

Papermill Drive Corridor Study Knoxville, Tennessee

CONCEPT PLAN STUDY

Prepared For:
City of Knoxville

Prepared By:



January 2022

Executive Summary

Purpose of Study

The purpose of this Technical Study of Papermill Drive Corridor from S. R. 1 (Kingston Pike) (L.M. 0.00) to N. Weisgarber Road (L.M. 0.61) in Knoxville, Tennessee is to provide an overview of traffic demand and operational deficiencies, develop conceptual design for multimodal improvements, and provide an opinion of construction costs for budgeting vehicle, bicycle and pedestrian improvements. Figure ES-1 displays the log miles (L.M.) of the project beginning to the end of construction area.



Figure ES-1
Papermill Drive Log Mile Designations

Description of the Existing Conditions

Vital information on Papermill Drive from Kingston Pike to N. Weisgarber Road is as follows:

- Typical section: 2-lanes
- Right-of-Way: 40 to 50 feet

- Existing Lane and Shoulder Widths: eleven (11) foot lanes to twelve (12) foot lanes with two (2) foot non-paved shoulder or paved in the end sections with curb and gutter
- Functional Classification: Urban Major Collector
- Speed Limit: 40 Miles per Hour (MPH)
- Pavement Condition: Recently paved to a good surface

Papermill Drive is located adjacent to I-40/75 in Knoxville, TN, west of downtown. This corridor provides a direct connection between the interstate, Northshore Drive, Kingston Pike, and Middlebrook Pike. Papermill Drive connects Tennessee State Route 1 (Kingston Pike) and Interstate 40/75 via a 2-lane roadway while providing connections to Middlebrook Pike via Weisgarber Road which services many industrial, commercial, and residential land uses.

The land use in the study along Papermill Drive is predominantly commercial and office. To the north of the interstate and south of Kingston Pike, there are concentrations of single and multi-family units. Commuters use this roadway to travel from their homes in West Hills to their work location. Residents use this roadway for purposes of accessing restaurants, churches, libraries, home supply stores, and entertainment in the area. McKay's bookstore is a very well attended establishment within the center of the study corridor. Cyclists use this route for both commuter and connecting between greenways. Papermill Bluff Greenway and Weisgarber Greenway have a connection to the eastern end of the Papermill Drive corridor within the study area where cyclists transfer to the paved road surface to use Kingston Pike to travel west for a connection to the Jean Teague Greenway in the West Hills community.

Existing and Horizon Traffic

The City of Knoxville supplied turning movement counts conducted on September 20th and 21st, 2017, at Papermill Drive and Weisgarber Road. A review of the CDM Smith traffic counts were compared to the City of Knoxville AM and PM peak hour count at Papermill Drive and Weisgarber Road from 2017. It was determined and discussed with the City of Knoxville in a progress meeting that the counts during COVID required a 25% increase in the AM peak hour and a 15% in the PM peak hour. This was consistent with TDOT's monitoring of COVID impacts because traffic volumes were less in the 7:30-8:30 AM peak hour since work from home was in place, but closer to normal during the 4:30-5:30 PM evening time period. TDOT maintains one count station on Papermill Drive between L.M. 0.00 and L.M. 0.61 (see **Figure 4-5**) and a 2020 AADT of 15,170 VPD was recorded at that station. Station 433 is located at L.M. 0.546, at the Weisgarber Road end of this project. All the study intersection turning movement counts were adjusted by these two factors (25% in the AM and 15% in the PM peak hours) to determine a 2021 AM and PM baseline volume data set without the impacts of COVID.

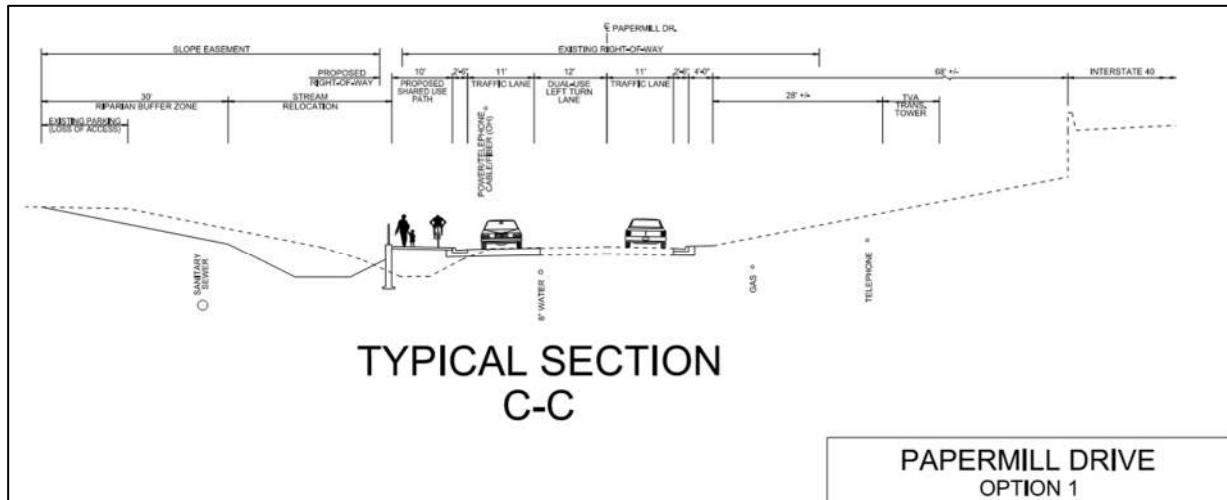
The calculated crash rate and severe rate of Papermill Drive was compared with the statewide averages using the 2019 ADT. The actual crash rate is 11.022 and the statewide average crash rate for urban two (2) lane state routes is 2.334, which are shown below. It is also important to note that the critical crash rate of Papermill Drive is 3.457, so the actual crash rate ratio to the critical crash rate is 3.19, indicating causative factors that can be corrected are contributing to the crashes.

Papermill Dr (04829) at S.R. 1 (Kingston Pk) (L.M. 0.00) to Weisgarber Rd (L.M. 0.61)		
Type	Crash Rate	SW Average
Total	11.843	2.334
Severe (Fatal + Incap)	0.099	0.093

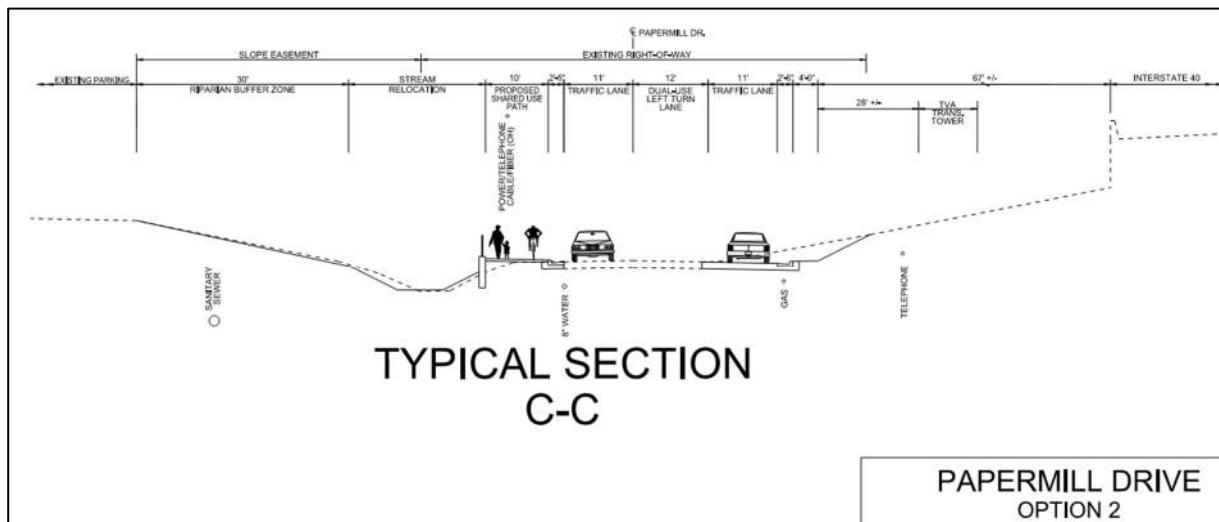
Conceptual Alternatives

Six alternatives were evaluated as a part of this Technical Study including a No-Build alternative.

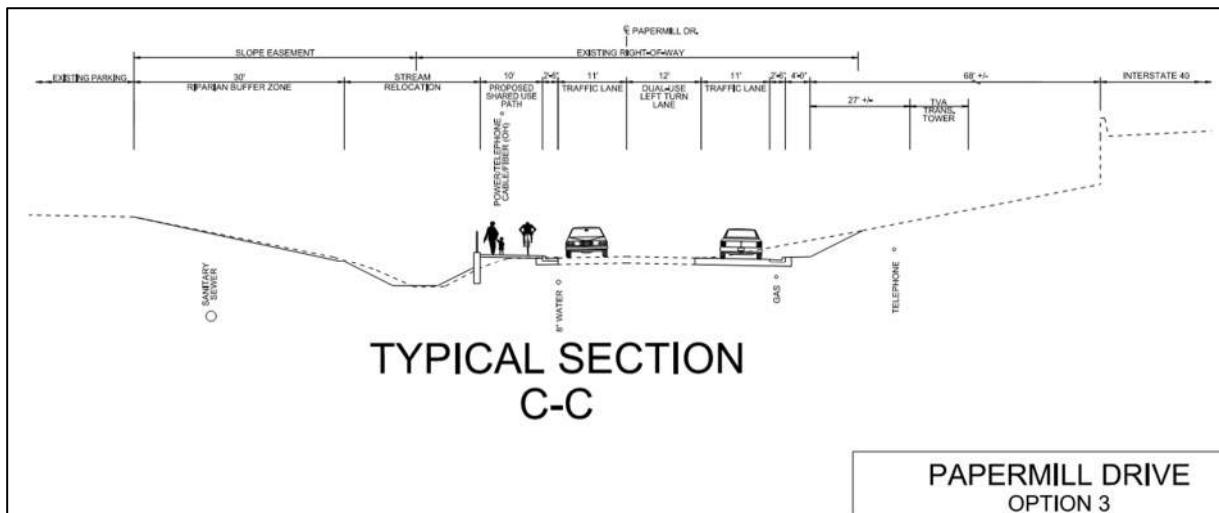
- **No-Build Alternative** - No improvements made to the corridor. Only routine maintenance, bridge rehabilitation/replacements, and current safety projects would be made with the No-Build Alternative.
- **Option 1 Alternative** - This alternative would propose roadway widening occur on the southside of Papermill Drive and include a 10-foot multi-use path on the southside of Papermill Drive adjacent to the eastbound travel lane from Kingston Pike to N. Weisgarber Road which requires a stream relocation.



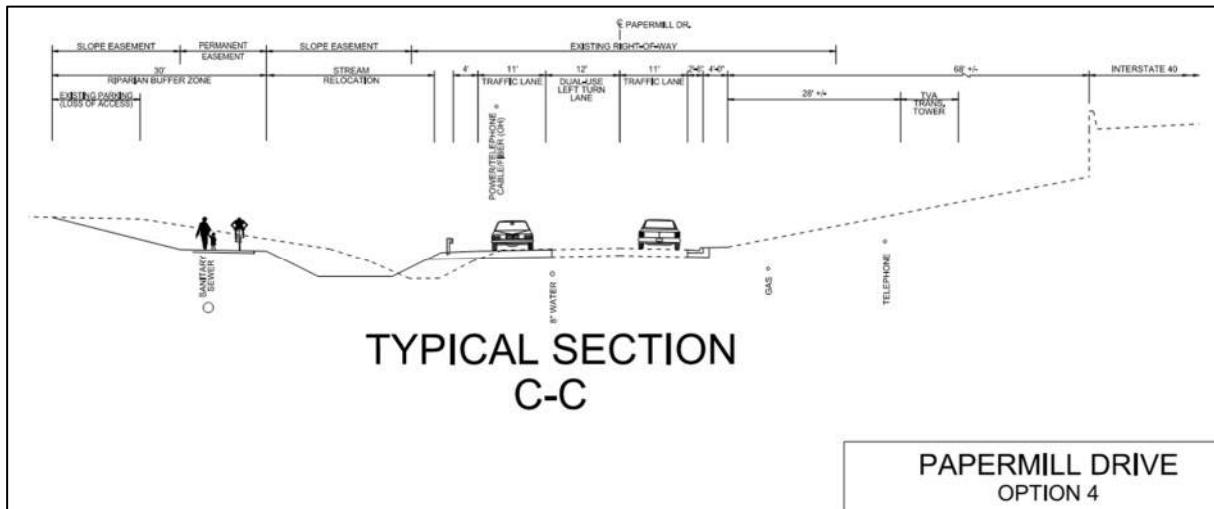
- **Option 2 Alternative** - This alternative would propose roadway widening occur on the northside of Papermill Drive and include a 10-foot multi-use path on the southside of Papermill Drive adjacent to the eastbound travel lane from Kingston Pike to N. Weisgarber Road which requires a stream relocation.



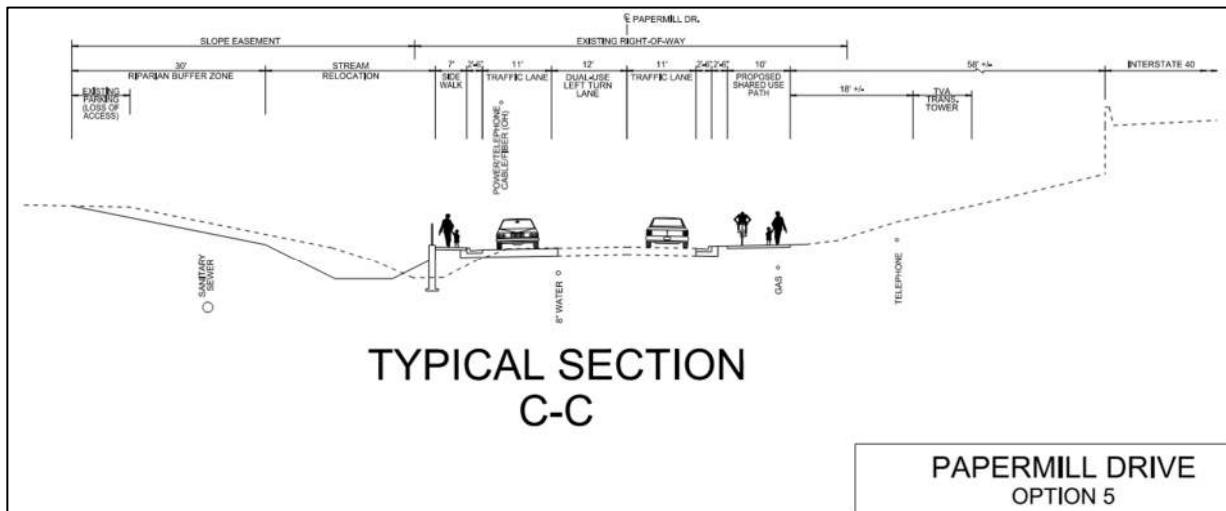
- Option 3 Alternative** - This alternative would propose roadway widening occur on the southside of Papermill Drive approximately 100 feet east of Westfield Road then transition to construction on the northside of Papermill Drive to N. Weisgarber Road intersection. This alternative would include a 10-foot multi-use path on the southside of Papermill Drive adjacent to the eastbound travel lane from Kingston Pike to N. Weisgarber Road which requires a stream relocation.



- Option 4 Alternative** - This alternative would propose roadway widening occur on the southside of Papermill Drive. The 10-foot multi-use path on the southside of Papermill Drive would vary in alignment. The segment between Westfield Road and in front of McKay's Books would be positioned on the southside of the unnamed stream to result in less of a stream relocation.



- **Option 5 Alternative** - This alternative would propose roadway widening occur on the southside of Papermill Drive and include a 10-foot multi-use path on the northside and a 7-foot sidewalk on the southside of Papermill Drive from Kingston Pike to N. Weisgarber Road which requires a stream relocation.



Concept plans and a full set of Typical Section displays for Options 1 thru 5 are included in the **Appendix**. The project team including the City of Knoxville staff reviewed the design features of each alternative in relation to motorists, pedestrians, and cyclists. Providing the two-way left-turn lane served the motorists that turned from Papermill Drive, the multi-use path on the northside connected the West Hills and Weisgarber Road bike trails, and the sidewalk on the southside facilitated mobility of all pedestrians between Kingston Pike and N. Weisgarber Road. It was noticed that the pedestrian and cyclists were not provided a crossing in the segment between Kingston Pike and Weisgarber Road. The project team considered uncontrolled crosswalks and active crosswalk warnings. The uncontrolled crosswalks would be accompanied with passive warning signs and pavement markings. The active warnings could be midblock pedestrian devices such as the "HAWK". Upon the project team assessment of this location, it

was determined that an uncontrolled crosswalk would not be a sufficient solution. The active warning device could not be located a sufficient distance not to impact Westfield Road or commercial driveways. While traffic volumes and pedestrian counts do not meet signal warrants, it was the suggestion of the project team to consider a traffic signal operation at Westfield Road with pedestrian signal equipment to adequately provide a pedestrian and bicycle crossing where the motorists would understand the assignment of right-of-way. Further study should be conducted to confirm the appropriateness of implementing a traffic signal at Westfield Road.

Recommendations

- Remove the westbound Kingston Pike channelized right-turn lane and receiving lane on Papermill Drive at the shopping center access. This recommendation would reduce the walk distances across Papermill Drive and remove one of the additional eastbound Papermill Drive lane that would not be needed after the channelization removal.
- Improve Papermill Road as per Option 5. This alternative would propose roadway widening occur on the southside of Papermill Drive and include a 10-foot multi-use path on the northside and a 7-foot sidewalk on the southside of Papermill Drive from Kingston Pike to N. Weisgarber Road which requires a stream relocation.
- Consider further study in regard to adding a traffic signal with pedestrian crosswalk equipment at the Papermill Road and Westfield Road intersection to provide safe and protected crossing of pedestrians and cyclists.
- Re-stripe the westbound Papermill Drive approach at N. Weisgarber Road from the dual through lanes to become a dual right turn-lane onto N. Weisgarber due to the elimination of the two receiving lanes on Papermill Drive.

These improvements are expected to have an order-of-magnitude for the construction, engineering design, construction engineering services, and right-of-way costs of approximately \$15.1 Million, excluding rock removal and utility relocation.

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Papermill Drive Technical Study
S.R. 1 (L.M. 0.00) to Weisgarber Road (L.M. 0.61)
Knoxville, TN

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Section 1

Introduction

CDM Smith has completed a technical study to investigate the feasibility of improving Papermill Drive between Kingston Pike and Weisgarber Road. The Technical Report process involves a comprehensive study of all historic, current, and projected highway data of Papermill Drive located to the west of downtown Knoxville, TN. An assembled team reviews the project to validate identified deficiencies and determine cost effective measures to resolve the existing deficiencies with an emphasis placed on multi-modal safety.

The purpose of this Technical Study of the Papermill Drive corridor from S.R.1 (Kingston Pike) to N. Weisgarber Road in Knoxville, Tennessee, is to provide an overview of traffic demand and operational deficiencies, develop a conceptual design for multi-modal improvements, and provide an opinion of construction costs for budgeting vehicle, bicycle and pedestrian needs.

1.1 Study Goals

Project goals were to develop a conceptual layout to improve the Papermill Drive corridor between Kingston Pike and Weisgarber Road that provides capacity and a safe environment to travel for all modes of users. The conceptual layouts were developed to determine the least impact on adjacent constraints as listed:

- TVA Towers
- Overhead/Underground Utilities
- Private Property
- TDOT ROW / Access Control
- Stream Relocation / Environmental Concerns

1.2 Project Initiation

A Project Initiation documentation was developed that clearly lays out the justification for a project, what the objectives will be, and how the project will be organized to ensure that the project team is well informed of the process and desired results. To achieve the project goals, the following tasks are to be undertaken within this Technical Study:

- Review 3-years of crash data, daily traffic count data, traffic signal timings, and turning movement counts.
- Identify problem areas such as high crash locations, geometric deficiencies, limited sight distances, long queue approaches, traffic signal cycle failures, and signage deficiencies.

- Meet with Utilities, TDOT, and TVA to coordinate their input.
- Analysis traffic operations for existing, future no-build and future build conditions during the AM and PM peak hours.
- Develop an accurate base map for conceptual plans development.
- Evaluate and prepare design conceptual layouts to add multi-modal components to the corridor and turn lanes as appropriate for side streets and driveways.
- Develop drawings based on the City's preferred alternative.
- Develop probable construction costs for the City's preferred alternative.
- Prepare a Technical Study to document the tasks undertaken with stated traffic analysis results and recommendations.

Section 2

Study Area

Papermill Drive corridor is located adjacent to I-40/75 in Knoxville, TN, west of downtown. This corridor provides a direct connection between the interstate, Northshore Drive, Kingston Pike, and Middlebrook Pike. **Figure 2-1** shows the location of the corridor in relation to downtown Knoxville, TN. Papermill Drive connects Tennessee State Route 1 (Kingston Pike) and Interstate 40/75 via a 2-lane roadway while providing connections to Middlebrook Pike via Weisgarber Road which services many industrial, commercial and residential land uses. **Figure 2-2** shows the relation of the street network within the study area. A map of the log mile designations is shown in **Figure 2-3**.

The land use along Papermill Drive is predominantly commercial and office. To the north of the interstate and south of Kingston Pike, there are concentrations of single and multi-family units. **Figure 2-4** shows the existing land use within the study area as provided by KGIS.



Many commuters use this roadway to travel from their homes in West Hills to their work location. Residents also use this roadway for purposes of accessing restaurants, churches, libraries, home supply stores, and entertainment in the area. McKay's bookstore is a very well attended establishment within the center of the study corridor. Cyclists use this route for both commuter and connecting between greenways. Papermill Bluff Greenway and Weisgarber Greenway have a connection to the eastern end of the Papermill Drive corridor within the study area where cyclists transfer to the paved road surface to use Kingston Pike to travel west for a connection to the Jean Teague Greenway in the West Hills community. **Figure 2-5** shows the existing greenways located within the project area as provided by KGIS.

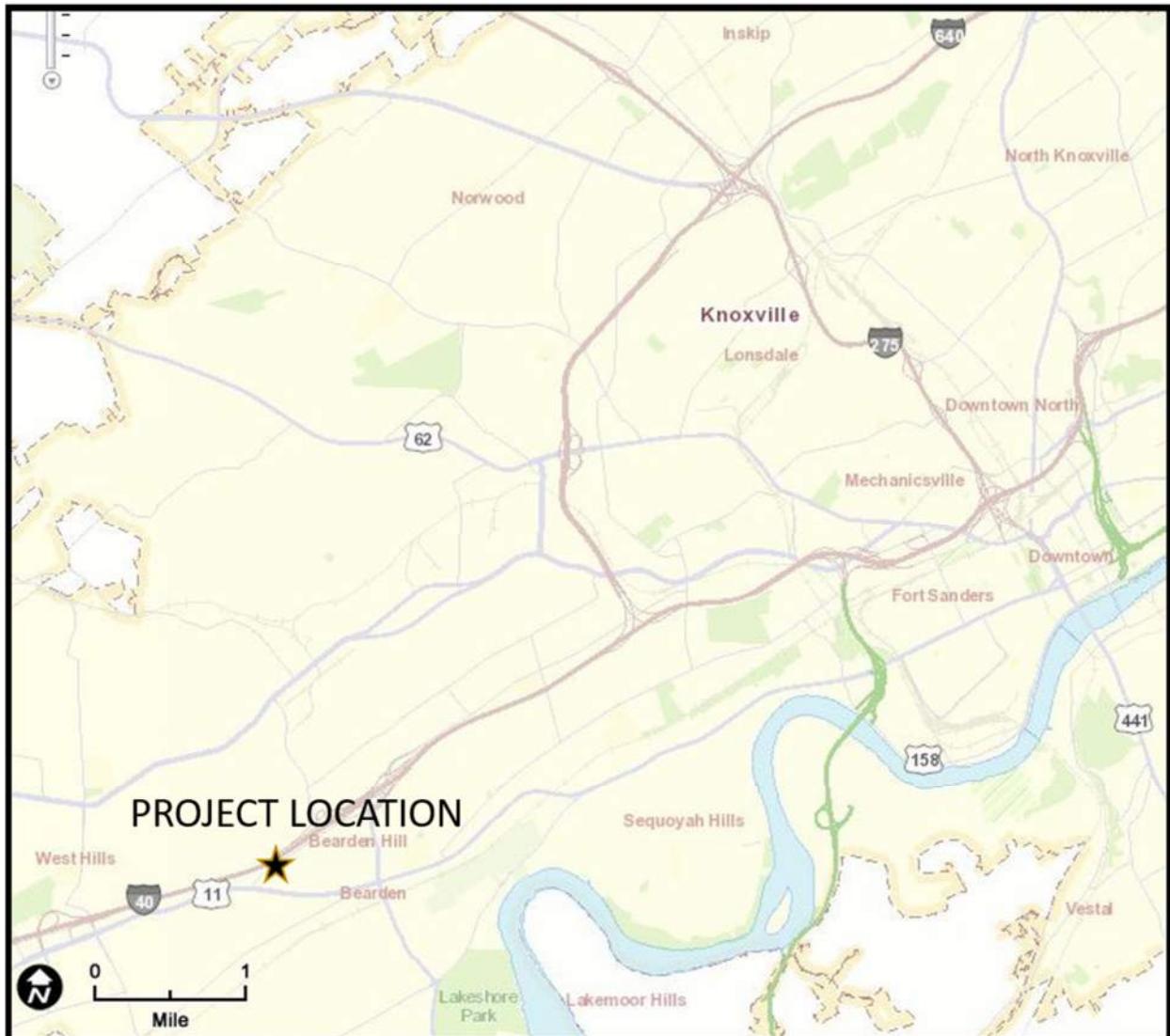


Figure 2-1
Location of Project

Papermill Drive Technical Study
S.R. 1 (L.M. 0.00) to Weisgarber Road (L.M. 0.61)
Knoxville, TN

