## FEASIBILITY STUDY

## State Road 421 at State Road 5A

Section 79230 - M.P. 2.382
Volusia County
Prepared for:

## RIVER TO SEA TRANSPORTATION PLANNING ORGANIZATION



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## EXECUTIVE SUMMARY

Traffic Engineering Data Solutions, Inc. (TEDS) was retained on behalf of the River to Sea Transportation Planning Organization (R2CTPO) to conduct an Intersection Analysis at the intersection of State Road 421 and State Road 5A located in Port Orange (Volusia County), Florida. The intent of the study was to evaluate the need for a westbound right-turn lane to and the feasibility of installation.

A total of three (3) rear-end crashes have occurred between January 1, 2011 and December 31, 2015 on the outside through lane of westbound State Road 421, within 300 feet east of State Road 5A. During the midday and afternoon peak-hour observations at the westbound approach, as many as ten (10) vehicles were observed to be in queue on the outside westbound through lane. During both the morning and afternoon peak-hour observations, westbound approaching vehicles rarely had to slow down slightly due to a vehicle in front slowing down to turn right onto State Road 5A.

Based on the data collected, field observations, alternatives analyses, and engineering judgement, installing a westbound right-turn lane at the intersection of State Road 421 and State Road 5A will provide for enhanced operations and safety at the intersection with the benefits expected to be more significant as traffic volumes continue to grow in the area.

The engineering and construction costs associated with this improvement are estimated at approximately $\$ 764,988$. Acquisition of 0.02 acres of right-of-way is anticipated to be required for this improvement, which is included in the estimate.

## 1

## INTRODUCTION

Traffic Engineering Data Solutions, Inc. (TEDS) was retained on behalf of the River to Sea Transportation Planning Organization (R2CTPO) to conduct a Feasibility Study at the intersection of State Road 421 and State Road 5A located in Port Orange (Volusia County), Florida. The study was requested by the City of Port Orange. The intent of the study was to evaluate the need for a westbound right-turn lane to enhance the operation and overall safety of the intersection and the feasibility of constructing the improvement. A location map of the study intersection is shown below as Figure 1.
The analysis methods used in completing this study are consistent with the Manual on Uniform Traffic Control Devices (MUTCD), Manual on Uniform Traffic Studies (MUTS), and engineering judgment. This report documents existing conditions, vehicle / pedestrian / bicycle counts, crash analysis, qualitative assessment, and recommendations.

Figure 1
General Location Map


Source: Google Maps

## 2

## EXISTING CONDITIONS

State Road 421 (Dunlawton Avenue) is an east-west arterial that extends from Interstate 95 through Port Orange east to US 1 where it turns into State Road A1A. As shown in Figure 2, State Road 421 is a six-lane divided arterial west of the study intersection and a four-lane divided arterial east of the study intersection. State Road 5A (Nova Road) is a north-south arterial that extends from US 1 south of Port Orange to US 1 in Ormond Beach. State Road 5A is a fourlane divided arterial south of the study intersection and a five-lane undivided arterial north of the study intersection. Large shopping centers are at the southwest, southeast, and northeast quadrants of the intersection, and Halifax health Medical Center of Port Orange and a smaller shopping center are northeast of the intersection. It should be noted that the existing sidewalk and pedestrian signal components located on the northeast corner of the intersection appear to encroach into private property.
Table 1 on the following page summarizes the existing conditions for the study intersection. An existing condition diagram depicts details of the study intersection and surrounding area and is provided as Figure 2. Photographs of the study intersection are included within this study. A straight line diagram is also included in the Appendix.

Table 1
Existing Conditions
State Road 421 at State Road 5A

| Feature | Description |
| :---: | :---: |
| Main Street | - State Road 421 (Dunlawton Avenue) |
| Side Street | - State Road 5A (Nova Road) |
| Area Location | - Port Orange (Volusia County), Florida |
| Adjacent Land Uses | - Southwest: Firestone Complete Auto Care, Countryside Shopping Center <br> - Southeast: Burger King restaurant, Dunlawton Square shopping center <br> - Northwest: CVS pharmacy, Wawa gas station <br> - Northeast: Bank of America Financial Center, Park Place Plaza shopping center |
| Traffic Control | - Signalized with protected-only left-turn phasing in all 4 directions |
| Adjacent Signalized Intersections | - South: Village Trail - 0.22 miles <br> - North: Herbert Street - 0.75 miles <br> - West: Village Trail/ N Swallow Tail Drive -0.51 miles <br> - East: Spruce Creek Road - 0.91 miles |
| State Road 421 | - Cross Section: 6-lane divided arterial (no curb or gutter) with bike lanes west of the intersection, and 4-lane divided arterial (no curb or gutter) with paved shoulders east of the intersection. <br> - Access: Class 5 <br> - Posted Speed Limit: 45 mph <br> - AADT 2015: 38,500 vehicles per day (vpd) west of the intersection; 30,500 vpd east of the intersection <br> - Eastbound Approach Lanes: 2 left-turn lanes, 3 through lanes, and 1 channelized right-turn lane <br> - Westbound Approach Lanes: 2 left-turn lanes and 3 through lanes <br> - Intersection Alignment: 90-degrees <br> - Pedestrian Crossings: Across the east and west approaches <br> - Sidewalks: Along both sides of the roadway <br> - Utilities: Overhead power lines along the south side of the roadway <br> - Street Lighting: Along the south side of the roadway west of the intersection; along the north side of the roadway east of the intersection; and on the southeast, northwest, and northeast corners of the intersection |
| State Road 5A | - Cross Section: 4-lane divided arterial (curb and gutter) with bike lanes south of the intersection, and 5-lane undivided arterial (curb and gutter) with two-way continuous left-turn lane and bike lanes <br> - Posted Speed Limit: 45 mph <br> - AADT 2015: $27,000 \mathrm{vpd}$ south of the intersection; $28,000 \mathrm{vpd}$ north of the intersection <br> - Northbound Approach Lanes: 2 left-turn lanes, 2 through lanes, and 1 right-turn lane <br> - Southbound Approach Lanes: 2 left-turn lanes, 2 through lanes, and 1 rightturn lane <br> - Pedestrian Crossings: Across the north and south approaches <br> - Sidewalks: Along both sides of the roadway <br> - Utilities: Overhead power lines along the west side of the roadway <br> - Street Lighting: Along the east side of the roadway |



## Eastbound Approach Photographs State Road 421 at State Road 5A



Looking East Towards Intersection


Looking West Away From Intersection

## Westbound Approach Photographs State Road 421 at State Road 5A



Looking West Towards Intersection


Looking East Away From Intersection

## Northbound Approach Photographs State Road 421 at State Road 5A



Looking North Towards Intersection


Looking South Away From Intersection

## Southbound Approach Photographs State Road 421 at State Road 5A



Looking South Towards Intersection


Looking North Away From Intersection

## Traffic Volumes

Twenty-four hour weekday approach counts, included in the Appendix, were conducted on all four (4) approaches at the study intersection. According to these counts, the intersection had a daily traffic volume of 60,757 vehicles that entered the intersection consisting of 17,653 eastbound vehicles, 16,393 westbound vehicles, 11,955 northbound vehicles, and 14,756 southbound vehicles.

Based on a review of the twentv-four hour count data eiaht (8) hours of manual turnina


- During the eight (8) hours of manually collected turning movement counts, heavy trucks, which include single-unit trucks such as delivery trucks (Class 5 to 7) and tractor-trailer trucks (Class 8 to 15), accounted for approximately $1.0 \%$ ( 431 vehicles) of the traffic passing through the State Road 421 at State Road 5A intersection.


Summaries of vehicle, pedestrian, and bicycle movements; approach count data; and manually collected turning movement count data are provided in the Appendix.

## Collision Data

Crash data for the study intersection for a 60-month period (January 1, 2011 to December 31, 2015) was obtained from FDOT's CAR database and University of Florida's Signal Four Analytics. One-hundred seventeen (117) crashes were reported and consisted of the following crash types:

| $\circ$ | 57 rear-end; |
| :--- | :--- |
| $\circ$ | 17 side-swipe; |
| $\circ$ | Ten (10) angle; |
| ○ | Nine (9) left-turn; |
| ○ | Nine (9) fixed-object; |
| ○ | Six (6) right-turn; |
| ○ | Four (4) bicycle; |
| ○ | Two (2) overturn; |
| $\circ$ | One (1) pedestrian; |
| $\circ$ | One (1) head-on; and, |
| $\circ$ | One (1) off-road. |

- The crashes resulted in one (1) fatality, 42 injuries, and $\$ 394,738$ in estimated property damage.
- Ninety-two (92) of the crashes occurred during the day and the remaining 25 occurred at night.
- One-hundred four (104) crashes occurred under dry pavement conditions and the remaining 13 occurred under wet pavement conditions.
- A total of three (3) rear-end crashes occurred in the outside through lane of westbound State Road 421, within 300 feet east of State Road 5A. The crashes resulted in three (3) injuries and $\$ 5,200$ in estimated property damage.
- Four (4) bicycle crashes and one (1) pedestrian crash occurred within the crosswalk of the west leg of the intersection. Two (2) of the crashes occurred when a southbound right-turning vehicle struck a northbound pedestrian or bicyclist that was crossing under a "Walk" indication. Two (2) bicycle crashes occurred when a bicyclist was crossing without activating the "Walk" indication. One (1) bicycle crash occurred when emergency preemption was activated for the signal as a fire truck was approaching; the walk phase was immediately terminated for a northbound bicyclist and upon receiving a green signal indication an eastbound vehicle struck the bicyclist. In addition to these five (5) pedestrian and bicycle crashes, one (1) rear-end crash occurred when eastbound right-turning vehicles had to brake suddenly as a pedestrian in a wheel chair crossed the channelized eastbound right-turn lane within the crosswalk.

A detailed collision summary of the intersection is provided on the following pages as Table 2. A collision diagram is also provided as Figure 5.

Table 2
Collision Summary
State Road 421 at State Road 5A


Source: Florida Department of Transportation and University of Florida's Signal Four Analytics

Table 2 (cont.) Collision Summary
State Road 421 at State Road 5A


Source: Florida Department of Transportation and University of Florida's Signal Four Analytics

