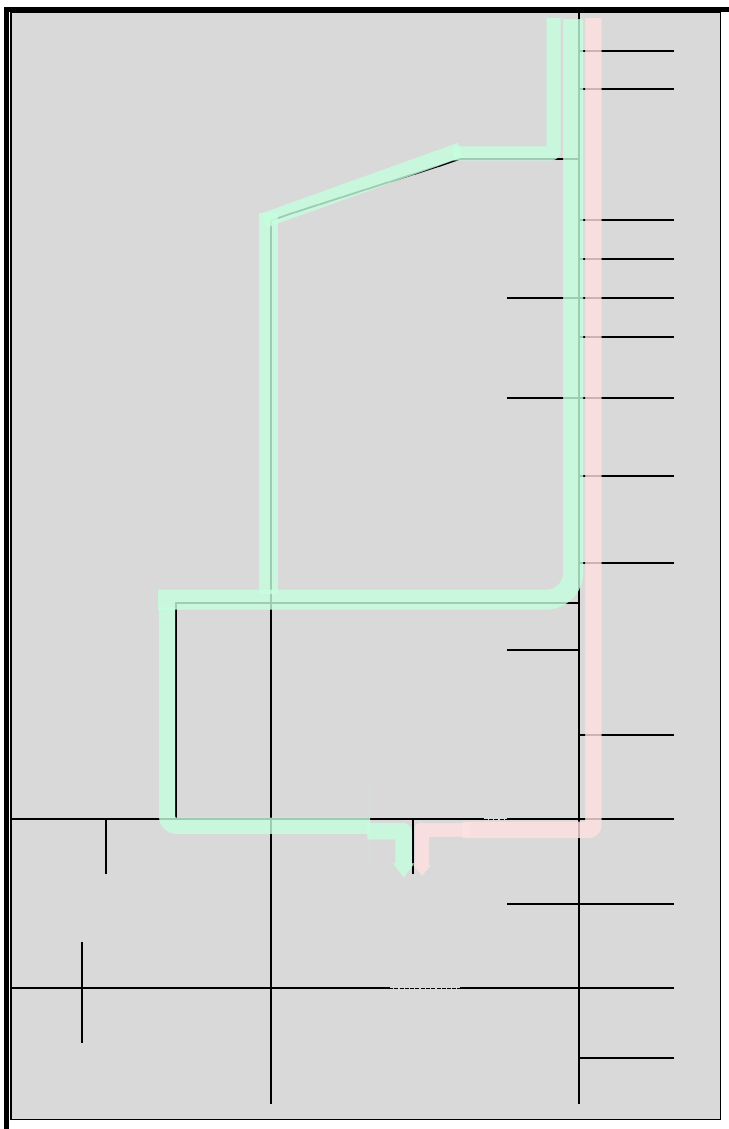
STEP 4: TO GODFREY CREEK ROAD FROM NORTH



2040 AVERAGE ANNUAL DAILY TRAFFIC	
BUILD SCENARIO 5	
Redistriubtion of Build Scenario 2 traffic volumes for addition of service road from Hoover Road to Midtown Interchange	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 6 of 13

STEP 5: TO SOUTH TOPSAIL ELEMENTARY SCHOOL FROM SOUTH



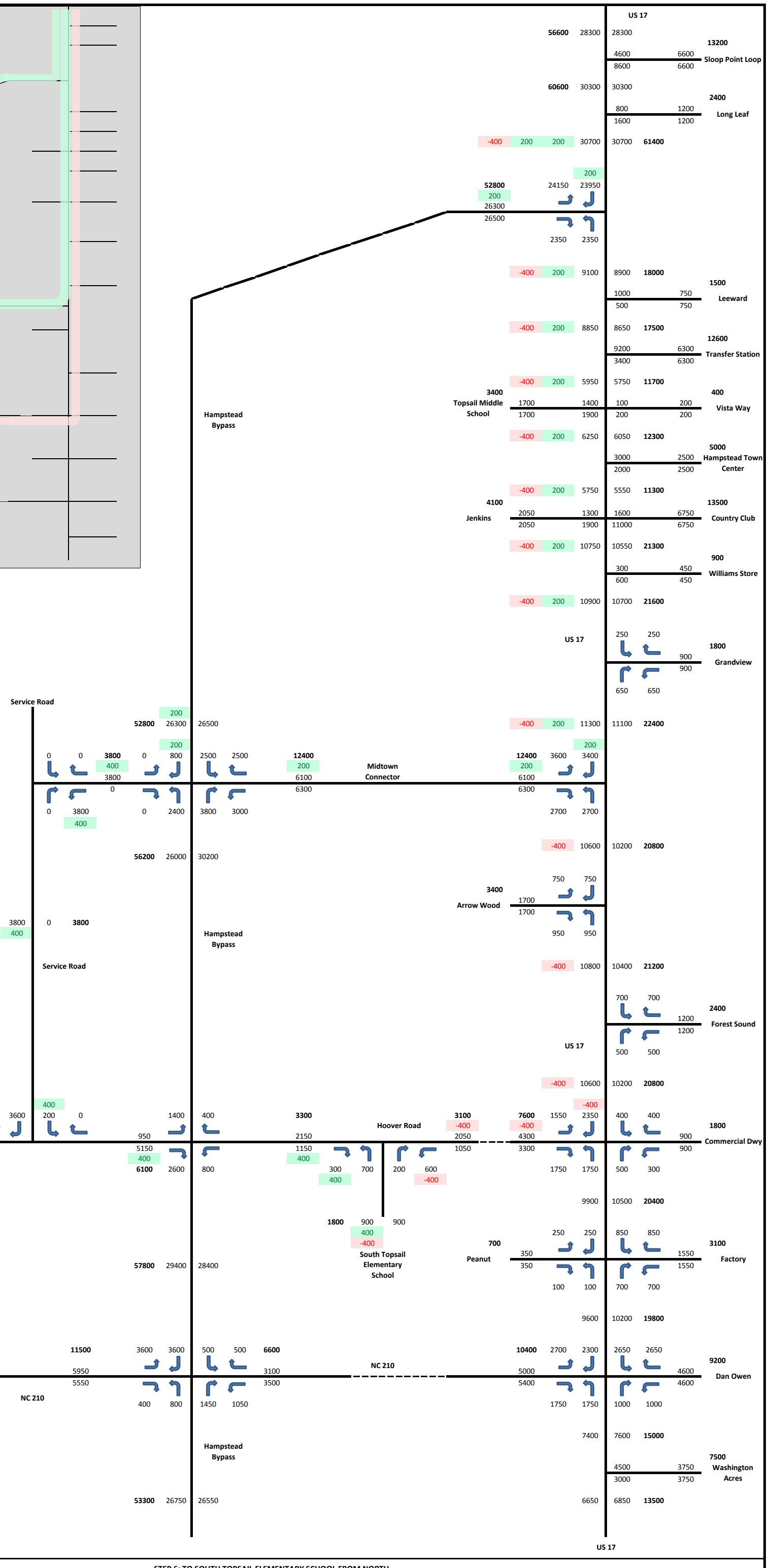
2040	AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 5

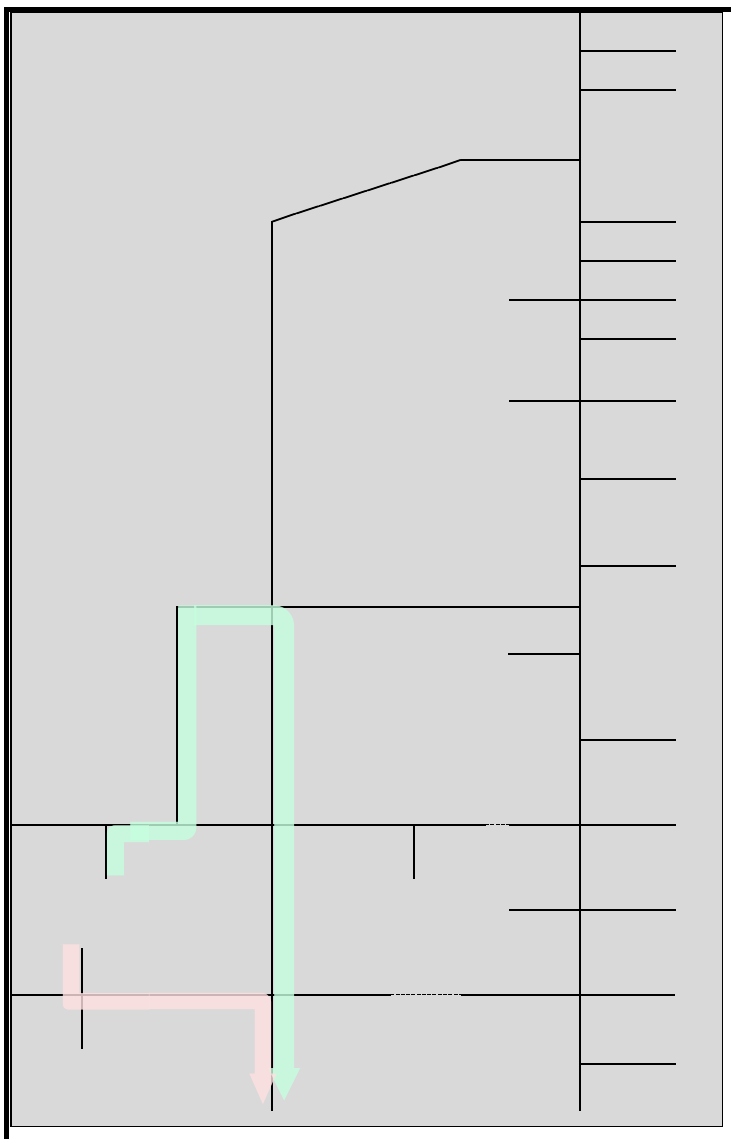
Redistriubtion of Build Scenario 2 traffic volumes for addition of service road from Hoover Road to Midtown Interchange

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 7 of 13



STEP 6: TO SOUTH TOPSAIL ELEMENTARY SCHOOL FROM NORTH



2040	AVERAGE ANNUAL DAILY TRAFFIC

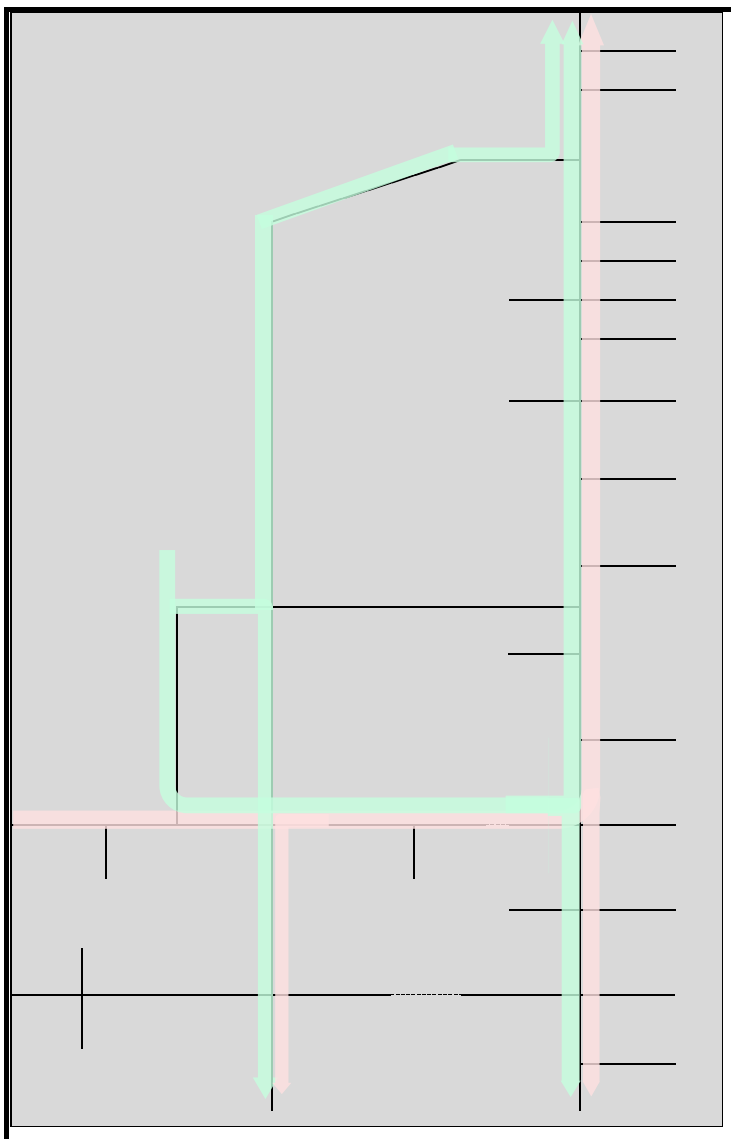
BUILD SCENARIO 5

Redistriubtion of Build Scenario 2 traffic volumes for addition of service road from Hoover Road to Midtown Interchange