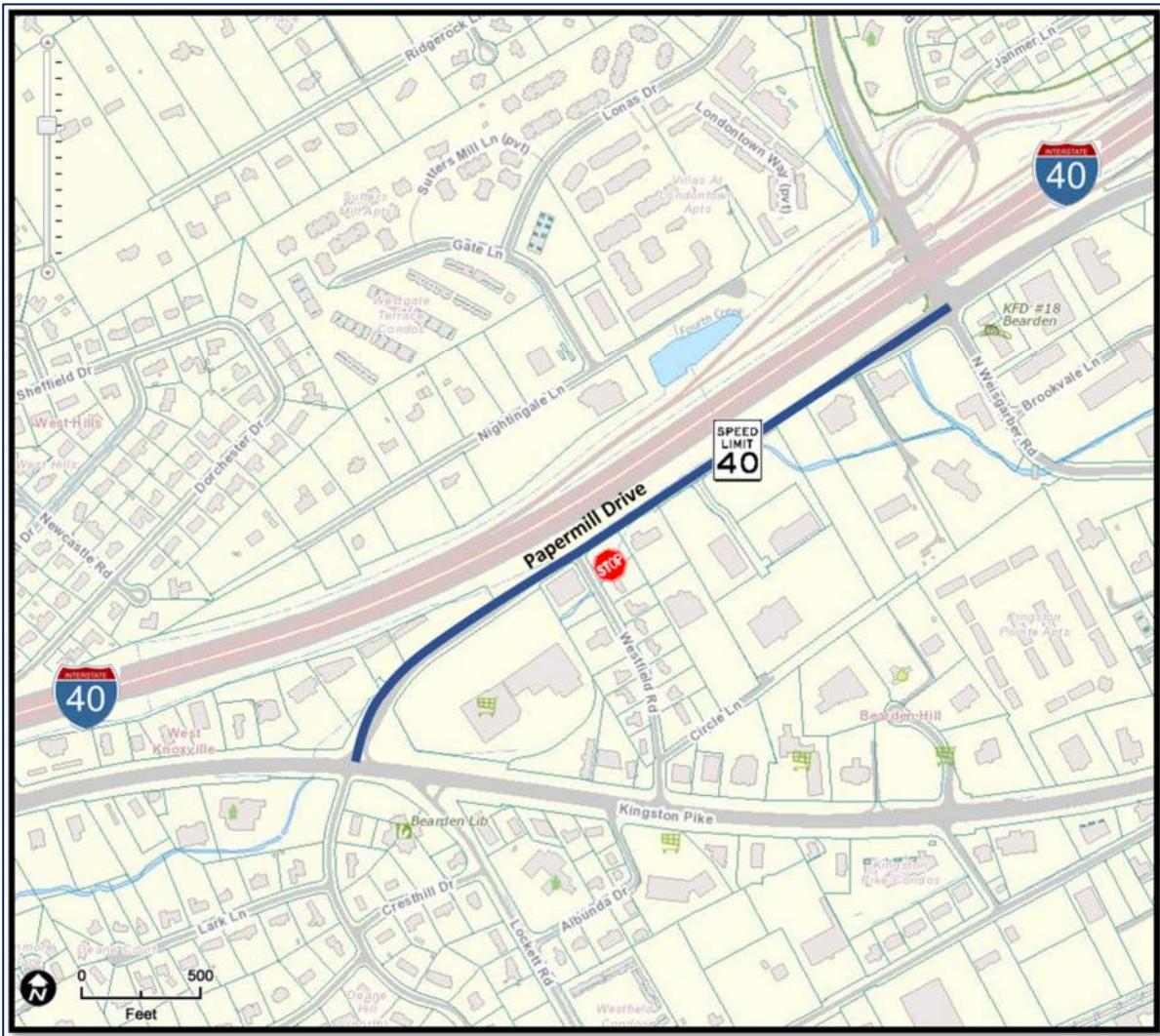


Figure 2-2
Papermill Drive between Kingston Pike and Weisgarber Road

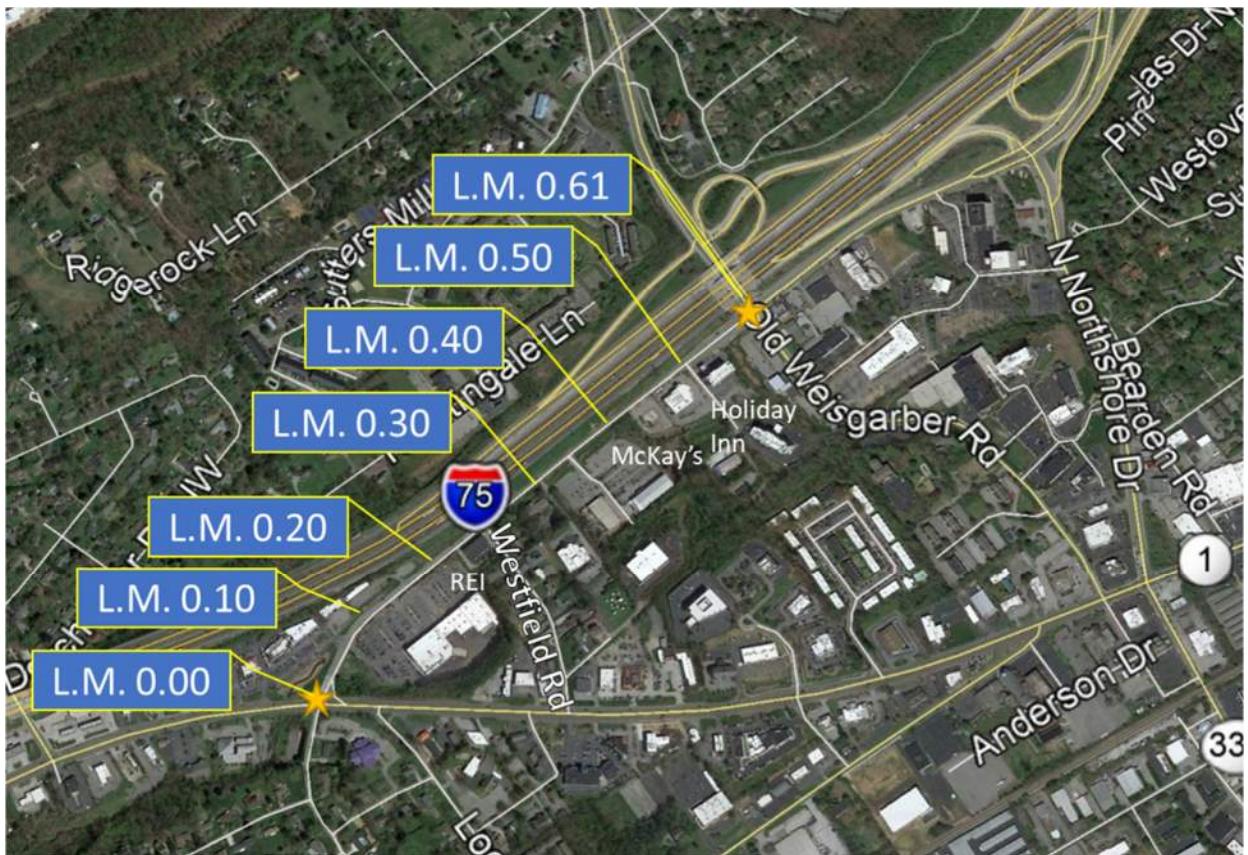


Figure 2-3
Papermill Drive Log Mile Designations



Figure 2-4
Study Area Existing Land Uses
Source: KGIS Maps

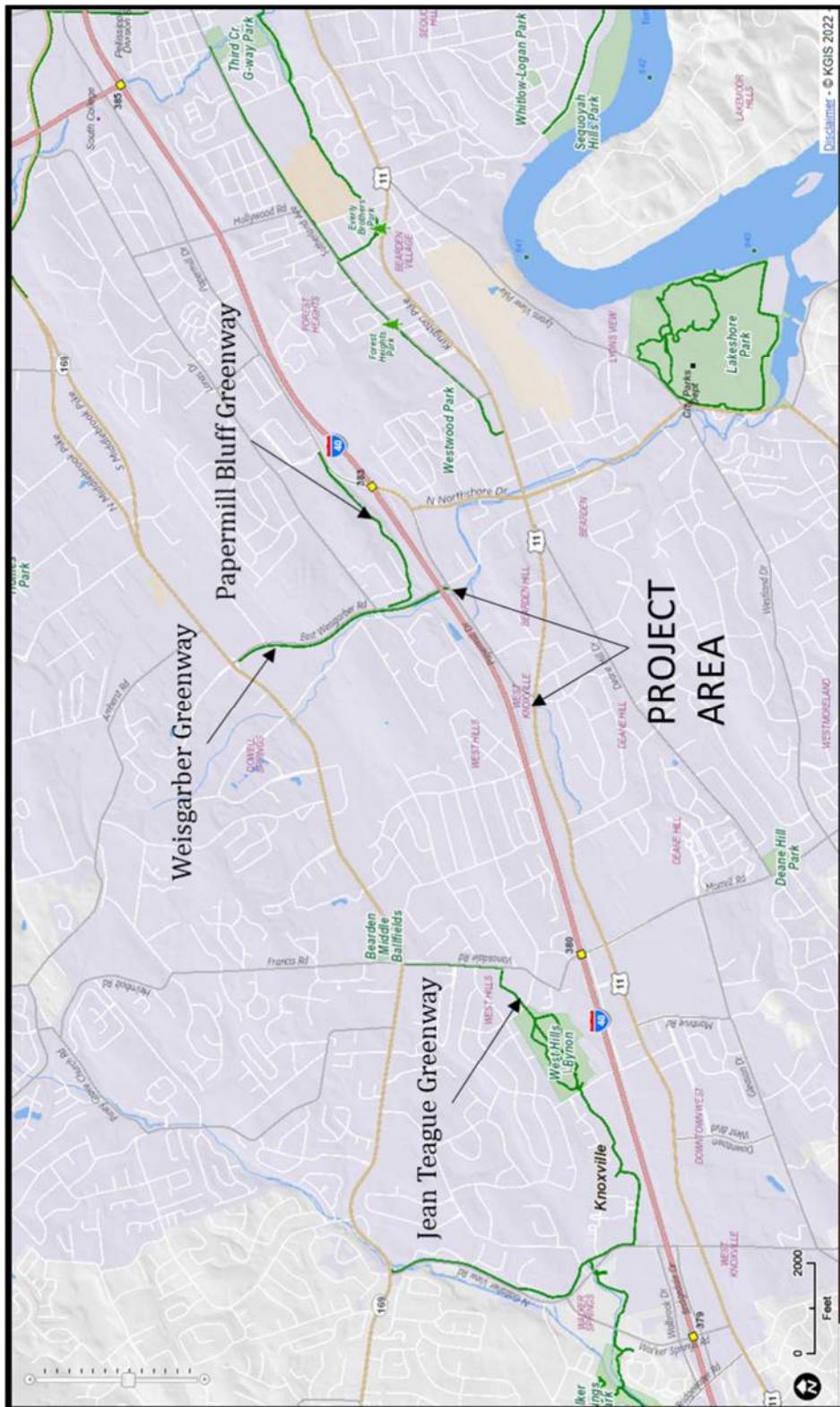


Figure 2-5
Greenway Map
Source: KGIS Maps

Section 3

Preliminary Purpose and Need

The City of Knoxville has recognized a need for investment for this section of Papermill Drive between Kingston Pike and N. Weisgarber Road based on the vehicle, bicycle, and pedestrian needs. Papermill Drive has an actual crash rate ratio to the critical crash rate of 3.19 using the 2019 ADT, suggesting that there are causative factors that can be corrected with road improvements. Sixty-three (63) percent of the most recent 3-year crash history was reported as rear-end crashes. (See Section 8 for details.) Papermill Drive has no turn lanes or median to provide separation between turning traffic from REI Shopping Center access (L.M. 0.17) through west of N. Weisgarber Road (L.M. 0.56). Its lack of shoulders is a contributing factor to the frequent lane departure crashes. Adding a left-turn lane and curb/gutter will improve safety by providing a safe area to conduct a left-turn and a barrier to prevent running off the road.

Papermill Drive's daily traffic volume in 2019 was measured as 16,300 vehicles per day (VPD) at the TDOT continuous count station at Station 433. Based on historical traffic volumes, a 0.5% annual growth rate was predicted for this segment of Papermill Drive. Future ADT is expected to be 34,230 VPD in the 2040 design year. (See Section 9 for details.) A two-lane peak hour segment capacity analysis was performed using the Highway Capacity methodology with the results summarized below:

- 2021: Volume/Capacity Ratio (V/C) = 0.49; Level of Service (LOS) = E
- 2040: Volume/Capacity Ratio (V/C) = 0.54; Level of Service (LOS) = E

The road operates at a less-than-desirable LOS E today and is expected to steadily worsen in the future.

There is a lack of sidewalks, bike paths, or bike lanes on Papermill Drive between Kingston Pike and N. Weisgarber Road. Moreover, between REI (L.M. 0.20) and Holiday Inn access (L.M. 0.50), there is a 2-foot non-paved shoulder and open ditches on both sides of Papermill Drive. Thus, Papermill Drive is not bike or pedestrian friendly; however, the land-use is primarily office, commercial, and residential and there are greenways at each end of this project that could be safely accessible via walking or biking if the infrastructure were in place.

The purpose of improving Papermill Drive is to reduce crashes, add road capacity, improve connectivity between two greenways, and improve pedestrian and bicycle mobility. By addressing safety and mobility as well as adding non-vehicular features for bikes and pedestrian, the project will facilitate economic growth in this area of Knoxville.

Section 4

Description of Existing Conditions

Papermill Drive is classified as an Urban Major Collector providing connectivity between SR 1 (Kingston Pike), Weisgarber Road, Northshore Drive, and Interstate 40/75. An average daily traffic volume measured in 2020 was 15,170 vehicles per day. The posted speed limit is 40 miles per hour in the study segment. The cross-section varies between Kingston Pike and Weisgarber Road from 2-lanes to 4-lanes with lane widths of 11 to 12 feet. Near Kingston Pike, Papermill Drive is a 4-lane roadway with curb and gutter consisting of turn lanes, as shown in **Figure 4-1**. Beginning log mile 0.09 to 0.20, Papermill Drive is a 3-lane having 12-foot lane widths and 2-foot paved shoulder, as shown in **Figure 4-2**. From log mile 0.20 to 0.50, Papermill Drive is a 2-lane roadway with 11-foot lanes and 2-foot dirt shoulder, as shown in **Figure 4-3**. The section from log mile 0.50 to 0.61 includes turn lanes at Weisgarber Road and paved shoulders, as shown in **Figure 4-4**.



Figure 4-1
Papermill Drive at SR 1 Kingston Pike (LM 0.00)

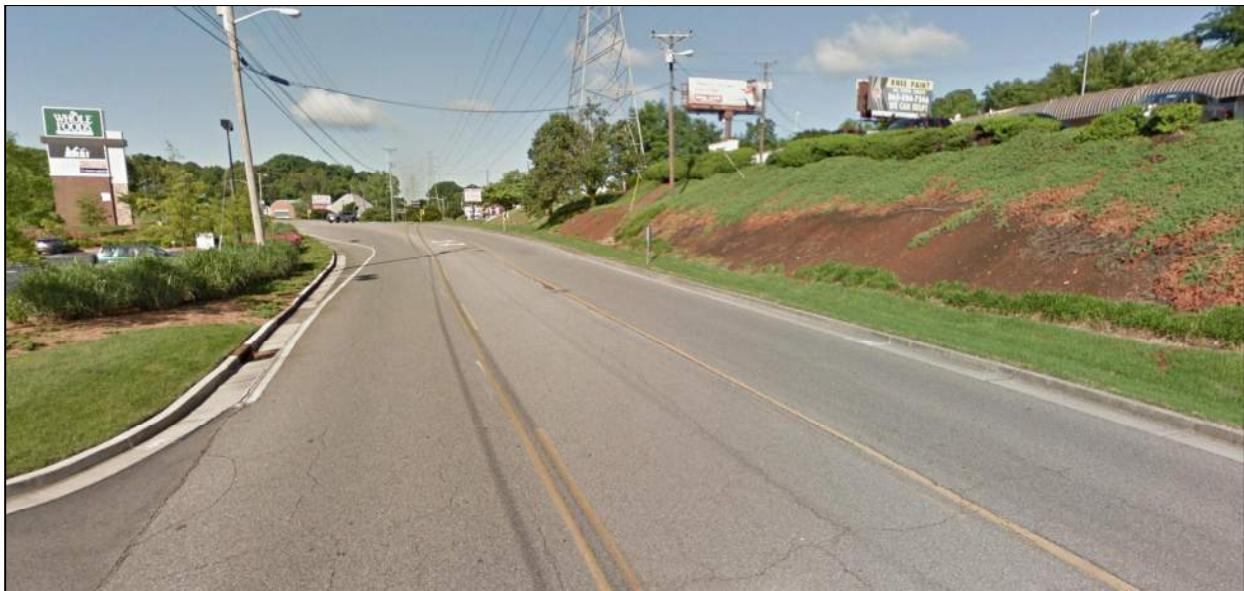


Figure 4-2
Papermill Drive at Business Drives (LM 0.20)



Figure 4-3
Papermill Drive at Westfield Road (LM 0.255)



Figure 4-4
Papermill Drive at Westfield Road (LM 0.50)

Concrete pavement conditions are cracking at the Papermill Drive approach to Kingston Pike. The asphalt pavement seems to be in reasonably good shape with some alligator cracking present on the west end of the project. There are more sections of old culvert repairs with cracking present and older resurfacing joints with cracking east of Westfield Road. Samples of photos taken are shown in **Figure 4-5**.



Figure 4-5
Pavement Condition Review

Existing intersection geometry of the study intersections are shown in **Figure 4-6**. The signalized intersection of Kingston Pike at Papermill Drive provides a channelized westbound right-turn lane. Westfield Road is stop controlled with single lane approaches. N. Weisgarber Road is a multi-lane signalized intersection having the westbound Papermill Drive dual thru lane merge immediately after crossing the intersection to a single lane.

The study area has an elevation lower than that of adjacent roads and commercial lots. This area has flooded during past heavy rain events. FEMA has mapped flood prone areas based on the existing typography as shown in **Figure 4-7**.

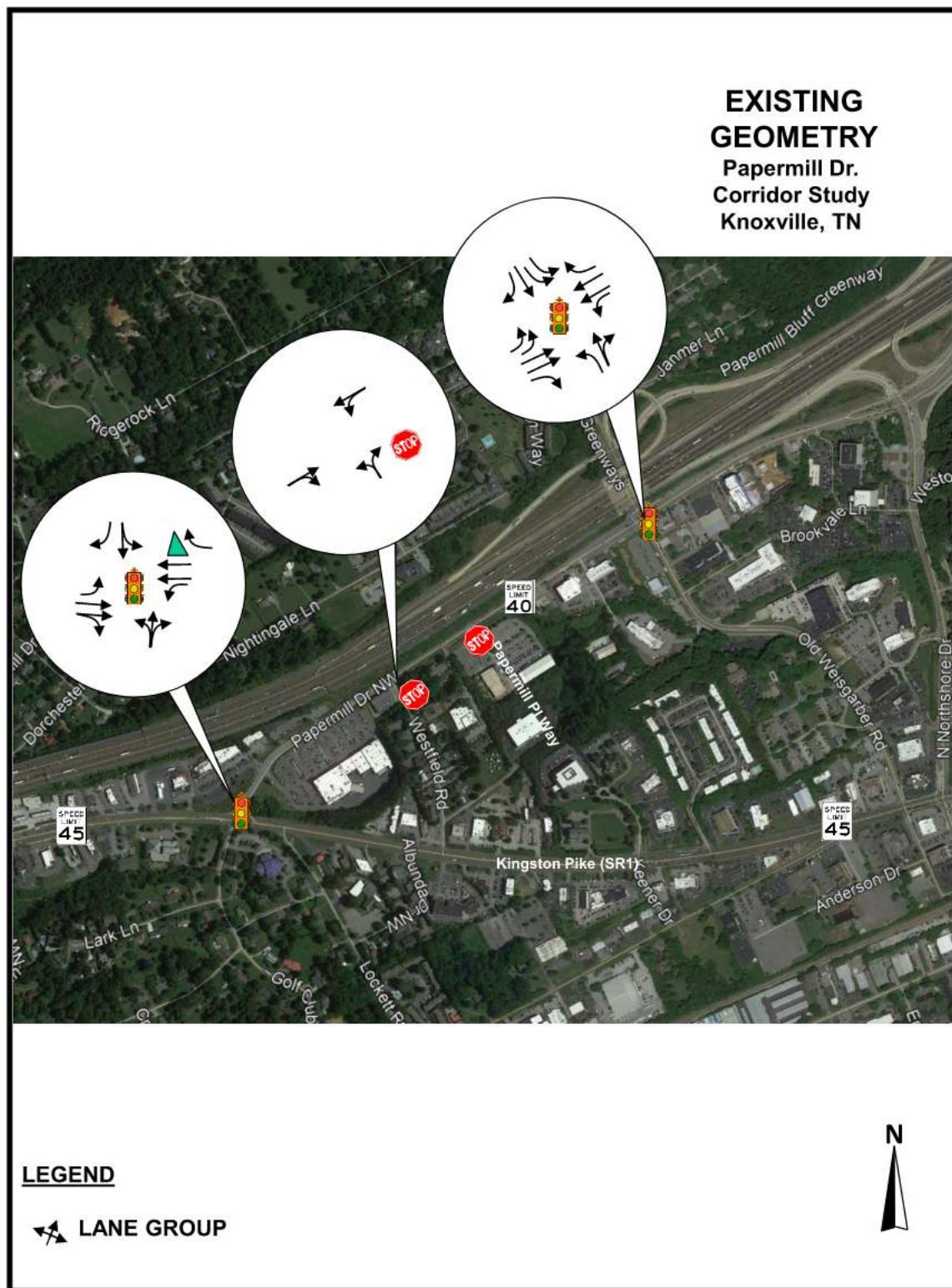


Figure 4-6
Existing Geometry

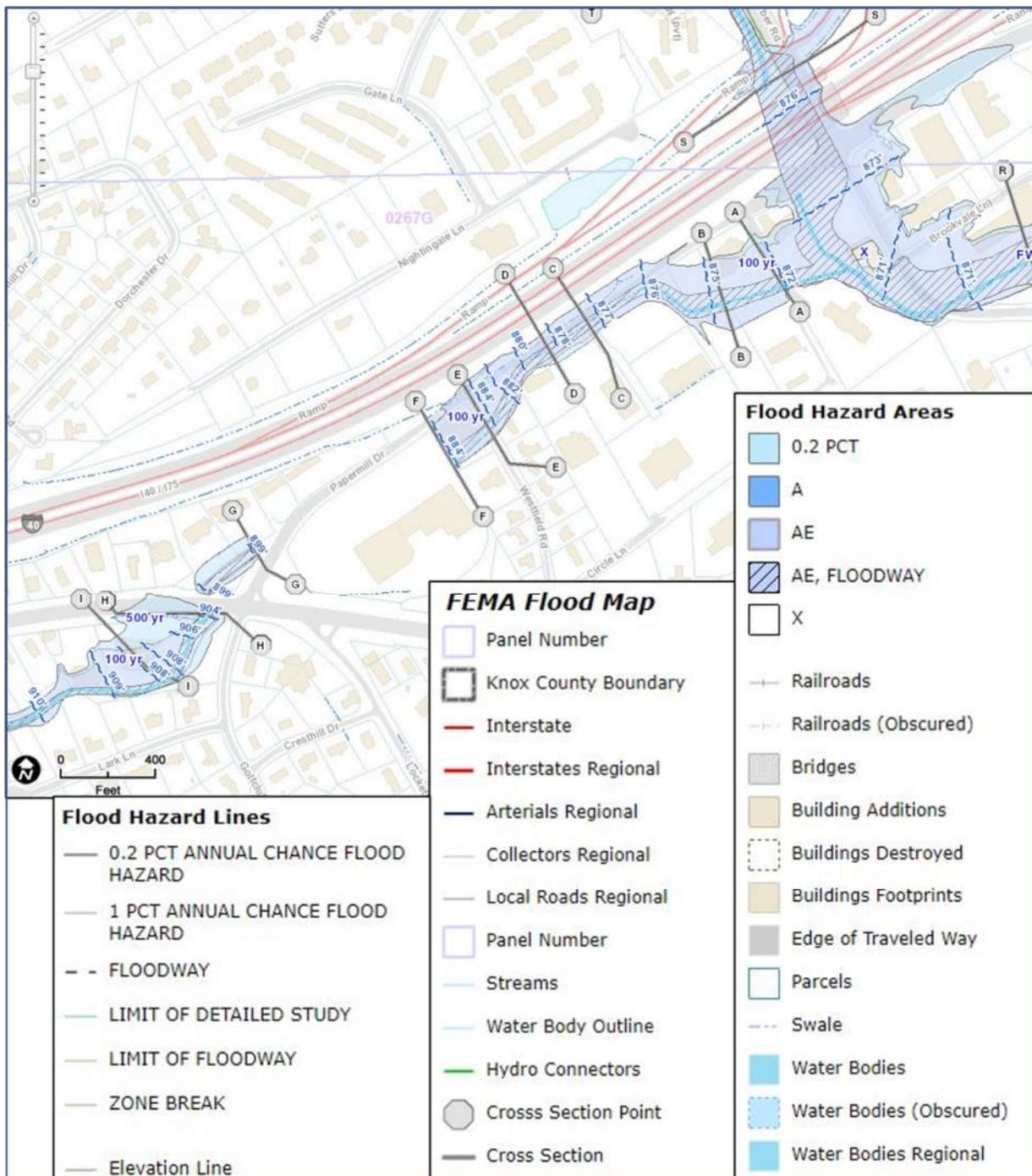


Figure 4-7
FEMA Flood Map

Section 5

Preliminary Constraints

Within the study area, there are a number of challenges including wetlands, streams, utilities, access control fencing, and Right of Way. The adjacent constraints are identified and listed as:

- TVA Towers
- Overhead/Underground Utilities
- Private Property
- TDOT ROW / Access Control
- Stream Relocation / Environmental Concerns

This area is part of the Fourth Creek Watershed. A bridge structure over Fourth Creek is located at L.M. 0.56 on Papermill Drive (35.937319, -84.009718). From the north, water flows in Fourth Creek in a closed system beneath I-40/75. From the west, water flows in an open ditch on the southside of Papermill Drive. The concepts evaluated as part of this technical report included converting the existing two-lane roadway to a three-lane cross-section providing a center two-way left-turn lane to facilitate left turns onto Westfield Road. A road widening project in this corridor is bounded by TDOT Right of Way, I-40/75 access control fencing, gas lines, and telephone lines to the north of Papermill Drive; Fourth Creek, wetlands in the low areas, sanitary sewer, and water lines to the southside of the project. **Figure 5-1** shows the close distance of the access control fencing to the project corridor.



Figure 5-1
Interstate Access Control Fencing

Section 6

Existing Utility Infrastructure

6.1 Observed Above Ground and Below Ground Utilities

This entire section of Papermill Drive is lined with a high-power transmission line on the northside, as shown in **Figure 6-1**, and utility poles on the southside of the road. The utility service poles are primarily substantial wood poles carrying primary and secondary electrical, cable and communication lines. In some locations the poles are only five (5) feet from the roadway. Underground utilities observed in the field included gas, water, and sewer. The presence of these underground utilities is expected with the high concentration of commercial and office land uses throughout the entire corridor.



Figure 6-1
High Power Transmission Line

TVA and local utilities attended a presentation where the alternatives were presented by CDM Smith and City of Knoxville. The meeting was to show the details of all the alternative considered. Regardless of the alignment, construction limits would be closer than the standard permit would

state for the large transmission towers of TVA. The project team explained that Option 5 was preferred and stated the amount of encroachment that would be required to construct. It was agreed by TVA and local utilities that Option 5 of the Papermill Drive improvements could be permitted to implement and constructed within the limits needed of the tower structures.

Section 7

Structures and Bridges Conditions

Along the study corridor, there are three bridge structures that will be impacted by the proposed improvements on Papermill Drive. Two bridges are located on private driveway connections. One bridge is a box culvert under Papermill Drive at L.M. 0.560. **Figure 7-1** shows the location of the three impacted bridges.

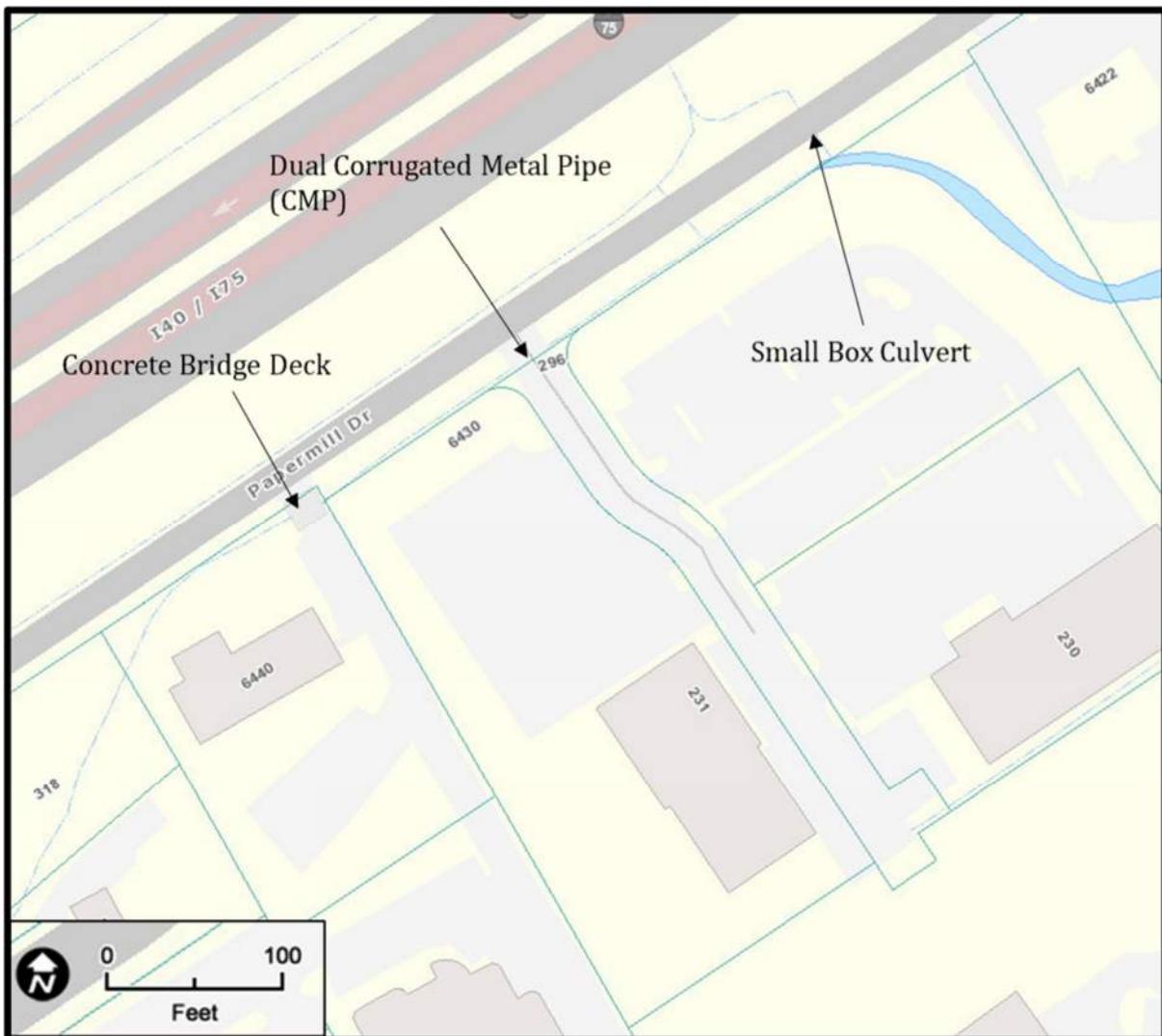


Figure 7-1
Papermill Drive Bridge Locations.

7.1 Description of Existing Bridges

The driveway connection of 6440 Papermill Drive is a concrete deck spanning across Fourth Creek. The bridge width is approximately 26 feet, and the length is approximately 24 feet. **Figure 7-2** is a photo of this bridge on Papermill Drive at L.M. 0.30.



Figure 7-2
Driveway Bridge at L.M. 0.30 Papermill Drive.

Papermill Place Way connects to Papermill Drive over two large, corrugated metal culverts (CMP) to provide access to McKay's Book Store. This asphalt paved driveway has a width of approximately 36 feet, and the length is approximately 45 feet. **Figure 7-3** is a photo of these culverts at Papermill Place Way at L.M. 0.328 on Papermill Drive.



Figure 7-3
Papermill Place Way at L.M. 0.328 Papermill Drive.

A box culvert directs water flow from the northside of I-40/75 under Papermill Drive at L.M. 0.560 to Fourth Creek. TDOT has this listed as a small out-of-the-system bridge. There was not further information within E-trims as to the age or condition of this box culvert. This concrete box culvert has a width of approximately 12 feet, and the length is approximately 60 feet. **Figure 7-4** is a photo of this box culvert at L.M. 0.560 on Papermill Drive.



Figure 7-4
Papermill Drive Box Culvert L.M. 0.560

Section 8

Crash History

Three years of crash history were reviewed from TDOT E-trims and TITAN website databases. Crash reports were reviewed to confirm an accurate data set for crashes occurring within the study corridor.

8.1 Crash Analysis on Existing Route

In the three (3) year reporting period from December 31, 2016, through December 31, 2019, there were 120 crashes reported in the section of Papermill Drive between L.M. 0.00 and L.M. 0.61. Almost four-fifths (79 percent) of the crashes occurred in daylight conditions and 81 percent occurred in clear or cloudy, but no rain, conditions. **Table 8-1** presents a summary of the crash statistics for the three (3) year reporting period. Of the 120 crashes, 111 (93 percent) were property damage only, 8 (7 percent) were non-incapacitating injury, and 1 crash resulted in a cyclist fatality. In the three (3) year reporting period, 1 percent of the crashes were severe with an incapacitating injury or fatality and 99 percent were non-severe with a property damage only or a non-incapacitating injury.