Table 2 (cont.) Collision Summary
State Road 421 at State Road 5A

| COLLISION SUMMARY |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Section: |  | 79230 |  |  |  |  | State Road: 421 |  | County: Volusia |  |  |  |
| Intersecting route: |  | State Road 5A |  |  |  |  | Milepost: | 2.382 | Data by: AJP |  |  |  |
| Study period: |  | 1/1/2011 | to | 12/31/2015 |  |  |  |  | Date: |  |  | 1/12/2017 |
| NO. | DATE | DAY | TIME | FATAL | INJURY | INJURY SEVERITY | PROPERTY DAMAGE | $\begin{gathered} \text { HARMFUL } \\ \text { EVENT } \end{gathered}$ | DUI | $\begin{array}{\|c\|} \hline \text { DAY I } \\ \text { NIGHT } \end{array}$ | WET / <br> DRY | CONTRIBUTING CAUSE |
| 73 | 09/06/14 | Saturday | 13:25 | 0 | 1 | 3 | \$2,000 | Side-Swipe | No | Day | Dry | Improper Lane Change |
| 74 | 09/22/14 | Monday | 15:52 | 0 | 0 | 1 | \$1,500 | Rear-End | No | Day | Wet | Careless Driving |
| 75 | 09/24/14 | Wednesday | 12:09 | 0 | 1 | 3 | \$5,500 | Rear-End | No | Day | Dry | Careless Driving |
| 76 | 10/11/14 | Saturday | 14:10 | 0 | 0 | 1 | \$50 | Side-Swipe | No | Day | Dry | Improper Lane Change |
| 77 | 10/15/14 | Wednesday | 16:39 | 0 | 2 | 3 | \$6,000 | Left-Turn | No | Day | Dry | Pisregarded Traffic Contro |
| 78 | 10/22/14 | Wednesday | 8:08 | 0 | 1 | 3 | \$10,100 | Rear-End | Yes | Night | Dry | DUI |
| 79 | 10/27/14 | Monday | 14:52 | 0 | 0 | 1 | \$600 | Bicycle | No | Day | Dry | Pisregarded Traffic Contro |
| 80 | 11/05/14 | Wednesday | 5:29 | 0 | 0 | 1 | \$1,904 | Fixed-Object | No | Night | Dry | Improper Turn |
| 81 | 12/07/17 | Thursday | 0:26 | 0 | 0 | 1 | \$2,000 | Rear-End | No | Night | Dry | Driver Distraction |
| 82 | 12/09/14 | Tuesday | 12:25 | 0 | 0 | 1 | \$2,500 | Rear-End | No | Day | Dry | Following Too Closely |
| 83 | 12/11/14 | Thursday | 9:35 | 0 | 0 | 1 | \$350 | Side-Swipe | No | Day | Dry | Improper Lane Change |
| 84 | 12/11/14 | Thursday | 14:27 | 0 | 0 | 1 | \$20,000 | Left-Turn | No | Day | Dry | Pisregarded Traffic Contro |
| 85 | 12/13/14 | Saturday | 12:11 | 0 | 0 | 1 | \$3,500 | Rear-End | No | Day | Dry | Careless Driving |
| 86 | 12/16/14 | Tuesday | 15:29 | 0 | 0 | 1 | \$2,200 | Fixed-Object | No | Day | Dry | Improper Turn |
| 87 | 12/17/14 | Wednesday | 17:00 | 0 | 0 | 1 | \$1,300 | Fixed-Object | No | Day | Dry | Improper Turn |
| 88 | 12/27/14 | Saturday | 21:00 | 0 | 0 | 1 | \$0 | Fixed-Object | No | Day | Dry | Improper Turn |
| 89 | 01/01/15 | Thursday | 18:36 | 0 | 1 | 3 | \$500 | Overturn | No | Night | Wet | Lost Control |
| 90 | 01/08/15 | Thursday | 9:27 | 0 | 0 | 1 | \$5,000 | Rear-End | No | Day | Dry | Careless Driving |
| 91 | 01/08/15 | Thursday | 15:30 | 0 | 0 | 1 | \$8,500 | Angle | No | Day | Dry | FTYRW |
| 92 | 01/15/15 | Thursday | 6:09 | 0 | 0 | 1 | \$10,500 | Rear-End | Yes | Night | Dry | DUI |
| 93 | 01/15/15 | Thursday | 9:36 | 0 | 0 | 1 | \$600 | Rear-End | No | Day | Dry | Careless Driving |
| 94 | 01/15/15 | Thursday | 13:46 | 0 | 0 | 1 | \$3,000 | Fixed-Object | No | Day | Dry | Improper Turn |
| 95 | 02/03/15 | Tuesday | 8:40 | 0 | 0 | 1 | \$1,500 | Side-Swipe | No | Day | Dry | Improper Lane Change |
| 96 | 02/19/15 | Thursday | 8:13 | 0 | 1 | 2 | \$1,500 | Rear-End | No | Day | Dry | Careless Driving |
| 97 | 03/03/15 | Tuesday | 8:20 | 0 | 1 | 2 | \$0 | Rear-End | No | Day | Dry | Careless Driving |
| 98 | 03/16/15 | Monday | 23:32 | 0 | 0 | 1 | \$904 | Fixed-Object | No | Night | Dry | Unknown |
| 99 | 04/04/16 | Monday | 0:21 | 0 | 0 | 1 | \$1,000 | Left-Turn | No | Night | Dry | Disregarded Traffic Contro |
| 100 | 04/24/15 | Friday | 10:38 | 0 | 0 | 1 | \$100 | Rear-End | No | Day | Dry | Careless Driving |
| 101 | 06/05/15 | Friday | 8:54 | 0 | 1 | 2 | \$1,550 | Rear-End | No | Day | Dry | Careless Driving |
| 102 | 06/20/15 | Saturday | 8:50 | 0 | 2 | 3 | \$2,000 | Rear-End | No | Day | Dry | Following Too Closely |
| 103 | 07/10/15 | Friday | 18:34 | 0 | 1 | 2 | \$200 | Rear-End | No | Day | Dry | Careless Driving |
| 104 | 07/13/15 | Monday | 7:45 | 0 | 0 | 1 | \$2,000 | Side-Swipe | No | Day | Dry | Reckless Driving |
| 105 | 07/23/15 | Thursday | 13:39 | 0 | 1 | 3 | \$1,300 | Rear-End | No | Day | Dry | Improper Lane Change |
| 106 | 08/04/15 | Tuesday | 22:42 | 0 | 1 | 3 | \$2,000 | Rear-End | No | Night | Dry | Drowsiness |
| 107 | 08/17/15 | Monday | 20:09 | 0 | 0 | 1 | \$9,000 | Right-Turn | No | Night | Dry | FTYRW |
| 108 | 09/03/15 | Thursday | 9:20 | 0 | 1 | 2 | \$12,500 | Angle | No | Day | Dry | FTYRW |
| 109 | 09/12/15 | Saturday | 20:24 | 0 | 0 | 1 | \$4,000 | Head-On | Yes | Night | Dry | DUI |

Source: Florida Department of Transportation and University of Florida's Signal Four Analytics

Table 2 (cont.) Collision Summary
State Road 421 at State Road 5A


Source: Florida Department of Transportation and University of Florida's Signal Four Analytics


## 3

## QUALITATIVE ASSESSMENT

The intersection of State Road 421 at State Road 5A was observed during the peak hours by a registered professional engineer under sunny and clear conditions to assess existing operating conditions and to determine if installing a westbound right-turn lane would be potentially beneficial.

## Operations:

Operations include the efficiency of operation and interaction of motor vehicles, pedestrians and bicycles at the study intersection. The goal of the observations was to determine the need for improvements to enhance the safety and efficiency of the study location.

- Sight distance is adequate for all motorists traveling in all directions.
- Traffic approaching the intersection was observed to travel in well-defined platoons, with the southbound approaching platoons being the least defined platoons.
- The traffic signal appeared to be coordinated for eastbound traffic as all other platoons typically arrived during a red-phase or portion thereof.
- The northbound and southbound left-turn movements operate under leading protectedonly control.
- The eastbound and westbound left-turn movements operate under lead/lag protectedonly control (westbound leads and eastbound lags).
- The eastbound approach on State Road 421 has three (3) through lanes, and departing the intersection, the outside through lane becomes a lane drop onto Jackson Street approximately 600 feet east of the intersection. Many of the cars in the outside through lane were observed merging into the middle lane to continue east on State Road 421. No issues or concerns were observed with this merging maneuver.


## Midday Observation

- Bicyclist and pedestrian volumes were consistent with the volume counts. All crossed without issue or conflict with most using the pedestrian signals. One (1) pedestrian did cross the north leg during the southbound left-turn phase by waiting for a gap in vehicles and ultimately crossing the intersection without issue (see photograph below).

- No issues or concerns were observed with regard to potential conflicts between rightturning vehicles and pedestrians at any of the approaches.
- No queue spillbacks were observed for any of the left-turn movements.
- Several phase failures were noted as follows:
- Eastbound left-turn movement - one (1) phase failure
- Northbound left-turn movement - three (3) phase failures
- Southbound left-turn movement - six (6) phase failures
- The westbound-to-eastbound U-turn movement on State Road 421 was noticed to be relatively heavy (ranging from 59 vehicles per hour to 107 vehicles per hour based on the eight-hour turning movement counts). Most of the U-turns would then turn into the Dunlawton Square shopping center in the southeast quadrant of the intersection. No issues were observed with regard to these U-turns.
- The westbound through movement on State Road 421 has three lanes, including the outside lane which is a shared through/right-turn lane. The outside westbound through lane begins at Jackson Street, approximately 600 feet east of State Road 5A. The queues for the inside and middle westbound through lanes extended to just west of Jackson Street in most cases and in some cases extended beyond Jackson Street. The queue in the outside shared through/right-turn lane was typically noted to be considerably shorter, ranging between six (6) to ten (10) vehicles (see photograph below). The majority of vehicles in the outside lane were westbound through vehicles.

- Westbound right-turning vehicles did not impede or have any noticeable impact on the flow of westbound through vehicles through the intersection because westbound vehicles were passing through the intersection at lower speeds as the platoons typically arrived during a red-phase. Also, the radius in the northeast quadrant along with two (2) departing northbound lanes enables right-turning motorists to navigate the turn at slightly higher speeds than most typical right turns. Additionally, there is a four-foot paved shoulder, thus as right-turning vehicles begin their maneuver, the vehicles can move more quickly out of the way of the trailing westbound through vehicles.
- On three (3) occasions, a westbound right-turning motorist stopped behind a westbound through vehicle at the intersection, snuck around the through vehicle, and performed a right-turn-on-red without issue.


## Afternoon Observation

- Bicyclist and pedestrian volumes were consistent with the volume counts. All crossed without issue or conflict with most using the pedestrian signals.
- No issues or concerns were observed with regard to potential conflicts between rightturning vehicles and pedestrians at any of the approaches.
- No queue spillbacks were observed for any of the left-turn movements.
- Several phase failures were noted as follows:
- Eastbound left-turn movement - one (1) phase failure
- Northbound left-turn movement - one (1) phase failure
- Southbound left-turn movement - three (3) phase failures
- The southbound through movement was noticed to be considerably heavier during the afternoon as compared to the midday observation ( 695 vehicles per hour during the midday peak hour and 816 vehicles per hour during the afternoon peak hour based on the eight-hour turning movement counts). Regardless, all queues cleared within each respective signal cycle.
- When the eastbound left-turn movement had a green signal indication, several southbound right-turning motorists were observed to roll through the red light without coming to a complete stop. No issues were observed with regard to southbound rightturning vehicles.
- The westbound-to-eastbound U-turn movement was noticed to be relatively heavy. Most of the U-turns would then turn into the Dunlawton Square shopping center in the southeast quadrant of the intersection. No issues were observed with regard to these U-turns.
- The queues for the inside and middle westbound through lanes extended to just west of Jackson Street in most cases and in some cases extended beyond Jackson Street. When the queue extended beyond Jackson Street, the westbound motorists were typically good Samaritans, allowing eastbound left-turning motorists to turn onto Jackson Street. No issues were observed with regard to long westbound queues in the middle and through lanes.
- The queue in the westbound outside shared through/right-turn lane was typically noted to be considerably shorter than the adjacent westbound lanes. The majority of vehicles in the outside lane were westbound through vehicles.
- Westbound right-turning vehicles did not impede or have any noticeable impact on the flow of westbound through vehicles through the intersection because westbound vehicles were passing through the intersection at lower speeds as the platoons typically arrived during a red-phase. Also, the radius in the northeast quadrant along with two (2) departing northbound lanes enables right-turning motorists to navigate the turn at slightly higher speeds than most typical right turns.


## Maintenance:

During the field reviews the condition of the study intersection's pavement, striping, signing and lighting were observed. The following are observations related to the maintenance of the intersection based on the various field reviews of the intersection:

- The roadway has recently been resurfaced; therefore the pavement markings and pavement conditions at the intersection of State Road 421 and State Road 5A are in very good condition.
- The signs are in good condition.
- The pedestrian push-button sign in the southeast quadrant for pedestrians looking to cross State Road 5A is missing (see photograph below). It is recommended to replace the pedestrian push-button sign.

- One (1) crash occurred when eastbound right-turning vehicles had to brake suddenly as a pedestrian in a wheel chair crossed the channelized eastbound right-turn lane within the crosswalk. It was observed that there are no signs warning drivers of possible
pedestrian crossings at the southwest quadrant (see photograph below). It is recommended to install a Pedestrian Crossing (W11-2) sign with a diagonal downward pointing arrow (W16-7P) plaque at the crosswalk.



## Safety:

Vehicle, pedestrian, and bicycle safety at the intersection was assessed through review of crash reports, identification of significant crash trends, and correlations to field conditions. The following observations were made with respect to the safety of the study intersection:

- Skid marks were observed at all approaches, but no signs of broken glass, plastic, or other indication of a crash were observed at the intersection.
- Two (2) crashes occurred when a southbound right-turning vehicle struck a northbound pedestrian or bicyclist within the crosswalk of the west leg under a "Walk" indication. It is recommended to install a Right Turning Vehicles Yield to Pedestrians (R10-15R) sign for southbound motorists just north of the pedestrian signal head and adjacent to the north leg crosswalk and relocate the State Road 421 Directional Assembly so that is a minimum of 100 feet from the proposed sign.


## 4

## IMPROVEMENT CONCEPT

As previously conveyed, the purpose of this study was to evaluate the need and feasibility of installing a westbound right-turn lane at the study intersection. For purposes of understanding the operational benefits of adding a westbound right-turn lane, capacity analyses were conducted for the midday and afternoon peak hours utilizing the Highway Capacity Software (HCS), existing turning movement counts, existing signal timings, and the existing and proposed intersection geometry. Based on the analyses with the existing intersection geometry (without an exclusive westbound right-turn lane), the intersection is projected to operate at LOS E (average delay of 68.3 seconds per vehicle) and LOS E (average delay of 74.9 seconds per vehicle) during the midday and afternoon peak hours, respectively. With the proposed westbound right-turn lane, the intersection is projected to operate at LOS E (average delay of 65.9 seconds per vehicle) and LOS E (average delay of 72.0 seconds per vehicle) during the midday and afternoon peak hours, respectively. Therefore, the average delay per vehicle will be reduced with the addition of the westbound right-turn lane. It is also important to note that the AASHTO's Highway Safety Manual (HSM) provides a crash modification factor of 0.96 for the installation of a right-turn lane on a major roadway at a signalized intersection thus indicating that such improvement has been shown to reduce all crashes at an intersection by four percent (4\%). Therefore, the installation of a westbound right-turn lane will provide both safety and operational benefits for the intersection and the benefits are expected to increase as traffic volumes increase.