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

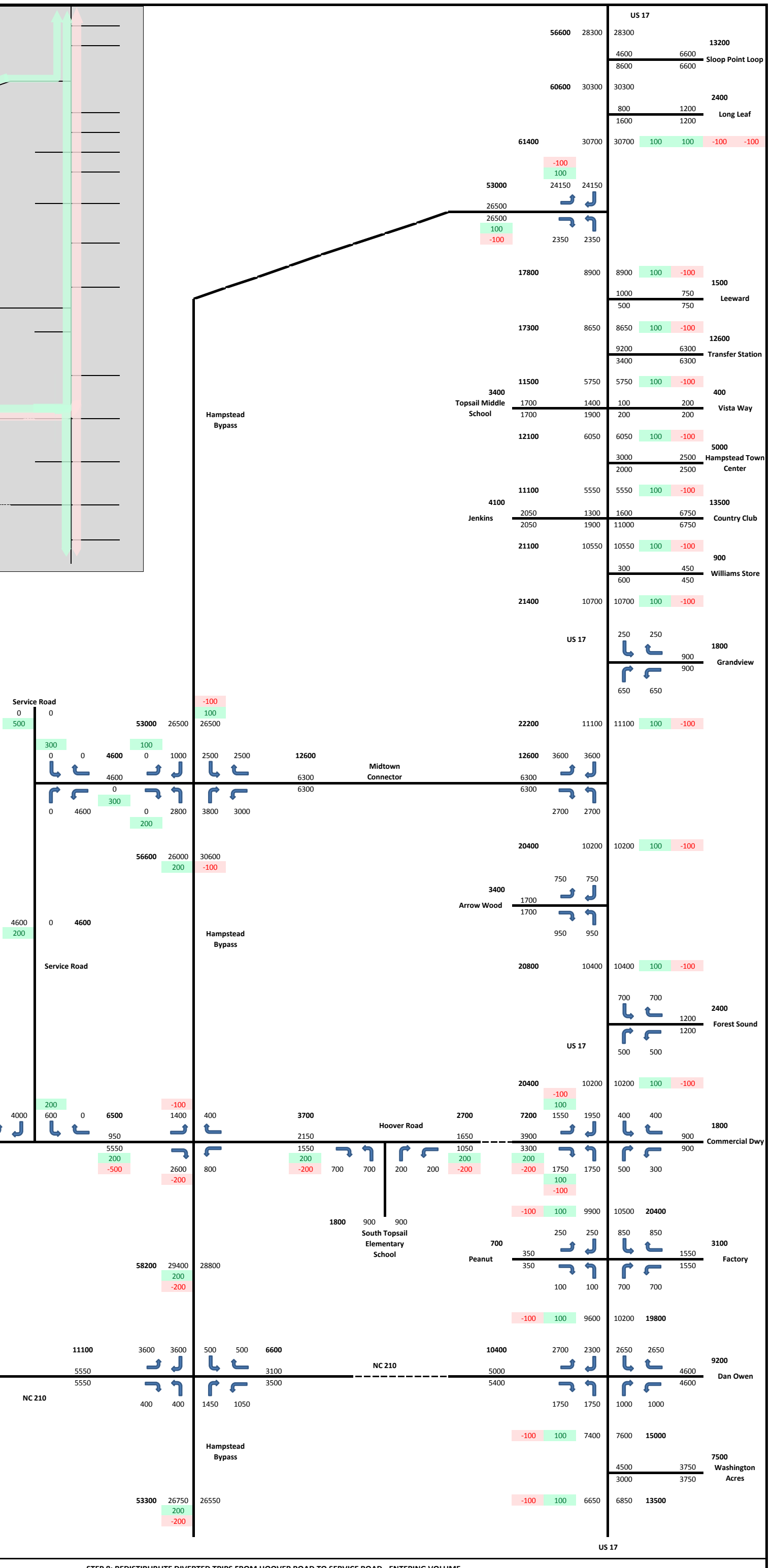
Sheet 8 of 13

STEP 7: REDISTIRUBUTE DIVERTED TRIPS FROM NC 210 TO HOOVER ROAD

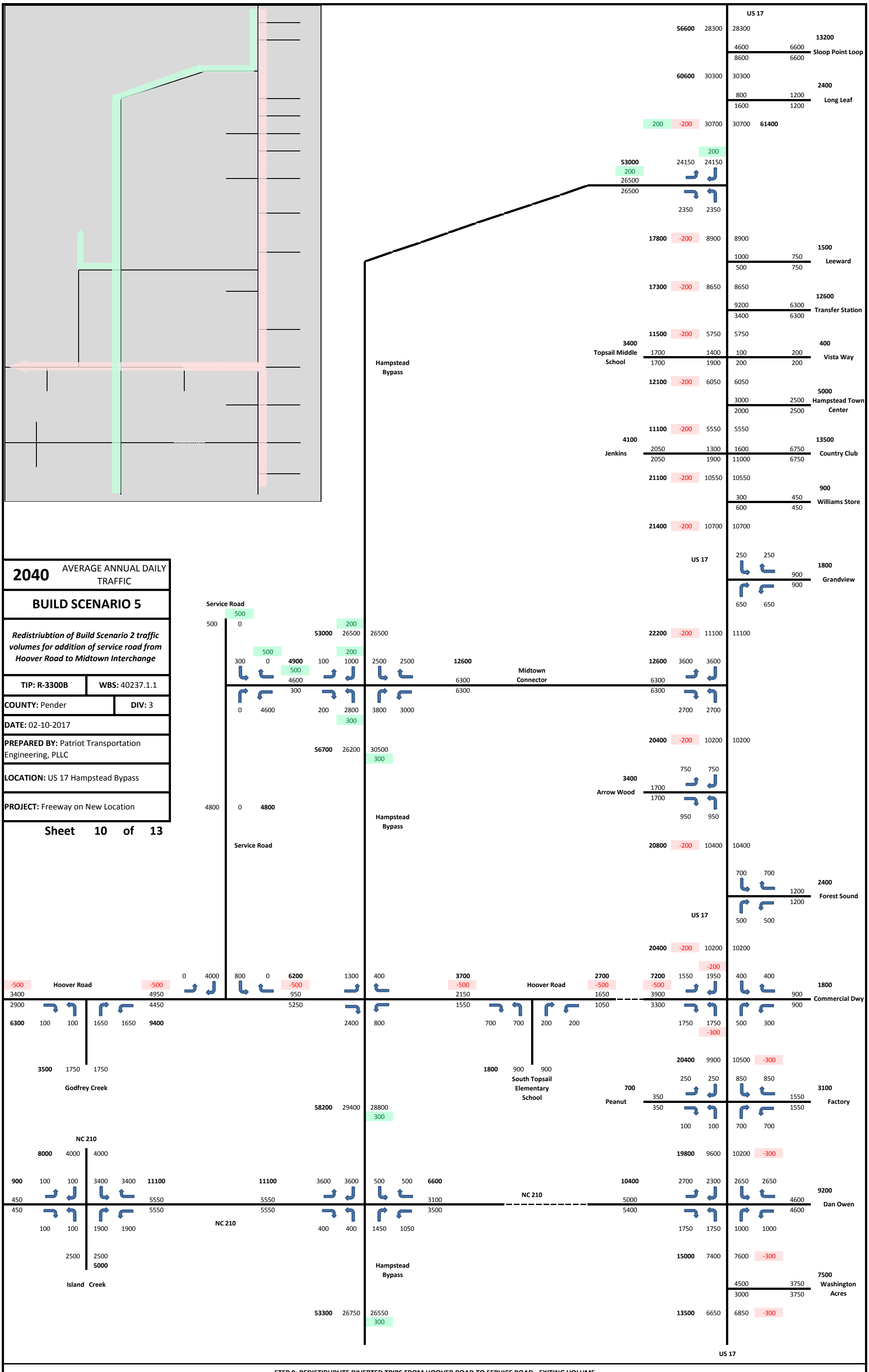


2040	AVERAGE ANNUAL DAILY TRAFFIC
BUILD SCENARIO 5	
Redistriubtion of Build Scenario 2 traffic volumes for addition of service road from Hoover Road to Midtown Interchange	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 9 of 13



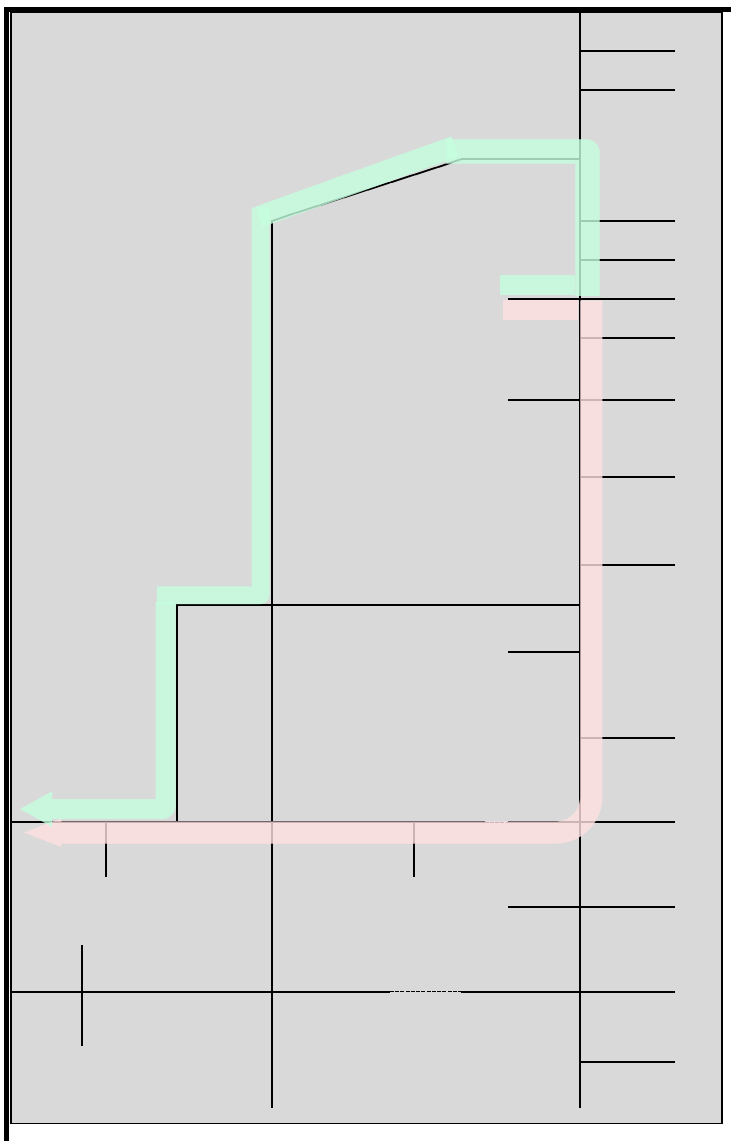
STEP 8: REDISTIRUBUTE DIVERTED TRIPS FROM HOOVER ROAD TO SERVICE ROAD - ENTERING VOLUME



2040	AVERAGE ANNUAL DAILY TRAFFIC
BUILD SCENARIO 5	
Redistriubtion of Build Scenario 2 traffic volumes for addition of service road from Hoover Road to Midtown Interchange	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

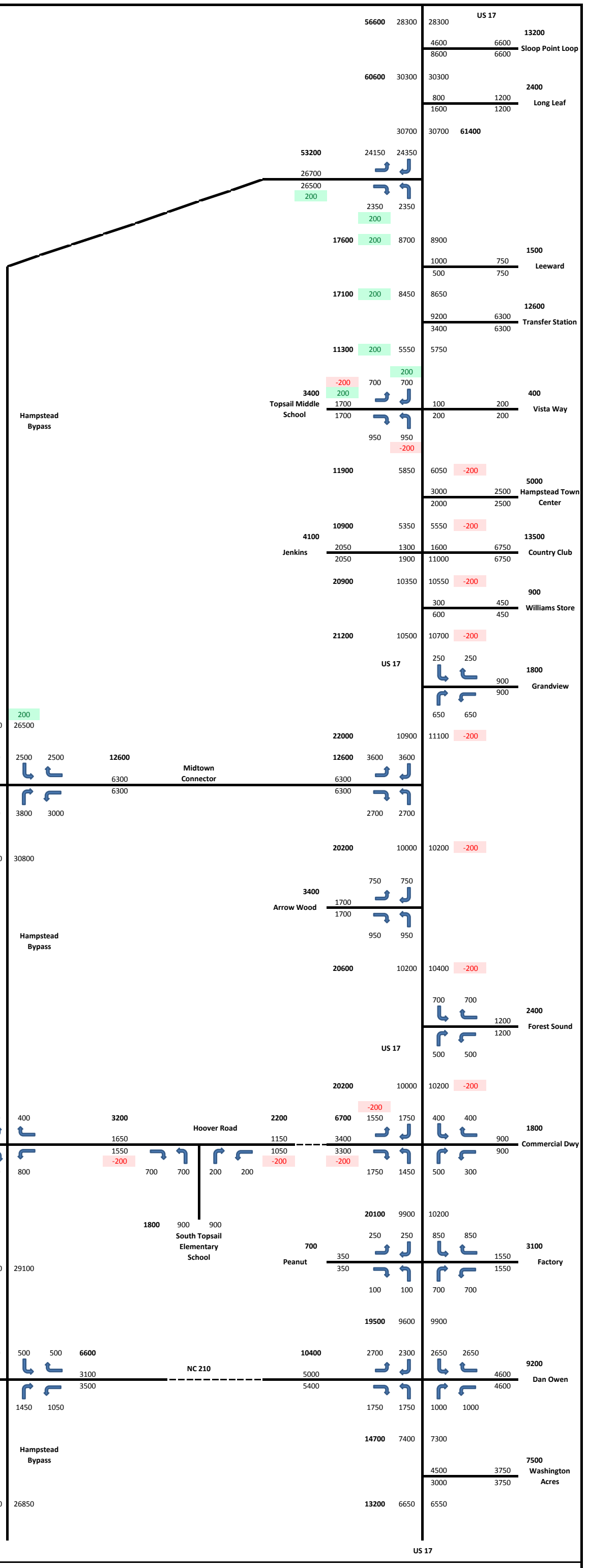
Sheet 10 of 13

STEP 9: REDISTIRUBUTE DIVERTED TRIPS FROM HOOVER ROAD TO SERVICE ROAD - EXITING VOLUME



2040	AVERAGE ANNUAL DAILY TRAFFIC
BUILD SCENARIO 5	
Redistriubtion of Build Scenario 2 traffic volumes for addition of service road from Hoover Road to Midtown Interchange	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