Table 8-1 also includes the calculated crash rate and severe rate of Papermill Drive compared with the statewide averages using the 2019 ADT. The actual crash rate is 11.022 and the statewide average crash rate for urban two (2) lane state routes is 2.334. It is also important to note that the critical crash rate of Papermill Drive is 3.457, so the actual crash rate ratio to the critical crash rate is 3.19, indicating causative factors that can be corrected are contributing to the crashes. The **Appendix** includes the detailed crash analysis sheet as well as the statewide average crash rates for sections and spots.

The type of crash occurring on Papermill Drive is indicative of its typical section and other key characteristics such as its lane width (11 feet), lack of shoulders, and lack of turn lanes. Sixty-three percent (76 crashes) of the crashes were rear-end, and the lack of a left turn lane is a contributing factor to many of those. There were also a significant number of rear-end crashes on Papermill Drive's approach to Kingston Pike and Weisgarber Road. Sideswipe, head-on, and no-collision-with-a-vehicle (run-off-the-road) are all lane departure type crashes that are generally caused by narrow lanes, and narrow or no shoulders. There were 13 sideswipe crashes, 7 head-on, and 4 run-off-the-road crashes reported in the three (3) year period from January 2016 through December 2019. These lane departure crashes comprised 20 percent of the total crashes occurring on Papermill Drive. Eight of the 14 angle crashes were injury but non-incapacitating. Angle crashes typically occur at intersections or driveways, and this holds true with Papermill Drive. All told, angle crashes account for 12 percent (14 crashes) of the total crashes. All the 120 crashes in the three-year reporting period were plotted on aerial maps in **Figure 8-1** and are displayed in the Appendix under Crash Diagrams. These illustrations include the type and severity of crash.

Table 8-1 Papermill Drive Crash Statistics

CRASH STATISTICS		
Condition	12/31/2016 - 12/31/2019	
	Number of Crashes	Percentage of Total
Lighting Conditions		
Daylight	95	79%
Dark - Not Lighted	0	0%
Dark - Lighted	8	7%
Dusk/Dawn	11	9%
Not Indicated	6	5%
TOTAL	120	100%
Crash Severity		
Property Damage	111	93%
Non-Incap Injury	8	7%
Incap Injury	0	0%
Fatality	1	1%
TOTAL	120	100%
Manner of Collision		
Rear-End	76	63%
Lane Departure	4	3%
Angle	14	12%
Sideswipe	13	11%
Head On	7	6%
Overturn	0	0%
Animal	0	0%
No Collision w/ Vehicle	0	0%
Other	0	0%
Not Indicated	6	5%
TOTAL	120	100%
Weather Conditions		
Clear	89	74%
Cloudy	8	7%
Rain	16	13%
Snow	0	0%
Sleet/Hail	0	0%
Smog/Smoke	0	0%
Foggy	1	1%
Not Indicated	6	5%
TOTAL	120	100%
Segment 1: Papermill Dr (04829) at S.R. 1 (Kingston Pk) (L.M. 0.00) to Weisgarber Rd (L.M. 0.61)		
Type	Crash Rate	SW Average
Total	11.022	2.334
Severe (Fatal + Incap)	0.092	0.093

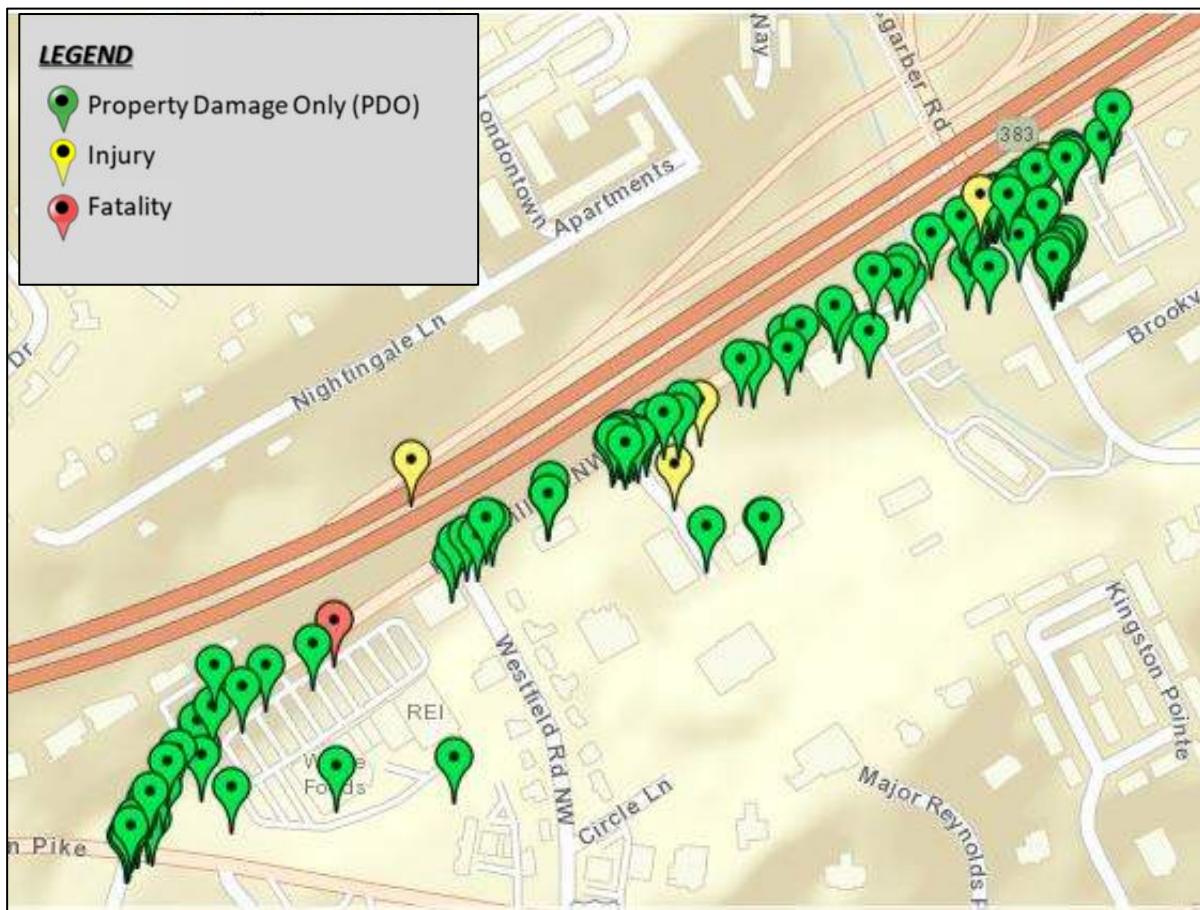


Figure 8-1
Plotted Crash Data 2016-2019.

Section 9

Existing and Future Traffic Projections

9.1 2021 Traffic Data

With the impacts of COVID on AM and PM peak hour traffic conditions, the 2021 turning movement counts required an adjustment factor. All agencies for State and Local Governments used some variation but resulted in a certain percentage increase above a measured value when work and schools were impacted. CDM Smith had turning movement traffic data collected at the study intersections on March 23, 2021.

The City of Knoxville supplied turning movement counts conducted on September 20th and 21st, 2017, at the intersection of Papermill Drive and Weisgarber Road. A review of the CDM Smith traffic counts were compared to the City of Knoxville AM and PM peak hour count at Papermill Drive and Weisgarber Road from 2017. It was determined and discussed with the City of Knoxville in a progress meeting that the CDM Smith counts made in 2021 during COVID required a 25% increase in the AM peak hour and a 15% in the PM peak hour to reflect normal pre-CIVOD conditions. This was consistent with the TDOT monitored stations where traffic volumes were observed to be less in the 7:30 AM hour since work from home was in place, but closer to normal during the 4:30 PM evening time period. TDOT maintains one count station on Papermill Drive between L.M. 0.00 and L.M. 0.61 and a 2020 AADT of 15,170 VPD was recorded at that station. Station 433 is located at L.M. 0.546, at the Weisgarber Road end of this project. All the study intersection turning movement counts were adjusted by these two factors (25% for the AM and 15% for the PM) to determine a 2021 AM and PM baseline volume data set without the impacts of COVID.

Figure 9-1 presents a diagram of the 2021 existing adjusted turning movements used in the traffic analysis. The details of this count data are provided in the **Appendix**.

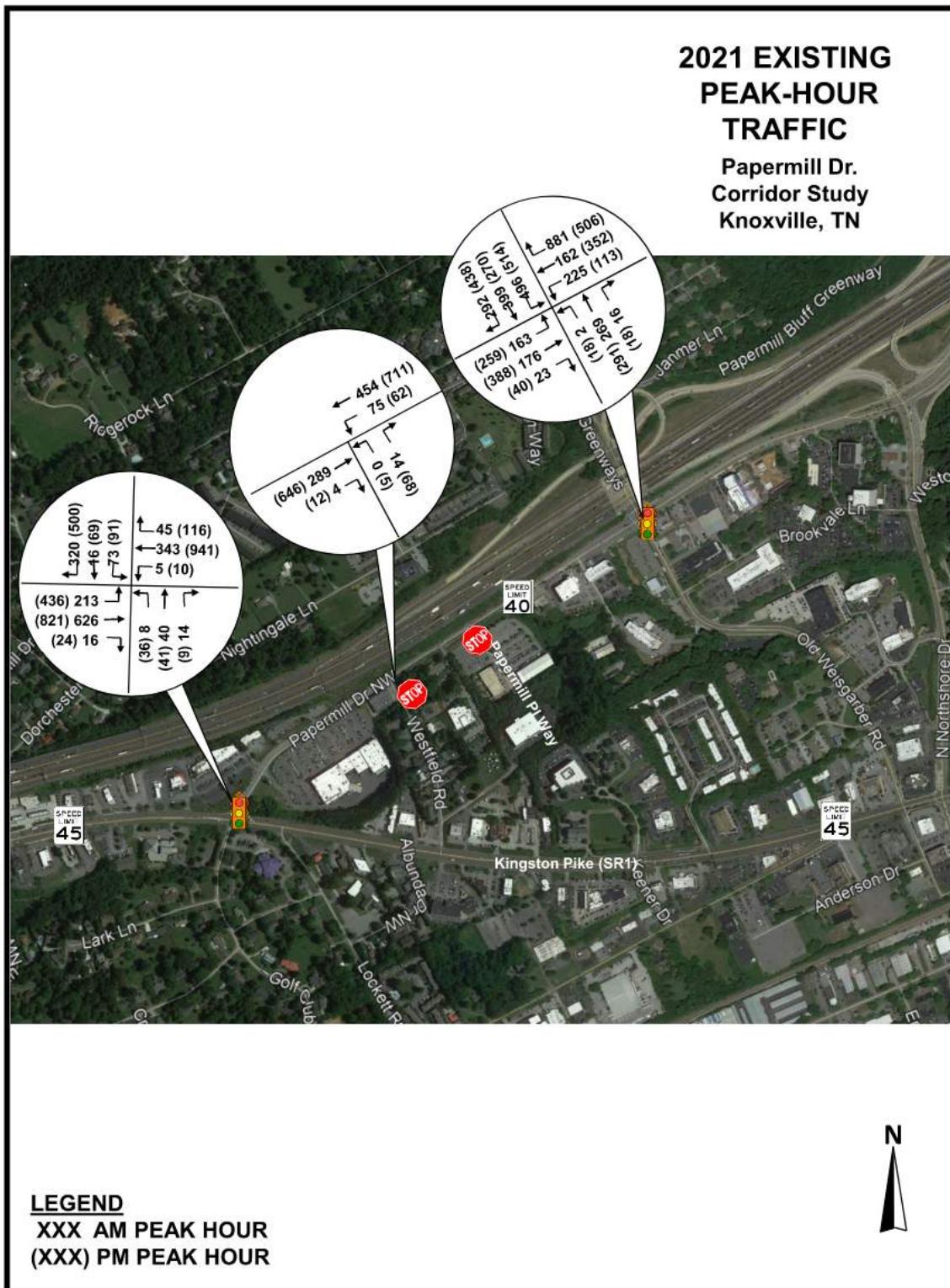


Figure 9-1
2021 Existing Peak-hour Traffic

9.2 2040 Traffic Data

Using the historical traffic count data supplied by TDOT's ATC Station 433, CDM Smith developed an average growth rate of 0.50% annually.

Table 9-1 TDOT Automatic Traffic Count Station 433

Primary Street	Papermill Dr
Cross Street	W of Weisgarber Rd
▪ 2001	15294
▪ 2002	14540
▪ 2003	
▪ 2004	14711
▪ 2005	
▪ 2006	15256
▪ 2007	
▪ 2008	13981
▪ 2009	13429
▪ 2010	14961
▪ 2011	14170
▪ 2012	14485
▪ 2013	14941
▪ 2014	14668
▪ 2015	14815
▪ 2016	
▪ 2017	16595
▪ 2018	16286
▪ 2019	16300

The estimated growth rate was applied to the 2021 adjusted turning movement counts to develop the 2040 design year turning movement volumes as shown in **Figure 9-2**. The details of this count data are provided in the **Appendix**.

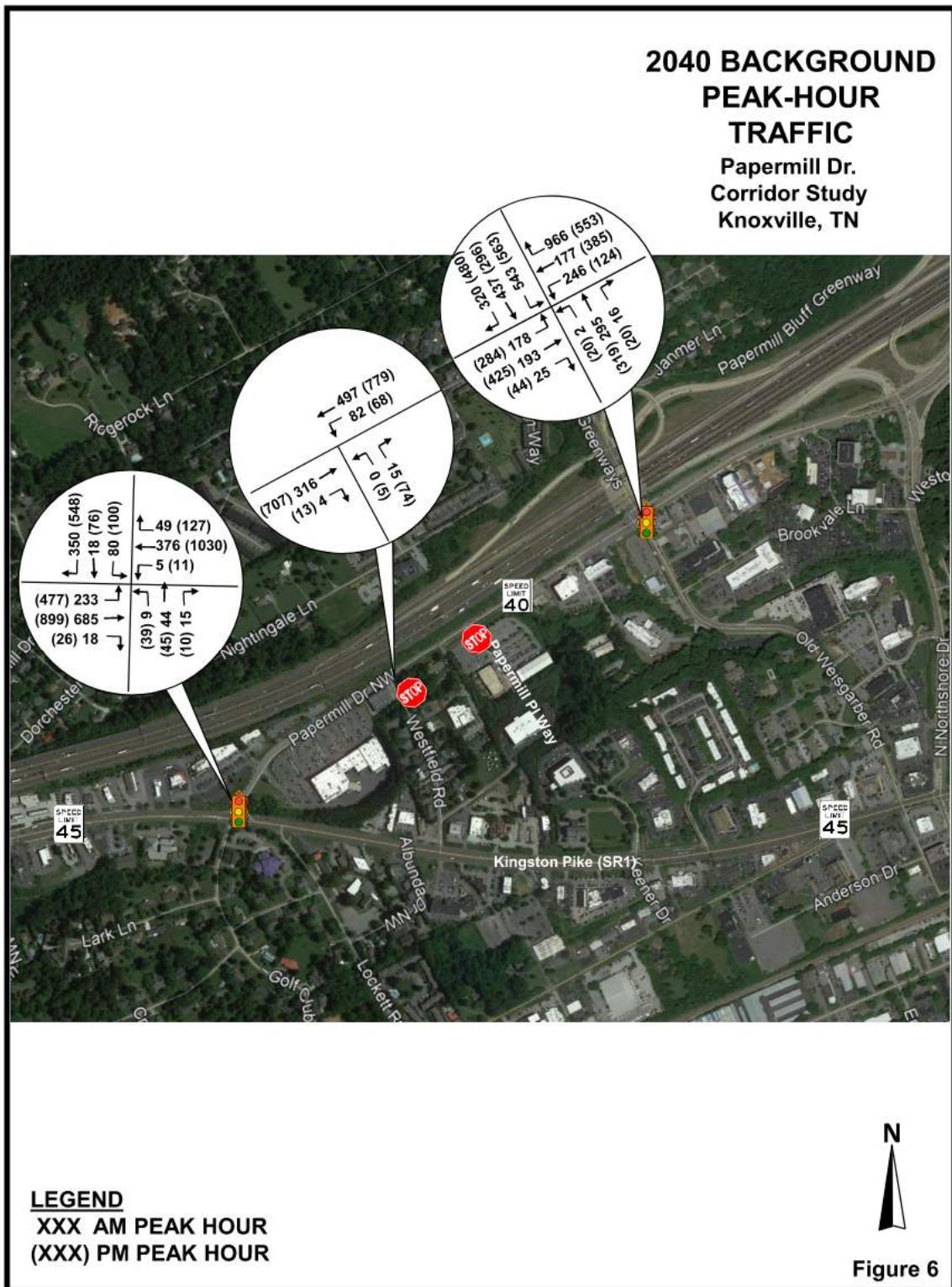


Figure 9-2
2040 Background Peak-hour Traffic

Section 10

Conceptual Alternatives

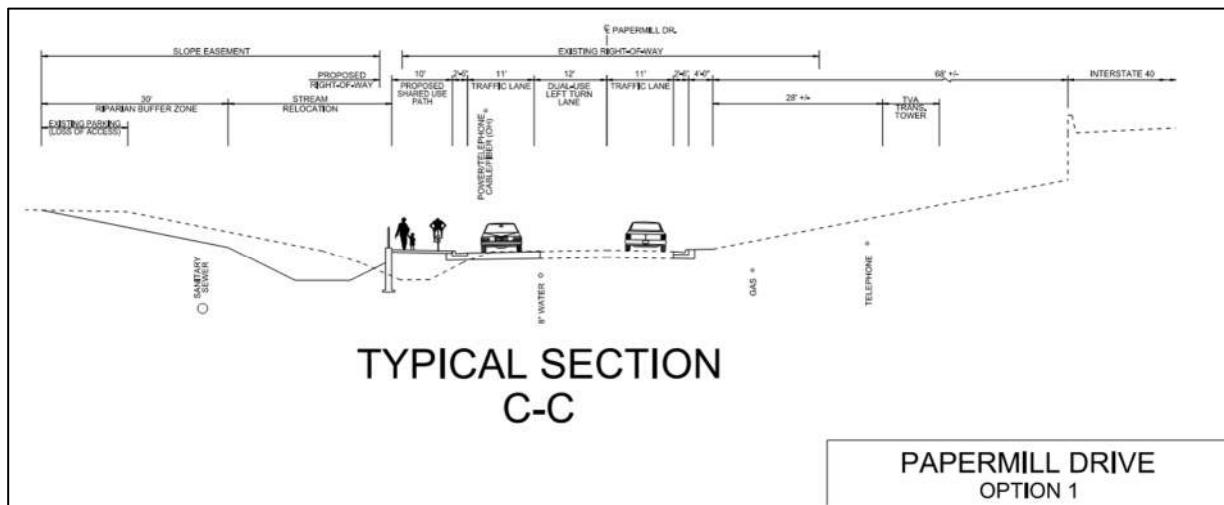
After evaluating the safety, operational, geometric conditions and impacts on the Papermill Drive study limits, five alternatives plus the No-Build option were considered to address the deficiencies and satisfy the Purpose and Need. These alternatives considered the identified constraints of multi-modal improvements; maintenance of traffic; constructability; roadway drainage (closed system, outfalls, and tie-ins); stream relocation/modification; location of utility, access control, stream, ROW; retaining walls and slope adjustments; and cost estimate.

10.1 Proposed Conceptual Alternatives

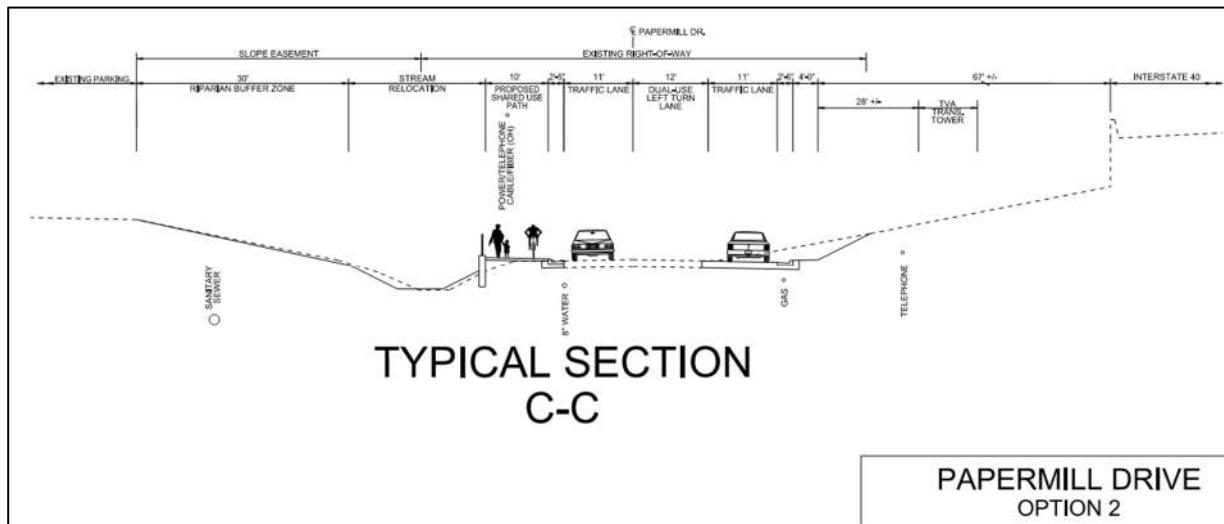
Five alternatives were evaluated as a part of this Technical Study plus a No-Build alternative. All the build alternatives consist of a removal of the westbound Kingston Pike channelized right -turn island, providing a three-lane configuration on Papermill Drive between Kingston Pike and N. Weisgarber Road, and lane assignment changes at the signalized intersection of Papermill Drive and N. Weisgarber Road. Removing the channelized island was to reduce the crosswalk distance and operate the right-turn movement under traffic signal control. The elimination of the additional eastbound Papermill Drive travel lane between the westbound Kingston Pike channelized right-turn lane and the REI shopping center will be removed as well to reduce merge and sideswipe crashes. A three-lane section improvement provides a center turn-lane into side streets and commercial businesses. All the alternatives would include a curb and gutter section that will provide for two (2) eleven (11) foot single lanes of directional travel with a center twelve (12) foot lane for left-turn movements into minor side-streets and driveways. The lane re-assignment of westbound dual through lanes on Papermill Drive at N. Weisgarber Road to become dual right-turn lanes was required due to the elimination of the two receiving lanes which merged into the existing westbound single lane that continues toward Kingston Pike. The alternatives described below are variations based on the location of the multi-use path, relocation of the stream, and centerline roadway alignment. A display of the typical cross-section at location C-C is provided to understand the location of the design components and relative differences between each alternative.

The six alternatives are described below:

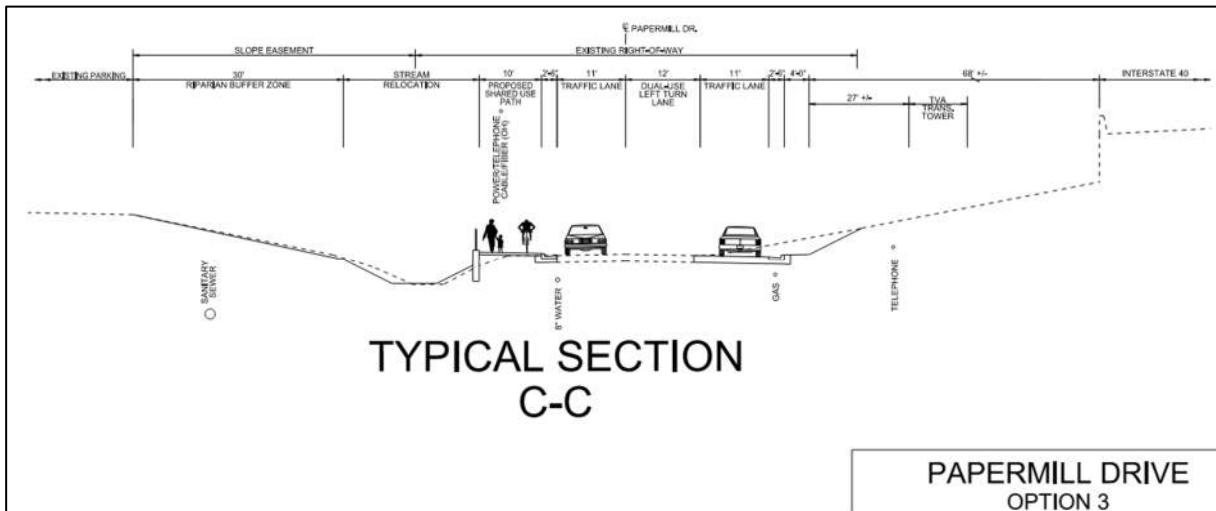
- **No-Build Alternative** - No improvements made to the corridor. Only routine maintenance, bridge rehabilitation/replacements, and current safety projects would be made with the No-Build Alternative.
- **Option 1 Alternative** - This alternative would propose roadway widening occur on the southside of Papermill Drive and include a 10-foot multi-use path on the southside of Papermill Drive adjacent to the eastbound travel lane from Kingston Pike to N. Weisgarber Road which requires a stream relocation.



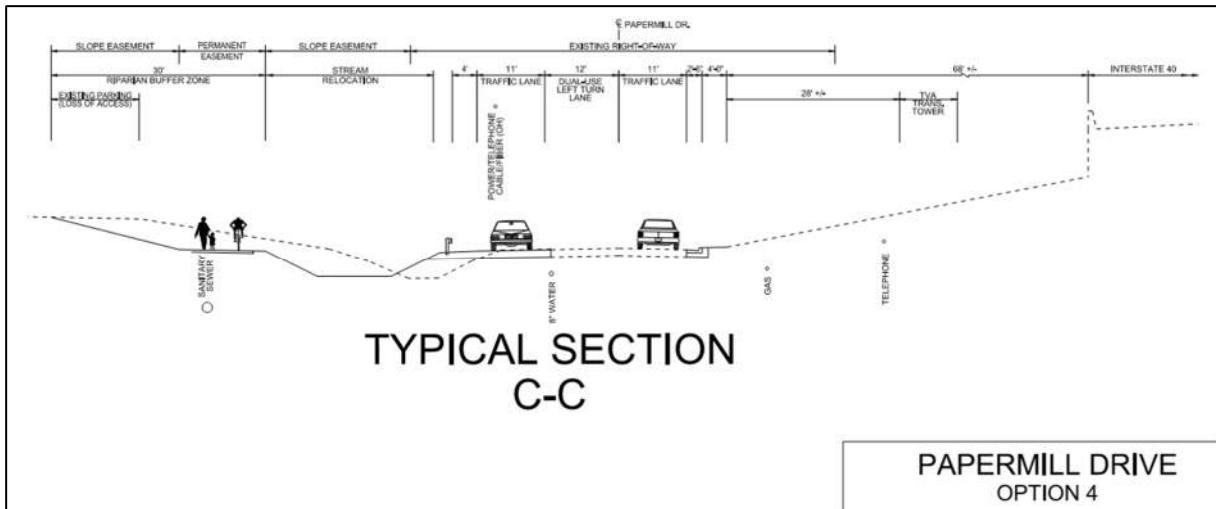
- **Option 2 Alternative** - This alternative would propose roadway widening occur on the northside of Papermill Drive and include a 10-foot multi-use path on the southside of Papermill Drive adjacent to the eastbound travel lane from Kingston Pike to N. Weisgarber Road which requires a stream relocation.



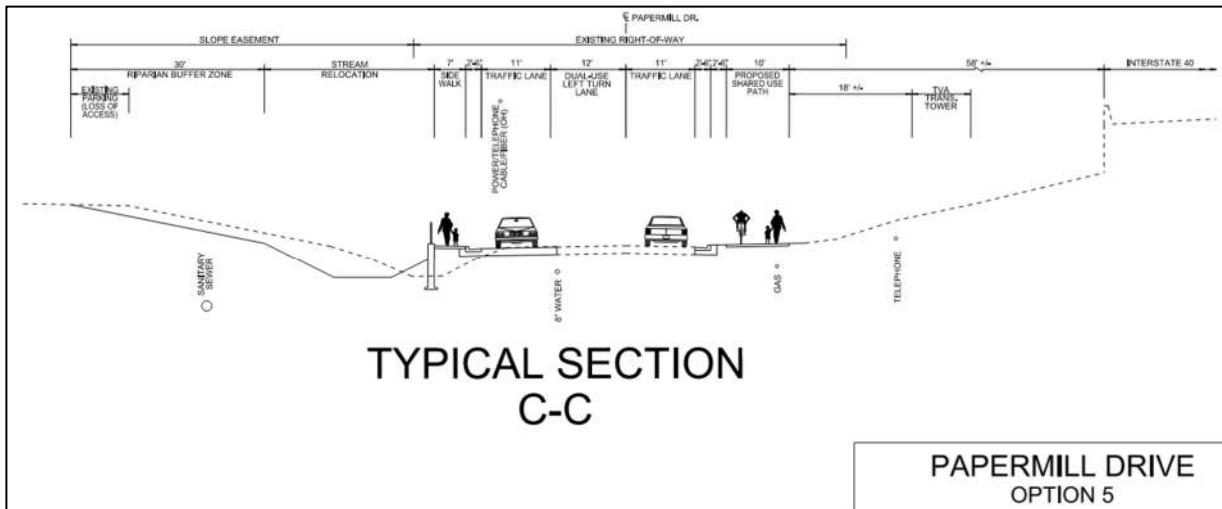
- **Option 3 Alternative** - This alternative would propose roadway widening occur on the southside of Papermill Drive approximately 100 feet east of Westfield Road then transition to construction on the northside of Papermill Drive to N. Weisgarber Road intersection. This alternative would include a 10-foot multi-use path on the southside of Papermill Drive adjacent to the eastbound travel lane from Kingston Pike to N. Weisgarber Road which requires a stream relocation.



- **Option 4 Alternative** - This alternative would propose roadway widening occur on the southside of Papermill Drive. The 10-foot multi-use path on the southside of Papermill Drive would vary in alignment. The segment between Westfield Road and in front of McKay's Books would be positioned on the southside of the unnamed stream to result in less of a stream relocation.