An improvement concept was developed for the installation of a westbound right-turn lane at the State Road 421 at State Road 5A intersection. Per FDOT's 2016 Design Standards, Index 301, a westbound right-turn lane length of 390 feet (inclusive of a 50 -foot taper) is recommended, based on a 150 -foot queue length and 240 feet of deceleration for a design speed of 50 mph using rural conditions (see Figure 6). Details of the proposed improvement are provided below and a typical section is included as the first item of the Appendix:

- Remove existing 5 -foot wide paved shoulder to construct a 12 -foot wide, 390 -foot long westbound right-turn lane with a 5 -foot wide keyhole bike lane and Type F curb and gutter along the turn lane.
- Remove approximately 490 feet of existing 8-foot sidewalk and construct proposed 8-foot sidewalk at back of curb.
- Reconfigure existing roadside ditch as necessary and sod.
- Remove two (2) existing MES's and construct new curb inlets with J-bottoms which connect to the existing driveway side drains.
- Remove existing ditch bottom inlet and pipe, adjust existing manhole to finished grade, and connect proposed storm pipe from existing manhole to proposed curb inlet with J-bottom near the Walgreens driveway.
- Adjust existing telephone manhole located within proposed right turn lane to existing grade.
- Construct two (2) MES's to receive runoff from adjacent properties with pipe connections to proposed curb inlets.
- Acquire approximately 0.02 acre of right-of-way at the northeast corner (Bank of America Financial Center) in order to completely construct the curb and gutter, curb ramp, and sidewalk and eliminate the existing encroachment.
- Install directional arrows and pavement markings.
- In the northeast quadrant, remove the existing pedestrian signal head and detector for the east leg crosswalk and install a new pedestrian signal head and detector.
- Adjust stop line and pedestrian crosswalk pavement markings on the east leg of the intersection and extend pedestrian crosswalk pavement markings on the north leg of the intersection.
- Reconstruct curb ramps and Type F curb and gutter on the northeast corner of the intersection.
- Reconstruct pedestrian refuge island.
- Relocate four (4) signs.
- Relocate luminaires behind proposed 8-foot sidewalk.
- Reconstruct Bank of America driveway to meet proposed right-turn lane.
- Replace impacted loops and pull boxes.
- Install a 3-section signal head for westbound traffic so that there is one (1) signal head for each westbound through lane. Also, install backplates to all of the eastbound and westbound signal heads.
- A structural analysis of the mast arm will be required. As a part of this analysis, consideration should be given to shifting the overhead street name sign closer to the upright.
- If the structural analysis concludes the mast arm cannot accommodate the additional loading, then an additional analysis should be conducted to determine if the mast arm can accommodate the additional signal head without the addition of backplates. FDOT has conveyed that they are acceptable to not adding the 3rd westbound through signal head and/or backplates given the additional costs associated with replacing the mast-arm.
- Adjust signal timings due to the extension of the pedestrian crosswalks.

Construction of a right turn lane would typically qualify for exemption from Environmental Resource Permit (ERP) under FAC 62-330.051. However, under Application No. 22818-1, the St. Johns River Water Management District (SJRWMD) previously issued an ERP for the widening of State Road 5A in 1988, to which there have been several subsequent modifications. As such, a permit modification is expected to be required from SJRWMD.
The overall improvement costs were estimated based on FDOT historical unit prices. The total cost of the improvements, including engineering and CEI, is estimated at approximately $\$ 728,882$ and is provided in Table 3.


| TABLE 3ENGINEER'S OPINION OF PROBABLE COSTSVOLUSIA COUNTYSTATE ROAD 421 AT NOVA ROAD |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| ITEM | DESCRIPTION | ESTIMATED QUANTITY | UNIT | UNIT PRICE | AMOUNT |
| I. ROADWAY |  |  |  |  |  |
| 102-1 | MOBILIZATION (25\%) | 1 | LS | \$103,480.46 | \$103,480.46 |
| 104-10-3 | SEDIMENT BARRIER | 500 | LF | \$1.13 | \$565.00 |
| 110-1-1 | CLEARING AND GRUBBING | 0.421 | AC | \$12,730.10 | \$5,359.37 |
| 110-4 | REMOVAL OF EXISTING CONCRETE PAVEMENT | 612 | SY | \$21.02 | \$12,864.24 |
| 120-1 | REGULAR EXCAVATION | 42 | CY | \$4.49 | \$188.58 |
| 120-6 | EMBANKMENT | 5 | CY | \$9.39 | \$46.95 |
| 160-4 | TYPE B STABILIZATION | 973 | SY | \$3.01 | \$2,928.73 |
| 285-701 | OPTIONAL BASE,BASE GROUP 01 | 992 | SY | \$9.55 | \$9,473.60 |
| 334-1-13 | SUPERPAVE ASPH CONC, TRAFFIC C (1") | 52 | TN | \$96.50 | \$5,018.00 |
| 337-7-55 | ASPH CONC FC, TRAFFIC C,FC-12.5,PG 82-22 (1.5") | 78 | TN | \$88.99 | \$6,941.22 |
| 425-1411 | INLETS, CURB TYPE J-1, <10' | 2 | EA | \$7,282.12 | \$14,564.24 |
| 425-5 | MANHOLE, ADJUST | 2 | EA | \$562.85 | \$1,125.70 |
| 430-982-123 | MITERED END SECTION, OPTIONAL ROUND, 15" CD | 2 | EA | \$1,071.31 | \$2,142.62 |
| 430-174-115 | PIPE CULVERT, OPTIONAL MATERIAL, ROUND 15" SD | 95 | LF | \$75.00 | \$7,125.00 |
| 430-174-124 | PIPE CULVERT, OPTIONAL MATERIAL, ROUND 24" SD | 115 | LF | \$86.95 | \$9,999.25 |
| 520-1-10 | CONCRETE CURB \& GUTTER, TYPE F | 503 | LF | \$17.31 | \$8,706.93 |
| 522-2 | SIDEWALK/DRIVEWAY CONCRETE, 6 " THICK | 538 | SY | \$44.20 | \$23,779.60 |
| 527-2 | DETECTABLE WARNINGS | 24 | SF | \$31.15 | \$747.60 |
| 570-1-2 | PERFORMANCE TURF, SOD | 524 | SY | \$2.30 | \$1,205.20 |
|  |  |  |  | SUBTOTAL | \$216,262.29 |
|  |  |  |  |  |  |
| 630-2-11 | CONDUIT, F\&I, OPEN TRENCH | 400 | LF | \$7.89 | \$3,156.00 |
| 630-2-12 | CONDUIT, F\&I, DIRECTIONAL BORE | 200 | LF | \$15.09 | \$3,018.00 |
| 632-7-1 | SIGNAL CABLE- NEW OR RECO, FUR \& INSTALL | 1 | PI | \$4,925.72 | \$4,925.72 |
| 635-2-11 | PULL \& SPLICE BOX, F\&I, 13 " $\times 24$ " | 5 | EA | \$566.09 | \$2,830.45 |
| 646-1-12 | ALUMINUM SIGNALS POLE, PED DETECT POST | 2 | EA | \$738.70 | \$1,477.40 |
| 650-1311 | TRAFFIC SIGNAL,F\&I,3 SECT,1 WAY,ALUMINUM | 1 | AS | \$1,037.25 | \$1,037.25 |
| 653-1-11 | PEDESTRIAN SIGNAL, F\&I LED COUNT, 1 WAY | 2 | AS | \$672.04 | \$1,344.08 |
| 653-1-60 | PEDESTRIAN SIGNAL, REMOVE | 2 | AS | \$74.14 | \$148.28 |
| 660-2-102 | LOOP ASSEMBLY, F\&I, TYPE B | 6 | AS | \$724.27 | \$4,345.62 |
| 660-2-106 | LOOP ASSEMBLY, F\&I, TYPE F | 2 | AS | \$925.06 | \$1,850.12 |
| 665-1-11 | PEDESTRIAN DETECTOR, F\&I, STANDARD | 2 | EA | \$260.86 | \$521.72 |
| 665-1-60 | PEDESTRIAN DETECTOR, REMOVE | 2 | EA | \$60.71 | \$121.42 |
| 671-2-40 | TRAFFIC CONTROLLER, MODIFY | 1 | EA | \$3,307.77 | \$3,307.77 |
| 700-5-22 | INTERNAL ILLUM SIGN, F\&I OM, 12-18 SF | 1 | EA | \$3,236.20 | \$3,236.20 |
| 700-5-60 | INTERNALILLUM SIGN, REMOVE | 1 | EA | \$185.82 | \$185.82 |
|  |  |  |  | SUBTOTAL | \$31,505.85 |
| II. SIGNING, PAVEMENT MARKINGS, AND LIGHTING |  |  |  |  |  |
| 700-1-11 | SINGLE POST SIGN, F\&I, GROUND MOUNT, UP TO 12SF | 4 | EA | \$300.00 | \$1,200.00 |
| 711-16-101 | THERMOPLASTIC, STD-OTH, WHITE, SOLID, 6 " | 0.155 | NM | \$3,899.85 | \$604.48 |
| 711-11-123 | THERMOPLASTIC, STD, WHITE, SOLID, 12" | 276 | LF | \$2.24 | \$618.24 |
| 711-11-124 | THERMOPLASTIC, STD, WHITE, SOLID, 18" FOR DIAGONAL | 47 | LF | \$2.92 | \$137.24 |
| 711-11-125 | THERMOPLASTIC, STANDARD, WHITE, SOLID, 24" | 30 | LF | \$4.19 | \$125.70 |
| 711-11-170 | THERMOPLASTIC, STANDARD, WHITE, ARROW | 4 | EA | \$59.57 | \$238.28 |
| 711-14-141 | THERMOPLASTIC, PREF, WHITE, 2-4 DOT, CON | 0.064 | GM | \$7,410.00 | \$474.24 |
| 711-16-201 | THERMOPLASTIC, STANDARD-OTHER SURFACE, YELLOW, SOLID, 6" | 0.000 | NM | \$3,754.65 | \$0.00 |
| 711-17 | THERMOPLASTIC, REMOVE | 429 | SF | \$2.25 | \$965.25 |
| 715-44-00 | LIGHTPOLE COMPLETE, RELOCATE | 2 | EA | \$2,885.37 | \$5,770.74 |
|  |  |  |  | SUBTOTAL | \$10,134.17 |
| IV. RIGHT OF WAY |  |  |  |  |  |
|  |  |  |  | RIGHT OF WAY | \$259,500.00 |
|  |  |  |  | SUBTOTAL | \$259,500.00 |
|  |  |  |  |  |  |
|  |  |  |  | SUBTOTAL | \$257,902.31 |
| MAINTENANCE OF TRAFFIC (20\%) |  |  |  |  | \$51,580.46 |
| CONTINGENCY (20\%) |  |  |  |  | \$51,580.46 |
| CONSTRUCTION TOTAL |  |  |  |  | \$361,063.24 |
| ENGINEERING (30\%) |  |  |  |  |  |
|  |  |  |  |  | \$108,318.97 |
| CEI (10\%) |  |  |  |  | \$36,106.32 |
|  |  |  |  |  | \$764,988.53 |
| PROJECT TOTAL (2017) |  |  |  |  | \$785,643.22 |
| PROJECT TOTAL (2019) ${ }^{1}$ |  |  |  |  | \$807,827.89 |
| Notes: |  |  |  |  |  |
| *Unit Prices from FDOTs 12-Month Moving Statewide Average. |  |  |  |  |  |
| ${ }^{1}$ An annual inflation factor of $2.7 \%$ and $2.8 \%$, as obtained from FDOTs Transportation Costs Reports, was applied to factor the costs to year 2018 and 2019, respectively. |  |  |  |  |  |
|  |  |  |  |  |  |

## 5

## CONCLUSION

Traffic Engineering Data Solutions, Inc. (TEDS) was retained on behalf of the River to Sea Transportation Planning Organization (R2CTPO) to conduct a Feasibility Study for State Road 421 (Dunlawton Avenue) at State Road 5A in Port Orange (Volusia County), Florida. Based on the data collected, field observations, alternatives analyses, and engineering judgement, installing a westbound right-turn lane at the intersection will provide for enhanced operations and safety at the intersection, with the benefits expected to be more significant as traffic volumes continue to grow in the area.

The engineering and construction costs associated with these improvements are estimated at approximately $\$ 764,988$.
Aside from the turn-lane installation, it is recommended for the maintaining agency to make the following improvements:

- Replace the pedestrian push-button sign in the southeast quadrant for pedestrians looking to cross State Road 5A.
- Install a Pedestrian Crossing (W11-2) sign with a diagonal downward pointing arrow (W16-7P) plaque at the crosswalk across the channelized eastbound right-turn lane.
- Install a Right Turning Vehicles Yield to Pedestrians (R10-15R) sign for southbound motorists just north of the pedestrian signal head and adjacent to the north leg crosswalk and relocate the State Road 421 Directional Assembly so that is a minimum of 100 feet from the proposed sign.