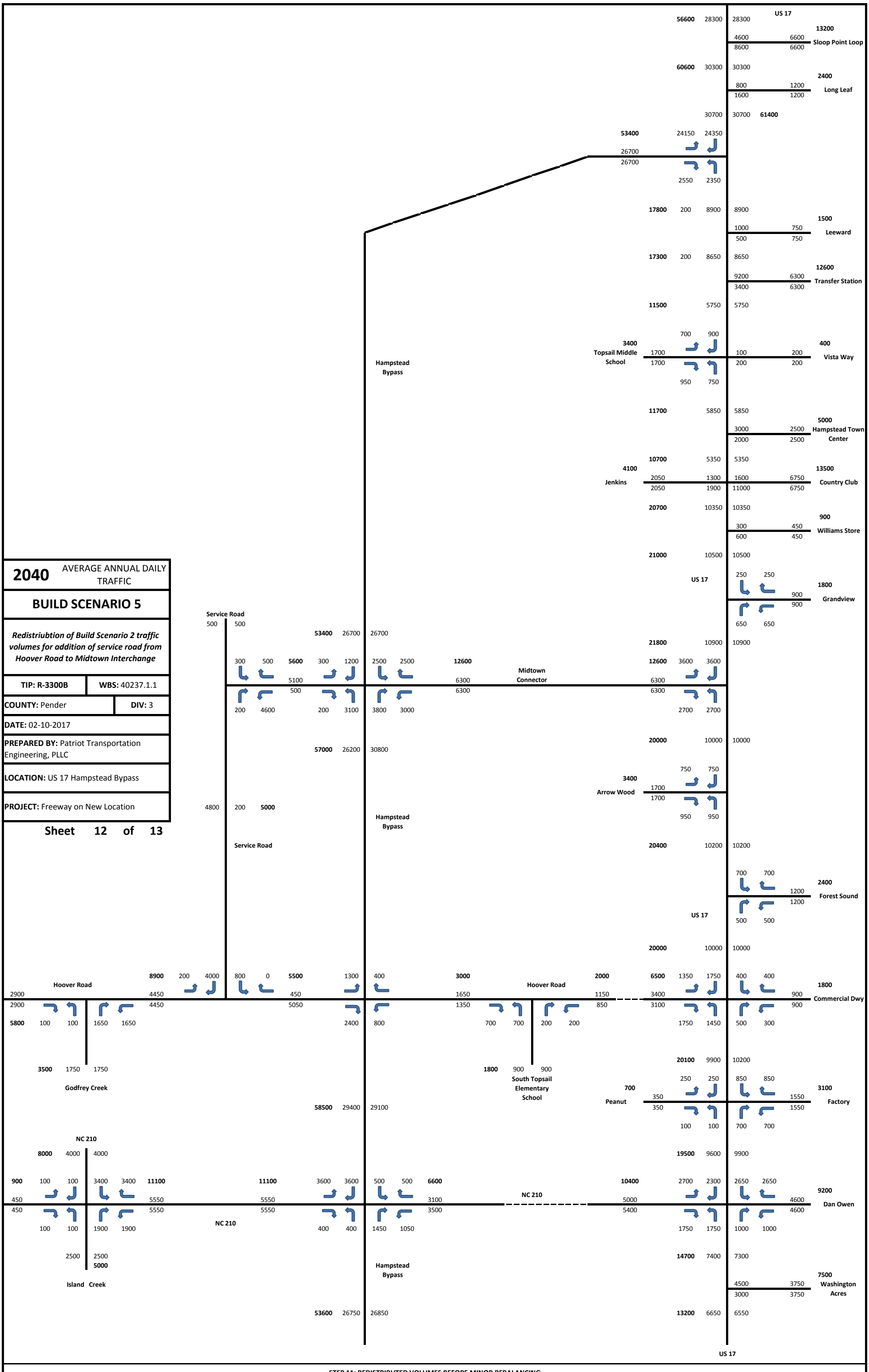
Sheet 11 of 13



STEP 10: DIVERT TRIPS BETWEEN HOOVER ROAD TO TOPSAIL MIDDLE SCHOOL/HIGH SCHOOL TO BYPASS

2040	AVERAGE ANNUAL DAILY TRAFFIC
BUILD SCENARIO 5	
Redistriubtion of Build Scenario 2 traffic volumes for addition of service road from Hoover Road to Midtown Interchange	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 12 of 13



STEP 11: REDISTRIBUTED VOLUMES BEFORE MINOR REBALANCING

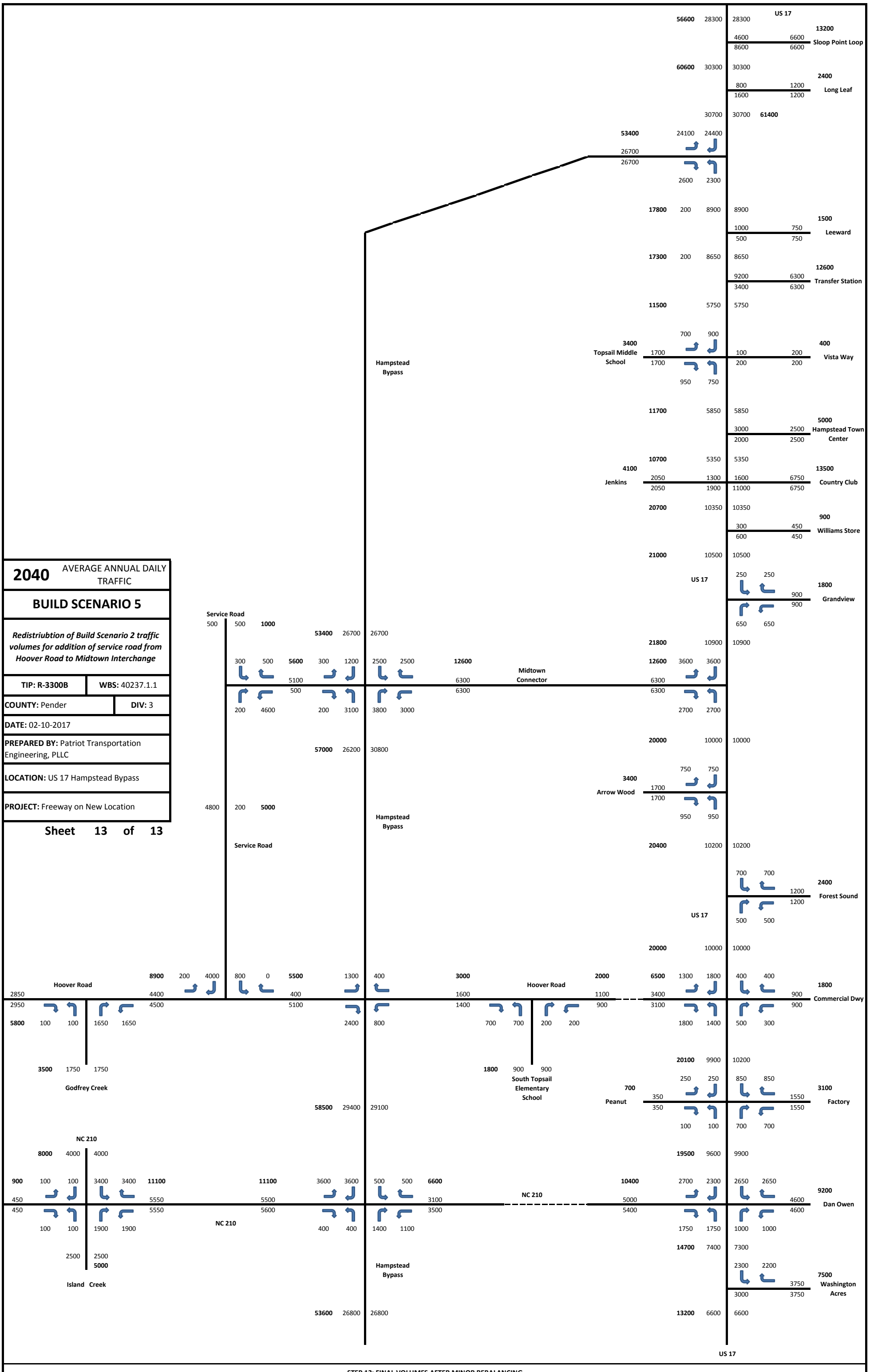
2040	AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 5

Redistriubtion of Build Scenario 2 traffic volumes for addition of service road from Hoover Road to Midtown Interchange

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 13 of 13



STEP 12: FINAL VOLUMES AFTER MINOR REBALANCING

APPENDIX D6:

2040 FUTURE YEAR VOLUME DEVELOPMENT

BUILD SCENARIO 6

2040	AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 6

Redistriubtion of Build Scenario 5 traffic volumes for removal of Hoover Road on-ramps

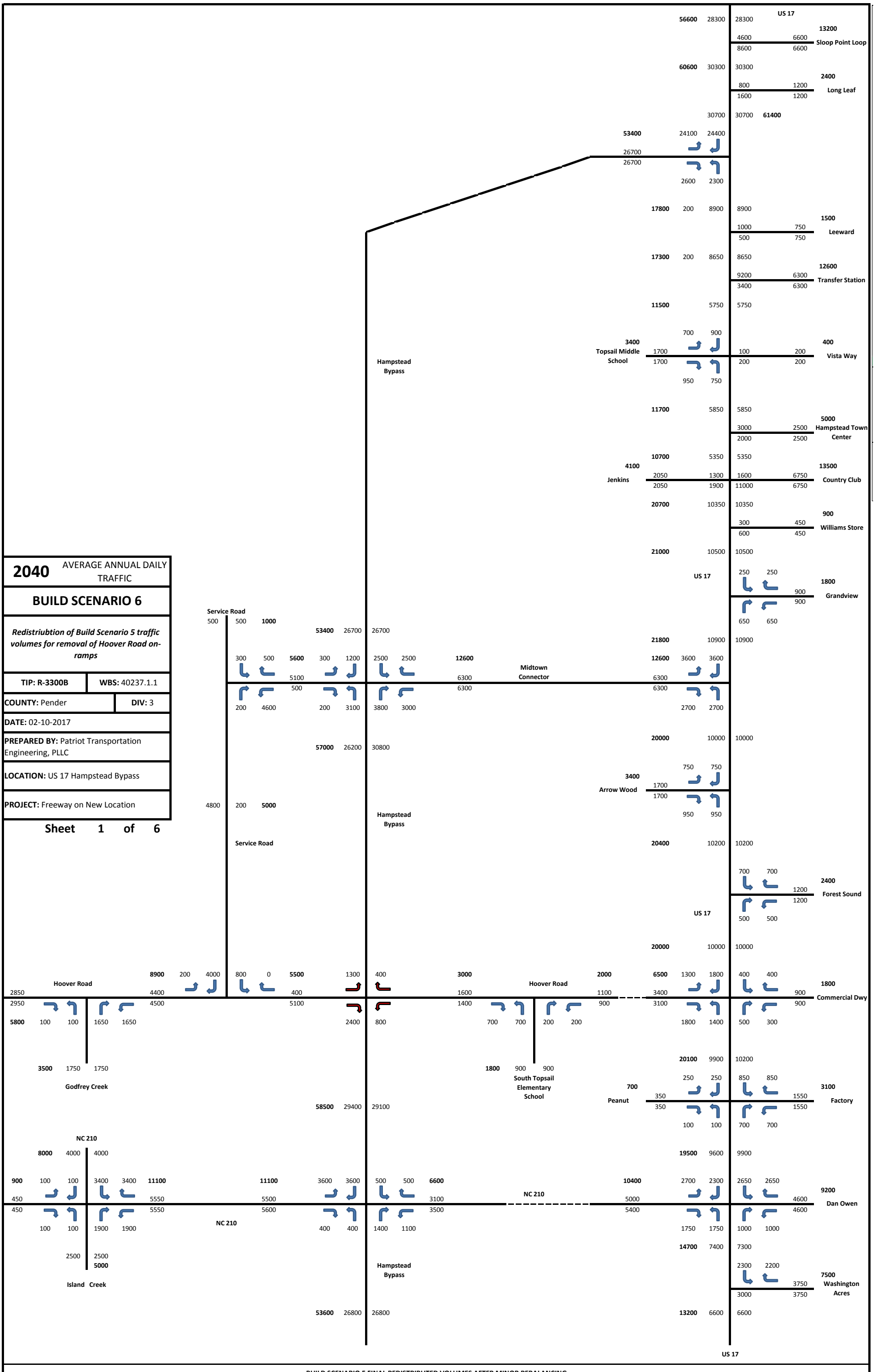
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3