- **Option 5 Alternative** - This alternative would propose roadway widening occur on the southside of Papermill Drive and include a 10-foot multi-use path on the northside and a 7-foot sidewalk on the southside of Papermill Drive from Kingston Pike to N. Weisgarber Road which requires a stream relocation.



Concept plans and a full set of Typical Section displays for Options 1 thru 5 are included in the **Appendix**. The project team including the City of Knoxville staff reviewed the design features of each alternative in relation to motorists, pedestrians, and cyclists. Providing the two-way left-turn lane served the motorists that turned from Papermill Drive, the multi-use path on the northside connected the West Hills and Weisgarber Road bike trails, and the sidewalk on the southside facilitated mobility of all pedestrians between Kingston Pike and N. Weisgarber Road. It was noticed that the pedestrian and cyclists were not provided a crossing in the segment between Kingston Pike and Weisgarber Road. The project team considered uncontrolled crosswalks and active crosswalk warnings. The uncontrolled crosswalks would be accompanied with passive warning signs and pavement markings. The active warnings could be midblock pedestrian devices such as the "HAWK". Upon the project team assessment of this location, it was determined that an uncontrolled crosswalk would not be a sufficient solution. The active warning device could not be located a sufficient distance not to impact Westfield Road or commercial driveways. While traffic volumes and pedestrian counts do not meet signal warrants, it was the suggestion of the project team to consider a traffic signal operation at Westfield Road with pedestrian signal equipment to adequately provide a pedestrian and bicycle crossing where the motorists would understand the assignment of right-of-way. Further study should be conducted to confirm the appropriateness of implementing a traffic signal at Westfield Road.

10.2 Proposed Alternative Costs

CDM Smith developed an opinion of probable construction costs using the latest TDOT and City of Knoxville historical construction cost data. These are allowances for estimating purposes only and not based on quantified information. The construction cost includes contingency, engineering design, construction engineering inspection services (CEI), and right-of-way acquisition. Property acquisition cost were per City of Knoxville Real Estate Manager. Cost excluded were rock removal and utility relocation costs. The total probable construction cost without utility relocation would be \$15,100,000. Considering the utilities present and relocating these services, the probable cost for local utility department to relocate their services would be approximately \$4,600,000. **Table 10-1** provides details of items included to determine the probable construction costs.

Table 10-1 Probable Construction and Utility Relocation Cost Estimate Summary

Papermill Drive Option 5				
PRELIMINARY Conceptual Construction Cost Estimate				Estimate by CDM Smith 3-17-22 Prepared by NCK
Item	Unit	Unit/Cost	Unit Quantity	Total Cost
Construction Items				
CONSTRUCTION STAKES, LINES AND GRADES	LS	\$15,000.00	1	\$15,000
CLEARING AND GRUBBING	LS	\$50,000.00	1	\$50,000
UNDERCUTTING	CY	\$30	2,000	\$60,000
SELECT MATERIAL	Tons	\$10	4000	\$40,000
REMOVAL OF ASPHALT PAVEMENT	SY	\$25	1800	\$45,000
REMOVAL OF RIGID PVMT, SIDEWALK, ETC.	SY	\$27	250	\$6,750
REMOVAL OF CURB AND GUTTER	LF	\$20	900	\$18,000
ROAD AND DRAINAGE EXCAVATION (UNCLASS)	CY	\$15	25000	\$375,000
FURNISHING AND SPREADING TOPSOIL	CY	\$35	1500	\$52,500
SODDING (NEW SOD)	SY	\$8	9000	\$72,000
LANDSCAPING (ALLOWANCE FOR 10,000SF)	LS	\$150,000	1	\$150,000
1.5" SURFACE GRADING "D"	Tons	\$105	12020	\$1,262,100
2" BITUMINOUS BINDER COURSE	Tons	\$95	315	\$29,925
3" BITUMINOUS BASE COURSE	Tons	\$85	480	\$40,800
12" GRADED AGGREGATE BASE	Tons	\$35	1880	\$65,800
PRIME COAT / TACK COAT	Tons	\$700	10	\$7,000
COLD PLANING BITUMINOUS PAVEMENT	CY	\$75	600	\$45,000
SAW CUTTING ASPHALT PAVEMENT	LF	\$4	3900	\$15,600
RETAINING WALL	SF	\$75	10700	\$802,500
CONCRETE DRAINAGE PIPE	LF	\$85	4400	\$374,000
CATCH BASINS	EACH	\$4,500	15	\$67,500
AREA DRAINS	EACH	\$3,500	10	\$35,000
STORM MANHOLES	EACH	\$4,000	5	\$20,000
BOX CULVERT BRIDGE (MCKAYS DW)	EACH	\$45,000	1	\$45,000
BOX CULVERT BRIDGE (ALCHEMY SALON DW)	EACH	\$45,000	1	\$45,000
CONCRETE ENDWALLS	EACH	\$3,000	5	\$15,000
CONCRETE SIDEWALK (6")	SF	\$12	18200	\$218,400
CONCRETE MULTIPURPOSE PATH (6")	SF	\$12	31000	\$372,000
CONCRETE CURB AND GUTTER (6-30)	LF	\$35	3900	\$136,500
CONCRETE VERTICAL CURB	LF	\$20	400	\$8,000
BIKE / PED SAFETY RAIL	LF	\$140	1600	\$224,000
VEHICLE / PED SAFETY RAIL	LF	\$195	1000	\$195,000
ENERGY ABSORPTION TERMINALS	EACH	\$8,000	4	\$32,000
REPLACE STREETLIGHTS (ALLOWANCE)	LS	\$320,000	1	\$320,000
ACCESS CONTROL FENCE (CHAIN LINK)	LF	\$20	700	\$14,000
SIGNAGE	LS	\$30,000	1	\$30,000
TRAFFIC SIGNALIZED INTERSECTION	LS	\$275,000	1	\$275,000
MODIFY TRAFFIC SIGNALIZED INTERSECTION	LS	\$75,000	1	\$75,000
TRAFFIC CONTROL	LS	\$180,000	1	\$180,000
EROSION CONTROL	LS	\$195,000	1	\$195,000
STREAM RELOCATION AND RESTORATION (ALLOWANCE)	LS	\$400,000	1	\$400,000
PAVEMENT MARKING	LS	\$40,000	1	\$40,000
MOBILIZATION	LS	\$35,000	1	\$35,000
<i>ITEMS TOTAL</i>				\$6,439,375
7% MISC APPURTENANCES				\$450,756
15% CONTINGENCY				\$965,906
GRAND TOTAL				\$7,856,038
ENGINEERING COSTS				\$1,050,000
CEI COSTS				\$1,200,000
ROW ACQUISITION COSTS				\$5,000,000
ESTIMATE TOTAL				\$15,106,038
OPINION OF PROBABLE COST = \$15,100,000				

*Allowances for estimating purposes only and not based on quantified information.

Assumptions

Property acquisition costs per City of Knoxville Real Estate Manager

No utility relocation costs are included.

Assumes no rock removal.

10.3 Proposed Alternatives Traffic Benefit Analysis

The proposed 3-lane roadway would benefit traffic operations by providing the left-turn lane at side streets and commercial driveways to minimize delay impacts to through traffic volumes on Papermill Drive. It will also improve safety by providing a physical separation between opposing traffic and a place for left turning vehicles to store. Section 11 discusses in detail the no-build and proposed construction scenario traffic analysis results.

The removal of the channelized westbound right-turn lane improves the v/c ratio during the AM and PM peak hours. The average delay at Kingston Pike increased by 12 seconds in the AM peak hour and decreased by 12 seconds in the PM peak hour on average. The proposed traffic signal controller at Westfield Road would provide a pedestrian controlled crossing along the middle of the study corridor. The Westfield Road traffic signal would operate at very good levels of service. The suggested lane re-assignment to create a westbound dual right-turn lane to go northbound on N. Weisgarber Road would improve the AM peak hour by gaining additional capacity resulting in lower average delay times.

10.4 Proposed Alternatives Safety Benefit Analysis

In the past three (3) years, Papermill Drive had 120 reported crashes in its over half (0.61) mile section with 76 rear-end, 14 angle, 13 side-swipe, and 17 other crash types. **Table 10-2** summarizes the Crash Modification Factors (CMF) related to adding a Two-Way-Left-Turn-Lane (TWLTL) for all crashes and rear-end crashes within an urban area. The TWLTL addition could potentially reduce overall crashes by 15 percent and rear-end crashes by 40 percent, hence the number of crashes occurring in a three (3) year period would decrease to 102 and the number of rear-end crashes to 46. These CMFs are based on very reliable data given 4 out of 5 stars in its rating for most studies. There were a few 3-star data points used in this average.

Table 10-2 Crash Modification Factors by Mitigation

CMF	CRF(%)	Quality	Crash Type	Crash Severity	Area Type	Reference
0.775	22.5	4 Stars	All	All	All	LYON ET AL., 2008
0.686	31.4	4 Stars	All	All	All	LYON ET AL., 2008
0.874	12.6	4 Stars	All	All	All	LYON ET AL., 2008
0.843	15.7	4 Stars	All	All	All	LYON ET AL., 2008
0.797	20.3	4 Stars	All	All	All	LYON ET AL., 2008
0.629	37.1	4 Stars	All	K (fatal),A (serious injury),B (minor injury),C (possible injury)	All	LYON ET AL., 2008
0.725	27.5	4 Stars	All	K (fatal),A (serious injury),B (minor injury),C (possible injury)	All	LYON ET AL., 2008
0.469	53.1	4 Stars	All	K (fatal),A (serious injury),B (minor injury),C (possible injury)	All	LYON ET AL., 2008
0.739	26.1	4 Stars	All	K (fatal),A (serious injury),B (minor injury),C (possible injury)	All	LYON ET AL., 2008
0.501	49.9	4 Stars	Rear end	All		LYON ET AL., 2008
0.506	49.4	4 Stars	Rear end	All	All	LYON ET AL., 2008
0.58	42	4 Stars	Rear end	All	All	LYON ET AL., 2008
0.783	21.7	4 Stars	Rear end	All	All	LYON ET AL., 2008
0.613	38.7	4 Stars	Rear end	All	All	LYON ET AL., 2008
0.488	51.2	4 Stars	All	All	Rural	LYON ET AL., 2008
0.492	50.8	4 Stars	All	All	Rural	LYON ET AL., 2008
0.727	27.3	4 Stars	All	All	Rural	LYON ET AL., 2008
1.019	-1.9	3 Stars	All	K (fatal),A (serious injury),B (minor injury),C (possible injury)	All	LYON ET AL., 2008
0.962	3.8	3 Stars	All	All	Urban	LYON ET AL., 2008
1.028	-2.8	3 Stars	All	All	Urban	LYON ET AL., 2008
0.833	16.7	3 Stars	All	All	Rural	LYON ET AL., 2008
0.906	9.4	3 Stars	All	All	Urban	LYON ET AL., 2008
1.05	-5	3 Stars	All	All	Urban	LYON ET AL., 2008
0.92	8	3 Stars	All	All		HOVEY AND CHOWDHURY, 2005
AVERAGE						
0.85	15%	3-4 Stars	All	All	All/Urban	
0.60	40%	4 Stars	Rear end	All	All	

Source: www.cmfclearinghouse.org

10.5 Proposed Alternatives Geometric Benefit Analysis

Option 5 would include improvements to provide a center turn lane, a multi-use path on the northside and a 7-foot sidewalk on the southside of Papermill Drive. The three (3) lane section would provide for two (2) eleven (11) foot single lanes of directional travel with a center twelve (12) foot lane for left-turn movements into minor side-streets and driveways. The center TWLTL would allow for safer turns made from Papermill Drive to side-streets and driveways; hence, this TWLTL would likely reduce rear-end crashes and provide improved separation of directional traffic reducing side-swipe crashes. The TWLTL would also provide a refuge area for turning vehicles from driveways and minor side-streets and would likely reduce angle crashes. A seven (7) foot sidewalk on the southside would be included and a 10-foot multi-use path on the northside of Papermill Drive. The new sidewalk and multi-use path would allow for safer use of alternative modes of transportation as they are currently not supported under existing conditions. The three (3) lane sections will have considerably less impact due to a smaller disturbance area footprint between I-40 and commercial businesses than a 4-lane or 5-lane facility at the cost of less vehicular capacity. However as analyzed, the three-lane section will be sufficient for the design year.

Section 11

Traffic Analysis

11.1 LOS Comparison Existing and Design Years

Level of Service Definition

In order to evaluate the current operations of the traffic control devices, capacity and level of service were calculated using Synchro v11, which is based on the 2000 Highway Capacity Manual, Special Report 209 published by the Transportation Research Board (TRB). Signalized and unsignalized intersections are evaluated based on estimated intersection delays, which may be related to level of service (LOS).

Level of service and capacity are the measurements of an intersection's ability to accommodate traffic volumes. Levels of service for intersections range from LOS A to LOS F. LOS A is the best. LOS F is failing. For signalized intersections, LOS A has an average estimated intersection delay of less than 10 seconds, and LOS F has an estimated delay of greater than 80 seconds. LOS C and D are typical design values. Within urban areas, a LOS D having delay between 35 and 55 seconds is considered acceptable by the Institute of Transportation Engineers (ITE) for signalized intersections.

Unsignalized intersection levels of service have lower thresholds of delays. LOS F exceeds estimated delays of 50 seconds. For urban arterials, minor approaches may frequently experience levels of service E. A full level of service description for unsignalized and signalized intersections is presented in **Tables 11-1** and **11-2**, respectively.

Table 11-1
LEVEL OF SERVICE (LOS) DESCRIPTION
FOR TWO-WAY STOP INTERSECTIONS

Level of Service	Average Control Delay per Vehicle (seconds)
A	≤ 10.0
B	> 10.0 and ≤ 15.0
C	> 15.0 and ≤ 25.0
D	> 25.0 and ≤ 35.0
E	> 35.0 and ≤ 50.0
F	> 50.0

SOURCE: Highway Capacity Manual, TRB Special Report 209

Table 11-2
LEVEL OF SERVICE (LOS) DESCRIPTION
FOR SIGNALIZED INTERSECTIONS

LOS	Average Control Delay per Vehicle (seconds)	Description
A	≤ 10.0	Very low delay with extremely favorable progression. Most vehicles don't stop.
B	> 10.0 and ≤ 20.0	Generally good progression. Increase number of stops from that described for LOS "A" resulting in higher delays
C	> 20.0 and ≤ 35.0	Fair progression with increased delay. Number of stopping vehicles become significant; however, many still pass through the intersection without stopping. Stable flow.
D	> 35.0 and ≤ 55.0	The influence of congestion becomes more noticeable. Longer delays resulting from unfavorable progression, longer cycles, or high V/C ratios. Approaching unstable flow.
E	> 55.0 and ≤ 80.0	Limit of acceptable delay. Long delays associated with poor progression, long cycles, or high V/C ratios.
F	> 80.0	Unacceptable operation resulting from oversaturation (flow rates exceed capacity). Poor progression, long cycles, and high V/C ratios.

SOURCE: Highway Capacity Manual, TRB Special Report 209

Level of Service (LOS) and capacity were assessed on Papermill Road using the methodologies of the Highway Capacity Manual (HCM) contained in the Synchro Version 11 software for the No-Build and Build alternatives for base and future years. Variations in the capacity analysis between Options 1 through 5 are not expected since the differences are mainly related to the location of the roadway centerline and multi-use path. Furthermore, the three-lane improvement does not add capacity to the roadway segment, but the intersections and driveways will be improved by reduced delays.

No-Build Conditions

Table 11-3 presents the existing 2021 LOS's for Papermill Drive. The intersections along the study area function at a LOS D and E or better during the AM and PM peak hours. The Kingston Pike intersection is nearing capacity with a 0.92 volume to capacity (V/C) ratio during the PM peak hour. While average delays indicate a LOS D, increases in volumes can dramatically deteriorate traffic operations. The Weisgarber Road intersection operates currently above its capacity during the AM peak hour. This is confirmed by long traffic queues at the study intersections during the AM and PM peak hours.

Table 11-3 Existing (2021) Delay and Levels of Service

INTERSECTION	TRAFFIC CONTROL	PEAK PERIOD	V/C	DELAY	LOS
SR 1 (Kingston Pike) at Papermill Drive	SIGNAL	AM	0.42	40.5	D
		PM	0.92	35.5	D
Westfield Road at Papermill Drive	STOP NB/WB-L	AM	0.02 / 0.07	10.0 / 1.8	A / A
		PM	0.19 / 0.08	15.4 / 1.9	C / A
Weisgarber Road at Papermill Drive	SIGNAL	AM	1.09	49.4	D
		PM	0.80	60.7	E

Note: Average vehicle delay estimated in seconds. STOP control analyses presented by total minor approaches.

Table 11-4 presents the future 2040 LOS's for Papermill Drive under No Build conditions. The intersections along the study area will operate at slightly higher V/C ratios and some peak hour operations will worsen. The Kingston Pike intersection, with a 0.92 volume to capacity (V/C) ratio, is approaching the delay levels of a LOS E during the PM peak hour. The Weisgarber Road intersection will continue to operate above its capacity during the AM peak hour.

Table 11-4 Future (2040) Delay and Levels of Service under No Build Conditions

INTERSECTION	TRAFFIC CONTROL	PEAK PERIOD	V/C	DELAY	LOS
SR 1 (Kingston Pike) at Papermill Drive	SIGNAL	AM	0.47	36.9	D
		PM	0.92	54.2	D
Westfield Road at Papermill Drive	STOP NB/WB-L	AM	0.02 / 0.07	10.2 / 1.9	B / A
		PM	0.22 / 0.09	16.8 / 2.3	C / A
Weisgarber Road at Papermill Drive	SIGNAL	AM	1.21	64.3	E
		PM	0.86	67.3	E

Note: Average vehicle delay estimated in seconds. STOP control analyses presented by total minor approaches.

Build Conditions

Table 11-5 presents the future 2040 LOS's for Papermill Drive under Build conditions. The removal of the channelized westbound right-turn lane improves the v/c ratio during the AM and PM peak hours. The average delay at Kingston Pike increased by 12 seconds in the AM peak hour and decreased by 12 seconds in the PM peak hour on average. The project team suggested a traffic signal-controlled intersection at Westfield Road would provide a solution to pedestrian crossing along the middle of the study corridor. The Westfield Road traffic signal would operate at very good levels of service. The solution to eliminate the extra through lane to be re-assignment to create a westbound dual right-turn lane on Papermill Drive onto northbound N. Weisgarber Road

would improve the AM peak hour by gaining additional capacity resulting in lower average delay times. However, delays and the V/C ratio will increase in the PM peak hour because of this change by not having the through lane which dropped on the departing side of the intersection.

Table 11-5 Future (2040) Delay and Levels of Service under Build Conditions

INTERSECTION	TRAFFIC CONTROL	PEAK PERIOD	V/C	DELAY	LOS
SR 1 (Kingston Pike) at Papermill Drive	SIGNAL	AM	0.47	17.7	B
		PM	0.92	54.2	D
Operate WB-R under signal control	SIGNAL	AM	0.46	29.8	C
	Mitigation	PM	0.89	43.9	D
Westfield Road at Papermill Drive	STOP	AM	0.02 / 0.07	10.2 / 8.2	B / A
	NB/WB-L	PM	0.22 / 0.09	16.8 / 9.7	C / A
	SIGNAL	AM	0.35	8.0	A
	Mitigation	PM	0.51	11.5	B
Holiday Inn Driveway at Papermill Drive	STOP	AM	0.25 / 0.01	12.6 / 8.0	B / A
	NB/WB-L	PM	0.05 / 0.06	16.9 / 9.9	C / A
Weisgarber Road at Papermill Drive	SIGNAL	AM	1.06	60.5	E
		PM	0.86	67.3	E
Lane re-assignment on Papermill Drive	SIGNAL	AM	0.78	45.0	D
	Mitigation	PM	0.87	72.7	E

Note: Average vehicle delay estimated in seconds. STOP control analyses presented by total minor approaches.

A comparison between No Build and Build conditions are provided in **Table 11-6**. The proposed mitigation does improve the expected future traffic operations at the study intersections.

Table 11-6 Year 2040 Papermill Drive Levels of Service and V/C Ration Comparison – No Build vs. Build Alternatives

CAPACITY AND LEVEL OF SERVICE SUMMARY										
INTERSECTION	TRAFFIC CONTROL PERIOD	PEAK V/C	2021 TRAFFIC DELAY	LOS	V/C	2040 NO BUILD DELAY	LOS	V/C	2040 BUILD DELAY	LOS
SR 1 (Kingston Pike) at Papermill Drive	SIGNAL AM	0.42	40.5	D	0.47	36.9	D	0.47	17.7	B
	PM	0.92	35.5	D	0.92	54.2	D	0.92	54.2	D
Operate WB-R under signal control	SIGNAL Mitigation AM							0.46	29.8	C
	PM							0.89	43.9	D
Westfield Road at Papermill Drive	STOP NB/WB-L	0.02 / 0.07 0.19 / 0.08	10.0 / 1.8 15.4 / 1.9	A / A C / A	0.02 / 0.07 0.22 / 0.09	10.2 / 1.9 16.8 / 2.3	B / A C / A	0.02 / 0.07 0.22 / 0.09	10.2 / 8.2 16.8 / 9.7	B / A C / A
	SIGNAL Mitigation AM							0.35	8.0	A
	PM							0.51	11.5	B
Holiday Inn Driveway at Papermill Drive	STOP NB/WB-L							0.25 / 0.01	12.6 / 8.0	B / A
	AM							0.05 / 0.06	16.9 / 9.9	C / A
	PM									
Weisgarber Road at Papermill Drive	SIGNAL AM	1.09	49.4	D	1.21	64.3	E	1.06	60.5	E
	PM	0.80	60.7	E	0.86	67.3	E	0.86	67.3	E
Lane re-assignment on Papermill Drive	SIGNAL Mitigation AM							0.78	45.0	D
	PM							0.87	72.7	E

Note: Average vehicle delay estimated in seconds. STOP control analyses presented by total minor approaches.

Section 12

Recommendations and Conclusion

Papermill Drive between S.R. 1 (Kingston Pike) (L.M. 0.00) and N. Weisgarber Road (L.M. 0.61) is a two (2) lane Urban Major Collector that is 24 to 48 feet wide and accommodates approximately 16,300 VPD. Its posted speed limit is 40 MPH. Land use along the route is primarily commercial with residential neighborhood access on side streets.

In the last three reporting years, Papermill Drive has experienced 120 crashes and its crash rate exceeds the statewide average having an actual to critical crash ratio of 3.19, suggesting causative factors that can be mitigated with improvements. A large percentage of the crashes occur during the daylight times during clear weather and are property damage only. Rear-end crashes are the predominate crash type. The most serious crash was a bike fatality. While rear-end crashes along the corridor indicate congestion that needs additional capacity, a multi-lane roadway is not appropriate given the traffic volumes and physical constraints. However, a two-way left-turn lane, though it does not add significant capacity, will provide left-turn movements refuge, so it was identified as the best mitigation to fit within the narrow-constrained corridor.

Five alternative alignments were considered, all adding a continuous Two-Way-Left-Turn-Lane (TWLTL) and bike and pedestrian facilities. Option 1 proposed widening to the southside of Papermill Drive to include a 10-foot multi-use path and a stream relocation. Option 2 proposed widening to the northside of Papermill Drive and would include a 10-foot multi-use path on the southside and a stream relocation. Option 3 was a combination of Option 1 and Option 2 creating a transition in the roadway alignment to avoid impacts to the TVA High-voltage Transmission Lines. Option 4 allowed the multi-use path to be routed along the southside of the stream to minimize the stream relocation distance. Option 5 provides the most benefit by having the widening occur about the centerline, then providing a 10-foot multi-use path on the northside to connect the City's greenway network and a 7-foot sidewalk on the southside for pedestrian connectivity and access to shopping.

A three (3) lane typical section with a sidewalk on one side and multiuse path on the other will require obtaining a ROW easement from TVA and several local utility relocations.

A continuous TWLTL will also reduce the number of crashes especially rear-end crashes, since the turn lane can be used as a refuge while performing a left turn. The CMF for adding a TWLTL to Papermill Drive is 0.85 for all crashes and 0.60 for rear-end crashes, so that change could reduce the total number of crashes from 120 to 102 in a three (3) year period. A multiuse path and sidewalks will significantly enhance bike and pedestrian mobility and will provide a desirable community amenity.

The following summarizes the recommendations:

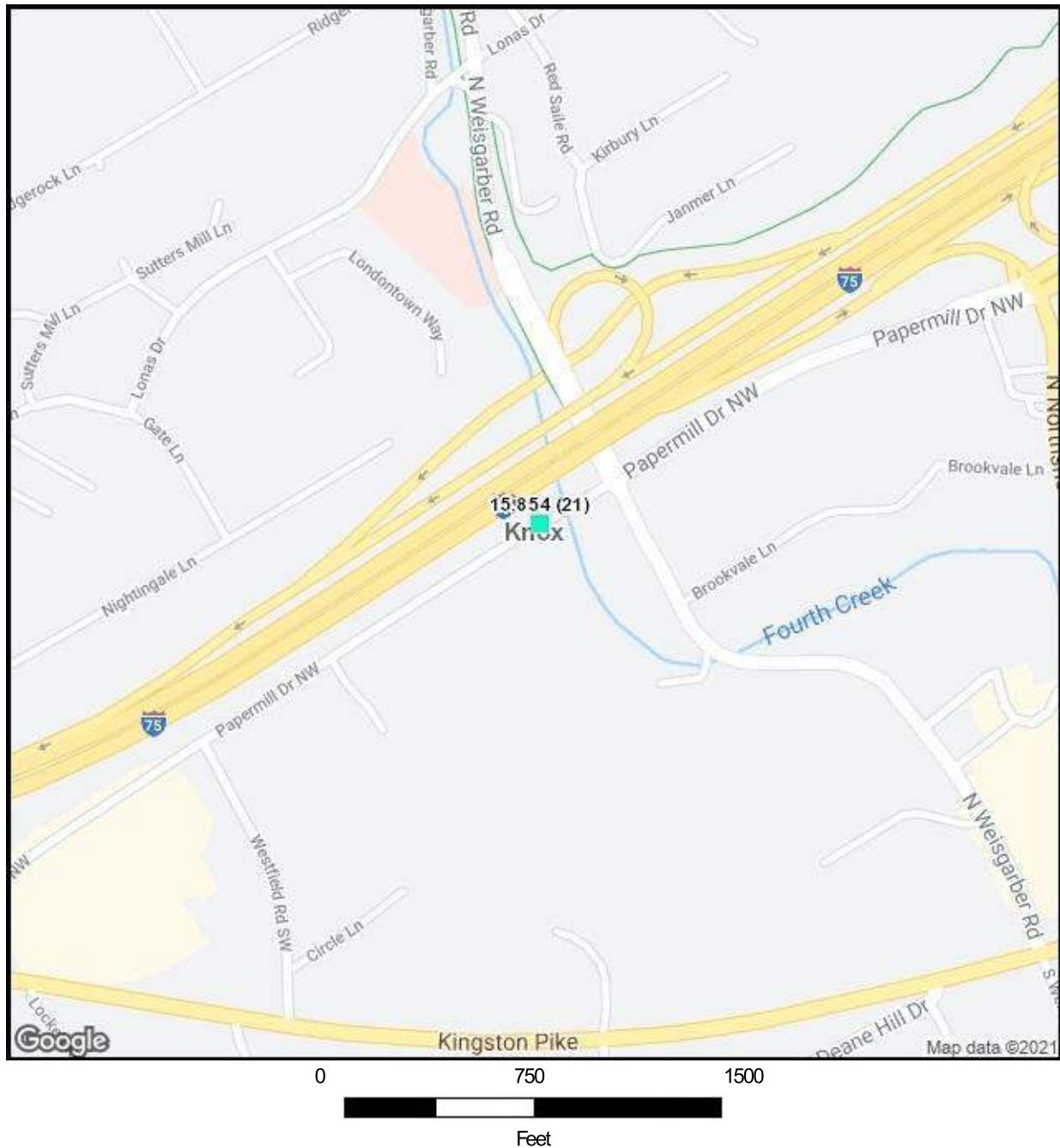
- Remove the westbound Kingston Pike channelized right-turn lane and receiving lane on Papermill Drive at the shopping center access. This recommendation would reduce the

walk distances across Papermill Drive and remove one of the additional eastbound Papermill Drive lane that would not be needed after the channelization removal.

- Improve Papermill Road as per Option 5. This alternative would propose roadway widening occur on the southside of Papermill Drive and include a 10-foot multi-use path on the northside and a 7-foot sidewalk on the southside of Papermill Drive from Kingston Pike to N. Weisgarber Road which requires a stream relocation.
- Consider further study in regard to adding a traffic signal with pedestrian crosswalk equipment at the Papermill Road and Westfield Road intersection to provide safe and protected crossing of pedestrians and cyclists.
- Re-stripe the westbound Papermill Drive approach at N. Weisgarber Road from the dual through lanes to become a dual right turn-lane onto N. Weisgarber due to the elimination of the two receiving lanes on Papermill Drive.