## APPENDIX



NEW CONSTRUCTION
OPTIONAL BASE GROUP O1 (TYPE B-12.5 ONLY) WITH
TYPE SP STRUCTURAL COURE (TRAFFIIC $)$ (1T) TYPE SP STRUCTURAL COURS (TRAFFIC C) ( $1^{1 ")}$
AND FRICTION COURSE FC-12.5 (1.5) (TRAFFIC C, PG 76-22, ARB)


|  | NOVA ROAD Northbound |  |  |  |  | NOVA ROAD Southbound |  |  |  |  | STATE ROAD 421 <br> Eastbound |  |  |  |  | STATE ROAD 421 <br> Westbound |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Start Time | Left | Thru | Right | Peds | App.Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Int. Total |
| 10:00 AM | 89 | 135 | 27 | 1 | 252 | 66 | 108 | 65 | 1 | 240 | 93 | 206 | 48 | 0 | 347 | 61 | 229 | 35 | 0 | 325 | 1164 |
| 10:15 AM | 105 | 125 | 19 | 0 | 249 | 38 | 123 | 64 | 1 | 226 | 81 | 200 | 55 | 0 | 336 | 58 | 254 | 42 | 0 | 354 | 1165 |
| 10:30 AM | 83 | 134 | 24 | 0 | 241 | 55 | 129 | 62 | 0 | 246 | 80 | 183 | 58 | 0 | 321 | 64 | 226 | 44 | 0 | 334 | 1142 |
| 10:45 AM | 100 | 157 | 33 | 0 | 290 | 61 | 127 | 91 | 1 | 280 | 91 | 220 | 53 | 0 | 364 | 58 | 217 | 45 | 0 | 320 | 1254 |
| Total | 377 | 551 | 103 | 1 | 1032 | 220 | 487 | 282 | 3 | 992 | 345 | 809 | 214 | 0 | 1368 | 241 | 926 | 166 | 0 | 1333 | 4725 |
| 11:00 AM | 101 | 174 | 35 | 0 | 310 | 69 | 150 | 82 | 0 | 301 | 98 | 206 | 53 | 0 | 357 | 92 | 219 | 55 | 2 | 368 | 1336 |
| 11:15 AM | 100 | 149 | 38 | 0 | 287 | 58 | 136 | 81 | 0 | 275 | 101 | 223 | 63 | 0 | 387 | 72 | 234 | 39 | 0 | 345 | 1294 |
| 11:30 AM | 88 | 163 | 28 | 1 | 280 | 60 | 128 | 80 | 0 | 268 | 79 | 243 | 62 | 1 | 385 | 72 | 240 | 44 | 0 | 356 | 1289 |
| 11:45 AM | 92 | 157 | 38 | 0 | 287 | 70 | 170 | 81 | 1 | 322 | 90 | 238 | 58 | 1 | 387 | 65 | 270 | 40 | 0 | 375 | 1371 |
| Total | 381 | 643 | 139 | 1 | 1164 | 257 | 584 | 324 | 1 | 1166 | 368 | 910 | 236 | 2 | 1516 | 301 | 963 | 178 | 2 | 1444 | 5290 |
| 12:00 PM | 93 | 171 | 30 | 1 | 295 | 69 | 134 | 77 | 1 | 281 | 103 | 225 | 52 | 1 | 381 | 85 | 280 | 39 | 0 | 404 | 1361 |
| 12:15 PM | 109 | 153 | 30 | 0 | 292 | 69 | 135 | 70 | 0 | 274 | 108 | 239 | 69 | 1 | 417 | 95 | 275 | 45 | 0 | 415 | 1398 |
| 12:30 PM | 88 | 154 | 45 | 1 | 288 | 69 | 191 | 81 | 2 | 343 | 88 | 210 | 61 | 1 | 360 | 97 | 232 | 45 | 0 | 374 | 1365 |
| 12:45 PM | 101 | 154 | 37 | 0 | 292 | 80 | 167 | 78 | 0 | 325 | 91 | 274 | 55 | 1 | 421 | 69 | 254 | 34 | 0 | 357 | 1395 |
| Total | 391 | 632 | 142 | 2 | 1167 | 287 | 627 | 306 | 3 | 1223 | 390 | 948 | 237 | 4 | 1579 | 346 | 1041 | 163 | 0 | 1550 | 5519 |
| 01:00 PM | 97 | 196 | 38 | 3 | 334 | 81 | 155 | 84 | 0 | 320 | 97 | 260 | 71 | 0 | 428 | 81 | 242 | 32 | 0 | 355 | 1437 |
| 01:15 PM | 89 | 160 | 47 | 0 | 296 | 64 | 139 | 89 | 0 | 292 | 109 | 269 | 59 | 2 | 439 | 85 | 265 | 31 | 4 | 385 | 1412 |
| 01:30 PM | 96 | 155 | 34 | 2 | 287 | 79 | 189 | 87 | 0 | 355 | 108 | 247 | 49 | 2 | 406 | 69 | 239 | 55 | 0 | 363 | 1411 |
| 01:45 PM | 107 | 143 | 38 | 5 | 293 | 75 | 170 | 92 | 0 | 337 | 94 | 228 | 61 | 0 | 383 | 70 | 230 | 40 | 1 | 341 | 1354 |
| Total | 389 | 654 | 157 | 10 | 1210 | 299 | 653 | 352 | 0 | 1304 | 408 | 1004 | 240 | 4 | 1656 | 305 | 976 | 158 | 5 | 1444 | 5614 |
| 02:00 PM | 105 | 172 | 29 | 1 | 307 | 80 | 197 | 88 | 0 | 365 | 116 | 257 | 60 | 0 | 433 | 80 | 246 | 53 | 0 | 379 | 1484 |
| 02:15 PM | 83 | 163 | 34 | 4 | 284 | 71 | 178 | 110 | 0 | 359 | 127 | 265 | 70 | 3 | 465 | 64 | 272 | 47 | 0 | 383 | 1491 |
| 02:30 PM | 110 | 154 | 34 | 2 | 300 | 72 | 195 | 90 | 0 | 357 | 101 | 237 | 73 | 0 | 411 | 91 | 252 | 39 | 0 | 382 | 1450 |
| 02:45 PM | 120 | 171 | 42 | 0 | 333 | 91 | 191 | 92 | 1 | 375 | 124 | 267 | 65 | 0 | 456 | 75 | 219 | 41 | 0 | 335 | 1499 |
| Total | 418 | 660 | 139 | 7 | 1224 | 314 | 761 | 380 | 1 | 1456 | 468 | 1026 | 268 | 3 | 1765 | 310 | 989 | 180 | 0 | 1479 | 5924 |
| 03:00 PM | 84 | 176 | 32 | 0 | 292 | 71 | 195 | 87 | 0 | 353 | 126 | 295 | 67 | 0 | 488 | 70 | 300 | 57 | 1 | 428 | 1561 |
| 03:15 PM | 109 | 177 | 30 | 0 | 316 | 80 | 233 | 98 | 0 | 411 | 121 | 237 | 59 | 0 | 417 | 77 | 285 | 52 | 1 | 415 | 1559 |
| 03:30 PM | 102 | 166 | 32 | 1 | 301 | 65 | 197 | 93 | 1 | 356 | 118 | 282 | 73 | 0 | 473 | 59 | 249 | 41 | 1 | 350 | 1480 |
| 03:45 PM | 81 | 129 | 30 | 0 | 240 | 52 | 180 | 75 | 0 | 307 | 110 | 301 | 49 | 0 | 460 | 115 | 264 | 44 | 2 | 425 | 1432 |
| Total | 376 | 648 | 124 | 1 | 1149 | 268 | 805 | 353 | 1 | 1427 | 475 | 1115 | 248 | 0 | 1838 | 321 | 1098 | 194 | 5 | 1618 | 6032 |
| 04:00 PM | 107 | 195 | 33 | 0 | 335 | 84 | 237 | 89 | 0 | 410 | 121 | 258 | 79 | 1 | 459 | 72 | 232 | 33 | 0 | 337 | 1541 |
| 04:15 PM | 103 | 143 | 22 | 0 | 268 | 77 | 211 | 93 | 0 | 381 | 145 | 286 | 52 | 1 | 484 | 88 | 317 | 49 | 0 | 454 | 1587 |
| 04:30 PM | 75 | 166 | 14 | 2 | 257 | 75 | 172 | 81 | 0 | 328 | 100 | 234 | 54 | 0 | 388 | 105 | 288 | 27 | 0 | 420 | 1393 |
| 04:45 PM | 90 | 169 | 29 | 1 | 289 | 79 | 204 | 74 | 0 | 357 | 115 | 230 | 56 | 0 | 401 | 80 | 259 | 30 | 1 | 370 | 1417 |
| Total | 375 | 673 | 98 | 3 | 1149 | 315 | 824 | 337 | 0 | 1476 | 481 | 1008 | 241 | 2 | 1732 | 345 | 1096 | 139 | 1 | 1581 | 5938 |
| 05:00 PM | 91 | 151 | 20 | 1 | 263 | 61 | 217 | 87 | 1 | 366 | 113 | 273 | 69 | 0 | 455 | 128 | 326 | 34 | 0 | 488 | 1572 |
| 05:15 PM | 86 | 151 | 34 | 0 | 271 | 101 | 255 | 84 | 0 | 440 | 117 | 230 | 67 | 1 | 415 | 110 | 290 | 39 | 0 | 439 | 1565 |
| 05:30 PM | 81 | 112 | 44 | 0 | 237 | 97 | 178 | 70 | 0 | 345 | 111 | 273 | 63 | 1 | 448 | 81 | 235 | 27 | 0 | 343 | 1373 |
| 05:45 PM | 83 | 136 | 19 | 0 | 238 | 78 | 191 | 50 | 0 | 319 | 128 | 266 | 67 | 0 | 461 | 103 | 238 | 32 | 1 | 374 | 1392 |
| Total | 341 | 550 | 117 | 1 | 1009 | 337 | 841 | 291 | 1 | 1470 | 469 | 1042 | 266 | 2 | 1779 | 422 | 1089 | 132 | 1 | 1644 | 5902 |
| Grand Total | 3048 | 5011 | 1019 | 26 | 9104 | 2297 | 5582 | 2625 | 10 | 10514 | 3404 | 7862 | 1950 | 17 | 13233 | 2591 | 8178 | 1310 | 14 | 12093 | 44944 |
| Apprch \% | 33.5 | 55 | 11.2 | 0.3 |  | 21.8 | 53.1 | 25 | 0.1 |  | 25.7 | 59.4 | 14.7 | 0.1 |  | 21.4 | 67.6 | 10.8 | 0.1 |  |  |
| Total \% | 6.8 | 11.1 | 2.3 | 0.1 | 20.3 | 5.1 | 12.4 | 5.8 | 0 | 23.4 | 7.6 | 17.5 | 4.3 | 0 | 29.4 | 5.8 | 18.2 | 2.9 | 0 | 26.9 |  |

 Peak Hour Analysis From 10:00 AM to 02:00 PM - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 01:15 PM

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| $01: 15 ~ P M ~$ | 89 | 160 | $\mathbf{4 7}$ | 0 | 296 | 64 | 139 | 89 | 0 | 292 | 109 | $\mathbf{2 6 9}$ | 59 | $\mathbf{2}$ | $\mathbf{4 3 9}$ | $\mathbf{8 5}$ | $\mathbf{2 6 5}$ | 31 | $\mathbf{4}$ | $\mathbf{3 8 5}$ | 1412 |
| $01: 30 \mathrm{PM}$ | 96 | 155 | 34 | 2 | 287 | 79 | 189 | 87 | 0 | 355 | 108 | 247 | 49 | 2 | 406 | 69 | 239 | $\mathbf{5 5}$ | 0 | 363 | 1411 |
| $01: 45 \mathrm{PM}$ | $\mathbf{1 0 7}$ | 143 | 38 | $\mathbf{5}$ | 293 | 75 | 170 | $\mathbf{9 2}$ | 0 | 337 | 94 | 228 | $\mathbf{6 1}$ | 0 | 383 | 70 | 230 | 40 | 1 | 341 | 1354 |
| $02: 00 \mathrm{PM}$ | 105 | $\mathbf{1 7 2}$ | 29 | 1 | $\mathbf{3 0 7}$ | $\mathbf{8 0}$ | $\mathbf{1 9 7}$ | 88 | 0 | $\mathbf{3 6 5}$ | $\mathbf{1 1 6}$ | 257 | 60 | 0 | 433 | 80 | $\mathbf{2 4 6}$ | 53 | 0 | 379 | $\mathbf{1 4 8 4}$ |
| Total Volume | 397 | 630 | 148 | 8 | 1183 | 298 | 695 | 356 | 0 | 1349 | 427 | 1001 | 229 | 4 | 1661 | 304 | 980 | 179 | 5 | 1468 | 5661 |
| \% App.Total | 33.6 | 53.3 | 12.5 | 0.7 |  | 22.1 | 51.5 | 26.4 | 0 |  | 25.7 | 60.3 | 13.8 | 0.2 |  | 20.7 | 66.8 | 12.2 | 0.3 |  |  |
| PHF | .928 | .916 | .787 | .400 | .963 | .931 | .882 | .967 | .000 | .924 | .920 | .930 | .939 | .500 | .946 | .894 | .925 | .814 | .313 | .953 | .954 |