DATE: 02-10-2017

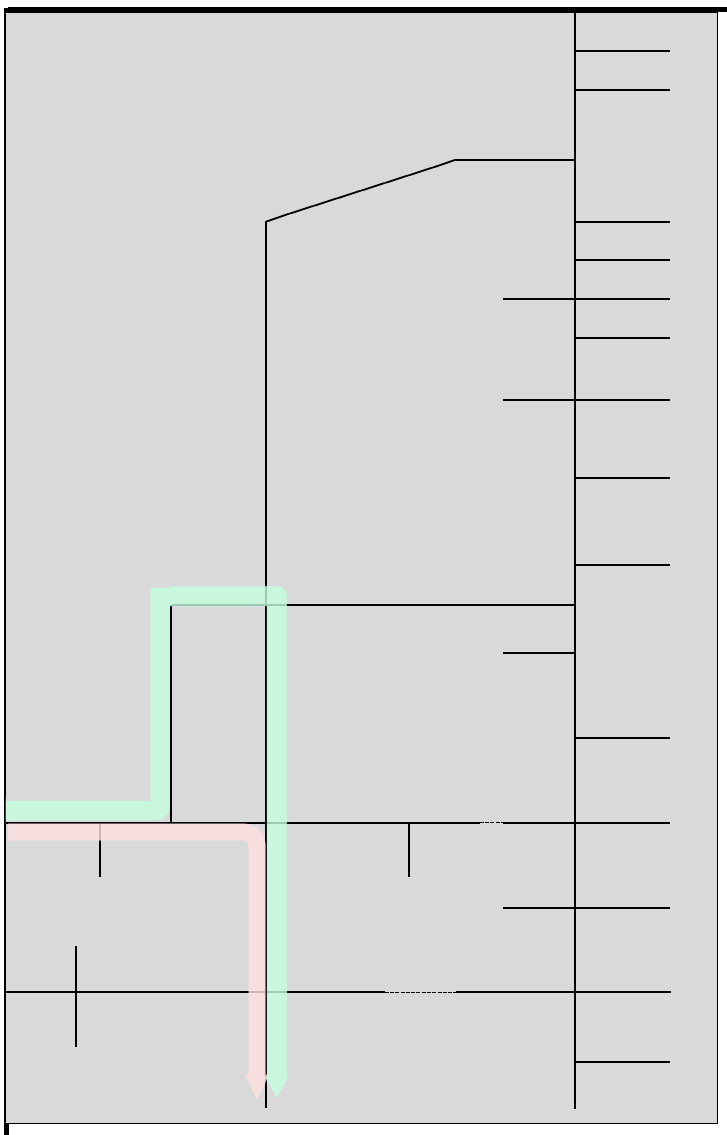
PREPARED BY: Patriot Transportation Engineering, PLLC

LOCATION: US 17 Hampstead Bypass

PROJECT: Freeway on New Location



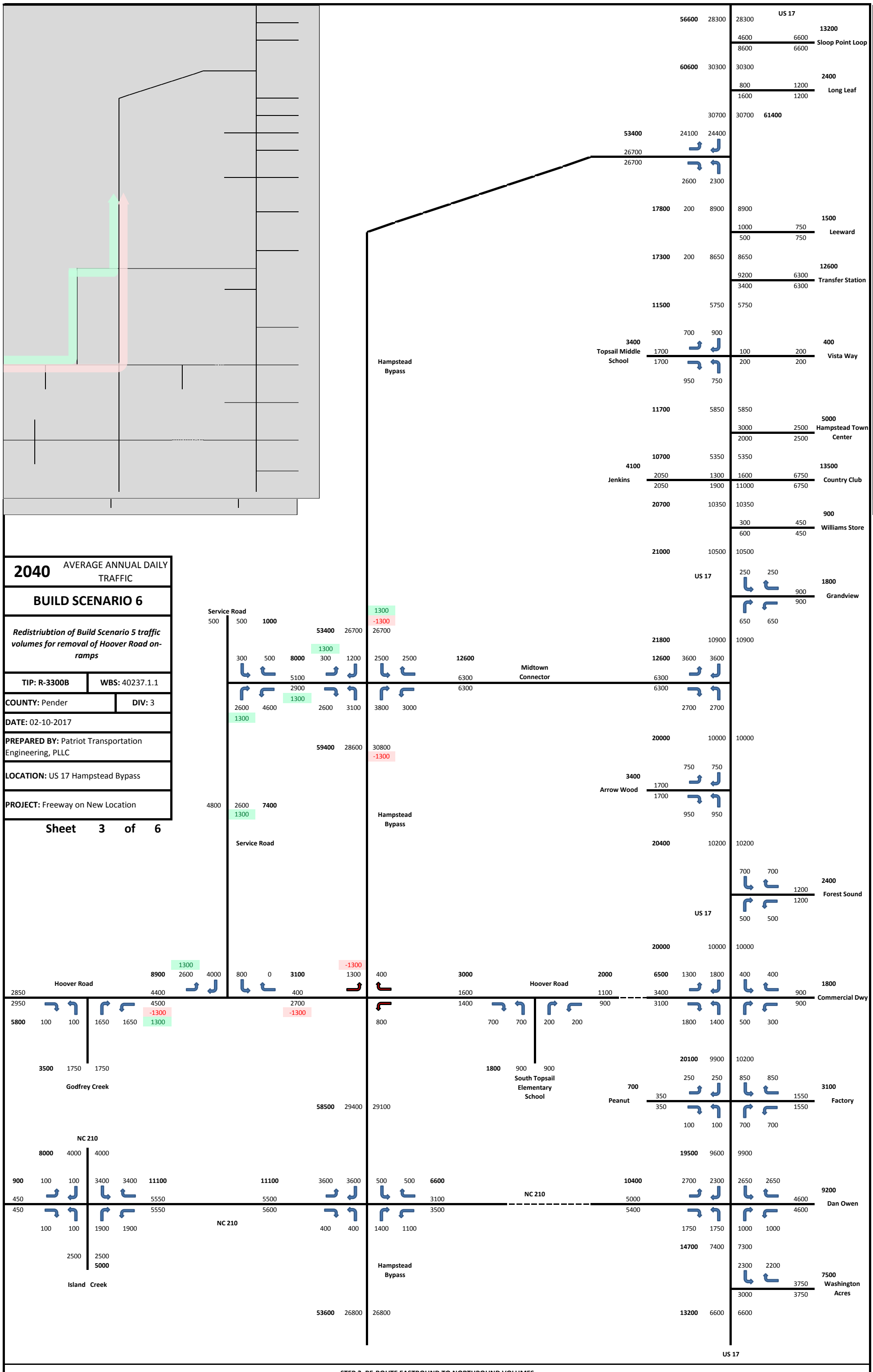
BUILD SCENARIO 5 FINAL REDISTRIBUTED VOLUMES AFTER MINOR REBALANCING



2040	AVERAGE ANNUAL DAILY TRAFFIC
BUILD SCENARIO 6	
Redistriubtion of Build Scenario 5 traffic volumes for removal of Hoover Road on-ramps	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 2 of 6

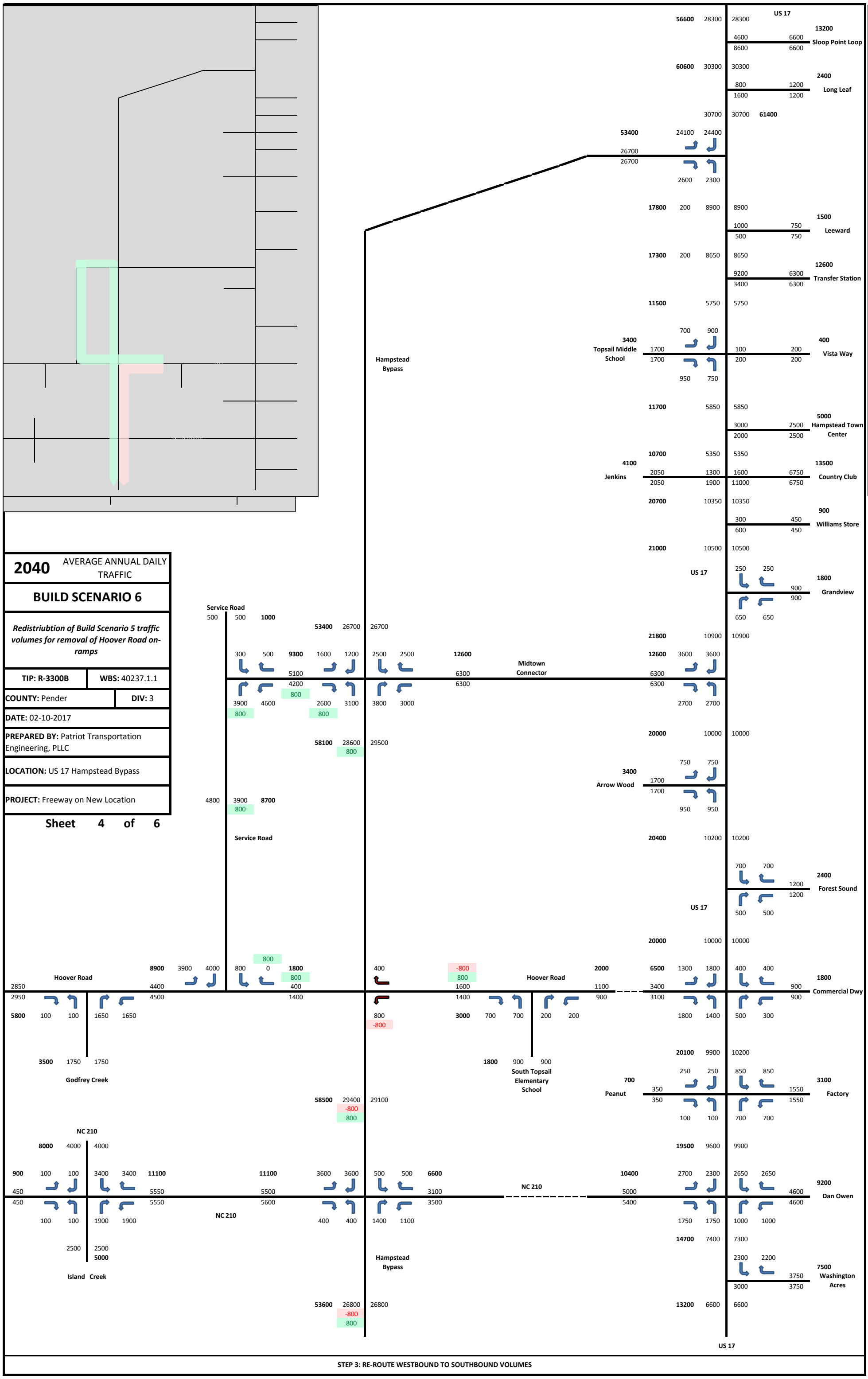
STEP 1: RE-ROUTE EASTBOUND TO SOUTHBOUND VOLUMES



2040 AVERAGE ANNUAL DAILY TRAFFIC	
BUILD SCENARIO 6	
Redistriubtion of Build Scenario 5 traffic volumes for removal of Hoover Road on-ramps	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 3 of 6

STEP 2: RE-ROUTE EASTBOUND TO NORTHBOUND VOLUMES



2040 AVERAGE ANNUAL DAILY TRAFFIC

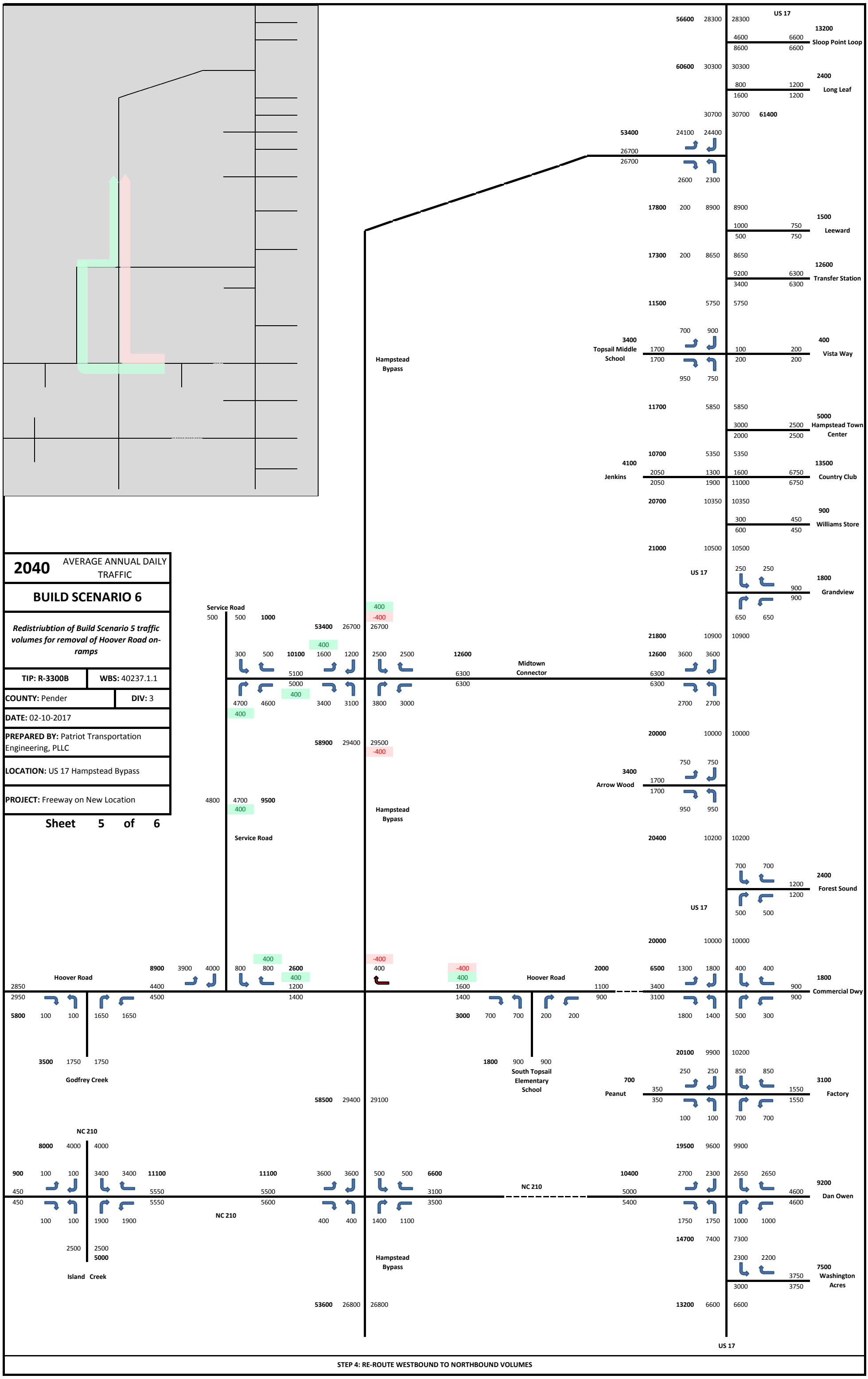
BUILD SCENARIO 6

Redistriubtion of Build Scenario 5 traffic volumes for removal of Hoover Road on-ramps