Appendix A

Traffic Data Sheets



3/25/2021

City of Knoxville

Traffic Engineering Department

N Weisgarber Rd & Papermill Dr

Time: 7:00am to 9:00am

Weather: Nice

Counted By: AH & CG

File Name : Not Named 41

Site Code : 00000000

Start Date : 9/21/2017

Page No : 1

Groups Printed- Unshifted

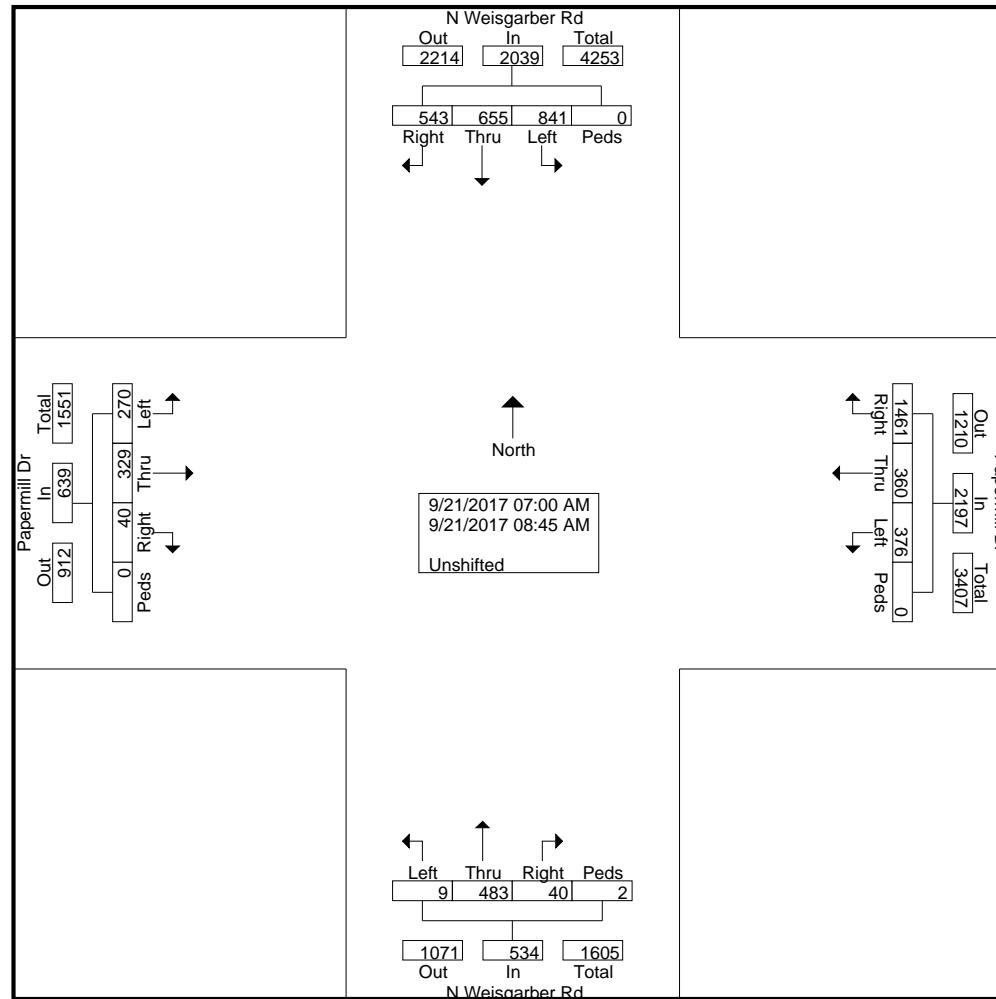
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	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
07:00 AM	37	45	61	0	143	117	15	27	0	159	3	29	0	1	33	2	25	22	0	49	384
07:15 AM	63	65	87	0	215	188	48	27	0	263	6	61	1	1	69	1	23	28	0	52	599
07:30 AM	60	74	134	0	268	249	43	62	0	354	5	71	0	0	76	5	43	32	0	80	778
07:45 AM	73	118	114	0	305	242	35	55	0	332	5	92	0	0	97	8	46	58	0	112	846
Total	233	302	396	0	931	796	141	171	0	1108	19	253	1	2	275	16	137	140	0	293	2607
08:00 AM	74	105	126	0	305	199	45	56	0	300	2	62	0	0	64	4	31	37	0	72	741
08:15 AM	79	94	112	0	285	174	36	48	0	258	4	39	2	0	45	6	53	33	0	92	680
08:30 AM	59	77	108	0	244	151	49	61	0	261	8	74	1	0	83	6	51	35	0	92	680
08:45 AM	98	77	99	0	274	141	89	40	0	270	7	55	5	0	67	8	57	25	0	90	701
Total	310	353	445	0	1108	665	219	205	0	1089	21	230	8	0	259	24	192	130	0	346	2802
Grand Total	543	655	841	0	2039	1461	360	376	0	2197	40	483	9	2	534	40	329	270	0	639	5409
Apprch %	26.6	32.1	41.2	0		66.5	16.4	17.1	0		7.5	90.4	1.7	0.4		6.3	51.5	42.3	0		
Total %	10	12.1	15.5	0	37.7	27	6.7	7	0	40.6	0.7	8.9	0.2	0	9.9	0.7	6.1	5	0	11.8	

City of Knoxville

Traffic Engineering Department

N Weisgarber Rd & Papermill Dr
Time: 7:00am to 9:00am
Weather: Nice
Counted By: AH & CG

File Name : Not Named 41
Site Code : 00000000
Start Date : 9/21/2017
Page No : 2

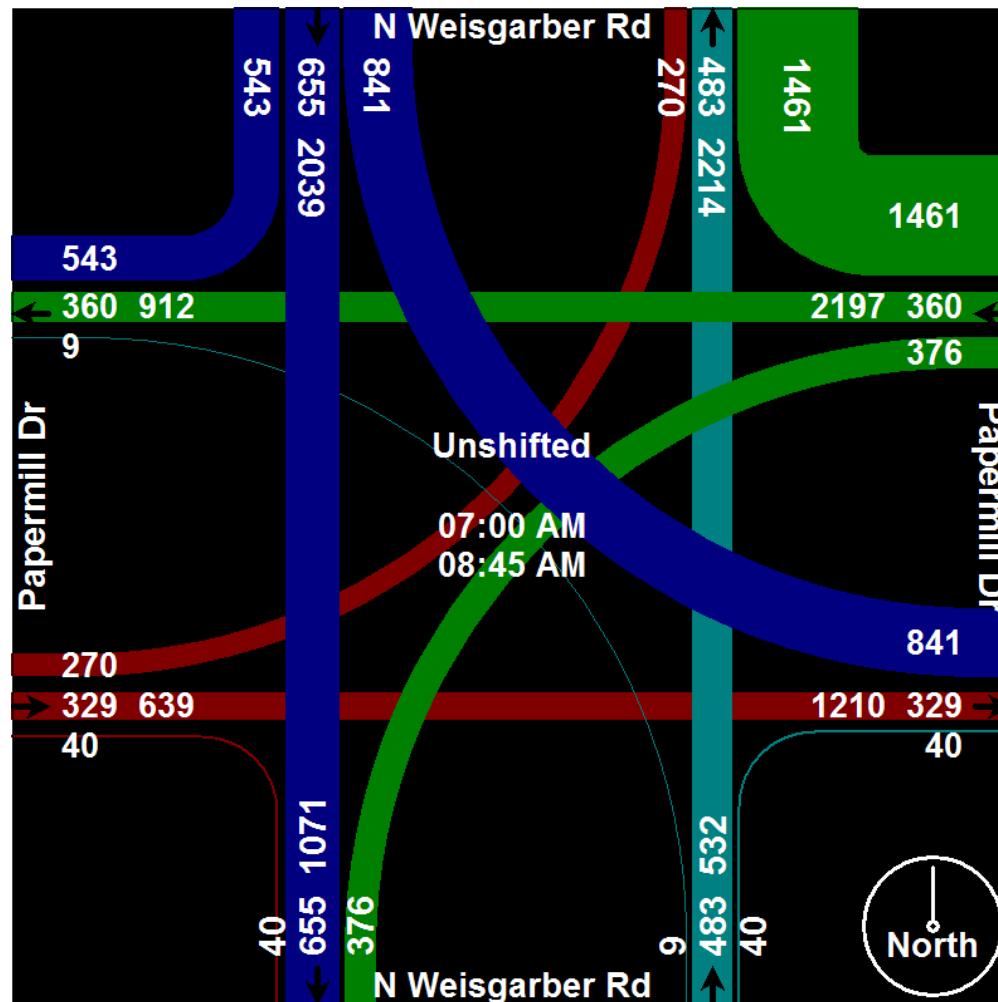


City of Knoxville

Traffic Engineering Department

N Weisgarber Rd & Papermill Dr
Time: 7:00am to 9:00am
Weather: Nice
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File Name : Not Named 41
Site Code : 00000000
Start Date : 9/21/2017
Page No : 3



City of Knoxville

Traffic Engineering Department

N Weisgarber Rd & Papermill Dr

Time: 7:00am to 9:00am

Weather: Nice

Counted By: AH & CG

File Name : Not Named 41

Site Code : 00000000

Start Date : 9/21/2017

Page No : 4

	N Weisgarber Rd Southbound					Papermill Dr Westbound					N Weisgarber Rd Northbound					Papermill Dr Eastbound					
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Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	60	74	134	0	268	249	43	62	0	354	5	71	0	0	76	5	43	32	0	80	778
07:45 AM	73	118	114	0	305	242	35	55	0	332	5	92	0	0	97	8	46	58	0	112	846
08:00 AM	74	105	126	0	305	199	45	56	0	300	2	62	0	0	64	4	31	37	0	72	741
08:15 AM	79	94	112	0	285	174	36	48	0	258	4	39	2	0	45	6	53	33	0	92	680
Total Volume	286	391	486	0	1163	864	159	221	0	1244	16	264	2	0	282	23	173	160	0	356	3045
% App. Total	24.6	33.6	41.8	0		69.5	12.8	17.8	0		5.7	93.6	0.7	0		6.5	48.6	44.9	0		
PHF	.905	.828	.907	.000	.953	.867	.883	.891	.000	.879	.800	.717	.250	.000	.727	.719	.816	.690	.000	.795	.900

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

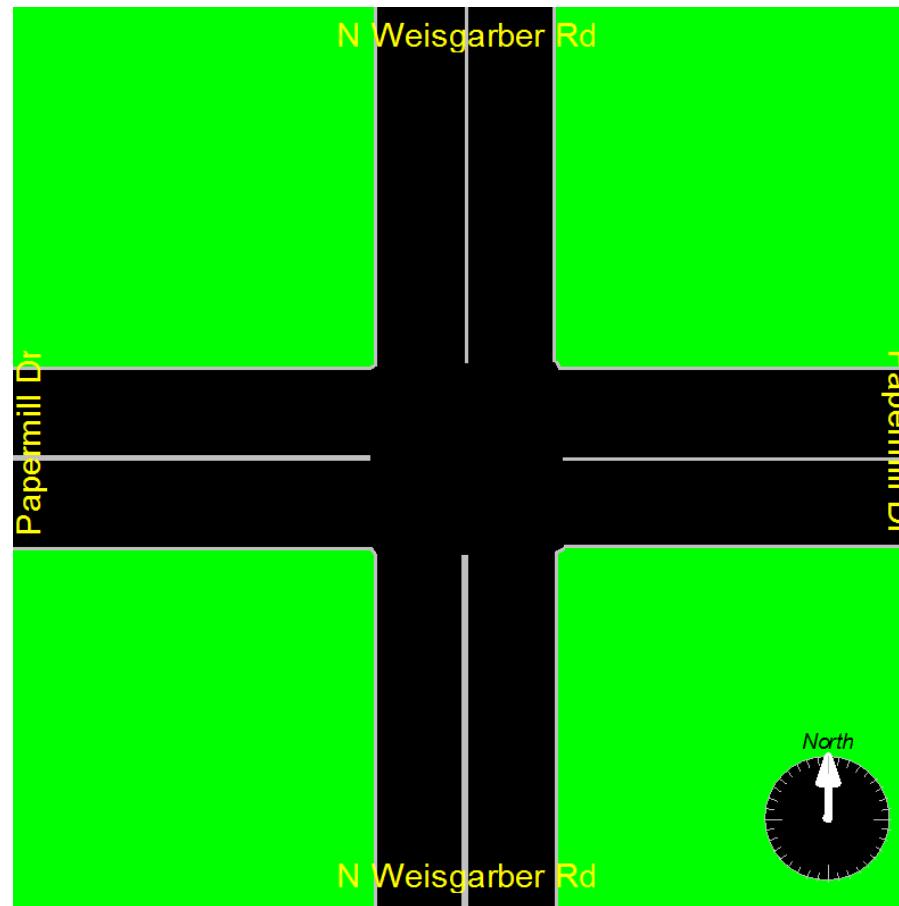
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+0 mins.	60	74	134	0	268	188	48	27	0	263	6	61	1	1	69	8	46	58	0	112
+15 mins.	73	118	114	0	305	249	43	62	0	354	5	71	0	0	76	4	31	37	0	72
+30 mins.	74	105	126	0	305	242	35	55	0	332	5	92	0	0	97	6	53	33	0	92
+45 mins.	79	94	112	0	285	199	45	56	0	300	2	62	0	0	64	6	51	35	0	92
Total Volume	286	391	486	0	1163	878	171	200	0	1249	18	286	1	1	306	24	181	163	0	368
% App. Total	24.6	33.6	41.8	0		70.3	13.7	16	0		5.9	93.5	0.3	0.3		6.5	49.2	44.3	0	
PHF	.905	.828	.907	.000	.953	.882	.891	.806	.000	.882	.750	.777	.250	.250	.789	.750	.854	.703	.000	.821

City of Knoxville

Traffic Engineering Department

N Weisgarber Rd & Papermill Dr
Time: 7:00am to 9:00am
Weather: Nice
Counted By: AH & CG

File Name : Not Named 41
Site Code : 00000000
Start Date : 9/21/2017
Page No : 5



City of Knoxville

Traffic Engineering Department

N Weisgarber Rd & Papermill Dr

Time: 11:00am to 1:00pm

Weather: Fine

Counted By: AH & CG

File Name : Not Named 42

Site Code : 00000000

Start Date : 9/22/2017

Page No : 1

Groups Printed- Unshifted

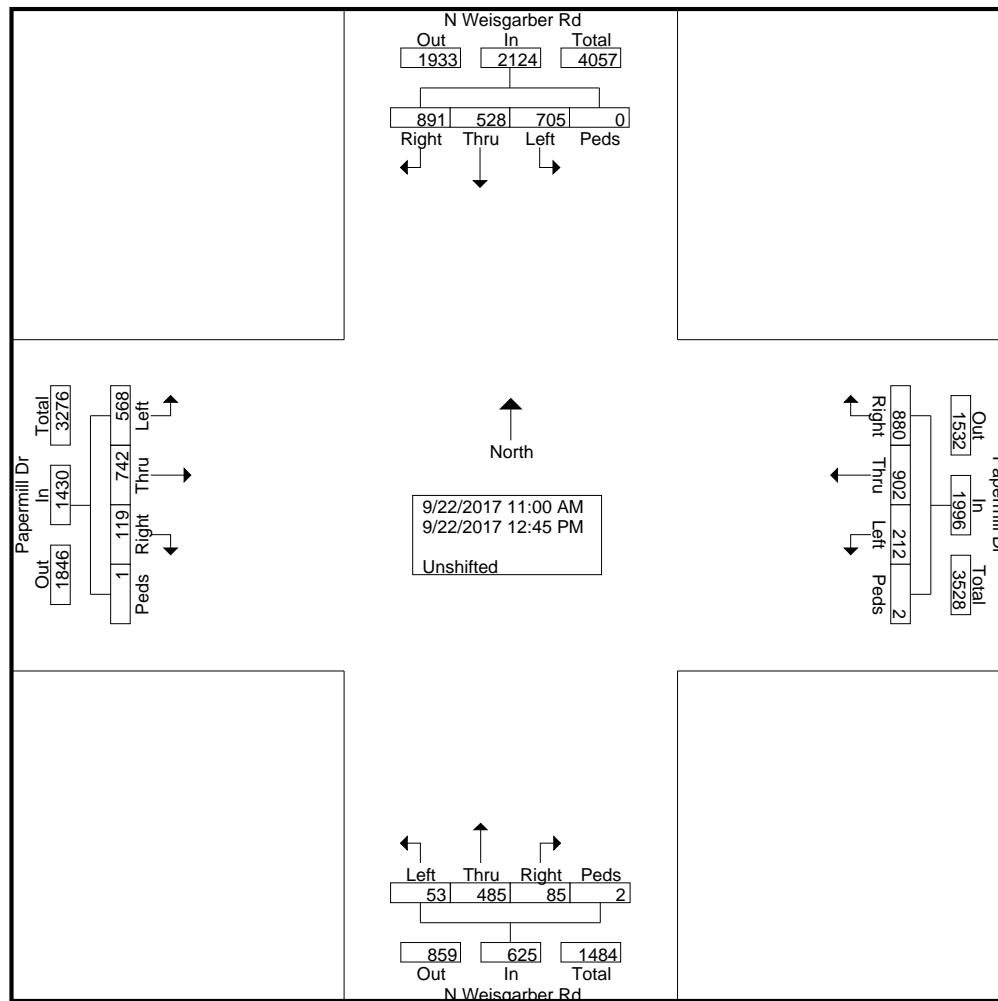
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11:00 AM	104	36	69	0	209	94	110	16	0	220	4	53	8	0	65	11	88	45	0	144	638
11:15 AM	101	68	75	0	244	104	126	28	0	258	11	64	7	0	82	9	60	49	0	118	702
11:30 AM	117	75	88	0	280	109	95	27	0	231	6	70	10	0	86	11	83	45	0	139	736
11:45 AM	123	78	105	0	306	122	132	25	2	281	9	63	4	2	78	14	85	65	0	164	829
Total	445	257	337	0	1039	429	463	96	2	990	30	250	29	2	311	45	316	204	0	565	2905
12:00 PM	139	81	116	0	336	116	116	16	0	248	9	56	13	0	78	10	118	83	0	211	873
12:15 PM	129	59	95	0	283	121	115	26	0	262	17	68	3	0	88	11	91	78	1	181	814
12:30 PM	95	60	78	0	233	99	112	24	0	235	12	68	7	0	87	26	95	105	0	226	781
12:45 PM	83	71	79	0	233	115	96	50	0	261	17	43	1	0	61	27	122	98	0	247	802
Total	446	271	368	0	1085	451	439	116	0	1006	55	235	24	0	314	74	426	364	1	865	3270
Grand Total	891	528	705	0	2124	880	902	212	2	1996	85	485	53	2	625	119	742	568	1	1430	6175
Apprch %	41.9	24.9	33.2	0		44.1	45.2	10.6	0.1		13.6	77.6	8.5	0.3		8.3	51.9	39.7	0.1		
Total %	14.4	8.6	11.4	0	34.4	14.3	14.6	3.4	0	32.3	1.4	7.9	0.9	0	10.1	1.9	12	9.2	0	23.2	

City of Knoxville

Traffic Engineering Department

N Weisgarber Rd & Papermill Dr
Time: 11:00am to 1:00pm
Weather: Fine
Counted By: AH & CG

File Name : Not Named 42
Site Code : 00000000
Start Date : 9/22/2017
Page No : 2

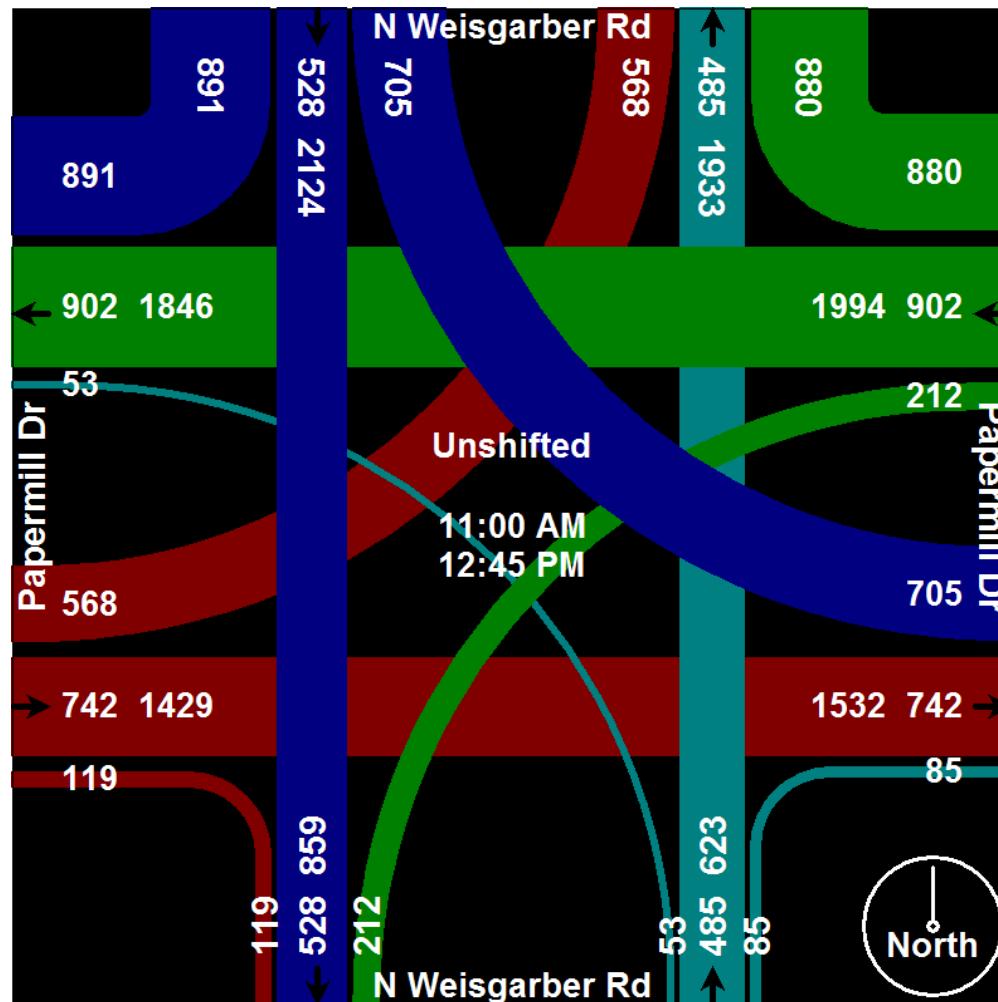


City of Knoxville

Traffic Engineering Department

N Weisgarber Rd & Papermill Dr
Time: 11:00am to 1:00pm
Weather: Fine
Counted By: AH & CG

File Name : Not Named 42
Site Code : 00000000
Start Date : 9/22/2017
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City of Knoxville

Traffic Engineering Department

N Weisgarber Rd & Papermill Dr

Time: 11:00am to 1:00pm

Weather: Fine

Counted By: AH & CG

File Name : Not Named 42

Site Code : 00000000

Start Date : 9/22/2017

Page No : 4

	N Weisgarber Rd Southbound					Papermill Dr Westbound					N Weisgarber Rd Northbound					Papermill Dr Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 11:45 AM																					
11:45 AM	123	78	105	0	306	122	132	25	2	281	9	63	4	2	78	14	85	65	0	164	829
12:00 PM	139	81	116	0	336	116	116	16	0	248	9	56	13	0	78	10	118	83	0	211	873
12:15 PM	129	59	95	0	283	121	115	26	0	262	17	68	3	0	88	11	91	78	1	181	814
12:30 PM	95	60	78	0	233	99	112	24	0	235	12	68	7	0	87	26	95	105	0	226	781
Total Volume	486	278	394	0	1158	458	475	91	2	1026	47	255	27	2	331	61	389	331	1	782	3297
% App. Total	42	24	34	0		44.6	46.3	8.9	0.2		14.2	77	8.2	0.6		7.8	49.7	42.3	0.1		
PHF	.874	.858	.849	.000	.862	.939	.900	.875	.250	.913	.691	.938	.519	.250	.940	.587	.824	.788	.250	.865	.944

Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

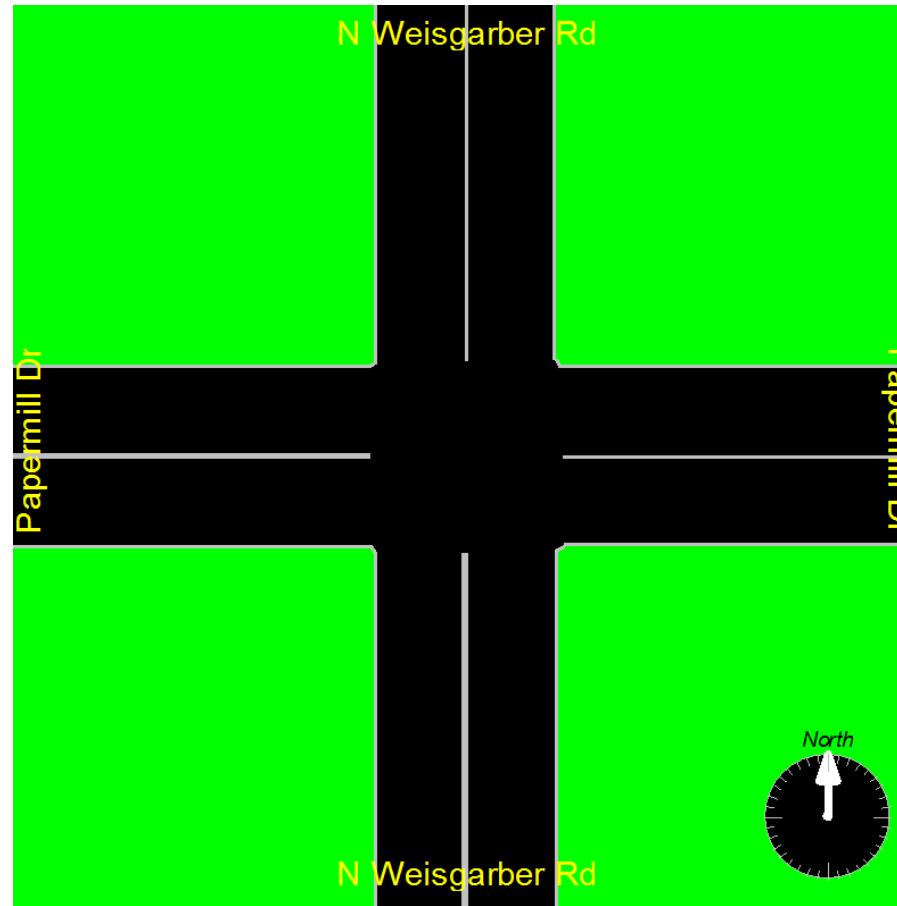
	11:30 AM					11:45 AM					11:45 AM					12:00 PM					
+0 mins.	117	75	88	0	280	122	132	25	2	281	9	63	4	2	78	10	118	83	0	211	
+15 mins.	123	78	105	0	306	116	116	16	0	248	9	56	13	0	78	11	91	78	1	181	
+30 mins.	139	81	116	0	336	121	115	26	0	262	17	68	3	0	88	26	95	105	0	226	
+45 mins.	129	59	95	0	283	99	112	24	0	235	12	68	7	0	87	27	122	98	0	247	
Total Volume	508	293	404	0	1205	458	475	91	2	1026	47	255	27	2	331	74	426	364	1	865	
% App. Total	42.2	24.3	33.5	0		44.6	46.3	8.9	0.2		14.2	77	8.2	0.6		8.6	49.2	42.1	0.1		
PHF	.914	.904	.871	.000	.897	.939	.900	.875	.250	.913	.691	.938	.519	.250	.940	.685	.873	.867	.250	.876	

City of Knoxville

Traffic Engineering Department

N Weisgarber Rd & Papermill Dr
Time: 11:00am to 1:00pm
Weather: Fine
Counted By: AH & CG

File Name : Not Named 42
Site Code : 00000000
Start Date : 9/22/2017
Page No : 5



City of Knoxville

Traffic Engineering Department

N Weisgarber Rd & Papermill Dr

Time: 4:00pm to 6:00pm

Weather: Clear

Counted By: AH & CG

File Name : Not Named 40

Site Code : 00000000

Start Date : 9/20/2017

Page No : 1

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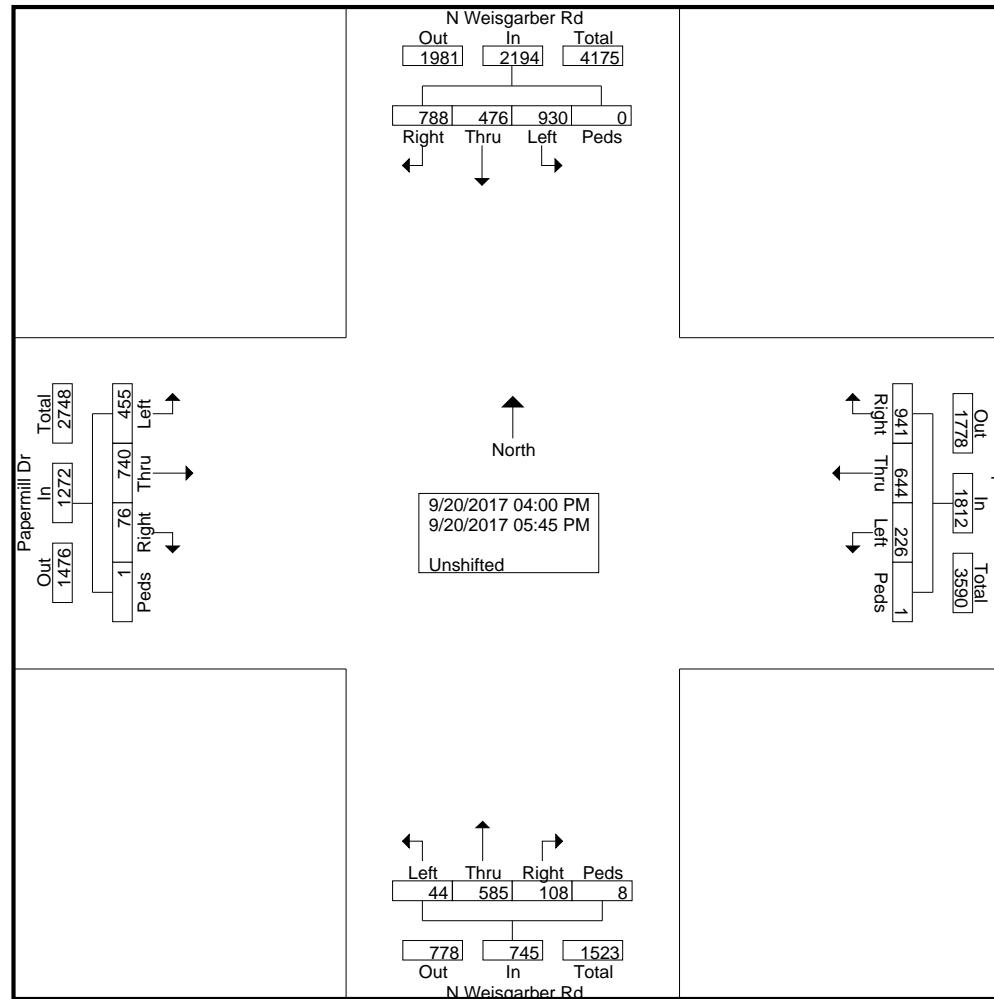
Start Time	N Weisgarber Rd Southbound					Papermill Dr Westbound					N Weisgarber Rd Northbound					Papermill Dr Eastbound					Int. Total
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	
04:00 PM	76	43	114	0	233	120	84	24	0	228	15	74	7	0	96	8	85	43	0	136	693
04:15 PM	84	37	97	0	218	137	72	25	0	234	23	69	9	0	101	8	89	41	0	138	691
04:30 PM	100	62	139	0	301	135	81	19	0	235	15	68	4	1	88	11	88	65	0	164	788
04:45 PM	107	61	121	0	289	86	76	22	1	185	9	60	7	3	79	8	78	45	0	131	684
Total	367	203	471	0	1041	478	313	90	1	882	62	271	27	4	364	35	340	194	0	569	2856
05:00 PM	99	77	134	0	310	143	102	30	0	275	14	83	6	0	103	10	97	66	0	173	861
05:15 PM	123	65	110	0	298	131	86	40	0	257	13	74	1	1	89	10	117	78	0	205	849
05:30 PM	114	73	113	0	300	98	84	32	0	214	11	71	7	3	92	9	93	51	1	154	760
05:45 PM	85	58	102	0	245	91	59	34	0	184	8	86	3	0	97	12	93	66	0	171	697
Total	421	273	459	0	1153	463	331	136	0	930	46	314	17	4	381	41	400	261	1	703	3167
Grand Total	788	476	930	0	2194	941	644	226	1	1812	108	585	44	8	745	76	740	455	1	1272	6023
Apprch %	35.9	21.7	42.4	0		51.9	35.5	12.5	0.1		14.5	78.5	5.9	1.1		6	58.2	35.8	0.1		
Total %	13.1	7.9	15.4	0	36.4	15.6	10.7	3.8	0	30.1	1.8	9.7	0.7	0.1	12.4	1.3	12.3	7.6	0	21.1	