File Name : Not Named 1
Site Code : 00000000 Start Date : 12/20/2016 Page No : 2

|  | NOVA ROAD Northbound |  |  |  |  | NOVA ROAD Southbound |  |  |  |  | STATE ROAD 421 Eastbound |  |  |  |  | STATE ROAD 421 Westbound |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Start Time | Left | Thru | Right | Peds | App.Total | Left | Thru | Right | Peds | App.Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App.Total | Int. Total |
| Peak Hour Analysis From 10:00 AM to 02:00 PM - Peak 1 of 1 Peak Hour for Each Approach Begins at: |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 12:30 PM |  |  |  |  | 01:15 PM |  |  |  |  | 12:45 PM |  |  |  |  | 11:45 AM |  |  |  |  |  |
| +0 mins. | 88 | 154 | 45 | 1 | 288 | 64 | 139 | 89 | 0 | 292 | 91 | 274 | 55 | 1 | 421 | 65 | 270 | 40 | 0 | 375 |  |
| +15 mins. | 101 | 154 | 37 | 0 | 292 | 79 | 189 | 87 | 0 | 355 | 97 | 260 | 71 | 0 | 428 | 85 | 280 | 39 | 0 | 404 |  |
| +30 mins. | 97 | 196 | 38 | 3 | 334 | 75 | 170 | 92 | 0 | 337 | 109 | 269 | 59 | 2 | 439 | 95 | 275 | 45 | 0 | 415 |  |
| +45 mins. | 89 | 160 | 47 | 0 | 296 | 80 | 197 | 88 | 0 | 365 | 108 | 247 | 49 | 2 | 406 | 97 | 232 | 45 | 0 | 374 |  |
| Total Volume | 375 | 664 | 167 | 4 | 1210 | 298 | 695 | 356 | 0 | 1349 | 405 | 1050 | 234 | 5 | 1694 | 342 | 1057 | 169 | 0 | 1568 |  |
| \% App. Total | 31 | 54.9 | 13.8 | 0.3 |  | 22.1 | 51.5 | 26.4 | 0 |  | 23.9 | 62 | 13.8 | 0.3 |  | 21.8 | 67.4 | 10.8 | 0 |  |  |
| PHF | . 928 | . 847 | . 888 | . 333 | . 906 | . 931 | . 882 | . 967 | . 000 | . 924 | . 929 | . 958 | . 824 | . 625 | . 965 | . 881 | . 944 | . 939 | . 000 | . 945 |  |
| Peak Hour Analysis From 02:15 PM to 05:45 PM - Peak 1 of 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Peak Hour for Entire Intersection Begins at 02:45 PM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02:45 PM | 120 | 171 | 42 | 0 | 333 | 91 | 191 | 92 | 1 | 375 | 124 | 267 | 65 | 0 | 456 | 75 | 219 | 41 | 0 | 335 | 1499 |
| 03:00 PM | 84 | 176 | 32 | 0 | 292 | 71 | 195 | 87 | 0 | 353 | 126 | 295 | 67 | 0 | 488 | 70 | 300 | 57 | 1 | 428 | 1561 |
| 03:15 PM | 109 | 177 | 30 | 0 | 316 | 80 | 233 | 98 | 0 | 411 | 121 | 237 | 59 | 0 | 417 | 77 | 285 | 52 | 1 | 415 | 1559 |
| 03:30 PM | 102 | 166 | 32 | 1 | 301 | 65 | 197 | 93 | 1 | 356 | 118 | 282 | 73 | 0 | 473 | 59 | 249 | 41 | 1 | 350 | 1480 |
| Total Volume | 415 | 690 | 136 | 1 | 1242 | 307 | 816 | 370 | 2 | 1495 | 489 | 1081 | 264 | 0 | 1834 | 281 | 1053 | 191 | 3 | 1528 | 6099 |
| \% App. Total | 33.4 | 55.6 | 11 | 0.1 |  | 20.5 | 54.6 | 24.7 | 0.1 |  | 26.7 | 58.9 | 14.4 | 0 |  | 18.4 | 68.9 | 12.5 | 0.2 |  |  |
| PHF | . 865 | . 975 | . 810 | . 250 | . 932 | . 843 | . 876 | . 944 | . 500 | . 909 | . 970 | . 916 | . 904 | . 000 | . 940 | . 912 | . 878 | . 838 | . 750 | . 893 | . 977 |

Peak Hour Analysis From 02:15 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

|  | 02:45 PM |  |  |  |  | 04:45 PM |  |  |  |  | 03:30 PM |  |  |  |  | 04:15 PM |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| +0 mins. | 120 | 171 | 42 | 0 | 333 | 79 | 204 | 74 | 0 | 357 | 118 | 282 | 73 | 0 | 473 | 88 | 317 | 49 | 0 | 454 |
| +15 mins. | 84 | 176 | 32 | 0 | 292 | 61 | 217 | 87 | 1 | 366 | 110 | 301 | 49 | 0 | 460 | 105 | 288 | 27 | 0 | 420 |
| +30 mins. | 109 | 177 | 30 | 0 | 316 | 101 | 255 | 84 | 0 | 440 | 121 | 258 | 79 | 1 | 459 | 80 | 259 | 30 | 1 | 370 |
| +45 mins. | 102 | 166 | 32 | 1 | 301 | 97 | 178 | 70 | 0 | 345 | 145 | 286 | 52 | 1 | 484 | 128 | 326 | 34 | 0 | 488 |
| Total Volume | 415 | 690 | 136 | 1 | 1242 | 338 | 854 | 315 | 1 | 1508 | 494 | 1127 | 253 | 2 | 1876 | 401 | 1190 | 140 | 1 | 1732 |
| \% App. Total | 33.4 | 55.6 | 11 | 0.1 |  | 22.4 | 56.6 | 20.9 | 0.1 |  | 26.3 | 60.1 | 13.5 | 0.1 |  | 23.2 | 68.7 | 8.1 | 0.1 |  |
| PHF | . 865 | . 975 | . 810 | . 250 | . 932 | . 837 | . 837 | . 905 | . 250 | . 857 | . 852 | . 936 | . 801 | . 500 | . 969 | . 783 | . 913 | . 714 | . 250 | . 887 |




| SECTION | 0 | CITY Port Orange |
| :--- | :--- | :---: | :---: |
| STATE ROUTE | State Road 421 | COUNTY Volusia |
| OBSERVER | TEDS | INTERSECTING ROUTE State Road 5A (Nova Rd) |
|  | DATE 12/20/2016 |  |

REMARKS $\qquad$

| HOURS | West side of |  |  | East side of |  |  | North side of |  |  | South side of |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | State Road 5A |  |  | State Road 5A |  |  | State Road 421 |  |  | State Road 421 |  |  |
|  | NB | SB | TOTAL | NB | SB | TOTAL | EB | WB | TOTAL | EB | WB | TOTAL |
| 10:00-11:00 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| 11:00-12:00 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 |
| 12:00-1:00 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 1:00-2:00 | 1 | 2 | 3 | 0 | 2 | 2 | 0 | 1 | 1 | 2 | 4 | 6 |
| 2:00-3:00 | 1 | 1 | 2 | 1 | 2 | 3 | 1 | 0 | 1 | 2 | 1 | 3 |
| 3:00-4:00 | 0 | 2 | 2 | 0 | 1 | 1 | 2 | 3 | 5 | 1 | 1 | 2 |
| 4:00-5:00 | 0 | 1 | 1 | 0 | 2 | 2 | 1 | 1 | 2 | 0 | 2 | 2 |
| 5:00-6:00 | 2 | 5 | 7 | 1 | 3 | 4 | 1 | 0 | 1 | 0 | 2 | 2 |
| TOTAL | 6 | 11 | 17 | 3 | 11 | 14 | 6 | 6 | 12 | 7 | 11 | 18 |

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|  | NOVA ROAD Northbound |  |  |  |  | NOVA ROAD Southbound |  |  |  |  | STATE ROAD 421 Eastbound |  |  |  |  | STATE ROAD 421 Westbound |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Start Time | Left | Thru | Right | Peds | App.Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Int. Total |
| 10:00 AM | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 3 | 7 | 0 | 0 | 0 | 7 | 9 | 0 | 0 | 0 | 9 | 19 |
| 10:15 AM | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 11 | 0 | 0 | 0 | 11 | 15 | 0 | 0 | 0 | 15 | 28 |
| 10:30 AM | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 7 | 0 | 0 | 0 | 7 | 19 | 0 | 0 | 0 | 19 | 28 |
| 10:45 AM | 1 | 0 | 0 | 0 | 1 | 6 | 0 | 0 | 0 | 6 | 6 | 0 | 0 | 0 | 6 | 16 | 0 | 0 | 0 | 16 | 29 |
| Total | 2 | 0 | 0 | 0 | 2 | 12 | 0 | 0 | 0 | 12 | 31 | 0 | 0 | 0 | 31 | 59 | 0 | 0 | 0 | 59 | 104 |
| 11:00 AM | 1 | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 4 | 13 | 0 | 0 | 0 | 13 | 26 | 0 | 0 | 0 | 26 | 44 |
| 11:15 AM | 6 | 0 | 0 | 0 | 6 | 2 | 0 | 0 | 0 | 2 | 4 | 0 | 0 | 0 | 4 | 19 | 0 | 0 | 0 | 19 | 31 |
| 11:30 AM | 2 | 0 | 0 | 0 | 2 | 6 | 0 | 0 | 0 | 6 | 9 | 0 | 0 | 0 | 9 | 24 | 0 | 0 | 0 | 24 | 41 |
| 11:45 AM | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 3 | 21 | 0 | 0 | 0 | 21 | 26 |
| Total | 9 | 0 | 0 | 0 | 9 | 14 | 0 | 0 | 0 | 14 | 29 | 0 | 0 | 0 | 29 | 90 | 0 | 0 | 0 | 90 | 142 |
| 12:00 PM | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 8 | 11 | 0 | 0 | 0 | 11 | 25 | 0 | 0 | 0 | 25 | 44 |
| 12:15 PM | 2 | 0 | 0 | 0 | 2 | 6 | 0 | 0 | 0 | 6 | 12 | 0 | 0 | 0 | 12 | 35 | 0 | 0 | 0 | 35 | 55 |
| 12:30 PM | 3 | 0 | 0 | 0 | 3 | 8 | 0 | 0 | 0 | 8 | 10 | 0 | 0 | 0 | 10 | 26 | 0 | 0 | 0 | 26 | 47 |
| 12:45 PM | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 5 | 11 | 0 | 0 | 0 | 11 | 16 | 0 | 0 | 0 | 16 | 32 |
| Total | 5 | 0 | 0 | 0 | 5 | 27 | 0 | 0 | 0 | 27 | 44 | 0 | 0 | 0 | 44 | 102 | 0 | 0 | 0 | 102 | 178 |
| 01:00 PM | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 3 | 4 | 0 | 0 | 0 | 4 | 14 | 0 | 0 | 0 | 14 | 21 |
| 01:15 PM | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 3 | 7 | 0 | 0 | 0 | 7 | 20 | 0 | 0 | 0 | 20 | 30 |
| 01:30 PM | 2 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 1 | 10 | 0 | 0 | 0 | 10 | 18 | 0 | 0 | 0 | 18 | 31 |
| 01:45 PM | 4 | 0 | 0 | 0 | 4 | 2 | 0 | 0 | 0 | 2 | 5 | 0 | 0 | 0 | 5 | 17 | 0 | 0 | 0 | 17 | 28 |
| Total | 6 | 0 | 0 | 0 | 6 | 9 | 0 | 0 | 0 | 9 | 26 | 0 | 0 | 0 | 26 | 69 | 0 | 0 | 0 | 69 | 110 |
| 02:00 PM | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 5 | 13 | 0 | 0 | 0 | 13 | 21 | 0 | 0 | 0 | 21 | 39 |
| 02:15 PM | 1 | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 4 | 8 | 0 | 0 | 0 | 8 | 26 | 0 | 0 | 0 | 26 | 39 |
| 02:30 PM | 2 | 0 | 0 | 0 | 2 | 4 | 0 | 0 | 0 | 4 | 7 | 0 | 0 | 0 | 7 | 18 | 0 | 0 | 0 | 18 | 31 |
| 02:45 PM | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 4 | 12 | 0 | 0 | 0 | 12 | 23 | 0 | 0 | 0 | 23 | 39 |
| Total | 3 | 0 | 0 | 0 | 3 | 17 | 0 | 0 | 0 | 17 | 40 | 0 | 0 | 0 | 40 | 88 | 0 | 0 | 0 | 88 | 148 |
| 03:00 PM | 1 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 2 | 8 | 0 | 0 | 0 | 8 | 23 | 0 | 0 | 0 | 23 | 34 |
| 03:15 PM | 4 | 0 | 0 | 0 | 4 | 6 | 0 | 0 | 0 | 6 | 6 | 0 | 0 | 0 | 6 | 18 | 0 | 0 | 0 | 18 | 34 |
| 03:30 PM | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 11 | 0 | 0 | 0 | 11 | 16 | 0 | 0 | 0 | 16 | 29 |
| 03:45 PM | 2 | 0 | 0 | 0 | 2 | 5 | 0 | 0 | 0 | 5 | 3 | 0 | 0 | 0 | 3 | 26 | 0 | 0 | 0 | 26 | 36 |
| Total | 7 | 0 | 0 | 0 | 7 | 15 | 0 | 0 | 0 | 15 | 28 | 0 | 0 | 0 | 28 | 83 | 0 | 0 | 0 | 83 | 133 |
| 04:00 PM | 2 | 0 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 3 | 12 | 0 | 0 | 0 | 12 | 23 | 0 | 0 | 0 | 23 | 40 |
| 04:15 PM | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 4 | 6 | 0 | 0 | 0 | 6 | 16 | 0 | 0 | 0 | 16 | 26 |
| 04:30 PM | 1 | 0 | 0 | 0 | 1 | 7 | 0 | 0 | 0 | 7 | 3 | 0 | 0 | 0 | 3 | 24 | 0 | 0 | 0 | 24 | 35 |
| 04:45 PM | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 4 | 2 | 0 | 0 | 0 | 2 | 20 | 0 | 0 | 0 | 20 | 26 |
| Total | 3 | 0 | 0 | 0 | 3 | 18 | 0 | 0 | 0 | 18 | 23 | 0 | 0 | 0 | 23 | 83 | 0 | 0 | 0 | 83 | 127 |
| 05:00 PM | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 4 | 11 | 0 | 0 | 0 | 11 | 22 | 0 | 0 | 0 | 22 | 37 |
| 05:15 PM | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 10 | 14 | 0 | 0 | 0 | 14 | 38 | 0 | 0 | 0 | 38 | 62 |
| 05:30 PM | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 4 | 2 | 0 | 0 | 0 | 2 | 19 | 0 | 0 | 0 | 19 | 25 |
| 05:45 PM | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 8 | 0 | 0 | 0 | 8 | 28 | 0 | 0 | 0 | 28 | 38 |
| Total | 1 | 0 | 0 | 0 | 1 | 19 | 0 | 0 | 0 | 19 | 35 | 0 | 0 | 0 | 35 | 107 | 0 | 0 | 0 | 107 | 162 |
| Grand Total | 36 | 0 | 0 | 0 | 36 | 131 | 0 | 0 | 0 | 131 | 256 | 0 | 0 | 0 | 256 | 681 | 0 | 0 | 0 | 681 | 1104 |
| Apprch \% | 100 | 0 | 0 | 0 |  | 100 | 0 | 0 | 0 |  | 100 | 0 | 0 | 0 |  | 100 | 0 | 0 | 0 |  |  |
| Total \% | 3.3 | 0 | 0 | 0 | 3.3 | 11.9 | 0 | 0 | 0 | 11.9 | 23.2 | 0 | 0 | 0 | 23.2 | 61.7 | 0 | 0 | 0 | 61.7 |  |