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 4 of 6

STEP 3: RE-ROUTE WESTBOUND TO SOUTHBOUND VOLUMES



2040 AVERAGE ANNUAL DAILY TRAFFIC	
BUILD SCENARIO 6	
Redistriubtion of Build Scenario 5 traffic volumes for removal of Hoover Road on-ramps	
TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 02-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 5 of 6

STEP 4: RE-ROUTE WESTBOUND TO NORTHBOUND VOLUMES

2040	AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 6

Redistriubtion of Build Scenario 5 traffic volumes for removal of Hoover Road on-ramps

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3

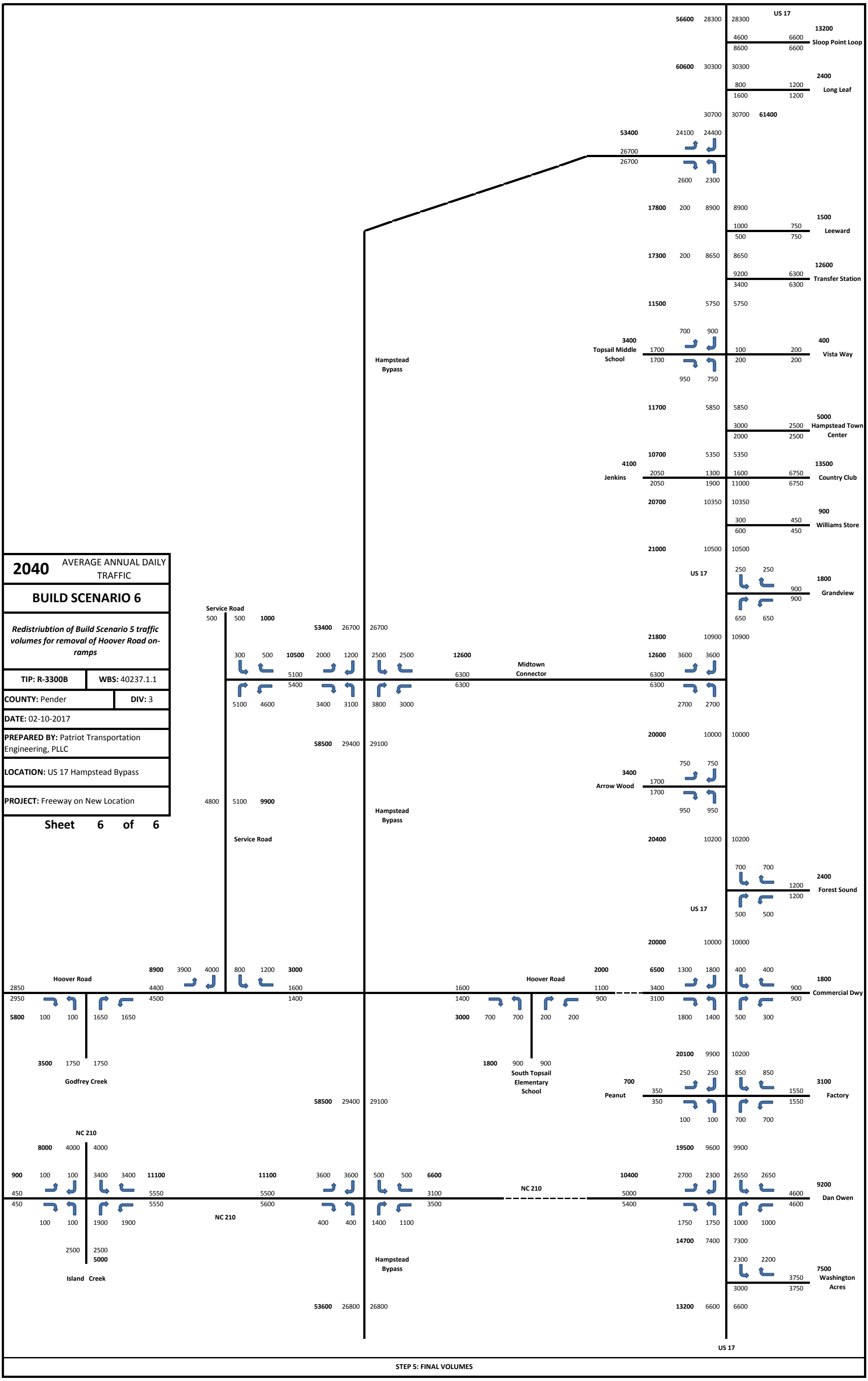
DATE: 02-10-2017

PREPARED BY: Patriot Transportation Engineering, PLLC

LOCATION: US 17 Hampstead Bypass

PROJECT: Freeway on New Location

Sheet 6 of 6



STEP 5: FINAL VOLUMES

APPENDIX D7:

2040 FUTURE YEAR VOLUME DEVELOPMENT

BUILD SCENARIO 7

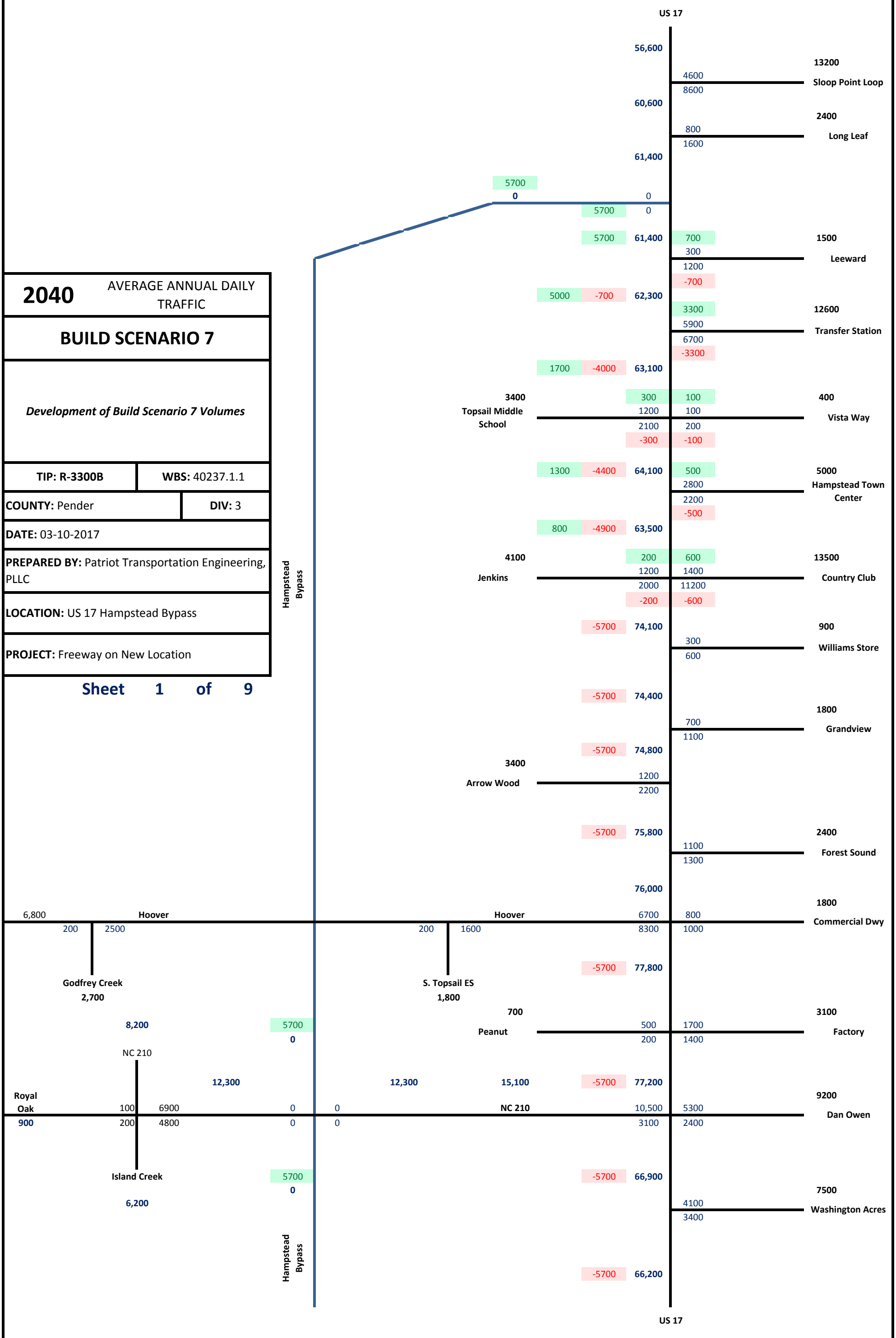
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 7

Development of Build Scenario 7 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 03-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 1 of 9



STEP 1: START WITH 2040 NO-BUILD VOLUMES AND RE-ROUTE VOLUMES TO US 17/HAMPSTEAD INTERCHANGE

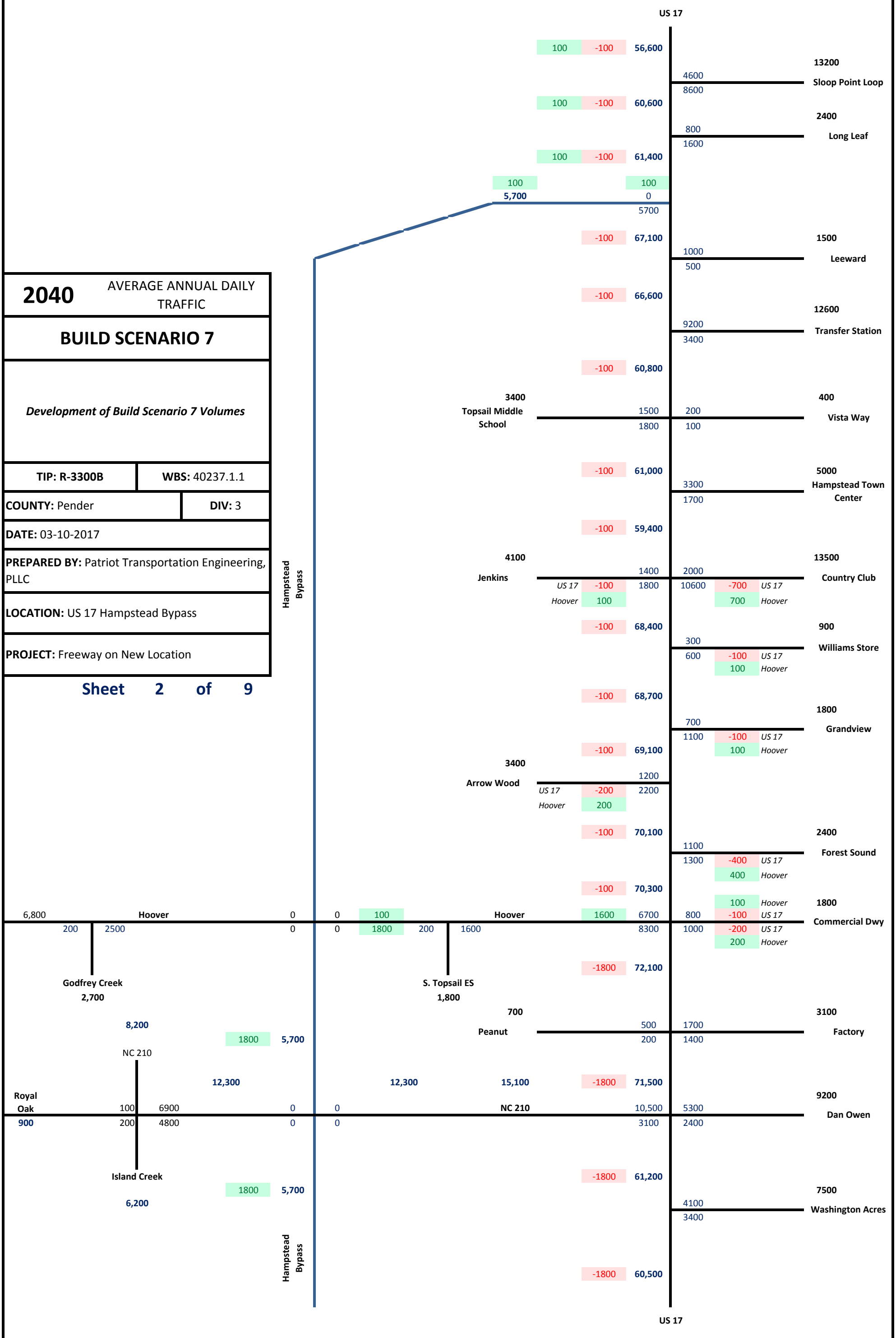
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 7

Development of Build Scenario 7 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 03-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 2 of 9