City of Knoxville

Traffic Engineering Department

N Weisgarber Rd & Papermill Dr
Time: 4:00pm to 6:00pm
Weather: Clear
Counted By: AH & CG

File Name : Not Named 40
Site Code : 00000000
Start Date : 9/20/2017
Page No : 2

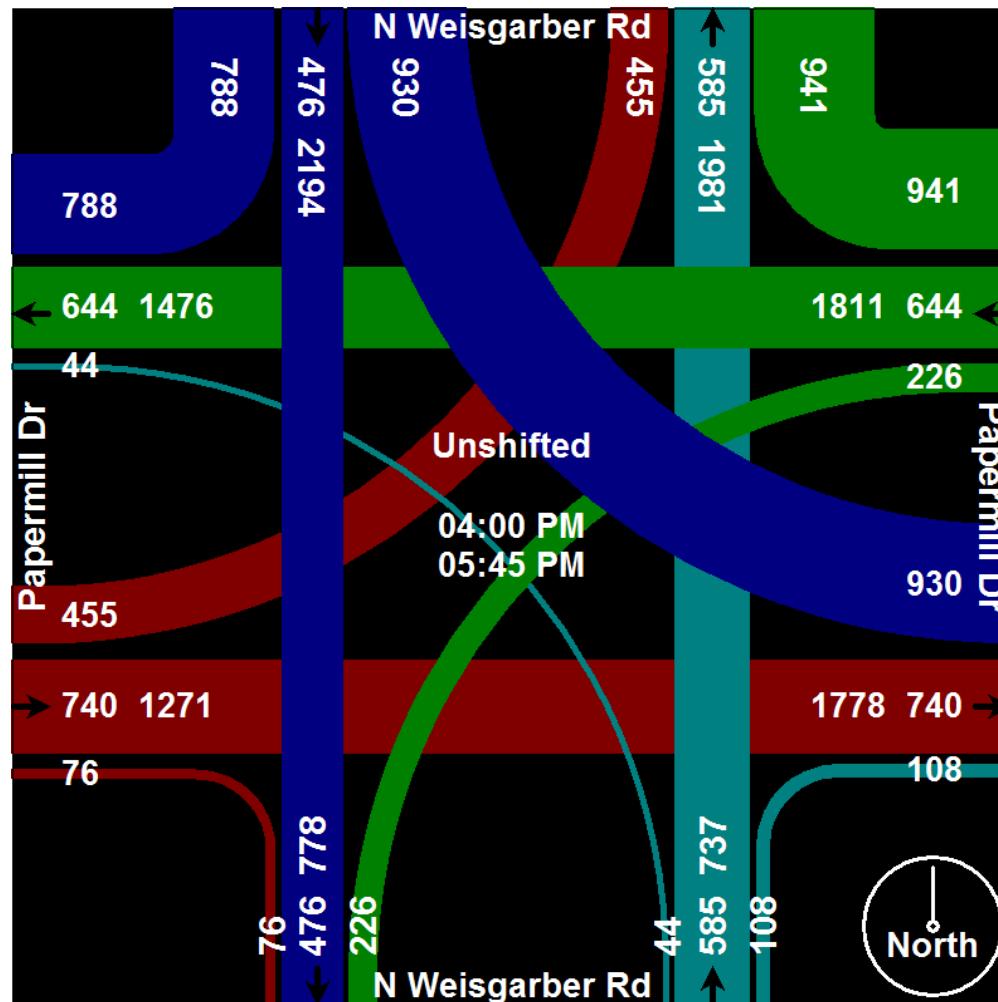


City of Knoxville

Traffic Engineering Department

N Weisgarber Rd & Papermill Dr
Time: 4:00pm to 6:00pm
Weather: Clear
Counted By: AH & CG

File Name : Not Named 40
Site Code : 00000000
Start Date : 9/20/2017
Page No : 3



City of Knoxville

Traffic Engineering Department

N Weisgarber Rd & Papermill Dr

Time: 4:00pm to 6:00pm

Weather: Clear

Counted By: AH & CG

File Name : Not Named 40

Site Code : 00000000

Start Date : 9/20/2017

Page No : 4

	N Weisgarber Rd Southbound					Papermill Dr Westbound					N Weisgarber Rd Northbound					Papermill Dr Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:30 PM																					
04:30 PM	100	62	139	0	301	135	81	19	0	235	15	68	4	1	88	11	88	65	0	164	788
04:45 PM	107	61	121	0	289	86	76	22	1	185	9	60	7	3	79	8	78	45	0	131	684
05:00 PM	99	77	134	0	310	143	102	30	0	275	14	83	6	0	103	10	97	66	0	173	861
05:15 PM	123	65	110	0	298	131	86	40	0	257	13	74	1	1	89	10	117	78	0	205	849
Total Volume	429	265	504	0	1198	495	345	111	1	952	51	285	18	5	359	39	380	254	0	673	3182
% App. Total	35.8	22.1	42.1	0		52	36.2	11.7	0.1		14.2	79.4	5	1.4		5.8	56.5	37.7	0		
PHF	.872	.860	.906	.000	.966	.865	.846	.694	.250	.865	.850	.858	.643	.417	.871	.886	.812	.814	.000	.821	.924

Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

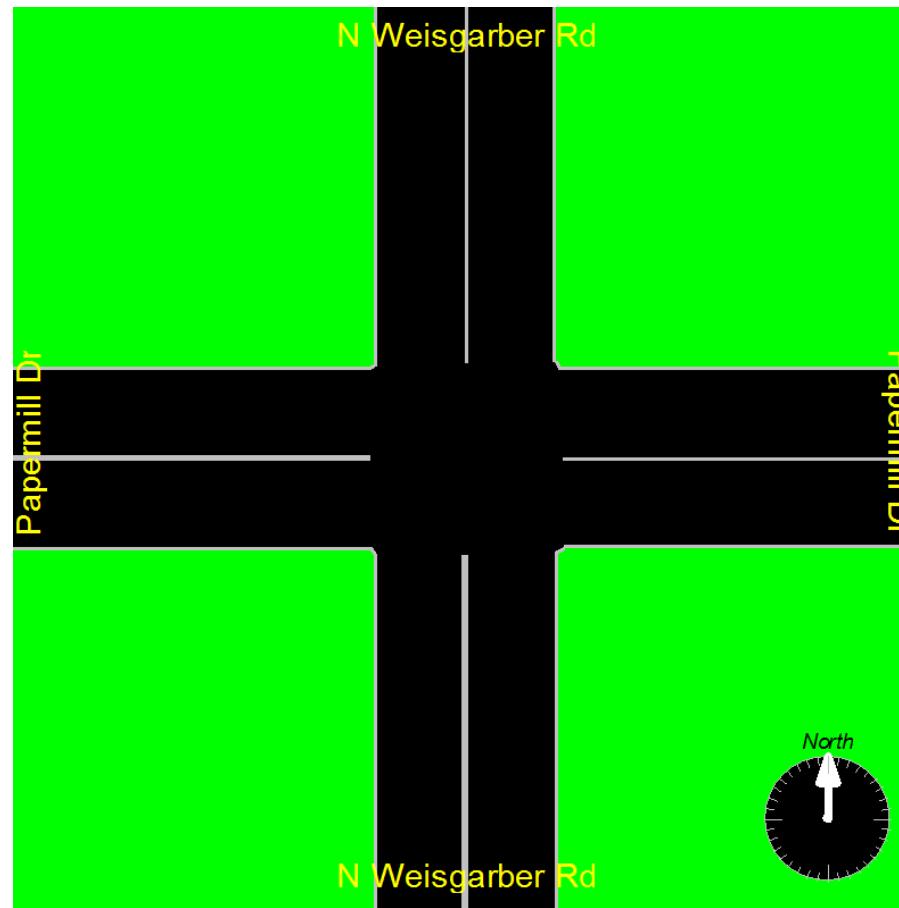
	04:30 PM					04:30 PM					05:00 PM					05:00 PM				
+0 mins.	100	62	139	0	301	135	81	19	0	235	14	83	6	0	103	10	97	66	0	173
+15 mins.	107	61	121	0	289	86	76	22	1	185	13	74	1	1	89	10	117	78	0	205
+30 mins.	99	77	134	0	310	143	102	30	0	275	11	71	7	3	92	9	93	51	1	154
+45 mins.	123	65	110	0	298	131	86	40	0	257	8	86	3	0	97	12	93	66	0	171
Total Volume	429	265	504	0	1198	495	345	111	1	952	46	314	17	4	381	41	400	261	1	703
% App. Total	35.8	22.1	42.1	0		52	36.2	11.7	0.1		12.1	82.4	4.5	1		5.8	56.9	37.1	0.1	
PHF	.872	.860	.906	.000	.966	.865	.846	.694	.250	.865	.821	.913	.607	.333	.925	.854	.855	.837	.250	.857

City of Knoxville

Traffic Engineering Department

N Weisgarber Rd & Papermill Dr
Time: 4:00pm to 6:00pm
Weather: Clear
Counted By: AH & CG

File Name : Not Named 40
Site Code : 00000000
Start Date : 9/20/2017
Page No : 5



Project ID: 21-190016-001

Location: N Weisgarber Rd/Old Weisgarber Rd & Papermill Dr
City: KnoxvilleDay: Tuesday
Date: 3/23/2021

Groups Printed - Cars, PU, Vans - Heavy Trucks																									
Start Time	N Weisgarber Rd/Old Weisgarber Rd Northbound						N Weisgarber Rd/Old Weisgarber Rd Southbound						Papermill Dr Eastbound					Papermill Dr Westbound					Int. Total		
	Left	Thru	Rgt	Uturn	Peds	App. Total	Left	Thru	Rgt	Uturn	Peds	App. Total	Left	Thru	Rgt	Uturn	Peds	App. Total	Left	Thru	Rgt	Uturn	Peds	App. Total	
7:00 AM	2	30	0	0	0	32	52	32	41	0	0	125	13	20	3	0	0	36	11	20	99	0	0	130	323
7:15 AM	2	41	0	0	0	43	73	51	43	0	0	167	20	26	1	0	0	47	26	31	109	0	0	166	423
7:30 AM	1	53	2	0	0	56	86	61	54	0	0	201	27	41	3	0	0	71	37	44	142	0	0	223	551
7:45 AM	2	39	6	0	0	47	73	82	84	0	0	239	28	31	3	0	0	62	45	32	195	0	0	272	620
Total	7	163	8	0	0	178	284	226	222	0	0	732	88	118	10	0	0	216	119	127	545	0	0	791	1917
8:00 AM	0	43	14	0	2	57	84	92	65	0	0	241	28	24	1	0	2	53	43	35	134	0	0	212	563
8:15 AM	0	40	9	0	0	49	77	63	64	0	0	204	31	30	3	0	0	64	34	42	126	0	0	202	519
8:30 AM	1	40	8	0	0	49	87	62	76	0	0	225	24	35	2	0	0	61	13	39	109	0	0	161	496
8:45 AM	1	30	9	0	2	40	68	57	101	0	0	226	33	42	5	0	0	80	28	48	94	0	0	170	516
Total	2	153	40	0	4	195	316	274	306	0	0	896	116	131	11	0	2	258	118	164	463	0	0	745	2094
BREAK																									
11:00 AM	11	42	9	0	0	62	69	57	139	0	0	265	47	69	11	0	0	127	20	110	90	0	1	220	674
11:15 AM	14	46	13	0	0	73	89	86	126	0	0	301	41	69	26	0	0	136	47	97	98	0	0	242	752
11:30 AM	12	51	15	0	0	78	92	80	126	0	0	298	41	82	19	0	0	142	69	116	132	0	0	317	835
11:45 AM	14	59	19	0	1	92	83	71	114	0	0	268	68	75	18	0	1	161	33	100	86	0	0	219	740
Total	51	198	56	0	1	305	333	294	505	0	0	1132	197	295	74	0	1	566	169	423	406	0	1	998	3001
12:00 PM	11	60	17	0	0	88	93	62	116	0	0	271	67	90	20	0	0	177	18	99	93	0	0	210	746
12:15 PM	11	53	19	0	0	83	78	65	113	0	0	256	84	92	6	0	0	182	22	89	97	0	0	208	729
12:30 PM	7	61	19	0	0	87	70	40	111	0	0	221	83	93	15	0	0	191	21	81	103	0	0	205	704
12:45 PM	5	63	22	0	0	90	67	45	98	0	0	210	75	110	12	0	0	197	22	83	109	0	0	214	711
Total	34	237	77	0	0	348	308	212	438	0	0	958	309	385	53	0	0	747	83	352	402	0	0	837	2890
BREAK																									
3:00 PM	6	47	22	0	0	75	103	54	81	0	0	238	68	86	8	0	0	162	25	80	115	0	0	220	695
3:15 PM	6	40	10	0	0	56	95	45	90	0	0	230	50	101	8	0	1	159	21	77	122	0	0	220	665
3:30 PM	5	69	12	0	0	86	104	42	91	0	0	237	54	97	12	0	0	163	16	52	124	0	0	192	678
3:45 PM	4	52	13	0	1	69	106	60	83	0	0	249	43	113	7	0	0	163	15	91	118	0	0	224	705
Total	21	208	57	0	1	286	408	201	345	0	0	954	215	397	35	0	1	647	77	300	479	0	0	856	2743
4:00 PM	6	54	16	0	0	76	113	56	93	0	0	262	73	96	8	0	0	177	24	71	106	0	0	201	716
4:15 PM	5	57	17	0	0	79	103	51	87	0	0	241	49	119	12	0	1	180	11	76	102	0	0	189	689
4:30 PM	4	56	15	0	0	75	110	41	102	1	0	254	58	112	8	0	0	178	11	58	84	0	0	153	660
4:45 PM	7	67	13	0	0	87	85	64	83	0	0	232	49	110	7	0	0	166	19	78	101	0	0	198	683
Total	22	234	61	0	0	317	411	212	365	1	0	989	229	437	35	0	1	701	65	283	393	0	0	741	2748
5:00 PM	11	74	19	0	0	104	125	51	106	0	0	282	60	127	14	0	0	201	10	71	93	0	0	174	761
5:15 PM	4	61	14	0	0	79	103	69	92	0	0	264	55	73	9	0	0	137	12	84	78	0	0	174	654
5:30 PM	2	49	17	0	0	68	69	39	86	0	0	194	67	105	5	0	0	177	22	64	89	0	0	175	614
5:45 PM	7	63	9	0	0	79	55	49	100	0	0	204	66	113	6	0	0	185	17	66	96	0	0	179	647
Total	24	247	59	0	0	330	352	208	384	0	0	944	248	418	34	0	0	700	61	285	356	0	0	702	2676
Grand Total	161	1440	358	0	6	1959	2412	1627	2565	1	0	6605	1402	2181	252	0	5	3835	692	1934	3044	0	1	5670	18069
Apprch %	8.2	73.5	18.3	0.0	0.3		36.5	24.6	38.8	0.0	0.0		36.6	56.9	6.6	0.0	0.1		12.2	34.1	53.7	0.0	0.0		
Total %	0.9	8.0	2.0	0.0	0.0	10.8	13.3	9.0	14.2	0.0	0.0	36.6	7.8	12.1	1.4	0.0	0.0	21.2	3.8	10.7	16.8	0.0	0.0	31.4	
Cars, PU, Vans	159	1415	352	0		1926	2252	1610	2522	1		6385	1376	2154	248	0		3778	686	1914	2756	0		5356	17445
% Cars, PU, Vans	98.8	98.3	98.3	0.0		98.3	93.4	99.0	98.3	100.0		96.7	98.1	98.8	98.4	0.0		98.5	99.1	99.0	90.5	0.0		94.5	96.5
Heavy trucks	2	25	6	0		33	160	17	43	0		220	26	27	4	0		57	6	20	288	0		314	624
% Heavy trucks	1.2	1.7	1.7	0.0		1.7	6.6	1.0	1.7	0.0		3.3	1.9	1.2	1.6	0.0		1.5	0.9	1.0	9.5	0.0		5.5	3.5

Project ID: 21-190016-001

Location: N Weisgarber Rd/Old Weisgarber Rd & Papermill I
City: Knoxville**PEAK HOURS**Day: Tuesday
Date: 3/23/2021**AM**

	N Weisgarber Rd/Old Weisgarber Rd Northbound					N Weisgarber Rd/Old Weisgarber Rd Southbound					Papermill Dr Eastbound					Papermill Dr Westbound					
Start Time	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Int. Total
Peak Hour Analysis from 07:00 AM - 09:00 AM																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
7:30 AM	1	53	2	0	56	86	61	54	0	201	27	41	3	0	71	37	44	142	0	223	551
7:45 AM	2	39	6	0	47	73	82	84	0	239	28	31	3	0	62	45	32	195	0	272	620
8:00 AM	0	43	14	0	57	84	92	65	0	241	28	24	1	0	53	43	35	134	0	212	563
8:15 AM	0	40	9	0	49	77	63	64	0	204	31	30	3	0	64	34	42	126	0	202	519
Total Volume	3	175	31	0	209	320	298	267	0	885	114	126	10	0	250	159	153	597	0	909	2253
% App. Total	1.4	83.7	14.8	0.0	100	36.2	33.7	30.2	0.0	100	45.6	50.4	4.0	0.0	100	17.5	16.8	65.7	0.0	100	
PHF		0.917						0.918							0.880			0.835		0.908	
Cars, PU, Vans	3	174	31	0	208	287	297	258	0	842	110	121	10	0	241	158	148	553	0	859	2150
% Cars, PU, Vans	100.0	99.4	100.0	0.0	99.5	89.7	99.7	96.6	0.0	95.1	96.5	96.0	100.0	0.0	96.4	99.4	96.7	92.6	0.0	94.5	95.4
Heavy trucks	0	1	0	0	1	33	1	9	0	43	4	5	0	0	9	1	5	44	0	50	103
% Heavy trucks	0.0	0.6	0.0	0.0	0.5	10.3	0.3	3.4	0.0	4.9	3.5	4.0	0.0	0.0	3.6	0.6	3.3	7.4	0.0	5.5	4.6

NOON

	N Weisgarber Rd/Old Weisgarber Rd Northbound					N Weisgarber Rd/Old Weisgarber Rd Southbound					Papermill Dr Eastbound					Papermill Dr Westbound					
Start Time	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Int. Total
Peak Hour Analysis from 11:00 AM - 01:00 PM																					
Peak Hour for Entire Intersection Begins at 11:15 AM																					
11:15 AM	14	46	13	0	73	89	86	126	0	301	41	69	26	0	136	47	97	98	0	242	752
11:30 AM	12	51	15	0	78	92	80	126	0	298	41	82	19	0	142	69	116	132	0	317	835
11:45 AM	14	59	19	0	92	83	71	114	0	268	68	75	18	0	161	33	100	86	0	219	740
12:00 PM	11	60	17	0	88	93	62	116	0	271	67	90	20	0	177	18	99	93	0	210	746
Total Volume	51	216	64	0	331	357	299	482	0	1138	217	316	83	0	616	167	412	409	0	988	3073
% App. Total	15.4	65.3	19.3	0.0	100	31.4	26.3	42.4	0.0	100	35.2	51.3	13.5	0.0	100	16.9	41.7	41.4	0.0	100	
PHF		0.899						0.945							0.870			0.779		0.920	
Cars, PU, Vans	50	210	63	0	323	336	297	471	0	1104	215	313	82	0	610	165	407	365	0	937	2974
% Cars, PU, Vans	98.0	97.2	98.4	0.0	97.6	94.1	99.3	97.7	0.0	97.0	99.1	99.1	98.8	0.0	99.0	98.8	98.8	89.2	0.0	94.8	96.8
Heavy trucks	1	6	1	0	8	21	2	11	0	34	2	3	1	0	6	2	5	44	0	51	99
% Heavy trucks	2.0	2.8	1.6	0.0	2.4	5.9	0.7	2.3	0.0	3.0	0.9	0.9	1.2	0.0	1.0	1.2	1.2	10.8	0.0	5.2	3.2

PM

	N Weisgarber Rd/Old Weisgarber Rd Northbound					N Weisgarber Rd/Old Weisgarber Rd Southbound					Papermill Dr Eastbound					Papermill Dr Westbound					
Start Time	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Int. Total
Peak Hour Analysis from 03:00 PM - 06:00 PM																					
Peak Hour for Entire Intersection Begins at 04:15 PM																					
4:15 PM	5	57	17	0	79	103	51	87	0	241	49	119	12	0	180	11	76	102	0	189	689
4:30 PM	4	56	15	0	75	110	41	102	1	254	58	112	8	0	178	11	58	84	0	153	660
4:45 PM	7	67	13	0	87	85	64	83	0	232	49	110	7	0	166	19	78	101	0	198	683
5:00 PM	11	74	19	0	104	125	51	106	0	282	60	127	14	0	201	10	71	93	0	174	761
Total Volume	27	254	64	0	345	423	207	378	1	1009	216	468	41	0	725	51	283	380	0	714	2793
% App. Total	7.8	73.6	18.6	0.0	100	41.9	20.5	37.5	0.1	100	29.8	64.6	5.7	0.0	100	7.1	39.6	53.2	0.0	100	
PHF		0.829						0.895							0.902			0.902		0.918	
Cars, PU, Vans	26	250	61	0	337	405	206	375	1	987	213	464	40	0	717	50	282	344	0	676	2717
% Cars, PU, Vans	96.3	98.4	95.3	0.0	97.7	95.7	99.5	99.2	100.0	97.8	98.6	99.1	97.6	0.0	98.9	98.0	99.6	90.5	0.0	94.7	97.3
Heavy trucks	1	4	3	0	8	18	1	3	0	22	3	4	1	0	8	1	1	36	0	38	76
% Heavy trucks	3.7	1.6	4.7	0.0	2.3	4.3	0.5	0.8	0.0	2.2	1.4	0.9	2.4	0.0	1.1	2.0	0.4	9.5	0.0	5.3	2.7

Project ID: 21-190016-002
 Location: Westfield Dr & Papermill Dr
 City: Knoxville

Day: Tuesday
 Date: 3/23/2021

Groups Printed - Cars, PU, Vans - Heavy Trucks																									
Start Time	Westfield Dr Northbound						Westfield Dr Southbound						Papermill Dr Eastbound						Papermill Dr Westbound						
	Left	Thru	Rgt	Uturn	Peds	App. Total	Left	Thru	Rgt	Uturn	Peds	App. Total	Left	Thru	Rgt	Uturn	Peds	App. Total	Left	Thru	Rgt	Uturn	Peds	App. Total	Int. Total
7:00 AM	0	0	2	0	0	2	0	0	0	0	0	0	0	29	0	0	0	29	4	53	0	0	0	57	88
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	45	0	0	0	45	6	61	0	0	0	67	112
7:30 AM	1	0	3	0	0	4	0	0	0	0	0	0	0	67	0	0	0	67	9	73	0	0	0	82	153
7:45 AM	0	0	2	0	0	2	0	0	0	0	0	0	0	50	0	0	0	50	17	79	0	0	0	96	148
Total	1	0	7	0	0	8	0	0	0	0	0	0	0	191	0	0	0	191	36	266	0	0	0	302	501
8:00 AM	0	0	1	0	0	1	0	0	0	0	0	0	0	47	0	0	0	47	10	82	0	0	0	92	140
8:15 AM	0	0	3	0	0	3	0	0	0	0	0	0	0	61	0	0	0	61	13	85	0	0	0	98	162
8:30 AM	0	0	2	0	0	2	0	0	0	0	0	0	0	56	1	0	0	57	17	87	0	0	0	104	163
8:45 AM	0	0	5	0	0	5	0	0	0	0	0	0	0	67	2	0	0	69	20	109	0	0	0	129	203
Total	0	0	11	0	0	11	0	0	0	0	0	0	0	231	3	0	0	234	60	363	0	0	0	423	668
BREAK																									
11:00 AM	0	0	9	0	0	9	0	0	0	0	0	0	0	104	2	0	0	106	12	202	0	0	0	214	329
11:15 AM	0	0	9	0	0	9	0	0	0	0	0	0	0	103	6	0	0	109	13	188	0	0	0	201	319
11:30 AM	1	0	9	0	0	10	0	0	0	0	0	0	0	116	4	0	0	120	17	218	0	0	0	235	365
11:45 AM	1	0	10	0	0	11	0	0	0	0	0	0	0	132	3	0	0	135	19	205	0	0	0	224	370
Total	2	0	37	0	0	39	0	0	0	0	0	0	0	455	15	0	0	470	61	813	0	0	0	874	1383
12:00 PM	1	0	5	0	1	6	0	0	0	0	0	0	0	144	3	0	0	147	11	209	0	0	0	220	373
12:15 PM	1	0	11	0	0	12	0	0	0	0	0	0	0	153	3	0	0	156	9	197	0	0	0	206	374
12:30 PM	0	0	23	0	0	23	0	0	0	0	0	0	0	162	3	0	0	165	13	171	0	0	0	184	372
12:45 PM	1	0	16	0	0	17	0	0	0	0	0	0	0	172	4	0	0	176	21	152	0	0	0	173	366
Total	3	0	55	0	1	58	0	0	0	0	0	0	0	631	13	0	0	644	54	729	0	0	0	783	1485
BREAK																									
3:00 PM	0	0	11	0	0	11	0	0	0	0	0	0	0	133	2	0	0	135	8	147	0	0	0	155	301
3:15 PM	0	0	8	0	0	8	0	0	0	0	0	0	0	127	1	0	0	128	17	128	0	0	0	145	281
3:30 PM	1	0	11	0	0	12	0	0	0	0	0	0	0	130	3	0	0	133	7	135	0	0	0	142	287
3:45 PM	1	0	4	0	0	5	0	0	0	0	0	0	0	141	1	0	0	142	13	145	0	0	0	158	305
Total	2	0	34	0	0	36	0	0	0	0	0	0	0	531	7	0	0	538	45	555	0	0	0	600	1174
4:00 PM	0	0	20	0	0	20	0	0	0	0	0	0	0	131	1	0	0	132	10	146	0	0	0	156	308
4:15 PM	0	0	12	0	0	12	0	0	0	0	0	0	0	146	0	0	0	146	9	143	0	0	0	152	310
4:30 PM	0	0	13	0	0	13	0	0	0	0	0	0	0	150	4	0	0	154	16	137	0	0	0	153	320
4:45 PM	1	0	14	0	0	15	0	0	0	0	0	0	0	137	2	0	0	139	13	156	0	0	0	169	323
Total	1	0	59	0	0	60	0	0	0	0	0	0	0	564	7	0	0	571	48	582	0	0	0	630	1261
5:00 PM	1	0	20	0	0	21	0	0	0	0	0	0	0	153	4	0	0	157	14	161	0	0	0	175	353
5:15 PM	2	0	12	0	1	14	0	0	0	0	0	0	0	122	0	0	0	122	11	164	0	0	0	175	311
5:30 PM	0	0	12	0	0	12	0	0	0	0	0	0	0	131	2	0	0	133	8	137	0	0	0	145	290
5:45 PM	0	0	9	0	0	9	0	0	0	0	0	0	0	159	2	0	0	161	15	151	0	0	0	166	336
Total	3	0	53	0	1	56	0	0	0	0	0	0	0	565	8	0	0	573	48	613	0	0	0	661	1290
Grand Total	12	0	256	0	2	268	0	0	0	0	0	0	0	3168	53	0	0	3221	352	3921	0	0	0	4273	7762
Apprch %	4.5	0.0	95.5	0.0	0.7		0.0	0.0	0.0	0.0	0.0	0.0	0.0	98.4	1.6	0.0	0.0		8.2	91.8	0.0	0.0	0.0		
Total %	0.2	0.0	3.3	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.8	0.7	0.0	0.0	41.5	4.5	50.5	0.0	0.0	0.0	55.1	
Cars, PU, Vans	12	0	253	0	265	0	0	0	0	0	0	0	0	3117	53	0	0	3170	346	3864	0	0	0	4210	7645
% Cars, PU, Vans	100.0	0.0	98.8	0.0	98.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	98.4	100.0	0.0	0.0	98.4	98.3	98.5	0.0	0.0	0.0	98.5	98.5
Heavy trucks	0	0	3	0	3	0	0	0	0	0	0	0	0	51	0	0	0	51	6	57	0	0	0	63	117
% Heavy trucks	0.0	0.0	1.2	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	1.6	1.7	1.5	0.0	0.0	0.0	1.5	1.5