|  | NOVA ROAD Northbound |  |  |  |  | NOVA ROAD Southbound |  |  |  |  | STATE ROAD 421 <br> Eastbound |  |  |  |  | STATE ROAD 421 Westbound |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Start Time | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App.Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Int.Total |
| Peak Hour Analysis From 10:00 AM to 02:00 PM - Peak 1 of 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Peak Hour for Entire Intersection Begins at 12:00 PM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 12:00 PM | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 8 | 11 | 0 | 0 | 0 | 11 | 25 | 0 | 0 | 0 | 25 | 44 |
| 12:15 PM | 2 | 0 | 0 | 0 | 2 | 6 | 0 | 0 | 0 | 6 | 12 | 0 | 0 | 0 | 12 | 35 | 0 | 0 | 0 | 35 | 55 |
| 12:30 PM | 3 | 0 | 0 | 0 | 3 | 8 | 0 | 0 | 0 | 8 | 10 | 0 | 0 | 0 | 10 | 26 | 0 | 0 | 0 | 26 | 47 |
| 12:45 PM | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 5 | 11 | 0 | 0 | 0 | 11 | 16 | 0 | 0 | 0 | 16 | 32 |
| Total Volume | 5 | 0 | 0 | 0 | 5 | 27 | 0 | 0 | 0 | 27 | 44 | 0 | 0 | 0 | 44 | 102 | 0 | 0 | 0 | 102 | 178 |
| \% App.Total | 100 | 0 | 0 | 0 |  | 100 | 0 | 0 | 0 |  | 100 | 0 | 0 | 0 |  | 100 | 0 | 0 | 0 |  |  |
| PHF | . 417 | . 000 | . 000 | . 000 | . 417 | . 844 | . 000 | . 000 | . 000 | . 844 | . 917 | . 000 | . 000 | . 000 | . 917 | . 729 | . 000 | . 000 | . 000 | . 729 | . 809 |

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|  | NOVA ROAD Northbound |  |  |  |  | NOVA ROAD Southbound |  |  |  |  | STATE ROAD 421 <br> Eastbound |  |  |  |  | STATE ROAD 421 Westbound |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Start Time | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App.Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Int. Total |

Peak Hour Analysis From 10:00 AM to 02:00 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

|  | 10:45 AM |  |  |  |  | 12:00 PM |  |  |  |  | 12:00 PM |  |  |  |  | 11:45 AM |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| +0 mins. | 1 | 0 | 0 | 0 | 1 | 8 | 0 | 0 | 0 | 8 | 11 | 0 | 0 | 0 | 11 | 21 | 0 | 0 | 0 | 21 |
| +15 mins. | 1 | 0 | 0 | 0 | 1 | 6 | 0 | 0 | 0 | 6 | 12 | 0 | 0 | 0 | 12 | 25 | 0 | 0 | 0 | 25 |
| +30 mins. | 6 | 0 | 0 | 0 | 6 | 8 | 0 | 0 | 0 | 8 | 10 | 0 | 0 | 0 | 10 | 35 | 0 | 0 | 0 | 35 |
| +45 mins. | 2 | 0 | 0 | 0 | 2 | 5 | 0 | 0 | 0 | 5 | 11 | 0 | 0 | 0 | 11 | 26 | 0 | 0 | 0 | 26 |
| Total Volume | 10 | 0 | 0 | 0 | 10 | 27 | 0 | 0 | 0 | 27 | 44 | 0 | 0 | 0 | 44 | 107 | 0 | 0 | 0 | 107 |
| \% App.Total | 100 | 0 | 0 | 0 |  | 100 | 0 | 0 | 0 |  | 100 | 0 | 0 | 0 |  | 100 | 0 | 0 | 0 |  |
| PHF | . 417 | . 000 | . 000 | . 000 | . 417 | . 844 | . 000 | . 000 | . 000 | . 844 | . 917 | . 000 | . 000 | . 000 | . 917 | . 764 | . 000 | . 000 | . 000 | . 764 |

Peak Hour Analysis From 02:15 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 05:00 PM

| eak |  | , |  | gin | 05:00 | M |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 05:00 PM | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 4 | 11 | 0 | 0 | 0 | 11 | 22 | 0 | 0 | 0 | 22 | 37 |
| 05:15 PM | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 10 | 14 | 0 | 0 | 0 | 14 | 38 | 0 | 0 | 0 | 38 | 62 |
| 05:30 PM | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 4 | 2 | 0 | 0 | 0 | 2 | 19 | 0 | 0 | 0 | 19 | 25 |
| 05:45 PM | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 8 | 0 | 0 | 0 | 8 | 28 | 0 | 0 | 0 | 28 | 38 |
| Total Volume | 1 | 0 | 0 | 0 | 1 | 19 | 0 | 0 | 0 | 19 | 35 | 0 | 0 | 0 | 35 | 107 | 0 | 0 | 0 | 107 | 162 |
| \% App. Total | 100 | 0 | 0 | 0 |  | 100 | 0 | 0 | 0 |  | 100 | 0 | 0 | 0 |  | 100 | 0 | 0 | 0 |  |  |
| PHF | . 250 | . 000 | . 000 | . 000 | . 250 | . 475 | . 000 | . 000 | . 000 | . 475 | . 625 | . 000 | . 000 | . 000 | . 625 | . 704 | . 000 | . 000 | . 000 | . 704 | . 653 |

Peak Hour Analysis From 02:15 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

|  | 03:15 PM |  |  |  |  | 04:30 PM |  |  |  |  | 02:45 PM |  |  |  |  | 05:00 PM |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| +0 mins. | 4 | 0 | 0 | 0 | 4 | 7 | 0 | 0 | 0 | 7 | 12 | 0 | 0 | 0 | 12 | 22 | 0 | 0 | 0 | 22 |
| +15 mins. | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 4 | 8 | 0 | 0 | 0 | 8 | 38 | 0 | 0 | 0 | 38 |
| +30 mins. | 2 | 0 | 0 | 0 | 2 | 4 | 0 | 0 | 0 | 4 | 6 | 0 | 0 | 0 | 6 | 19 | 0 | 0 | 0 | 19 |
| +45 mins. | 2 | 0 | 0 | 0 | 2 | 10 | 0 | 0 | 0 | 10 | 11 | 0 | 0 | 0 | 11 | 28 | 0 | 0 | 0 | 28 |
| Total Volume | 8 | 0 | 0 | 0 | 8 | 25 | 0 | 0 | 0 | 25 | 37 | 0 | 0 | 0 | 37 | 107 | 0 | 0 | 0 | 107 |
| \% App. Total | 100 | 0 | 0 | 0 |  | 100 | 0 | 0 | 0 |  | 100 | 0 | 0 | 0 |  | 100 | 0 | 0 | 0 |  |
| PHF | . 500 | . 000 | . 000 | . 000 | . 500 | . 625 | . 000 | . 000 | . 000 | . 625 | . 771 | . 000 | . 000 | . 000 | . 771 | . 704 | . 000 | . 000 | . 000 | . 704 |

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|  | NOVA ROAD Northbound |  |  |  |  | NOVA ROAD Southbound |  |  |  |  | STATE ROAD 421 <br> Eastbound |  |  |  |  | STATE ROAD 421 Westbound |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Start Time | Left | Thru | Right | Peds | App.Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Int. Total |
| 10:00 AM | 5 | 1 | 0 | 0 | 6 | 1 | 1 | 0 | 1 | 3 | 1 | 4 | 0 | 0 | 5 | 1 | 6 | 0 | 0 | 7 | 21 |
| 10:15 AM | 0 | 2 | 1 | 0 | 3 | 0 | 1 | 1 | 1 | 3 | 0 | 5 | 1 | 0 | 6 | 0 | 8 | 2 | 0 | 10 | 22 |
| 10:30 AM | 2 | 1 | 0 | 0 | 3 | 0 | 3 | 1 | 0 | 4 | 0 | 8 | 0 | 0 | 8 | 1 | 8 | 0 | 0 | 9 | 24 |
| 10:45 AM | 1 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 0 | 0 | 7 | 1 | 7 | 0 | 0 | 8 | 17 |
| Total | 8 | 5 | 1 | 0 | 14 | 1 | 5 | 2 | 2 | 10 | 3 | 22 | 1 | 0 | 26 | 3 | 29 | 2 | 0 | 34 | 84 |
| 11:00 AM | 4 | 3 | 0 | 0 | 7 | 0 | 0 | 1 | 0 | 1 | 0 | 2 | 0 | 0 | 2 | 0 | 4 | 0 | 0 | 4 | 14 |
| 11:15 AM | 4 | 3 | 2 | 0 | 9 | 1 | 2 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 2 | 15 |
| 11:30 AM | 2 | 1 | 0 | 0 | 3 | 0 | 2 | 1 | 0 | 3 | 0 | 4 | 2 | 1 | 7 | 0 | 5 | 0 | 0 | 5 | 18 |
| 11:45 AM | 2 | 2 | 1 | 0 | 5 | 0 | 0 | 1 | 0 | 1 | 1 | 2 | 0 | 0 | 3 | 0 | 3 | 1 | 0 | 4 | 13 |
| Total | 12 | 9 | 3 | 0 | 24 | 1 | 4 | 3 | 0 | 8 | 1 | 9 | 2 | 1 | 13 | 0 | 14 | 1 | 0 | 15 | 60 |
| 12:00 PM | 3 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 3 | 0 | 4 | 0 | 0 | 4 | 10 |
| 12:15 PM | 1 | 2 | 1 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 3 | 0 | 7 | 1 | 0 | 8 | 15 |
| 12:30 PM | 0 | 2 | 0 | 1 | 3 | 0 | 1 | 0 | 2 | 3 | 0 | 2 | 1 | 1 | 4 | 0 | 2 | 0 | 0 | 2 | 12 |
| 12:45 PM | 3 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 1 | 0 | 3 | 1 | 1 | 5 | 0 | 5 | 0 | 0 | 5 | 14 |
| Total | 7 | 4 | 1 | 1 | 13 | 0 | 1 | 1 | 2 | 4 | 1 | 9 | 3 | 2 | 15 | 0 | 18 | 1 | 0 | 19 | 51 |
| 01:00 PM | 3 | 1 | 0 | 3 | 7 | 0 | 2 | 3 | 0 | 5 | 0 | 2 | 0 | 0 | 2 | 1 | 3 | 0 | 0 | 4 | 18 |
| 01:15 PM | 0 | 2 | 1 | 0 | 3 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 2 | 0 | 1 | 0 | 4 | 5 | 11 |
| 01:30 PM | 2 | 1 | 1 | 1 | 5 | 2 | 2 | 1 | 0 | 5 | 1 | 6 | 0 | 2 | 9 | 0 | 0 | 0 | 0 | 0 | 19 |
| 01:45 PM | 1 | 1 | 0 | 4 | 6 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 1 | 0 | 6 | 0 | 2 | 0 | 1 | 3 | 15 |
| Total | 6 | 5 | 2 | 8 | 21 | 2 | 5 | 4 | 0 | 11 | 2 | 13 | 2 | 2 | 19 | 1 | 6 | 0 | 5 | 12 | 63 |
| 02:00 PM | 3 | 1 | 0 | 1 | 5 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 4 | 1 | 0 | 5 | 12 |
| 02:15 PM | 2 | 3 | 2 | 0 | 7 | 0 | 0 | 1 | 0 | 1 | 0 | 3 | 1 | 0 | 4 | 0 | 1 | 2 | 0 | 3 | 15 |
| 02:30 PM | 0 | 2 | 0 | 2 | 4 | 0 | 4 | 0 | 0 | 4 | 2 | 2 | 0 | 0 | 4 | 0 | 2 | 0 | 0 | 2 | 14 |
| 02:45 PM | 1 | 1 | 0 | 0 | 2 | 1 | 1 | 0 | 1 | 3 | 1 | 7 | 1 | 0 | 9 | 0 | 6 | 0 | 0 | 6 | 20 |
| Total | 6 | 7 | 2 | 3 | 18 | 2 | 5 | 1 | 1 | 9 | 3 | 13 | 2 | 0 | 18 | 0 | 13 | 3 | 0 | 16 | 61 |
| 03:00 PM | 2 | 0 | 0 | 0 | 2 | 1 | 4 | 0 | 0 | 5 | 0 | 6 | 0 | 0 | 6 | 0 | 4 | 0 | 1 | 5 | 18 |
| 03:15 PM | 1 | 2 | 1 | 0 | 4 | 0 | 2 | 0 | 0 | 2 | 2 | 3 | 1 | 0 | 6 | 0 | 1 | 1 | 0 | 2 | 14 |
| 03:30 PM | 2 | 3 | 0 | 0 | 5 | 0 | 1 | 1 | 1 | 3 | 0 | 3 | 0 | 0 | 3 | 0 | 6 | 2 | 0 | 8 | 19 |
| 03:45 PM | 1 | 3 | 0 | 0 | 4 | 0 | 1 | 0 | 0 | 1 | 1 | 5 | 0 | 0 | 6 | 1 | 3 | 1 | 1 | 6 | 17 |
| Total | 6 | 8 | 1 | 0 | 15 | 1 | 8 | 1 | 1 | 11 | 3 | 17 | 1 | 0 | 21 | 1 | 14 | 4 | 2 | 21 | 68 |
| 04:00 PM | 5 | 1 | 0 | 0 | 6 | 1 | 4 | 0 | 0 | 5 | 0 | 0 | 2 | 0 | 2 | 0 | 5 | 0 | 0 | 5 | 18 |
| 04:15 PM | 1 | 3 | 1 | 0 | 5 | 1 | 0 | 1 | 0 | 2 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 9 |
| 04:30 PM | 1 | 1 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 2 | 1 | 2 | 0 | 0 | 3 | 1 | 4 | 0 | 0 | 5 | 12 |
| 04:45 PM | 2 | 1 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 3 | 0 | 3 | 0 | 1 | 4 | 11 |
| Total | 9 | 6 | 1 | 1 | 17 | 2 | 6 | 1 | 0 | 9 | 1 | 4 | 4 | 0 | 9 | 1 | 13 | 0 | 1 | 15 | 50 |
| 05:00 PM | 4 | 1 | 0 | 1 | 6 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 5 | 0 | 3 | 1 | 0 | 4 | 15 |
| 05:15 PM | 1 | 2 | 1 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 05:30 PM | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 1 | 5 |
| 05:45 PM | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 3 | 5 |
| Total | 7 | 3 | 1 | 1 | 12 | 0 | 1 | 0 | 0 | 1 | 1 | 6 | 0 | 1 | 8 | 2 | 4 | 1 | 1 | 8 | 29 |
| Grand Total | 61 | 47 | 12 | 14 | 134 | 9 | 35 | 13 | 6 | 63 | 15 | 93 | 15 | 6 | 129 | 8 | 111 | 12 | 9 | 140 | 466 |
| Apprch \% | 45.5 | 35.1 | 9 | 10.4 |  | 14.3 | 55.6 | 20.6 | 9.5 |  | 11.6 | 72.1 | 11.6 | 4.7 |  | 5.7 | 79.3 | 8.6 | 6.4 |  |  |
| Total \% | 13.1 | 10.1 | 2.6 | 3 | 28.8 | 1.9 | 7.5 | 2.8 | 1.3 | 13.5 | 3.2 | 20 | 3.2 | 1.3 | 27.7 | 1.7 | 23.8 | 2.6 | 1.9 | 30 |  |