STEP 2: SPLIT OUT VOLUMES TO HOOVER ROAD INTERCHANGE

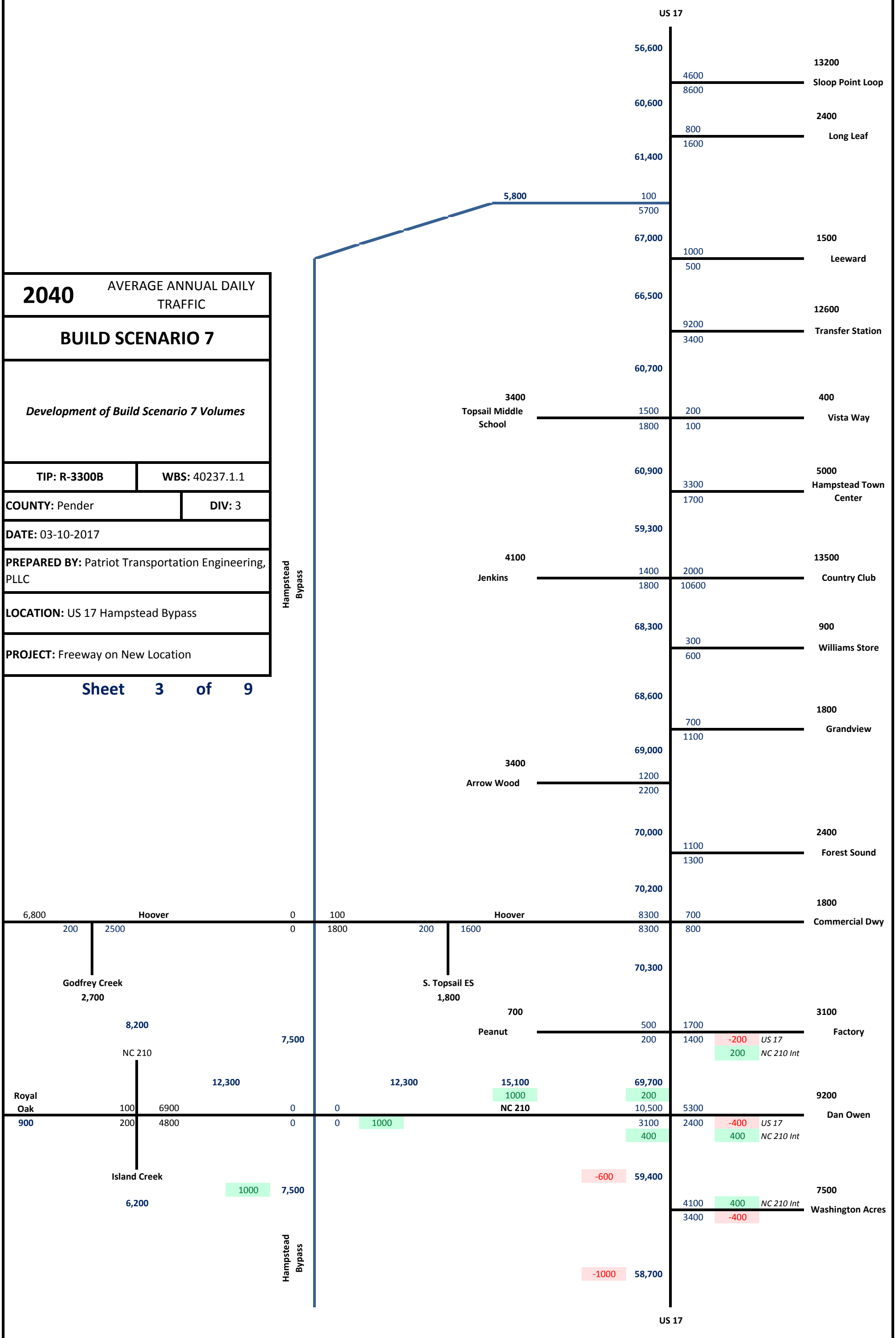
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 7

Development of Build Scenario 7 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 03-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 3 of 9



STEP 3: SPLIT OUT VOLUMES TO NC 210 INTERCHANGE

2040 Build Scenario 7 Model Volumes

US 17 - North of Bypass	47,718
Bypass - West of US 17	41,572
US 17 - South of Bypass	18,852
Volume to Hoover Road	3,030
Percent Diversion to Bypass	**69.0%**
Volume to Bypass	**42,400**

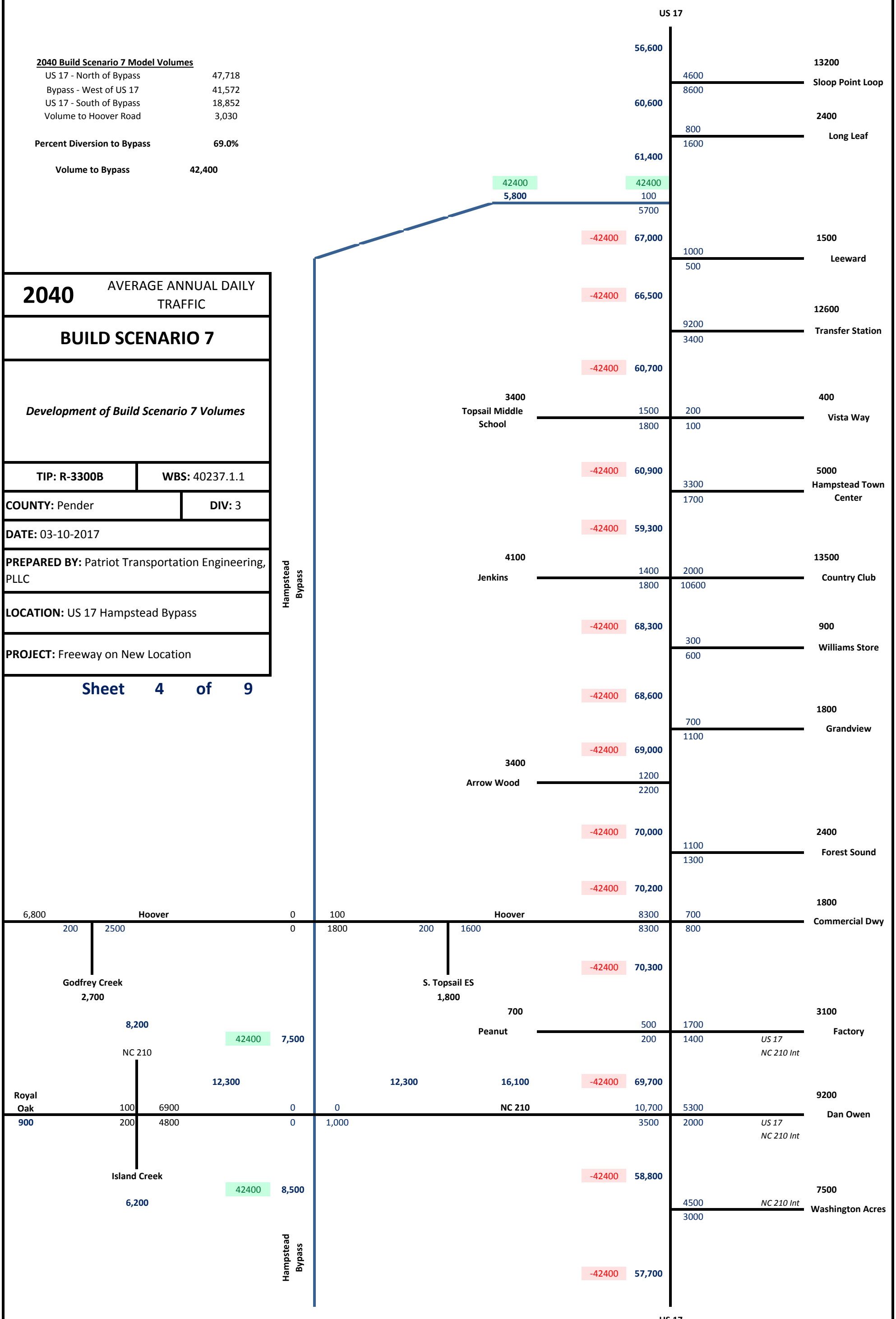
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 7

Development of Build Scenario 7 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 03-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 4 of 9



STEP 4: DETERMINE DIVERSION TO BYPASS FROM NORTH BY USING TRAVEL DEMAND MODEL DIVERSION RATE

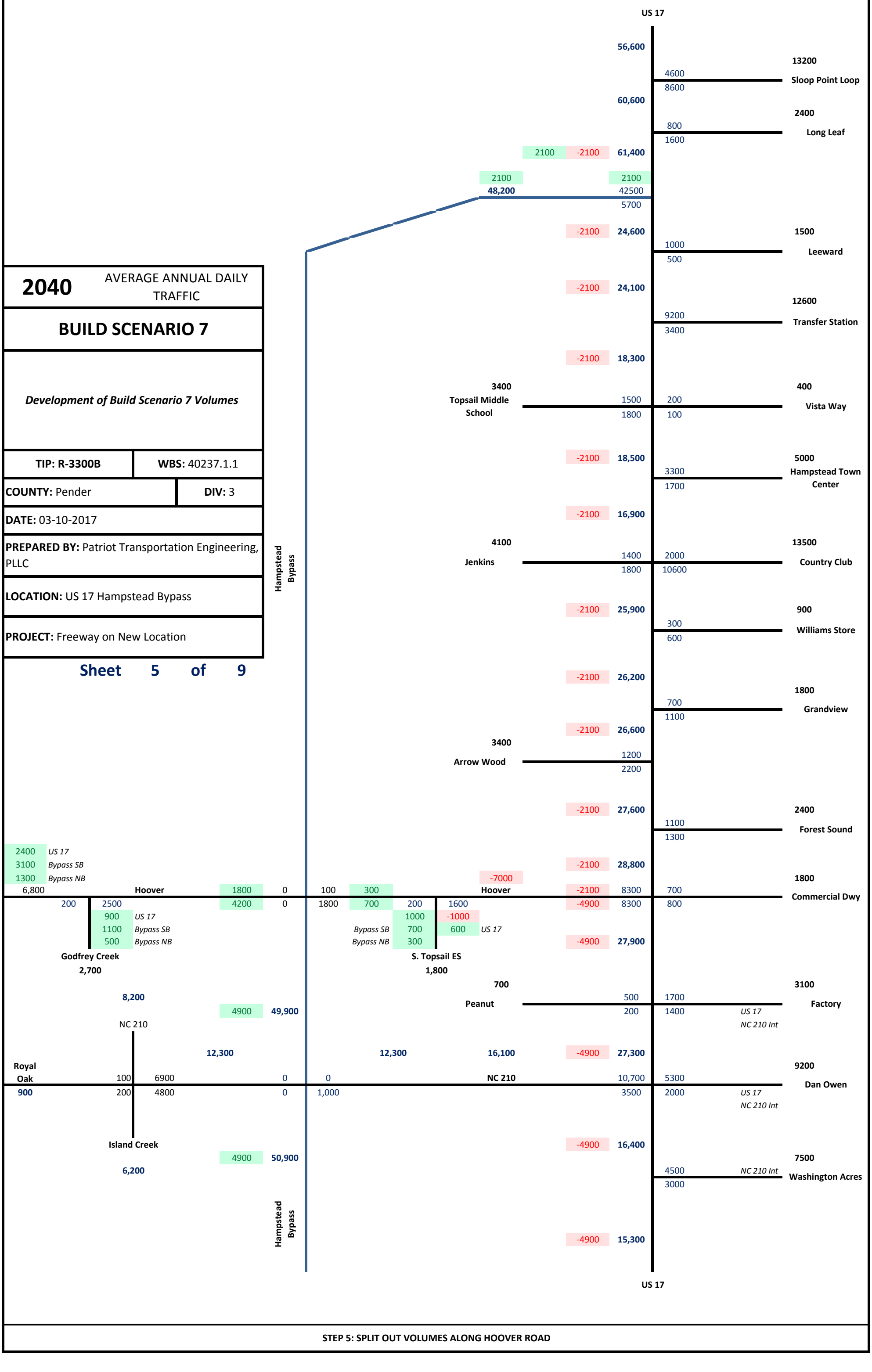
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 7

Development of Build Scenario 7 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 03-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 5 of 9



STEP 5: SPLIT OUT VOLUMES ALONG HOOVER ROAD

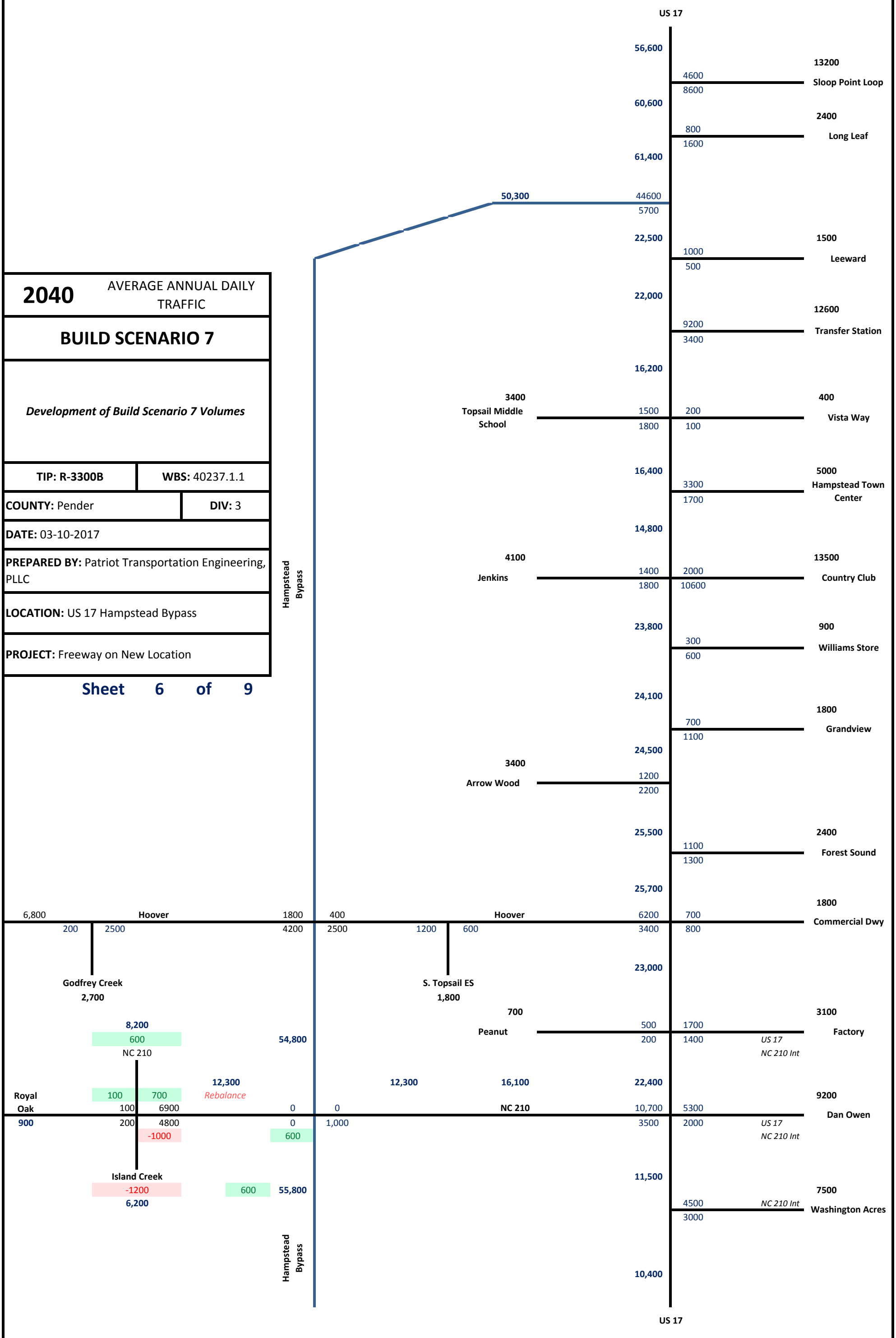
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 7