Project ID: 21-190016-002
 Location: Westfield Dr & Papermill Dr
 City: Knoxville

PEAK HOURS

Day: Tuesday
 Date: 3/23/2021

AM

	Westfield Dr Northbound					Westfield Dr Southbound					Papermill Dr Eastbound					Papermill Dr Westbound					
Start Time	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Int. Total
Peak Hour Analysis from 07:00 AM - 09:00 AM																					
Peak Hour for Entire Intersection Begins at 08:00 AM																					
8:00 AM	0	0	1	0	1	0	0	0	0	0	0	47	0	0	47	10	82	0	0	92	140
8:15 AM	0	0	3	0	3	0	0	0	0	0	0	61	0	0	61	13	85	0	0	98	162
8:30 AM	0	0	2	0	2	0	0	0	0	0	0	56	1	0	57	17	87	0	0	104	163
8:45 AM	0	0	5	0	5	0	0	0	0	0	0	67	2	0	69	20	109	0	0	129	203
Total Volume	0	0	11	0	11	0	0	0	0	0	0	231	3	0	234	60	363	0	0	423	668
% App. Total	0.0	0.0	100.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	98.7	1.3	0.0	100	14.2	85.8	0.0	0.0	100	
PHF	0.550															0.848					0.820
Cars, PU, Vans	0	0	11	0	11	0	0	0	0	0	0	221	3	0	224	58	350	0	0	408	643
% Cars, PU, Vans	0.0	0.0	100.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	95.7	100.0	0.0	95.7	96.7	96.4	0.0	0.0	96.5	96.3
Heavy trucks	0	0	0	0	0	0	0	0	0	0	0	10	0	0	10	2	13	0	0	15	25
%Heavy trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	0.0	0.0	4.3	3.3	3.6	0.0	0.0	3.5	3.7

NOON

	Westfield Dr Northbound					Westfield Dr Southbound					Papermill Dr Eastbound					Papermill Dr Westbound					
Start Time	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Int. Total
Peak Hour Analysis from 11:00 AM - 01:00 PM																					
Peak Hour for Entire Intersection Begins at 11:45 AM																					
11:45 AM	1	0	10	0	11	0	0	0	0	0	0	132	3	0	135	19	205	0	0	224	370
12:00 PM	1	0	5	0	6	0	0	0	0	0	0	144	3	0	147	11	209	0	0	220	373
12:15 PM	1	0	11	0	12	0	0	0	0	0	0	153	3	0	156	9	197	0	0	206	374
12:30 PM	0	0	23	0	23	0	0	0	0	0	0	162	3	0	165	13	171	0	0	184	372
Total Volume	3	0	49	0	52	0	0	0	0	0	0	591	12	0	603	52	782	0	0	834	1489
% App. Total	5.8	0.0	94.2	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	98.0	2.0	0.0	100	6.2	93.8	0.0	0.0	100	
PHF	0.565															0.914					0.931
Cars, PU, Vans	3	0	49	0	52	0	0	0	0	0	0	583	12	0	595	52	772	0	0	824	1471
% Cars, PU, Vans	100.0	0.0	100.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	98.6	100.0	0.0	98.7	100.0	98.7	0.0	0.0	98.8	98.8
Heavy trucks	0	0	0	0	0	0	0	0	0	0	0	8	0	0	8	0	10	0	0	10	18
%Heavy trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	1.3	0.0	1.3	0.0	0.0	1.2	1.2

PM

	Westfield Dr Northbound					Westfield Dr Southbound					Papermill Dr Eastbound					Papermill Dr Westbound					
Start Time	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Int. Total
Peak Hour Analysis from 03:00 PM - 06:00 PM																					
Peak Hour for Entire Intersection Begins at 04:30 PM																					
4:30 PM	0	0	13	0	13	0	0	0	0	0	0	150	4	0	154	16	137	0	0	153	320
4:45 PM	1	0	14	0	15	0	0	0	0	0	0	137	2	0	139	13	156	0	0	169	323
5:00 PM	1	0	20	0	21	0	0	0	0	0	0	153	4	0	157	14	161	0	0	175	353
5:15 PM	2	0	12	0	14	0	0	0	0	0	0	122	0	0	122	11	164	0	0	175	311
Total Volume	4	0	59	0	63	0	0	0	0	0	0	562	10	0	572	54	618	0	0	672	1307
% App. Total	6.3	0.0	93.7	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	98.3	1.7	0.0	100	8.0	92.0	0.0	0.0	100	
PHF	0.750															0.911					0.960
Cars, PU, Vans	4	0	59	0	63	0	0	0	0	0	0	555	10	0	565	54	615	0	0	669	1297
% Cars, PU, Vans	100.0	0.0	100.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	98.8	100.0	0.0	98.8	100.0	99.5	0.0	0.0	99.6	99.2
Heavy trucks	0	0	0	0	0	0	0	0	0	0	0	7	0	3	0	0	0	3	0	10	
%Heavy trucks	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	1.2	0.0	0.5	0.0	0.0	0.4	0.8

Project ID: 21-190016-003

Location: Papermill Dr/Golf Club Rd & US 11/US 70/SR/Kingston Pike
City: KnoxvilleDay: Tuesday
Date: 3/23/2021

Groups Printed - Cars, PU, Vans - Heavy Trucks																									
Start Time	Papermill Dr/Golf Club Rd Northbound						Papermill Dr/Golf Club Rd Southbound						US 11/US 70/SR/Kingston Pike Eastbound					US 11/US 70/SR/Kingston Pike Westbound					Int. Total		
	Left	Thru	Rgt	Uturn	Peds	App. Total	Left	Thru	Rgt	Uturn	Peds	App. Total	Left	Thru	Rgt	Uturn	Peds	App. Total	Left	Thru	Rgt	Uturn	Peds	App. Total	
7:00 AM	4	2	2	0	0	8	6	3	37	0	0	46	25	48	0	0	0	73	1	16	3	0	0	20	147
7:15 AM	2	3	1	0	0	6	3	0	52	0	0	55	37	70	1	0	0	108	1	44	5	0	0	50	219
7:30 AM	2	3	1	0	0	6	11	3	56	0	0	70	60	93	0	0	0	153	0	58	6	0	0	64	293
7:45 AM	4	13	3	0	0	20	10	4	56	0	0	70	33	141	0	0	0	174	0	71	6	0	0	77	341
Total	12	21	7	0	0	40	30	10	201	0	0	241	155	352	1	0	0	508	2	189	20	0	0	211	1000
8:00 AM	2	6	4	0	0	12	21	5	54	0	0	80	36	107	2	0	0	145	3	72	6	0	0	81	318
8:15 AM	1	9	3	0	0	13	14	3	63	0	0	80	40	141	1	0	0	182	1	71	10	0	0	82	357
8:30 AM	2	7	1	0	0	10	10	4	65	0	0	79	45	135	7	0	0	187	0	68	9	0	0	77	353
8:45 AM	1	10	3	0	0	14	13	1	74	0	0	88	49	118	3	0	0	170	0	63	11	0	0	74	346
Total	6	32	11	0	0	49	58	13	256	0	0	327	170	501	13	0	0	684	4	274	36	0	0	314	1374
BREAK																									
11:00 AM	12	13	0	0	0	25	10	5	148	0	0	163	81	125	6	0	0	212	2	197	32	0	0	231	631
11:15 AM	10	8	5	0	0	23	16	4	173	0	0	193	72	153	3	0	0	228	1	244	19	0	0	264	708
11:30 AM	10	12	6	0	1	28	14	6	170	0	0	190	80	177	3	0	0	260	5	284	25	0	1	314	792
11:45 AM	11	10	3	0	0	24	9	9	184	0	0	202	86	172	7	0	0	265	4	257	28	0	0	289	780
Total	43	43	14	0	1	100	49	24	675	0	0	748	319	627	19	0	0	965	12	982	104	0	1	1098	2911
12:00 PM	19	8	5	0	1	32	17	6	145	0	0	168	100	200	10	0	0	310	2	235	26	0	1	263	773
12:15 PM	19	11	3	0	0	33	27	13	158	0	0	198	98	206	9	0	1	313	3	221	29	0	0	253	797
12:30 PM	14	9	1	0	0	24	20	8	129	0	0	157	115	248	4	0	0	367	4	213	30	0	0	247	795
12:45 PM	8	4	5	0	0	17	14	7	110	0	0	131	117	235	17	0	0	369	1	215	30	0	0	246	763
Total	60	32	14	0	1	106	78	34	542	0	0	654	430	889	40	0	1	1359	10	884	115	0	1	1009	3128
BREAK																									
3:00 PM	5	4	1	0	0	10	16	10	113	0	4	139	98	159	6	0	0	263	3	180	22	0	0	205	617
3:15 PM	7	11	1	0	0	19	15	8	107	0	0	130	98	168	7	0	1	273	1	178	27	0	0	206	628
3:30 PM	7	6	3	0	0	16	15	9	113	0	0	137	93	174	7	0	0	274	3	146	18	0	0	167	594
3:45 PM	4	4	2	0	0	10	16	9	113	0	0	138	103	188	14	0	0	305	2	177	26	0	0	205	658
Total	23	25	7	0	0	55	62	36	446	0	4	544	392	689	34	0	1	1115	9	681	93	0	0	783	2497
4:00 PM	9	5	1	0	0	15	21	12	118	0	0	151	98	190	7	0	0	295	4	182	22	0	0	208	669
4:15 PM	3	6	1	0	0	10	14	12	103	0	0	129	93	186	5	0	0	284	0	201	29	0	0	230	653
4:30 PM	7	4	1	0	0	12	19	11	98	0	0	128	102	190	4	0	0	296	3	186	29	0	0	218	654
4:45 PM	17	8	1	0	0	26	18	11	117	0	1	146	90	167	4	0	0	261	5	164	31	0	0	200	633
Total	36	23	4	0	0	63	72	46	436	0	1	554	383	733	20	0	0	1136	12	733	111	0	0	856	2609
5:00 PM	5	14	3	0	0	22	21	17	112	0	0	150	103	172	9	0	0	284	4	215	26	0	0	245	701
5:15 PM	11	4	3	0	0	18	28	16	116	0	0	160	89	163	4	0	0	256	3	211	28	0	0	242	676
5:30 PM	9	12	1	0	0	22	19	12	100	0	1	131	95	202	5	0	0	302	0	176	26	0	0	202	657
5:45 PM	6	6	1	0	0	13	11	15	107	0	0	133	92	177	3	0	0	272	2	216	21	0	0	239	657
Total	31	36	8	0	0	75	79	60	435	0	1	574	379	714	21	0	0	1114	9	818	101	0	0	928	2691
Grand Total	211	212	65	0	2	488	428	223	2991	0	6	3642	2228	4505	148	0	2	6881	58	4561	580	0	2	5199	16210
Appr %	43.2	43.4	13.3	0.0	0.4		11.8	6.1	82.1	0.0	0.2		32.4	65.5	2.2	0.0	0.0		1.1	87.7	11.2	0.0	0.0		
Total %	1.3	1.3	0.4	0.0	0.0	3.0	2.6	1.4	18.5	0.0	0.0	22.5	13.7	27.8	0.9	0.0	0.0	42.4	0.4	28.1	3.6	0.0	0.0	32.1	
Cars, PU, Vans	209	209	65	0		483	419	223	2940	0		3582	2191	4428	147	0		6766	58	4500	566	0		5124	15955
% Cars, PU, Vans	99.1	98.6	100.0	0.0		99.0	97.9	100.0	98.3	0.0		98.4	98.3	98.3	99.3	0.0		98.3	100.0	98.7	97.6	0.0		98.4	
Heavy trucks	2	3	0	0		5	9	0	51	0		60	37	77	1	0		115	0	61	14	0		75	255
% Heavy trucks	0.9	1.4	0.0	0.0		1.0	2.1	0.0	1.7	0.0		1.6	1.7	1.7	0.7	0.0		1.7	0.0	1.3	2.4	0.0		1.4	

Project ID: 21-190016-003

Location: Papermill Dr/Golf Club Rd & US 11/US 70/SR/Kingston Pike
City: Knoxville**PEAK HOURS**Day: Tuesday
Date: 3/23/2021**AM**

	Papermill Dr/Golf Club Rd Northbound					Papermill Dr/Golf Club Rd Southbound					US 11/US 70/SR/Kingston Pike Eastbound					US 11/US 70/SR/Kingston Pike Westbound					
	Start Time	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total
Peak Hour Analysis from 07:00 AM - 09:00 AM																					
Peak Hour for Entire Intersection Begins at 08:00 AM																					
8:00 AM	2	6	4	0	12	21	5	54	0	80	36	107	2	0	145	3	72	6	0	81	318
8:15 AM	1	9	3	0	13	14	3	63	0	80	40	141	1	0	182	1	71	10	0	82	357
8:30 AM	2	7	1	0	10	10	4	65	0	79	45	135	7	0	187	0	68	9	0	77	353
8:45 AM	1	10	3	0	14	13	1	74	0	88	49	118	3	0	170	0	63	11	0	74	346
Total Volume	6	32	11	0	49	58	13	256	0	327	170	501	13	0	684	4	274	36	0	314	1374
% App. Total	12.2	65.3	22.4	0.0	100	17.7	4.0	78.3	0.0	100	24.9	73.2	1.9	0.0	100	1.3	87.3	11.5	0.0	100	
PHF		0.875						0.929				0.914					0.957		0.962		
Cars, PU, Vans	6	31	11	0	48	55	13	246	0	314	163	484	13	0	660	4	264	34	0	302	1324
% Cars, PU, Vans	100.0	96.9	100.0	0.0	98.0	94.8	100.0	96.1	0.0	96.0	95.9	96.6	100.0	0.0	96.5	100.0	96.4	94.4	0.0	96.2	96.4
Heavy trucks	0	1	0	0	1	3	0	10	0	13	7	17	0	0	24	0	10	2	0	12	50
%Heavy trucks	0.0	3.1	0.0	0.0	2.0	5.2	0.0	3.9	0.0	4.0	4.1	3.4	0.0	0.0	3.5	0.0	3.6	5.6	0.0	3.8	3.6

NOON

	Papermill Dr/Golf Club Rd Northbound					Papermill Dr/Golf Club Rd Southbound					US 11/US 70/SR/Kingston Pike Eastbound					US 11/US 70/SR/Kingston Pike Westbound					
	Start Time	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total
Peak Hour Analysis from 11:00 AM - 01:00 PM																					
Peak Hour for Entire Intersection Begins at 11:45 AM																					
11:45 AM	11	10	3	0	24	9	9	184	0	202	86	172	7	0	265	4	257	28	0	289	780
12:00 PM	19	8	5	0	32	17	6	145	0	168	100	200	10	0	310	2	235	26	0	263	773
12:15 PM	19	11	3	0	33	27	13	158	0	198	98	206	9	0	313	3	221	29	0	253	797
12:30 PM	14	9	1	0	24	20	8	129	0	157	115	248	4	0	367	4	213	30	0	247	795
Total Volume	63	38	12	0	113	73	36	616	0	725	399	826	30	0	1255	13	926	113	0	1052	3145
% App. Total	55.8	33.6	10.6	0.0	100	10.1	5.0	85.0	0.0	100	31.8	65.8	2.4	0.0	100	1.2	88.0	10.7	0.0	100	
PHF		0.856					0.897					0.855					0.910		0.987		
Cars, PU, Vans	61	38	12	0	111	71	36	606	0	713	393	814	29	0	1236	13	915	110	0	1038	3098
% Cars, PU, Vans	96.8	100.0	100.0	0.0	98.2	97.3	100.0	98.4	0.0	98.3	98.5	98.5	96.7	0.0	98.5	100.0	98.8	97.3	0.0	98.7	98.5
Heavy trucks	2	0	0	0	2	2	0	10	0	12	6	12	1	0	19	0	11	3	0	14	47
%Heavy trucks	3.2	0.0	0.0	0.0	1.8	2.7	0.0	1.6	0.0	1.7	1.5	1.5	3.3	0.0	1.5	0.0	1.2	2.7	0.0	1.3	1.5

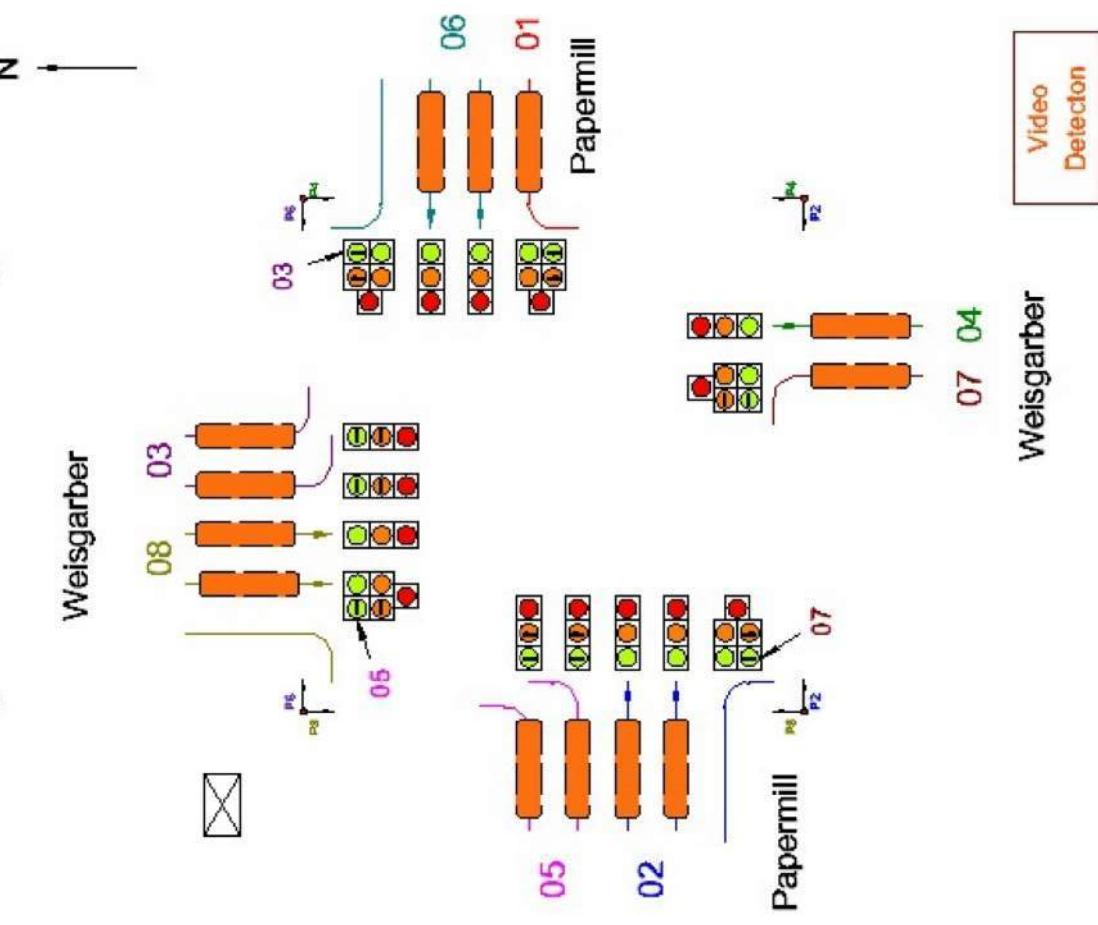
PM

	Papermill Dr/Golf Club Rd Northbound					Papermill Dr/Golf Club Rd Southbound					US 11/US 70/SR/Kingston Pike Eastbound					US 11/US 70/SR/Kingston Pike Westbound					
	Start Time	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total	Left	Thru	Rgt	Uturn	App. Total
Peak Hour Analysis from 03:00 PM - 06:00 PM																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
5:00 PM	5	14	3	0	22	21	17	112	0	150	103	172	9	0	284	4	215	26	0	245	701
5:15 PM	11	4	3	0	18	28	16	116	0	160	89	163	4	0	256	3	211	28	0	242	676
5:30 PM	9	12	1	0	22	19	12	100	0	131	95	202	5	0	302	0	176	26	0	202	657
5:45 PM	6	6	1	0	13	11	15	107	0	133	92	177	3	0	272	2	216	21	0	239	657
Total Volume	31	36	8	0	75	79	60	435	0	574	379	714	21	0	1114	9	818	101	0	928	2691
% App. Total	41.3	48.0	10.7	0.0	100	13.8	10.5	75.8	0.0	100	34.0	64.1	1.9	0.0	100	1.0	88.1	10.9	0.0	100	
PHF		0.852					0.897					0.922					0.947		0.960		
Cars, PU, Vans	31	35	8	0	74	79	60	433	0	572	374	709	21	0	1104	9	813	99	0	921	2671
% Cars, PU, Vans	100.0	97.2	100.0	0.0	98.7	100.0	100.0	99.5	0.0	99.7	98.7	99.3	100.0	0.0	99.1	100.0	99.4	98.0	0.0	99.2	99.3
Heavy trucks	0	1	0	0	1	0	0	2	0	2	5	5	0	0	10	0	5	2	0	7	20
%Heavy trucks	0.0	2.8	0.0	0.0	1.3	0.0	0.0	0.5	0.0	0.3	1.3	0.7	0.0	0.0	0.9	0.0	0.6	2.0	0.0	0.8	0.7

Appendix B

Signal Timing

Papermill & Weisgarber



Day Plan Events					
Day Plan	HH:MM	Pattern	Day Plan	HH:MM	Pattern
1	0000	Free	2	0000	free
1	0600	1	2	0600	2
1	1000	2	2	2200	Free
1	1500	3			
1	2000	Free			

Week Day Plan							
Plan	Sun	Mon	Tue	Wed	Thu	Fri	Sat
1		X	X	X	X	X	
2	X						X

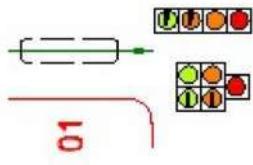
Notes :No short 2,4,6,8

Kingston Pk & Papermill

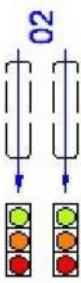
Phasing After May 1, 2000 @ 07:27 PM

N
Papermill

03



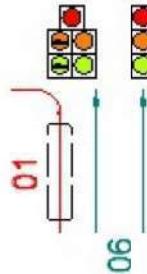
01



02



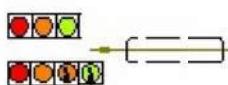
Kingston Pk



01



Kingston Pk



04

Golf Club Rd



Kingston Pk

Appendix C

Capacity Analysis (Synchro V11)

HCS7 Two-Lane Highway Report

Project Information

Analyst	KCole	Date	12/7/2021
Agency	CDM Smith	Analysis Year	2021
Jurisdiction	Knoxville, TN	Time Analyzed	PM Peak hour
Project Description	Papermill Drive Corridor Improvement Study	Units	U.S. Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Constrained	Length, ft	5280
Measured FFS	Measured	Free-Flow Speed, mi/h	40.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	840	Opposing Demand Flow Rate, veh/h	-
Peak Hour Factor	0.92	Total Trucks, %	2.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.49

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	40.0
Speed Slope Coefficient	4.62517	Speed Power Coefficient	0.41674
PF Slope Coefficient	-1.39619	PF Power Coefficient	0.69758
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	16.6
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	35.9

Vehicle Results

Average Speed, mi/h	35.9	Percent Followers, %	71.0
Segment Travel Time, minutes	1.67	Follower Density, followers/mi/ln	16.6
Vehicle LOS	E		

Bicycle Results

Percent Occupied Parking	0	Pavement Condition Rating	4
Flow Rate Outside Lane, veh/h	840	Bicycle Effective Width, ft	11
Bicycle LOS Score	5.23	Bicycle Effective Speed Factor	4.17
Bicycle LOS	E		

Facility Results

T	Follower Density, followers/mi/ln	LOS
1	16.6	E

HCS7 Two-Lane Highway Report

Project Information

Analyst	KCole	Date	12/7/2021
Agency	CDM Smith	Analysis Year	2040
Jurisdiction	Knoxville, TN	Time Analyzed	PM Peak hour
Project Description	Papermill Drive Corridor Improvement Study	Units	U.S. Customary

Segment 1

Vehicle Inputs

Segment Type	Passing Constrained	Length, ft	5280
Measured FFS	Measured	Free-Flow Speed, mi/h	40.0

Demand and Capacity

Directional Demand Flow Rate, veh/h	921	Opposing Demand Flow Rate, veh/h	-
Peak Hour Factor	0.92	Total Trucks, %	2.00
Segment Capacity, veh/h	1700	Demand/Capacity (D/C)	0.54

Intermediate Results

Segment Vertical Class	1	Free-Flow Speed, mi/h	40.0
Speed Slope Coefficient	4.62517	Speed Power Coefficient	0.41674
PF Slope Coefficient	-1.39619	PF Power Coefficient	0.69758
In Passing Lane Effective Length?	No	Total Segment Density, veh/mi/ln	18.9
%Improved % Followers	0.0	% Improved Avg Speed	0.0

Subsegment Data

#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h
1	Tangent	5280	-	-	35.7

Vehicle Results

Average Speed, mi/h	35.7	Percent Followers, %	73.2
Segment Travel Time, minutes	1.68	Follower Density, followers/mi/ln	18.9
Vehicle LOS	E		

Bicycle Results

Percent Occupied Parking	0	Pavement Condition Rating	4
Flow Rate Outside Lane, veh/h	921	Bicycle Effective Width, ft	11
Bicycle LOS Score	5.27	Bicycle Effective Speed Factor	4.17
Bicycle LOS	E		

Facility Results

T	Follower Density, followers/mi/ln	LOS
1	18.9	E

Queues
1: Weisgarber Rd & Papermill Drive

Baseline - 2021 AM
Papermill Drive Corridor Study



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	177	191	25	245	176	958	2	309	539	434	317
v/c Ratio	0.58	0.27	0.04	0.61	0.24	1.06	0.01	1.01	0.58	0.55	0.30
Control Delay	61.9	30.8	0.1	32.4	34.1	70.6	16.5	95.8	33.9	25.2	2.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	61.9	30.8	0.1	32.4	34.1	70.6	16.5	95.8	33.9	25.2	2.0
Queue Length 50th (ft)	58	50	0	114	49	~650	1	~199	152	216	0
Queue Length 95th (ft)	88	65	0	181	81	#902	4	#376	206	320	36
Internal Link Dist (ft)		385			1702				741		1059
Turn Bay Length (ft)	180		200	250		275	200				
Base Capacity (vph)	353	702	660	404	734	900	320	307	933	794	1060
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.27	0.04	0.61	0.24	1.06	0.01	1.01	0.58	0.55	0.30

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

1: Weisgarber Rd & Papermill Drive

Baseline - 2021 AM

Papermill Drive Corridor Study

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑↑	↑↑	↑	↑	↑↑	↑	↑	↑	↑	↑↑	↑	↑
Traffic Volume (vph)	163	176	23	225	162	881	2	269	16	496	399	292
Future Volume (vph)	163	176	23	225	162	881	2	269	16	496	399	292
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.0	6.0	6.5	6.0	6.0	6.0	6.5	6.0	6.5	6.5	6.5
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00	0.97	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	1.00	1.00	0.85	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3367	3471	1553	1719	3438	1538	1770	1847	3335	1810	1538	
Flt Permitted	0.95	1.00	1.00	0.59	1.00	1.00	0.51	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3367	3471	1553	1071	3438	1538	951	1847	3335	1810	1538	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	177	191	25	245	176	958	2	292	17	539	434	317
RTOR Reduction (vph)	0	0	20	0	0	58	0	2	0	0	0	149
Lane Group Flow (vph)	177	191	5	245	176	900	2	307	0	539	434	168
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	2%	2%	2%	5%	5%	5%
Turn Type	Prot	NA	pm+ov	pm+pt	NA	pm+ov	pm+pt	NA	Prot	NA	pm+ov	
Protected Phases	5	2	7	1	6	3	7	4	3	8	5	
Permitted Phases			2	6		6	4				8	
Actuated Green, G (s)	9.1	17.8	20.8	29.3	19.0	47.0	21.9	18.9	28.0	43.9	53.0	
Effective Green, g (s)	9.1	17.8	20.8	29.3	19.0	47.0	21.9	18.9	28.0	43.9	53.0	
Actuated g/C Ratio	0.09	0.18	0.21	0.29	0.19	0.47	0.22	0.19	0.28	0.44	0.53	
Clearance Time (s)	6.5	6.0	6.0	6.5	6.0	6.0	6.0	6.5	6.0	6.5	6.5	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	306	617	416	380	653	815	232	349	933	794	915	
v/s Ratio Prot	0.05	0.06	0.00	c0.07	0.05	c0.31	0.00	c0.17	0.16	0.24	0.02	
v/s Ratio Perm			0.00	0.12		0.28	0.00				0.09	
v/c Ratio	0.58	0.31	0.01	0.64	0.27	1.10	0.01	0.88	0.58	0.55	0.18	
Uniform Delay, d1	43.6	35.8	31.4	29.3	34.6	26.5	30.5	39.4	30.9	20.7	12.2	
Progression Factor	1.25	0.88	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.6	1.3	0.0	2.8	1.0	64.2	0.0	20.7	0.5	0.4	0.0	
Delay (s)	56.2	32.6	31.4	32.1	35.6	90.7	30.5	60.1	31.5	21.1	12.3	
Level of Service	E	C	C	C	D	F	C	E	C	C	B	
Approach Delay (s)		43.2			73.2			59.9		23.3		
Approach LOS		D			E			E		C		
Intersection Summary												
HCM 2000 Control Delay			49.4									D
HCM 2000 Volume to Capacity ratio			1.09									
Actuated Cycle Length (s)			100.0									25.0
Intersection Capacity Utilization			90.2%									E
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
2: Westfield Rd & Papermill Drive