 Peak Hour Analysis From 10:00 AM to 02:00 PM - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 10:00 AM

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| 10:00 AM | $\mathbf{5}$ | 1 | 0 | 0 | $\mathbf{6}$ | $\mathbf{1}$ | 1 | 0 | $\mathbf{1}$ | 3 | 1 | 4 | 0 | 0 | 5 | $\mathbf{1}$ | 6 | 0 | 0 | 7 | 21 |
| $10: 15 \mathrm{AM}$ | 0 | $\mathbf{2}$ | $\mathbf{1}$ | 0 | 3 | 0 | 1 | $\mathbf{1}$ | 1 | 3 | 0 | 5 | $\mathbf{1}$ | 0 | 6 | 0 | $\mathbf{8}$ | $\mathbf{2}$ | 0 | $\mathbf{1 0}$ | 22 |
| $10: 30 \mathrm{AM}$ | 2 | 1 | 0 | 0 | 3 | 0 | $\mathbf{3}$ | 1 | 0 | $\mathbf{4}$ | 0 | $\mathbf{8}$ | 0 | 0 | $\mathbf{8}$ | 1 | 8 | 0 | 0 | 9 | $\mathbf{2 4}$ |
| 10:45 AM | 1 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | $\mathbf{2}$ | 5 | 0 | 0 | 7 | 1 | 7 | 0 | 0 | 8 | 17 |
| Total Volume | 8 | 5 | 1 | 0 | 14 | 1 | 5 | 2 | 2 | 10 | 3 | 22 | 1 | 0 | 26 | 3 | 29 | 2 | 0 | 34 | 84 |
| \% App. Total | 57.1 | 35.7 | 7.1 | 0 |  | 10 | 50 | 20 | 20 |  | 11.5 | 84.6 | 3.8 | 0 |  | 8.8 | 85.3 | 5.9 | 0 |  |  |
| PHF | 400 | 625 | 250 | 000 | 583 | 250 | 417 | 500 | 500 | 625 | 375 | 688 | 250 | 000 | 813 | 750 | 906 | 250 | 000 | 850 | 875 |

File Name: TMC (8-hr)
Site Code : 00000000
Start Date : 12/20/2016
Page No : 2

|  | NOVA ROAD Northbound |  |  |  |  | NOVA ROAD Southbound |  |  |  |  | STATE ROAD 421 Eastbound |  |  |  |  | STATE ROAD 421 Westbound |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Start Time | Left | Thru | Right | Peds | App.Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | t. Total |

Peak Hour Analysis From 10:00 AM to 02:00 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

|  | 11:00 AM |  |  |  |  | 12:45 PM |  |  |  |  | 10:00 AM |  |  |  |  | 10:00 AM |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| +0 mins. | 4 | 3 | 0 | 0 | 7 | 0 | 0 | 1 | 0 | 1 | 1 | 4 | 0 | 0 | 5 | 1 | 6 | 0 | 0 | 7 |
| +15 mins. | 4 | 3 | 2 | 0 | 9 | 0 | 2 | 3 | 0 | 5 | 0 | 5 | 1 | 0 | 6 | 0 | 8 | 2 | 0 | 10 |
| +30 mins. | 2 | 1 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 1 | 0 | 8 | 0 | 0 | 8 | 1 | 8 | 0 | 0 | 9 |
| +45 mins. | 2 | 2 | 1 | 0 | 5 | 2 | 2 | 1 | 0 | 5 | 2 | 5 | 0 | 0 | 7 | 1 | 7 | 0 | 0 | 8 |
| Total Volume | 12 | 9 | 3 | 0 | 24 | 2 | 5 | 5 | 0 | 12 | 3 | 22 | 1 | 0 | 26 | 3 | 29 | 2 | 0 | 34 |
| \% App. Total | 50 | 37.5 | 12.5 | 0 |  | 16.7 | 41.7 | 41.7 | 0 |  | 11.5 | 84.6 | 3.8 | 0 |  | 8.8 | 85.3 | 5.9 | 0 |  |
| PHF | . 750 | 750 | . 375 | . 000 | .667 | . 250 | . 625 | . 417 | . 000 | . 600 | . 375 | . 688 | . 250 | 000 | . 813 | . 750 | . 906 | . 250 | 000 | . 850 |

Peak Hour Analysis From 02:15 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 02:45 PM

| ak Hour | Entir |  | , | gi |  | M |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 02:45 PM | 1 | 1 | 0 | 0 | 2 | 1 | 1 | 0 | 1 | 3 | 1 | 7 | 1 | 0 | 9 | 0 | 6 | 0 | 0 | 6 | 20 |
| 03:00 PM | 2 | 0 | 0 | 0 | 2 | 1 | 4 | 0 | 0 | 5 | 0 | 6 | 0 | 0 | 6 | 0 | 4 | 0 | 1 | 5 | 18 |
| 03:15 PM | 1 | 2 | 1 | 0 | 4 | 0 | 2 | 0 | 0 | 2 | 2 | 3 | 1 | 0 | 6 | 0 | 1 | 1 | 0 | 2 | 14 |
| 03:30 PM | 2 | 3 | 0 | 0 | 5 | 0 | 1 | 1 | 1 | 3 | 0 | 3 | 0 | 0 | 3 | 0 | 6 | 2 | 0 | 8 | 19 |
| Total Volume | 6 | 6 | 1 | 0 | 13 | 2 | 8 | 1 | 2 | 13 | 3 | 19 | 2 | 0 | 24 | 0 | 17 | 3 | 1 | 21 | 71 |
| \% App.Total | 46.2 | 46.2 | 7.7 | 0 |  | 15.4 | 61.5 | 7.7 | 15.4 |  | 12.5 | 79.2 | 8.3 | 0 |  | 0 | 81 | 14.3 | 4.8 |  |  |
| PHF | . 750 | . 500 | . 250 | . 000 | . 650 | . 500 | . 500 | . 250 | . 500 | .650 | . 375 | . 679 | . 500 | . 000 | . 667 | . 000 | . 708 | . 375 | . 250 | . 656 | . 888 |

Peak Hour Analysis From 02:15 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

|  | 03:30 PM |  |  |  |  | 02:30 PM |  |  |  |  | 02:30 PM |  |  |  |  | 02:45 PM |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| +0 mins. | 2 | 3 | 0 | 0 | 5 | 0 | 4 | 0 | 0 | 4 | 2 | 2 | 0 | 0 | 4 | 0 | 6 | 0 | 0 | 6 |
| +15 mins. | 1 | 3 | 0 | 0 | 4 | 1 | 1 | 0 | 1 | 3 | 1 | 7 | 1 | 0 | 9 | 0 | 4 | 0 | 1 | 5 |
| +30 mins. | 5 | 1 | 0 | 0 | 6 | 1 | 4 | 0 | 0 | 5 | 0 | 6 | 0 | 0 | 6 | 0 | 1 | 1 | 0 | 2 |
| +45 mins. | 1 | 3 | 1 | 0 | 5 | 0 | 2 | 0 | 0 | 2 | 2 | 3 | 1 | 0 | 6 | 0 | 6 | 2 | 0 | 8 |
| Total Volume | 9 | 10 | 1 | 0 | 20 | 2 | 11 | 0 | 1 | 14 | 5 | 18 | 2 | 0 | 25 | 0 | 17 | 3 | 1 | 21 |
| \% App. Total | 45 | 50 | 5 | 0 |  | 14.3 | 78.6 | 0 | 7.1 |  | 20 | 72 | 8 | 0 |  | 0 | 81 | 14.3 | 4.8 |  |
| PHF | . 450 | . 833 | . 250 | . 000 | . 833 | . 500 | . 688 | . 000 | . 250 | . 700 | . 625 | . 643 | . 500 | . 000 | . 694 | . 000 | . 708 | . 375 | . 250 | 656 |


| LOCATION: |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Port O | FREE: |  | DATE: |  |  |  |
| SIGNAL \#: | 152 | CO-ORD: | X | Design |  | M. Tobin |  |

NETWORK \#: Port Orange Area Network \# 60

## Controller Timing Chart

| PHASE | $\mathbf{1}$ | 2 | 3 | 4 | 5 | 6 | 7 | 8 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DIRECTION | EBL | WB | SBL | NB | WBL | EB | NBL | SB |  |
| TURN TYPE | PROT | - | PROT | - | PROT | - | PROT | - |  |
| MIN GREEN | 5 | 15 | 5 | 15 | 5 | 15 | 5 | 15 |  |
| WALK |  | 9 |  | 7 |  | 9 |  | 7 |  |
| PED CLR |  | 36 |  | 41 |  | 29 |  | 36 |  |
| YELLOW | 5.5 | 5.5 | 5.0 | 5.0 | 5.5 | 5.5 | 5.0 | 5.0 |  |
| RED CLR | 2.5 | 2.0 | 3.0 | 3.0 | 2.5 | 2.0 | 3.0 | 3.0 |  |
| EXTENSION | 4 | 4 | 3 | 4 | 4 | 4 | 3 | 4 |  |
| MAX 1 | 25 | 50 | 25 | 40 | 25 | 50 | 25 | 40 |  |
| MAX 2 | 41 | 90 | 25 | 48 | 41 | 90 | 25 | 48 |  |
| MAX 3 |  | - |  | - |  | - |  | - |  |
| DYM MAX |  | 60 |  | 60 |  | 60 |  | 6 |  |
| DYM STP |  | 10 |  | 10 |  | 10 |  |  |  |
| RECALL |  | MIN |  | - |  | MIN |  |  |  |
| DETECTOR | LOCK | LOCK | LOCK | LOCK | LOCK | LOCK | LOCK | LOCK |  |
| FLASH | RED | YELLOW | RED | RED | RED | YELLOW | RED | RED |  |


| COORDINATION TIMINGS |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| PATTERN | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |  |
| CYCLE | 150 | 150 | 160 | - | - | - | - | - |  |
| OFFSET | 93 | 89 | 94 | - | - | - | - | - |  |




| PHASE | $\mathbf{1}$ | $\mathbf{2}$ | $\mathbf{3}$ | $\mathbf{4}$ | $\mathbf{5}$ | $\mathbf{6}$ | $\mathbf{7}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| INITIAL | 5 | 15 | 5 | 15 | 5 | 15 | 5 |
| EXTENSION | 4 | 4 | 3 | 4 | 4 | 4 | 3 |
| YELLOW | 5.5 | 5.5 | 5 | 5 | 5.5 | 5.5 | 5 |
| RED | 2.5 | 2 | 3 | 3 | 2.5 | 2 | 3 |
| Pattern 1 | 24 | 48 | 22 | 56 | 19 | 53 | 27 |
| Pattern 2 | 26 | 48 | 20 | 56 | 27 | 47 | 25 |
| Pattern 3 | 28 | 53 | 23 | 56 | 31 | 50 | 28 |
| Pattern 4 | - | - | - | - | - | - | - |
| Pattern 5 | - | - | - | - | - | - | - |
| Max split | 28 | 53 | 23 | 56 | 31 | 53 | 28 |
| GREEN | 20 | 45.5 | 15 | 48 | 23 | 45.5 | 20 |
| GREEN - Initial | 11 | - | 7 | 29.5 | 14 | - | 12 |
| MAX 2 | 50 | 93 | 15 | 55 | 48 | 96 | 20 |


| $\mathbf{8}$ |
| :---: |
| 15 |
| 4 |
| 5 |
| 3 |
| 51 |
| 51 |
| 51 |
| - |
| - |
| 51 |
| 43 |
| 24.5 |
| 55 |

Dunlawton Ave. @ Nova Rd.

| Phase | Direction | Lane Type | LT Type | Speed | Slope | Width | Yellow | All Red |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Eastbound |  | - | - | 0.00\% | 0 |  |  |
|  |  |  |  | - |  | 0 |  |  |
| 4 | Westbound | Right |  | 25 | 0.00\% | 68 | 3.30 | 2.4 |
| 7 |  | Left |  | 25 |  | 167 |  | 5.1 |
| 2 | Southbound | Through |  | 45 | 0.05\% | 132 | 4.80 | 2.3 |
| 5 |  | Left |  | 25 |  | 107 |  | 3.5 |
| 6 | Northbound | Through |  | 45 | -0.05\% | 112 | 4.80 | 2 |
| 1 |  | U-turn |  | 25 |  | 55 |  | 2.1 |

Note:
The approach speed for a road with rural conditions and a Speed of 50 is 44 mph .