Development of Build Scenario 7 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 03-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 6 of 9



STEP 6: DETERMINE DIVERSION FROM NC 210 AND ISLAND CREEK ROAD USING TRAVEL DEMAND MODEL DIVERSION RATE AND REBALANCE TO EAST

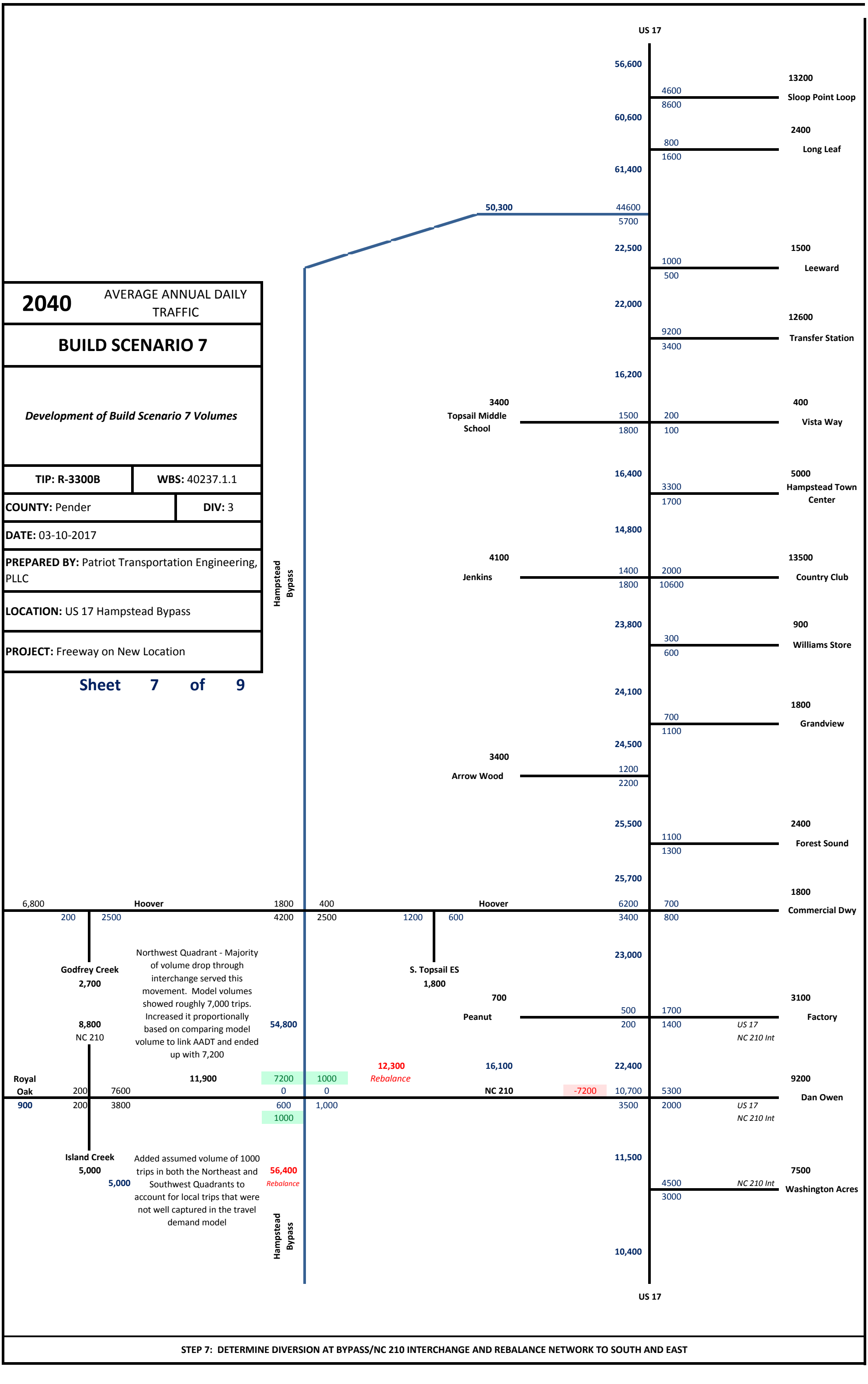
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 7

Development of Build Scenario 7 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 03-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 7 of 9



STEP 7: DETERMINE DIVERSION AT BYPASS/NC 210 INTERCHANGE AND REBALANCE NETWORK TO SOUTH AND EAST

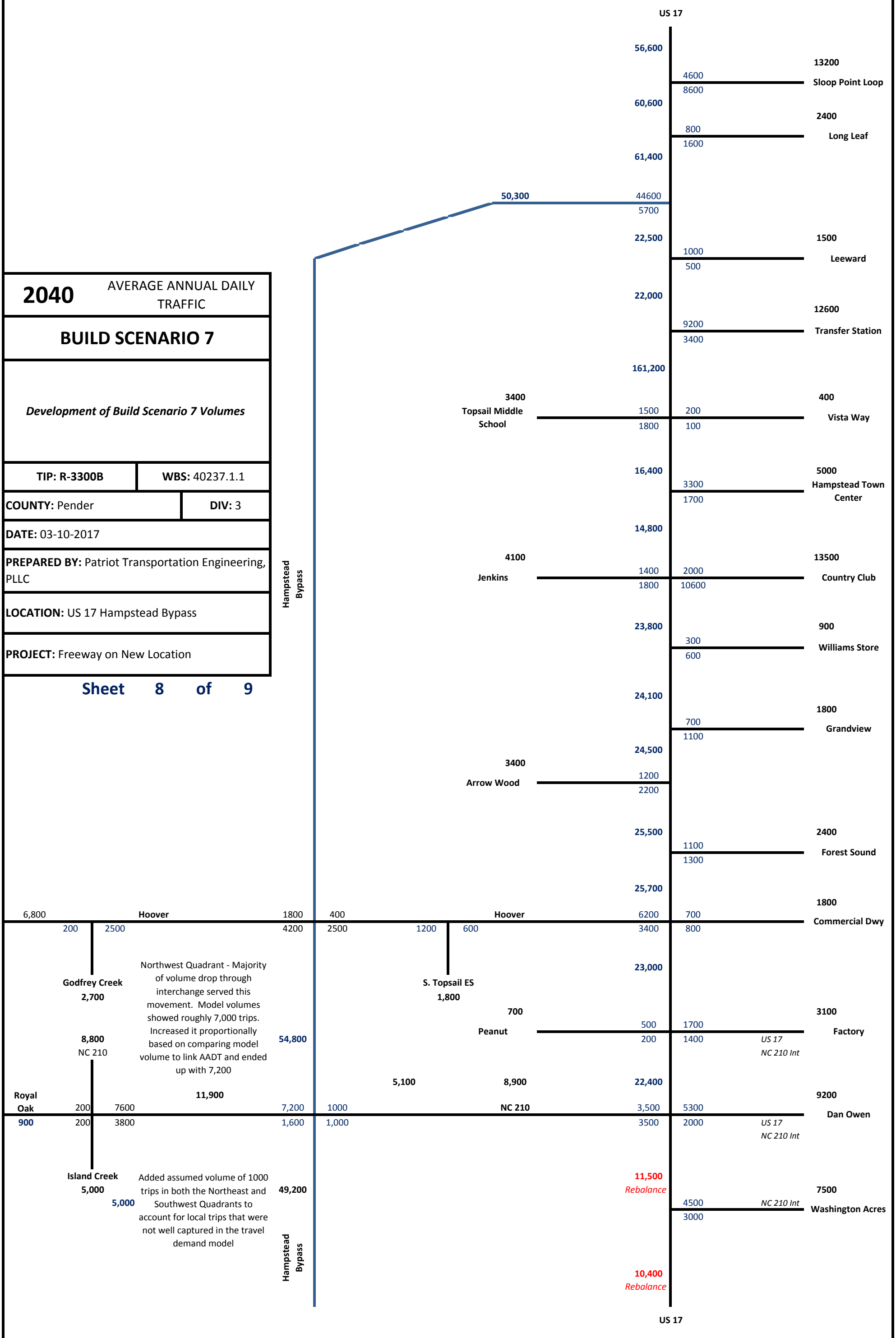
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 7

Development of Build Scenario 7 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 03-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 8 of 9



STEP 8: REBALANCE NETWORK TO SOUTH ON US 17

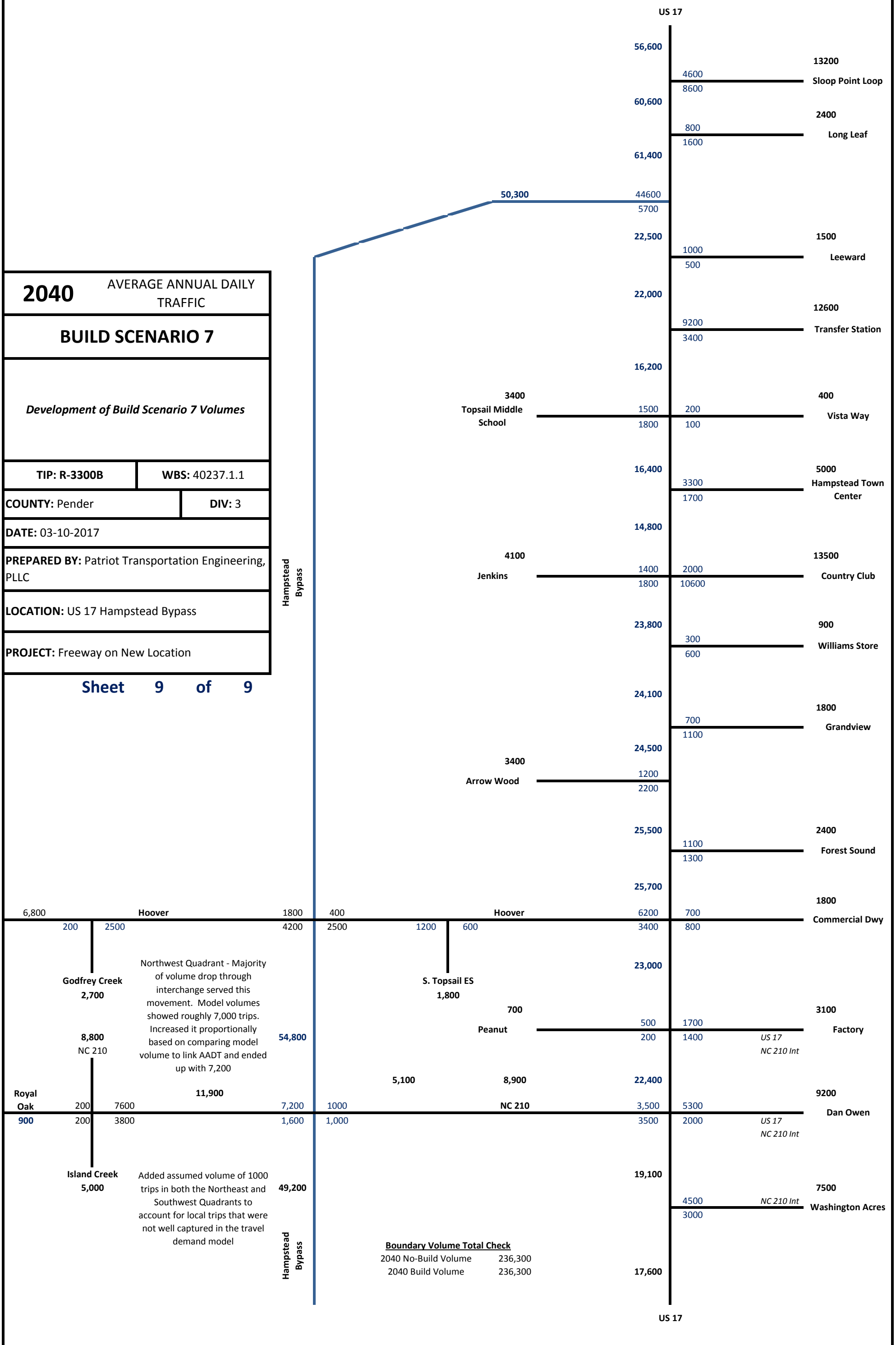
2040 AVERAGE ANNUAL DAILY TRAFFIC

BUILD SCENARIO 7

Development of Build Scenario 7 Volumes

TIP: R-3300B	**WBS:** 40237.1.1
COUNTY: Pender	**DIV:** 3
DATE: 03-10-2017	
PREPARED BY: Patriot Transportation Engineering, PLLC	
LOCATION: US 17 Hampstead Bypass	
PROJECT: Freeway on New Location	

Sheet 9 of 9



STEP 9: CHECK BOUNDARY VOLUMES AND FINALIZE

APPENDIX E:

MODIFICATIONS TO WILMINGTON REGIONAL MODEL

Preparation and Modification of the Wilmington Regional Demand Model in Support of the Traffic Forecast R-3300B

Recent Model Updates

Patriot Transportation Engineering recently led an effort to revise the Wilmington Metropolitan Planning Organization (WMPO) Travel Demand Model. An extensive review of the WMPO 2040 Metropolitan Transportation Plan (MTP) was made to determine project specifications, locations, and projected completion years. The WMPO Model masternet was then modified to reconcile with the 2040 MTP project list. Travel Analysis Zone (TAZ) centroid loadings were also adjusted to conform to realistic access points in the coastal areas of Pender County. A detailed summary of the model update was delivered to WMPO and the NCDOT Transportation Planning Branch (TPB) in December of 2016.