Ref: 10575 TWO \#7

# TECHNICAL MEMORANDUM 

To: $\quad$ Mr. Robert Meth, Senior Planner<br>From: Chris J. Walsh, P.E.<br>Subject: Feasibility Study - State Road 421 at State Road 5A<br>Date: March 27, 2017

We have received comments on the Feasibility Study at the State Road 421 at State Road 5A intersection. We have revised the study accordingly and offer the following responses:

## Comments from Mr. Robert Keeth

Comment \#1: Per Jon Cheney's recommendation, please state in the introduction section that the feasibility study was requested by the City of Port Orange.

Response: Information has been added to the study.
Comment \#2: On page 2, Introduction, please note that the intent of the study was to evaluate the "feasibility" of constructing the improvement in addition to evaluating the need.

Response: Information has been added to the study.
Comment \#3: On page 23, Improvement Concept, please revise the first sentence to note that the purpose of the study was to evaluate the "need" for the intersection improvement as well as the feasibility.

Response: Information has been added to the study.
Comment \#4: There does not seem to be much of a problem with the westbound right turn movement; the report notes that it does not impede the flow of westbound through vehicles, and over the 3-year period, there have been only 3 rear-end crashes in the westbound outside shared right turn/through lane. Operational analysis shows full intersection delay is reduced by only 2.4 seconds per vehicle in the midday peak and 2.9 seconds per vehicle in the afternoon peak. AASHTO Highway Safety Manual provides a Crash Modification Factor of 0.96 with the addition of the right-turn lane. Is this $4 \%$ reduction in total crashes for the intersection reasonable given that rear end crashes in the westbound outside right turn/through lane represented only $2.6 \%$ of crashes? Is the project needed? Please explain in the conclusion section ( pg 27 ) why you are recommending the installation of the westbound right turn lane. Do the seemingly marginal benefits justify it?

Response: It's impossible to conclude if the 4\% is reasonable or not. Perhaps most WB through motorists use the $\mathbf{2}$ inside lanes because they feel the outside lane is predominantly right turns. Thus, the additional density of traffic may contribute to other crashes associated with those 2 lanes (rear ends, red light running, crashes associated with the median opening to the west because the queues extend back, etc). Should this right-turn lane be provided, there could be a better distribution of through vehicles within the WB through lanes. From a
needs perspective, the addition of a turn-lane enhances the capacity of an intersection and has traditionally shown to provide a reduction in crashes based on the CMF. It is also important to note that this is based on current conditions without consideration of future growth. Thus, the turn lane is expected to provide a benefit. Please see the revised conclusion section within the study.

Comment \#5: What affect will this proposed improvement have on pedestrian safety? And will intersection capacity be reduced if additional pedestrian crossing time is required for the extended pedestrian crossing distance?

Response: No issues were noted with vehicle-pedestrian conflicts, right turns on red currently occur at the intersection, and no such crashes occurred relative to this particular right-turn movement over the past five years. Motorists do become more aggressive when they are delayed further, but the right-turn lane is showing an improvement in intersection capacity. Therefore, we do not have a reason to believe pedestrian safety will be diminished. Relative to pedestrian crossing times, they will be increased 3.5 seconds, but pedestrian activity is not significant. Therefore, with the limited number of pedestrian calls and the small increase in pedestrian crossing time, this consideration will have a marginal effect on intersection operations. It should also be noted that if desired, the County could simply provide this additional pedestrian clearance time into the yellow change interval which would therefore have no impact at all on the green time for the intersection.

Comment \#6: Please provide the project cost estimate for each of three years, 2017, 2018 and 2019 using FDOT's latest available construction inflation factors or other appropriate factors.

Response: Study has been revised to include the three (3) years of cost estimates.

## Comments from Mr. Amir Asgarinik

Comment \#1: Widening impacts the existing roadside swale: can conveyance be maintained within the existing R/W? What is the proposed ditch width and corresponding side slopes? Typical does not specify. What is the volume of run-off expected to be received from adjacent properties with the two MES's?

Response: Yes, conveyance can be maintained within the right of way. Record plans were obtained for State Project No. 79230-3504 which completed the 6-lane widening of SR 421 in 1994 from west of I-95 to SR 5A (Nova Rd.) As shown on the Drainage Maps from that project, runoff from roadway areas between CR 483 (Clyde Morris Blvd.) and SR 5A (Nova Rd.) is conveyed under SR 5A within a 54" pipe system that was depicted in the outside existing lane on the Improvement Diagram. The collection system directs runoff north down Jackson St. discharging it to an existing stormwater management facility (Pond 3) nearby. Thus, only the existing through lanes contribute runoff to the existing roadside swale. In proposed conditions, Type F curb \& gutter will collect runoff from the roadway \& sidewalk areas, and the swale behind the sidewalk is provided to receive runoff from landscape buffer areas at the perimeter of the adjacent properties. Note that as shown on the Improvement Diagram, the Bank of America property contains an on-site stormwater management facility that discharges through a pipe connection.

The proposed ditch width and side slopes have been depicted on the revised Typical Section at maximum values. Special ditch profiling is anticipated to be required during design.

Comment \#2: There appears to be a utility marker in front of the existing sidewalk. Are there any utility impacts with the turn lane/shifted ditch?

Response: Existing utility information has been incorporated into the conceptual design, including telephone, gas, reclaimed water, and potable water. However, in proposed conditions, construction will predominantly result in greater cover over the existing utilities, as generally depicted on the Typical Section. As such, only minor utility adjustment is anticipated.
Comment \#3: Concept does not provide separate ramps on the reconstructed return to match the other three returns.

Response: The study has been revised to include separate pedestrian ramps at the northeast corner.

Commment \#4: The report recommends an additional WB signal head be added to the mast arm but that FDOT was agreeable to leaving 2-thru heads if the structural analysis failed; was this considered or discussed with installing backplates to the existing heads for both EB and WB in accordance to MUTCD?

Response: No, but the study has been revised to include a recommendation to evaluate the structural stability of accommodating the addition of backplates in addition to the third westbound through signal head. If the mast arm structure is inadequate then forego backplates.

Comment \#5: Does the 20\% design fee of \$68k include Surveying \& Mapping for R/W acquisition on the NE quadrant?

Response: The design fee was increased to $\mathbf{3 0 \%}$ to account for the Surveying an Mapping. Comment \#6: The Department would need to concur with the City to acquire the R/W.

## Response: Acknowledged.

## Comments from Mr. Michael Sanders, P.E.

Comment \#1: Figure 2, the Existing Conditions Diagram, seems to be missing the South SR 5A sign facing north on the west side of SR 5A just south of the intersection.

Response: Correction has been made to the study.
Comment \#2: On page 10, the volumes on Figure 3 add up to 5,644 and 6,093 vehicles not 5,661 and 6,099 vehicles.

Response: The figure is correct; correction has been made to the study.
Comment \#3: On page 23 , please verify where the 150 -foot queue length comes from.
Response: Clarification has been added to the study. The turn lane was intentionally extended back to the Walgreens driveway to maximize its length, while avoiding extending it across two (2) driveways. This resulting length of 390 feet more than exceeds the Department's deceleration distance of 240 feet per Index 301 while also accommodating a queue of 150 feet. With that being said, the HCS analyses show projected queues of 230 feet and 260 feet in the midday and afternoon peak hours, respectively (this assumes zero (0) right turns on red and
thus presents a worst-case scenario). Thus, the proposed 390 -foot right-turn lane can fully accommodate these queues.

Comment \#4: From field observations most of the westbound through traffic at the intersection stayed in the inside and middle westbound through lanes with lane utilization for outside lane largely serving right turns due to added lane with taper upstream.

Response: Correct.
Comment \#5: No hard braking in the outside westbound through lane for right turns was observed.
Response: Correct.
Comment \#6: Some westbound right turns on red were observed to bypass standing through queues.
Response: Correct.
Comment \#7: Westbound right turn will increase crossing distance for peds and introduce potential for conflict.

Response: The conflict with right-turning vehicles exists regardless of the alternative, however, no issues were observed (and no such crashes occurred over the past five years). The Flashing Don't Walk timings should be adjusted as a result of the additional crossing distance.

Comment \#8: Right turn lane will increase RTOR and conflict potential for opposing movements including EB dual lefts and SB to NB u-turns. If RTOR needs to be prohibited in the future, any capacity benefit from an exclusive right turn lane is further depreciated.

Response: No issues or concerns were observed with such potential conflicts. Also, even if right turns on red were prohibited, the westbound right-turn volume can be accommodated by the westbound through green. The HCS analysis projected queues and delay are based on 0 right turns on red.

Comment \#9: A right turn lane may not provide a 4\% reduction in crashes as noted in study, based on existing generally good safety history for this movement.

Response: Please see the response to Robert Keeth's comment \#4.
Comment \#10: An exclusive westbound right turn lane does not appear to provide significant benefit to overall intersection operation and safety.

Response: Although not significant, the study does show a capacity benefit as well as a safety benefit. It should also be noted that such benefits are expected to increase as development continues and traffic volumes continue to grow in the area.

## Comments from Mr. Tim Burman

Comment \#1: Page 1: Include statement that City of Port Orange submitted the application.
Response: Information has been added to the study.
Comment \#2: Should the project cost estimate page include also include estimates for 2018 and 2019 ?
Response: Study has been revised to include the three (3) years of cost estimates.

Comment \#3: Was only the midday peak hour and afternoon peak hour studied based on the 24 -hour weekday approach counts? Therefore, the AM peak hour was not reviewed because the AM peak hour counts were less than midday and afternoon peak hour.

## Response: Correct.

Comment \#4: On Sheet 26, please consider adding button posts ten feet apart, conduits, and splice boxes at grade for future Audible Pedestrian Signals as part of the Engineer's Opinion of Probable Cost. To the best of Community Development's information, intersections of State Highways are highest on the priorities to receive Audible Pedestrian Signals. Recommend the Consultant call FDOT's Chad Lingenfelter at 386-943-5336 to determine the priority of this particular intersection.

Response: The cost estimate and improvement diagram account for providing separate pedestrian detectors which could ultimately be converted to APS. The improvement diagram has been updated to show push-button posts a minimum of 10 feet apart.

## Comments from Ms. Melanie Schmotzer

Comment \#1: Page 1: Include statement that City of Port Orange submitted the application.
Response: Information has been added to the study.
Comment \#2: Should the project cost estimate page include also include estimates for 2018 and 2019?
Response: Study has been revised to include the three (3) years of cost estimates.
Comment \#3: Was only the midday peak hour and afternoon peak hour studied based on the 24 -hour weekday approach counts? Therefore, the AM peak hour was not reviewed because the AM peak hour counts were less than midday and afternoon peak hour.

Response: Correct.
Comment \#4: On Sheet 26, please consider adding button posts ten feet apart, conduits, and splice boxes at grade for future Audible Pedestrian Signals as part of the Engineer's Opinion of Probable Cost. To the best of Community Development's information, intersections of State Highways are highest on the priorities to receive Audible Pedestrian Signals. Recommend the Consultant call FDOT's Chad Lingenfelter at 386-943-5336 to determine the priority of this particular intersection.

Response: The cost estimate and improvement diagram account for providing separate pedestrian detectors which could ultimately be converted to APS. The improvement diagram has been updated to show push-button posts a minimum of 10 feet apart.

Comment \#5: Show existing City utilities. As-built drawings are attached.
Response: Existing utility information has been provided by the City and added to the improvement diagram.

Should you have any questions, please contact me at (386) 753-0558.