WMPO Project Sources

Unless otherwise stated, all projects discussed below are contained (in some form) in Cape Fear Transportation 2040: A Metropolitan Transportation Plan (MTP), adopted by the Wilmington MPO on November 18, 2015. The MTP can be found at the following link: http://www.transportation2040.org/PDFs/CFT2040_adoptiondate_111815.pdf

Modifications to the Model Code (GISDK Script)

The model code was modified to correct inconsistencies in the way the roadway capacities were being factored based on a roadway's median treatment. For all arterials and collectors in the model, regardless of their secondary classifications (urban, rural, minor, major, etc.), the median treatment is a factor in determining the roadway capacity. Non-arterials and non-collectors in the model do not use medians to determine capacity, either because a median's presence or non-presence is either assumed, such as in the case of interstates or ramps, or because a median wouldn't significantly impact the capacity, such as in the case of local roads.

For each roadway, a base capacity is determined via a lookup table according to the roadway classification and, in the case of arterials and collectors, its median treatment. The way the table has been set up, there is a separate base capacity for divided roads and undivided roads. For the purposes of the lookup table, undivided roads include both TWLTL roads and completely undivided roads. Once the base capacities have been assigned, the capacity for roads that have a TWLTL median are supposed to be factored up to capture the increased capacity that a TWLTL road has over a totally undivided road. This process stratifies the capacities for the arterials and collectors so that divided roads have the highest capacity, undivided roads have the lowest capacity, and TWLTL roads have a capacity between fully divided road and totally undivided roads.

In the original script, the first cross-classification determination to distinguish between "divided" roads and "undivided" roads was conflating TWLTL roads with fully divided roads. This meant that TWLTL roads were receiving the same capacity as fully divided roads. The following script lines were modified so that TWLTL roads were no longer cross-classed as "divided" (the double slash, "//", at the beginning of a line means that the line is not a "live" line in the model code):

Original Coding

```
1409: if (median = "TWLTL" | median = "DIVIDED") then cross_class = "Divided"
1410: //if (median = "DIVIDED") then cross_class = "Divided"
```

Modified Coding

```
1409: //if (median = "TWLTL" | median = "DIVIDED") then cross_class = "Divided"
1410: if (median = "DIVIDED") then cross_class = "Divided"
```

Also, the TWLTL capacity factor was being applied to all roads that are not fully divided instead of just the TWLTL roads. In order to correct this, the following script lines were added to the model script:

Modified Coding

```
1449: if (median = "TWLTL") then Fclt = 1.08
1450: if (median <> "TWLTL") then Fclt = 1.00
```

These script changes are in line with similar changes made to the Wilmington Model as part of the forecasting efforts for NCDOT project U-5863 and had been approved by the State Traffic Forecast Engineer for that project on 8/24/2016.

Forecast Study Alternatives

This traffic forecast considers six future year scenarios for the Hampstead Bypass:

- 2040 No Build Scenario – all MTP projects are included in the model run except for the Hampstead Bypass
- 2040 Build Alternatives – all the scenarios include the full extent of the Hampstead Bypass, but with varied access points and roadway add-ons
    - Scenario 1 – includes interchanges at NC 210, Midtown and US 17 (R-3300 Preferred Alternative from NEPA)
    - Scenario 2 – Includes interchanges at NC 210, Midtown, US 17 and on-ramps from Hoover Road
    - Scenario 3 – Includes interchanges at NC 210 and US 17
    - Scenario 4 – Includes interchanges at NC 210, US 17 and on-ramps from Hoover Road
    - Scenario 5 – Includes interchanges at NC 210, Midtown, US 17, on-ramps from Hoover Road and a service road from the Midtown interchange to Hoover Road

Supporting File Development – Project List Files

The model is based on a master network. The masternet contains all the links in the study area for the existing roadway network and future network, with all potential projects, simultaneously. Each model run starts from the masternet and creates a travel network by modifying the masternet based on what set of projects is to be included and what year the model is being run for. The potential projects and their pertinent information is contained in a bin file that is referenced when creating the travel network for each run.

PRJ_ID1 is a field on the masternet links, and it's how the masternet and project list bin file are linked. The PRJ_ID (the project ID number) values from the project list is placed in the PRJ_ID1 field if that link is to be modified according to the values found in the corresponding row of the project list file.

PRJ_ID is a unique ID number for actions and parameters associated with each project in the project list file. A roadway project, however, can have multiple PRJ_IDs associated with it in the project list. For example, a roadway realignment project will have separate actions for adding and for removing links from the model network. Similarly, adding an interchange will have separate actions associated with multiple road types – removing roads, adding roads, and adding ramps (which have different parameters than mainline links).

A copy of the existing project bin file was made and then re-named to "WMPO_Projects_PTEupdate_Jan2017". The existing project bin file was set up to make a full 2040 model run, with all of the MTP projects included; and it includes the Hampstead Bypass project in its preferred scenario. Model runs to test variations of the preferred setup were made by altering the project bin file to match the differing alternatives and, when necessary, altering the masternet to add project-specific roadway links.

2040 Future Year Model Runs

2040 No-Build Scenario

This scenario assumes that the Hampstead Bypass is not built, but that all other MTP projects would be completed.

No alterations to the masternet were necessary to complete the 2040 No-Build scenario model run.

To remove the project from the model run, all the PRJ_ID values for the Hampstead Bypass project were removed from the project bin file. In that way, even though the PRJ_ID1 values remain on the masternet, there is nothing to be read for them from the project bin file; and so the project links are not added to the output roadway network. Upon completion of the model run, the PRJ_ID values were restored to the project bin file.

2040 Build Alternative 1

This is the preferred alternative scenario for the project. It includes the following roadways and specifications:

1. Hampstead Bypass
    a. Rural freeway
    b. 65 mph
    c. Median divided
    d. 2 lanes, each direction
2. Interchange at NC 210
    a. Ramps connecting principal arterial to freeway
    b. 45 mph
    c. Median divided
    d. 1 lane
3. Midtown Interchange
    a. Ramps
        i. Ramps connecting principal arterial to freeway
        ii. 45 mph

        iii. Median divided
        iv. 1 lane
    b. Midtown connection to US 17
        i. Rural principal arterial
        ii. 55 mph
        iii. Median divided
        iv. 2 lanes, each direction
4. Northern terminus interchange at US 17
    a. Ramps
        i. Ramps connecting principal arterial to freeway
        ii. 45 mph
        iii. Median divided
        iv. 1 lane
    b. Connecting roadways from interchange to US 17
        i. Rural principal arterial
        ii. 55 mph
        iii. Median divided
        iv. 2 lanes, each direction

No alterations to the masternet were necessary to complete the 2040 Build Alternative 1 model run.

No alterations to the project bin file were necessary to complete the 2040 Build Alternative 1 model run. All rows for the Hampstead Bypass in the project bin file were active for the model run.

<u>2040 Build Alternative 1A</u>

This scenario is the preferred project alternative with the addition of on-ramps to the Hampstead Bypass from Hoover Road. No off-ramps to Hoover Road would be provided, so there would not be a full interchange at Hoover Road. This alternative includes the following roadways and specifications:

1. Hampstead Bypass
    a. Rural freeway
    b. 65 mph
    c. Median divided
    d. 2 lanes, each direction
2. Interchange at NC 210
    a. Ramps connecting principal arterial and freeway
    b. 45 mph
    c. Median divided
    d. 1 lane
3. Hoover Road on-ramps
    a. Ramps connecting collector and freeway
    b. 45 mph
    c. Median divided
    d. 1 lane
4. Midtown Interchange
    a. Ramps

        i. Ramps connecting principal arterial and freeway
        ii. 45 mph
        iii. Median divided
        iv. 1 lane
    b. Midtown connection to US 17
        i. Rural principal arterial
        ii. 55 mph
        iii. Median divided
        iv. 2 lanes, each direction
5. Northern terminus interchange at US 17
    a. Ramps
        i. Ramps connecting principal arterial and freeway
        ii. 45 mph
        iii. Median divided
        iv. 1 lane
    b. Connecting roadways from interchange to US 17
        i. Rural principal arterial
        ii. 55 mph
        iii. Median divided
        iv. 2 lanes, each direction

To run this model for Alternative 1A, it was necessary to add the Hoover Road on-ramps to the original masternet.

A new row was added to the project bin file to represent the Hoover Road on-ramps. All rows for the Hampstead Bypass in the project bin file, including the new row, were active for the model run.

2040 Build Alternative 2

This scenario is the preferred project alternative but without the Midtown interchange. This alternative includes the following roadways and specifications:

1. Hampstead Bypass
    a. Rural freeway
    b. 65 mph
    c. Median divided
    d. 2 lanes, each direction
2. Interchange at NC 210
    a. Ramps connecting principal arterial and freeway
    b. 45 mph
    c. Median divided
    d. 1 lane
3. Northern terminus interchange at US 17
    a. Ramps
        i. Ramps connecting principal arterial and freeway
        ii. 45 mph
        iii. Median divided

        iv. 1 lane
    b. Connecting roadways from interchange to US 17
        i. Rural principal arterial
        ii. 55 mph
        iii. Median divided
        iv. 2 lanes, each direction

No additional alterations to the masternet were necessary to complete the 2040 Build Alternative 2 model run.

For this alternative model run, the PRJ_ID values for the Midtown Interchange and Midtown connector road were removed from the project bin file. The Hoover Road on-ramps row was also deactivated for this model run. All other Hampstead Bypass rows were active in the project bin file to perform the 2040 Build Alternative 2 model run.

2040 Build Alternative 2A

This scenario is the preferred project alternative but with the Hoover Road on-ramps and without the Midtown interchange. This alternative includes the following roadways and specifications:

1. Hampstead Bypass
    a. Rural freeway
    b. 65 mph
    c. Median divided
    d. 2 lanes, each direction
2. Interchange at NC 210
    a. Ramps connecting principal arterial and freeway
    b. 45 mph
    c. Median divided
    d. 1 lane
3. Hoover Road on-ramps
    a. Ramps connecting collector and freeway
    b. 45 mph
    c. Median divided
    d. 1 lane
4. Northern terminus interchange at US 17
    a. Ramps
        i. Ramps connecting principal arterial and freeway
        ii. 45 mph
        iii. Median divided
        iv. 1 lane
    b. Connecting roadways from interchange to US 17
        i. Rural principal arterial
        ii. 55 mph
        iii. Median divided
        iv. 2 lanes, each direction

No additional alterations to the masternet were necessary to complete the 2040 Build Alternative 2A model run.

For this alternative model run, the PRJ_ID values for the Midtown Interchange and Midtown connector road were removed from the project bin file. The Hoover Road on-ramps row was activated for this model run. All other Hampstead Bypass rows were active in the project bin file to perform the 2040 Build Alternative 2A model run.

2040 Build Alternative 3

This project scenario includes the Hoover Road on-ramps, the Midtown Interchange and connection, as well as a service road between the Midtown Interchange and Hoover Road. This alternative includes the following roadways and specifications:

1. Hampstead Bypass
    a. Rural freeway
    b. 65 mph
    c. Median divided
    d. 2 lanes, each direction
2. Interchange at NC 210
    a. Ramps connecting principal arterial and freeway
    b. 45 mph
    c. Median divided
    d. 1 lane
3. Hoover Road on-ramps
    a. Ramps connecting collector and freeway
    b. 45 mph
    c. Median divided
    d. 1 lane
4. Midtown Interchange
    a. Ramps
        i. Ramps connecting principal arterial and freeway
        ii. 45 mph
        iii. Median divided
        iv. 1 lane
    b. Midtown connection to US 17
        i. Rural principal arterial
        ii. 55 mph
        iii. Median divided
        iv. 2 lanes, each direction
5. Midtown-Hoover Rd service road
    a. Rural minor collector
    b. 45 mph
    c. Undivided
    d. 1 lane, each direction
6. Northern terminus interchange at US 17

a. Ramps
    i. Ramps connecting principal arterial and freeway
    ii. 45 mph
    iii. Median divided
    iv. 1 lane
b. Connecting roadways from interchange to US 17
    i. Rural principal arterial
    ii. 55 mph
    iii. Median divided
    iv. 2 lanes, each direction

Modifying the masternet to run Build Alternative 3 required changing the Midtown interchange as well as adding the service road. When the Hampstead Bypass project was originally added to the masternet, an intersection on the northern end of the Midtown Interchange was not envisioned. Modifying the Midtown Interchange in the masternet to include such an intersection would add a number of competing project ID references which could become complicated. Ultimately, it was decided to make a new copy of the masternet file to complete the modifications to the Midtown Interchange.

The new service road was also added to the masternet copy. It was modeled on the north side of the Hampstead Bypass and to closely follow the alignment of the Hampstead Bypass between Hoover Road and the Midtown Interchange. The service road connects to Hoover Road slightly north of the Hoover Road on-ramps.

A new row was added to the project bin file to represent the Hoover-Midtown service road. All rows for the Hampstead Bypass in the project bin file, including the new row, were active for the model run.

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