Baseline - 2021 AM
Papermill Drive Corridor Study



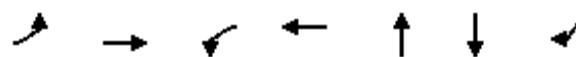
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑ ↗			↖ ↘	↖ ↗	
Traffic Volume (veh/h)	289	4	75	454	0	14
Future Volume (Veh/h)	289	4	75	454	0	14
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	314	4	82	493	0	15
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume		318		973	316	
vC1, stage 1 conf vol				316		
vC2, stage 2 conf vol				657		
vCu, unblocked vol		318		973	316	
tC, single (s)		4.1		6.4	6.2	
tC, 2 stage (s)				5.4		
tF (s)		2.2		3.5	3.3	
p0 queue free %		93		100	98	
cM capacity (veh/h)		1231		446	729	
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	318	575	15			
Volume Left	0	82	0			
Volume Right	4	0	15			
cSH	1700	1231	729			
Volume to Capacity	0.19	0.07	0.02			
Queue Length 95th (ft)	0	5	2			
Control Delay (s)	0.0	1.8	10.0			
Lane LOS		A	B			
Approach Delay (s)	0.0	1.8	10.0			
Approach LOS		B				
Intersection Summary						
Average Delay		1.3				
Intersection Capacity Utilization		56.8%		ICU Level of Service		B
Analysis Period (min)		15				

Queues

3: Golf Club Rd/Papermill Drive & Kingston Pike (SR1)

Baseline - 2021 AM

Papermill Drive Corridor Study



Lane Group	EBL	EBT	WBL	WBT	NBT	SBT	SBR
Lane Group Flow (vph)	232	697	5	422	67	96	348
v/c Ratio	0.35	0.28	0.01	0.23	0.44	0.57	0.61
Control Delay	8.5	7.6	17.0	14.7	45.6	59.4	14.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.5	7.6	17.0	14.7	45.6	59.4	14.3
Queue Length 50th (ft)	52	90	2	73	34	62	59
Queue Length 95th (ft)	101	143	9	130	75	113	42
Internal Link Dist (ft)		675		1538	1452	271	
Turn Bay Length (ft)	300			100			
Base Capacity (vph)	805	2466	386	1870	234	219	744
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.28	0.01	0.23	0.29	0.44	0.47

Intersection Summary

HCM Signalized Intersection Capacity Analysis
3: Golf Club Rd/Papermill Drive & Kingston Pike (SR1)

Baseline - 2021 AM
Papermill Drive Corridor Study

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑		↑	↑↑			↔		↑	↑	↑
Traffic Volume (vph)	213	626	16	5	343	45	8	40	14	73	16	320
Future Volume (vph)	213	626	16	5	343	45	8	40	14	73	16	320
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	6.0		6.0	6.0			5.5			5.5	5.5
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	1.00
Frt	1.00	1.00		1.00	0.98			0.97			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.96	1.00
Satd. Flow (prot)	1736	3458		1736	3411			1794			1755	1553
Flt Permitted	0.45	1.00		0.39	1.00			0.99			0.96	1.00
Satd. Flow (perm)	825	3458		706	3411			1794			1755	1553
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	232	680	17	5	373	49	9	43	15	79	17	348
RTOR Reduction (vph)	0	1	0	0	7	0	0	11	0	0	0	284
Lane Group Flow (vph)	232	696	0	5	415	0	0	56	0	0	96	64
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	2%	2%	2%	4%	4%	4%
Turn Type	pm+pt	NA		Perm	NA		Split	NA		Split	NA	pm+ov
Protected Phases	1	6			2		4	4		3	3	1
Permitted Phases	6			2								3
Actuated Green, G (s)	67.9	67.9		52.4	52.4			6.7			8.4	18.4
Effective Green, g (s)	67.9	67.9		52.4	52.4			6.7			8.4	18.4
Actuated g/C Ratio	0.68	0.68		0.52	0.52			0.07			0.08	0.18
Clearance Time (s)	5.5	6.0		6.0	6.0			5.5			5.5	5.5
Vehicle Extension (s)	2.0	2.0		2.0	2.0			2.0			2.0	2.0
Lane Grp Cap (vph)	651	2347		369	1787			120			147	285
v/s Ratio Prot	c0.04	0.20			0.12			c0.03			c0.05	0.02
v/s Ratio Perm	c0.21			0.01								0.02
v/c Ratio	0.36	0.30		0.01	0.23			0.47			0.65	0.22
Uniform Delay, d1	6.2	6.5		11.4	12.9			44.9			44.4	34.7
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.08	4.58
Incremental Delay, d2	0.1	0.3		0.1	0.3			1.0			7.6	0.1
Delay (s)	6.3	6.8		11.5	13.2			46.0			55.6	159.1
Level of Service	A	A		B	B			D			E	F
Approach Delay (s)		6.7			13.2			46.0			136.8	
Approach LOS		A			B			D			F	
Intersection Summary												
HCM 2000 Control Delay		40.5			HCM 2000 Level of Service				D			
HCM 2000 Volume to Capacity ratio		0.42										
Actuated Cycle Length (s)		100.0			Sum of lost time (s)				22.5			
Intersection Capacity Utilization		56.4%			ICU Level of Service				B			
Analysis Period (min)		15										
c Critical Lane Group												

Queues
1: Weisgarber Rd & Papermill Drive

Baseline - 2021 PM
Papermill Drive Corridor Study



Lane Group	EBL	EBT	EBC	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	282	422	43	123	383	549	20	336	559	293	476
v/c Ratio	0.68	0.35	0.05	0.30	0.37	0.63	0.05	0.81	1.32	0.54	0.60
Control Delay	66.4	20.8	0.5	20.5	33.5	16.4	18.0	55.4	197.7	35.9	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	66.4	20.8	0.5	20.5	33.5	16.4	18.0	55.4	197.7	35.9	5.9
Queue Length 50th (ft)	107	71	0	47	111	151	8	224	~263	178	0
Queue Length 95th (ft)	m106	m144	m2	96	179	331	21	301	#372	241	71
Internal Link Dist (ft)		385			1702				741		1059
Turn Bay Length (ft)	180		200	250		275	200				
Base Capacity (vph)	439	1213	1044	441	1040	871	599	614	424	547	797
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.64	0.35	0.04	0.28	0.37	0.63	0.03	0.55	1.32	0.54	0.60

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
- m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis

1: Weisgarber Rd & Papermill Drive

Baseline - 2021 PM

Papermill Drive Corridor Study

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑↑	↑↑	↑	↑	↑↑	↑	↑	↑	↑	↑↑	↑	↑
Traffic Volume (vph)	259	388	40	113	352	505	18	291	18	514	270	438
Future Volume (vph)	259	388	40	113	352	505	18	291	18	514	270	438
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.0	6.0	6.5	6.0	6.0	6.0	6.5	6.0	6.5	6.5	6.5
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00	0.97	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	1.00	1.00	0.85	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3467	3574	1599	1719	3438	1538	1770	1846	3335	1810	1538	
Flt Permitted	0.95	1.00	1.00	0.50	1.00	1.00	0.56	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3467	3574	1599	903	3438	1538	1048	1846	3335	1810	1538	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	282	422	43	123	383	549	20	316	20	559	293	476
RTOR Reduction (vph)	0	0	26	0	0	143	0	2	0	0	0	332
Lane Group Flow (vph)	282	422	17	123	383	406	20	334	0	559	293	144
Heavy Vehicles (%)	1%	1%	1%	5%	5%	5%	2%	2%	2%	5%	5%	5%
Turn Type	Prot	NA	pm+ov	pm+pt	NA	pm+ov	pm+pt	NA	Prot	NA	Perm	
Protected Phases	5	2	3	1	6	7	3	8	7	4		
Permitted Phases			2	6		6	8			4		
Actuated Green, G (s)	13.2	36.1	42.5	41.3	32.1	46.1	32.1	25.7	14.0	33.3	33.3	
Effective Green, g (s)	13.2	36.1	42.5	41.3	32.1	46.1	32.1	25.7	14.0	33.3	33.3	
Actuated g/C Ratio	0.12	0.33	0.39	0.38	0.29	0.42	0.29	0.23	0.13	0.30	0.30	
Clearance Time (s)	6.5	6.0	6.0	6.5	6.0	6.0	6.0	6.5	6.0	6.5	6.5	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	416	1172	705	407	1003	728	347	431	424	547	465	
v/s Ratio Prot	c0.08	c0.12	0.00	0.03	0.11	c0.07	0.00	c0.18	c0.17	0.16		
v/s Ratio Perm			0.01	0.09		0.19	0.01			0.09		
v/c Ratio	0.68	0.36	0.02	0.30	0.38	0.56	0.06	0.77	1.32	0.54	0.31	
Uniform Delay, d1	46.4	28.2	20.9	23.1	31.0	24.2	27.9	39.4	48.0	31.9	29.5	
Progression Factor	1.31	0.69	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.4	0.6	0.0	0.2	1.1	0.5	0.0	7.7	159.1	0.5	0.1	
Delay (s)	63.3	19.9	20.9	23.3	32.1	24.8	27.9	47.2	207.1	32.4	29.6	
Level of Service	E	B	C	C	C	C	C	D	F	C	C	
Approach Delay (s)		36.4			27.3			46.1		105.0		
Approach LOS		D			C			D		F		
Intersection Summary												
HCM 2000 Control Delay			60.7									
HCM 2000 Volume to Capacity ratio			0.80									
Actuated Cycle Length (s)			110.0									
Intersection Capacity Utilization			70.9%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
2: Westfield Rd & Papermill Drive

Baseline - 2021 PM
Papermill Drive Corridor Study



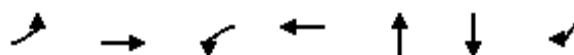
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↓	↖	↙	↗	↘
Traffic Volume (veh/h)	646	12	62	711	5	68
Future Volume (Veh/h)	646	12	62	711	5	68
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	702	13	67	773	5	74
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume		715		1616	708	
vC1, stage 1 conf vol				708		
vC2, stage 2 conf vol				907		
vCu, unblocked vol		715		1616	708	
tC, single (s)		4.1		6.4	6.2	
tC, 2 stage (s)				5.4		
tF (s)		2.2		3.5	3.3	
p0 queue free %		92		98	83	
cM capacity (veh/h)		890		304	438	
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	715	840	79			
Volume Left	0	67	5			
Volume Right	13	0	74			
cSH	1700	890	426			
Volume to Capacity	0.42	0.08	0.19			
Queue Length 95th (ft)	0	6	17			
Control Delay (s)	0.0	1.9	15.4			
Lane LOS		A	C			
Approach Delay (s)	0.0	1.9	15.4			
Approach LOS			C			
Intersection Summary						
Average Delay		1.7				
Intersection Capacity Utilization		90.1%		ICU Level of Service		E
Analysis Period (min)		15				

Queues

3: Golf Club Rd/Papermill Drive & Kingston Pike (SR1)

Baseline - 2021 PM

Papermill Drive Corridor Study



Lane Group	EBL	EBT	WBL	WBT	NBT	SBT	SBR
Lane Group Flow (vph)	474	918	11	1149	94	174	543
v/c Ratio	0.92	0.38	0.05	0.87	0.57	0.90	0.75
Control Delay	54.0	9.2	25.8	41.7	59.0	95.0	18.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	54.0	9.2	25.8	41.7	59.0	95.0	18.4
Queue Length 50th (ft)	268	145	5	413	62	128	53
Queue Length 95th (ft)	#501	203	19	#560	113	#258	#260
Internal Link Dist (ft)		675		1538	1452	271	
Turn Bay Length (ft)	300		100				
Base Capacity (vph)	520	2397	217	1319	226	193	722
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.91	0.38	0.05	0.87	0.42	0.90	0.75

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
3: Golf Club Rd/Papermill Drive & Kingston Pike (SR1)

Baseline - 2021 PM
Papermill Drive Corridor Study

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑		↑	↑↑			↔		↑	↓	↑
Traffic Volume (vph)	436	821	24	10	941	116	36	41	9	91	69	500
Future Volume (vph)	436	821	24	10	941	116	36	41	9	91	69	500
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	6.0		6.0	6.0			5.5			5.5	5.5
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	1.00
Frt	1.00	1.00		1.00	0.98			0.99			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.98			0.97	1.00
Satd. Flow (prot)	1787	3559		1787	3515			1816			1847	1615
Flt Permitted	0.09	1.00		0.31	1.00			0.98			0.97	1.00
Satd. Flow (perm)	166	3559		585	3515			1816			1847	1615
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	474	892	26	11	1023	126	39	45	10	99	75	543
RTOR Reduction (vph)	0	2	0	0	8	0	0	4	0	0	0	134
Lane Group Flow (vph)	474	916	0	11	1141	0	0	90	0	0	174	409
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	0%	0%	0%
Turn Type	pm+pt	NA		Perm	NA		Split	NA		Split	NA	pt+ov
Protected Phases	1	6			2		4	4		3	3	3 1
Permitted Phases	6			2								
Actuated Green, G (s)	72.9	72.9		39.9	39.9			8.6			11.5	39.0
Effective Green, g (s)	72.9	72.9		39.9	39.9			8.6			11.5	39.0
Actuated g/C Ratio	0.66	0.66		0.36	0.36			0.08			0.10	0.35
Clearance Time (s)	5.5	6.0		6.0	6.0			5.5			5.5	
Vehicle Extension (s)	2.0	2.0		2.0	2.0			2.0			2.0	
Lane Grp Cap (vph)	515	2358		212	1274			141			193	572
v/s Ratio Prot	c0.23	0.26			0.32			c0.05			c0.09	0.25
v/s Ratio Perm	c0.38			0.02								
v/c Ratio	0.92	0.39		0.05	0.90			0.64			0.90	0.72
Uniform Delay, d1	32.1	8.4		22.8	33.1			49.2			48.7	30.7
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.12	0.80
Incremental Delay, d2	21.6	0.5		0.5	10.0			7.2			34.9	3.2
Delay (s)	53.7	8.9		23.2	43.1			56.4			89.5	27.6
Level of Service	D	A		C	D			E			F	C
Approach Delay (s)		24.2			42.9			56.4			42.6	
Approach LOS		C			D			E			D	
Intersection Summary												
HCM 2000 Control Delay		35.5			HCM 2000 Level of Service				D			
HCM 2000 Volume to Capacity ratio		0.92										
Actuated Cycle Length (s)		110.0			Sum of lost time (s)				22.5			
Intersection Capacity Utilization		80.7%			ICU Level of Service				D			
Analysis Period (min)		15										
c Critical Lane Group												

Queues
1: Weisgarber Rd & Papermill Drive

No Build - 2040 AM
Papermill Drive Corridor Study



Lane Group	EBL	EBT	EBC	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	193	210	27	267	192	1049	2	341	590	475	348
v/c Ratio	0.61	0.30	0.04	0.67	0.26	1.17	0.01	1.11	0.63	0.60	0.33
Control Delay	48.0	29.7	0.2	35.2	34.5	111.0	16.5	124.3	35.1	26.6	2.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.0	29.7	0.2	35.2	34.5	111.0	16.5	124.3	35.1	26.6	2.0
Queue Length 50th (ft)	59	62	0	126	54	~778	1	~249	169	244	0
Queue Length 95th (ft)	89	89	1	198	87	#1031	4	#426	227	358	37
Internal Link Dist (ft)		385			1702			741		1059	
Turn Bay Length (ft)	180		200	250		275	200				
Base Capacity (vph)	353	697	658	399	726	896	314	307	933	794	1072
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.30	0.04	0.67	0.26	1.17	0.01	1.11	0.63	0.60	0.32

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

1: Weisgarber Rd & Papermill Drive

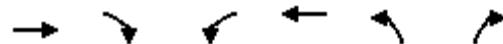
No Build - 2040 AM

Papermill Drive Corridor Study

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑↑	↑↑	↑	↑	↑↑	↑	↑	↑	↑	↑↑	↑	↑
Traffic Volume (vph)	178	193	25	246	177	965	2	295	18	543	437	320
Future Volume (vph)	178	193	25	246	177	965	2	295	18	543	437	320
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.0	6.0	6.5	6.0	6.0	6.0	6.5	6.0	6.5	6.5	6.5
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00	0.97	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	1.00	1.00	0.85	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3367	3471	1553	1719	3438	1538	1770	1846	3335	1810	1538	
Flt Permitted	0.95	1.00	1.00	0.59	1.00	1.00	0.49	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3367	3471	1553	1062	3438	1538	915	1846	3335	1810	1538	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	193	210	27	267	192	1049	2	321	20	590	475	348
RTOR Reduction (vph)	0	0	20	0	0	52	0	2	0	0	0	140
Lane Group Flow (vph)	193	210	7	267	192	997	2	339	0	590	475	208
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	2%	2%	2%	5%	5%	5%
Turn Type	Prot	NA	pt+ov	pm+pt	NA	pt+ov	pm+pt	NA	Prot	NA	pt+ov	
Protected Phases	5	2	27	1	6	63	7	4	3	8	85	
Permitted Phases				6			4					
Actuated Green, G (s)	9.4	17.7	26.7	29.1	18.7	52.7	21.9	18.9	28.0	43.9	59.8	
Effective Green, g (s)	9.4	17.7	26.7	29.1	18.7	52.7	21.9	18.9	28.0	43.9	59.8	
Actuated g/C Ratio	0.09	0.18	0.27	0.29	0.19	0.53	0.22	0.19	0.28	0.44	0.60	
Clearance Time (s)	6.5	6.0		6.5	6.0		6.0	6.5	6.0	6.5		
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0		
Lane Grp Cap (vph)	316	614	414	377	642	810	226	348	933	794	919	
v/s Ratio Prot	0.06	0.06	0.00	c0.07	0.06	c0.65	0.00	c0.18	0.18	0.26	0.14	
v/s Ratio Perm				0.13			0.00					
v/c Ratio	0.61	0.34	0.02	0.71	0.30	1.23	0.01	0.97	0.63	0.60	0.23	
Uniform Delay, d1	43.5	36.0	27.0	30.1	35.0	23.6	30.5	40.3	31.5	21.3	9.3	
Progression Factor	0.91	0.83	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.4	1.5	0.0	4.9	1.2	114.9	0.0	40.6	1.0	0.8	0.0	
Delay (s)	42.0	31.5	27.0	35.0	36.2	138.5	30.5	80.9	32.5	22.2	9.4	
Level of Service	D	C	C	C	D	F	C	F	C	C	A	
Approach Delay (s)		35.9			107.2			80.6		23.3		
Approach LOS		D			F			F		C		
Intersection Summary												
HCM 2000 Control Delay				64.3						E		
HCM 2000 Volume to Capacity ratio				1.21								
Actuated Cycle Length (s)				100.0						25.0		
Intersection Capacity Utilization				97.3%						F		
Analysis Period (min)				15								
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
2: Westfield Rd & Papermill Drive

No Build - 2040 AM
Papermill Drive Corridor Study



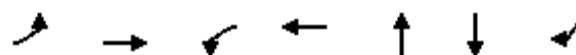
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑			↑	↑	
Traffic Volume (veh/h)	316	4	82	497	0	15
Future Volume (Veh/h)	316	4	82	497	0	15
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	343	4	89	540	0	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume		347		1063	345	
vC1, stage 1 conf vol				345		
vC2, stage 2 conf vol				718		
vCu, unblocked vol		347		1063	345	
tC, single (s)		4.1		6.4	6.2	
tC, 2 stage (s)				5.4		
tF (s)		2.2		3.5	3.3	
p0 queue free %		93		100	98	
cM capacity (veh/h)		1201		414	702	
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	347	629	16			
Volume Left	0	89	0			
Volume Right	4	0	16			
cSH	1700	1201	702			
Volume to Capacity	0.20	0.07	0.02			
Queue Length 95th (ft)	0	6	2			
Control Delay (s)	0.0	1.9	10.2			
Lane LOS		A	B			
Approach Delay (s)	0.0	1.9	10.2			
Approach LOS			B			
Intersection Summary						
Average Delay		1.4				
Intersection Capacity Utilization		60.9%		ICU Level of Service		B
Analysis Period (min)		15				

Queues

3: Golf Club Rd/Papermill Drive & Kingston Pike (SR1)

No Build - 2040 AM

Papermill Drive Corridor Study



Lane Group	EBL	EBT	WBL	WBT	NBT	SBT	SBR
Lane Group Flow (vph)	253	765	5	462	74	107	380
v/c Ratio	0.41	0.33	0.01	0.26	0.47	0.61	0.60
Control Delay	9.6	8.5	18.0	16.3	46.7	54.1	12.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.6	8.5	18.0	16.3	46.7	54.1	12.0
Queue Length 50th (ft)	59	104	2	85	39	69	65
Queue Length 95th (ft)	112	163	10	147	82	113	101
Internal Link Dist (ft)		675		1538	1452	271	
Turn Bay Length (ft)	300		100				
Base Capacity (vph)	757	2321	337	1746	234	219	812
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.33	0.01	0.26	0.32	0.49	0.47

Intersection Summary

HCM Signalized Intersection Capacity Analysis
3: Golf Club Rd/Papermill Drive & Kingston Pike (SR1)

No Build - 2040 AM
Papermill Drive Corridor Study

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑		↑	↑↑			↔		↑	↑	↑
Traffic Volume (vph)	233	685	18	5	376	49	9	44	15	80	18	350
Future Volume (vph)	233	685	18	5	376	49	9	44	15	80	18	350
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	6.0		6.0	6.0			5.5			5.5	5.5
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	1.00
Frt	1.00	1.00		1.00	0.98			0.97			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.96	1.00
Satd. Flow (prot)	1736	3458		1736	3411			1796			1756	1553
Flt Permitted	0.42	1.00		0.36	1.00			0.99			0.96	1.00
Satd. Flow (perm)	771	3458		661	3411			1796			1756	1553
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	253	745	20	5	409	53	10	48	16	87	20	380
RTOR Reduction (vph)	0	1	0	0	7	0	0	10	0	0	0	302
Lane Group Flow (vph)	253	764	0	5	455	0	0	64	0	0	107	78
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	2%	2%	2%	4%	4%	4%
Turn Type	pm+pt	NA		Perm	NA		Split	NA		Split	NA	pt+ov
Protected Phases	1	6			2		4	4		3	3	31
Permitted Phases	6			2								
Actuated Green, G (s)	66.0	66.0		49.9	49.9			7.0			10.0	20.6
Effective Green, g (s)	66.0	66.0		49.9	49.9			7.0			10.0	20.6
Actuated g/C Ratio	0.66	0.66		0.50	0.50			0.07			0.10	0.21
Clearance Time (s)	5.5	6.0		6.0	6.0			5.5			5.5	
Vehicle Extension (s)	2.0	2.0		2.0	2.0			2.0			2.0	
Lane Grp Cap (vph)	611	2282		329	1702			125			175	319
v/s Ratio Prot	c0.04	0.22			0.13			c0.04			c0.06	0.05
v/s Ratio Perm	c0.23			0.01								
v/c Ratio	0.41	0.33		0.02	0.27			0.51			0.61	0.25
Uniform Delay, d1	7.1	7.4		12.6	14.5			44.8			43.1	33.2
Progression Factor	1.00	1.00		1.00	1.00			1.00			0.92	4.17
Incremental Delay, d2	0.2	0.4		0.1	0.4			1.5			4.3	0.1
Delay (s)	7.3	7.8		12.7	14.9			46.3			44.0	138.6
Level of Service	A	A		B	B			D			D	F
Approach Delay (s)		7.7			14.8			46.3			117.8	
Approach LOS		A			B			D			F	
Intersection Summary												
HCM 2000 Control Delay		36.9			HCM 2000 Level of Service			D				
HCM 2000 Volume to Capacity ratio		0.47										
Actuated Cycle Length (s)		100.0			Sum of lost time (s)			22.5				
Intersection Capacity Utilization		58.6%			ICU Level of Service			B				
Analysis Period (min)		15										
c Critical Lane Group												

Queues
1: Weisgarber Rd & Papermill Drive

No Build- 2040 PM
Papermill Drive Corridor Study



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	309	462	48	135	418	601	22	369	612	322	522
v/c Ratio	0.73	0.35	0.06	0.34	0.38	0.70	0.06	0.88	1.33	0.55	0.65
Control Delay	66.3	31.9	0.1	23.2	35.6	22.4	21.7	69.4	204.7	39.9	10.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	66.3	31.9	0.1	23.2	35.6	22.4	21.7	69.4	204.7	39.9	10.1
Queue Length 50th (ft)	131	150	0	62	143	278	11	298	~343	228	48
Queue Length 95th (ft)	#260	210	0	113	191	424	26	397	#462	305	159
Internal Link Dist (ft)		385			1702				741		1059
Turn Bay Length (ft)	180		200	250		275	200				
Base Capacity (vph)	424	1323	834	408	1097	858	345	512	461	640	831
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.35	0.06	0.33	0.38	0.70	0.06	0.72	1.33	0.50	0.63

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

1: Weisgarber Rd & Papermill Drive

No Build- 2040 PM

Papermill Drive Corridor Study

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑↑	↑↑	↑	↑	↑↑	↑	↑	↑	↑	↑↑	↑	↑
Traffic Volume (vph)	284	425	44	124	385	553	20	319	20	563	296	480
Future Volume (vph)	284	425	44	124	385	553	20	319	20	563	296	480
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.0	6.0	6.5	6.0	6.0	6.0	6.5	6.0	6.5	6.5	6.5
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00	0.97	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	1.00	1.00	0.85	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3467	3574	1599	1719	3438	1538	1770	1846	3335	1810	1538	
Flt Permitted	0.95	1.00	1.00	0.48	1.00	1.00	0.55	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3467	3574	1599	872	3438	1538	1020	1846	3335	1810	1538	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	309	462	48	135	418	601	22	347	22	612	322	522
RTOR Reduction (vph)	0	0	28	0	0	93	0	2	0	0	0	299
Lane Group Flow (vph)	309	462	20	135	418	508	22	367	0	612	322	223
Heavy Vehicles (%)	1%	1%	1%	5%	5%	5%	2%	2%	2%	5%	5%	5%
Turn Type	Prot	NA	pm+ov	pm+pt	NA	pm+ov	pm+pt	NA	Prot	NA	Perm	
Protected Phases	5	2	3	1	6	7	3	8	7	4		
Permitted Phases			2	6		6	8				4	
Actuated Green, G (s)	15.9	46.9	53.3	49.6	40.3	58.3	37.2	30.8	18.0	42.4	42.4	
Effective Green, g (s)	15.9	46.9	53.3	49.6	40.3	58.3	37.2	30.8	18.0	42.4	42.4	
Actuated g/C Ratio	0.12	0.36	0.41	0.38	0.31	0.45	0.29	0.24	0.14	0.33	0.33	
Clearance Time (s)	6.5	6.0	6.0	6.5	6.0	6.0	6.0	6.5	6.0	6.5	6.5	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	424	1289	729	393	1065	760	328	437	461	590	501	
v/s Ratio Prot	c0.09	0.13	0.00	0.02	0.12	c0.09	0.00	c0.20	c0.18	0.18		
v/s Ratio Perm			0.01	0.11		0.24	0.02				0.14	
v/c Ratio	0.73	0.36	0.03	0.34	0.39	0.67	0.07	0.84	1.33	0.55	0.44	
Uniform Delay, d1	55.0	30.5	22.9	27.0	35.2	28.2	33.5	47.3	56.0	35.9	34.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	5.2	0.8	0.0	0.2	1.1	1.7	0.0	13.1	161.8	0.6	0.2	
Delay (s)	60.2	31.3	22.9	27.2	36.3	30.0	33.6	60.4	217.8	36.5	34.8	
Level of Service	E	C	C	C	D	C	C	E	F	D	C	
Approach Delay (s)		41.7			32.0			58.9		112.1		
Approach LOS		D			C			E		F		
Intersection Summary												
HCM 2000 Control Delay			67.3									E
HCM 2000 Volume to Capacity ratio			0.86									
Actuated Cycle Length (s)			130.0									25.0
Intersection Capacity Utilization			76.2%									D
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
2: Westfield Rd & Papermill Drive

No Build- 2040 PM
Papermill Drive Corridor Study

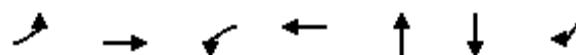
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→	↓ ↘	↖ ↙	←	↖ ↗	↗ ↘
Traffic Volume (veh/h)	707	13	68	779	5	74
Future Volume (Veh/h)	707	13	68	779	5	74
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	768	14	74	847	5	80
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume		782		1770	775	
vC1, stage 1 conf vol				775		
vC2, stage 2 conf vol				995		
vCu, unblocked vol		782		1770	775	
tC, single (s)		4.1		6.4	6.2	
tC, 2 stage (s)				5.4		
tF (s)		2.2		3.5	3.3	
p0 queue free %		91		98	80	
cM capacity (veh/h)		840		272	401	
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	782	921	85			
Volume Left	0	74	5			
Volume Right	14	0	80			
cSH	1700	840	390			
Volume to Capacity	0.46	0.09	0.22			
Queue Length 95th (ft)	0	7	20			
Control Delay (s)	0.0	2.3	16.8			
Lane LOS		A	C			
Approach Delay (s)	0.0	2.3	16.8			
Approach LOS			C			
Intersection Summary						
Average Delay		2.0				
Intersection Capacity Utilization		97.6%		ICU Level of Service		F
Analysis Period (min)		15				

Queues

3: Golf Club Rd/Papermill Drive & Kingston Pike (SR1)

No Build- 2040 PM

Papermill Drive Corridor Study



Lane Group	EBL	EBT	WBL	WBT	NBT	SBT	SBR
Lane Group Flow (vph)	518	1005	12	1258	102	192	596
v/c Ratio	0.92	0.42	0.07	1.04	0.66	0.77	0.75
Control Delay	64.0	12.6	34.9	84.2	84.0	82.7	24.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	64.0	12.6	34.9	84.2	84.0	82.7	24.3
Queue Length 50th (ft)	439	226	8	~697	96	183	241
Queue Length 95th (ft)	#724	300	25	#840	156	#295	355
Internal Link Dist (ft)		675		1538	1452	271	
Turn Bay Length (ft)	300		100				
Base Capacity (vph)	566	2376	183	1209	220	257	800
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.92	0.42	0.07	1.04	0.46	0.75	0.74

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
3: Golf Club Rd/Papermill Drive & Kingston Pike (SR1)

No Build- 2040 PM
Papermill Drive Corridor Study

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑		↑	↑↑			↔			↑	↑
Traffic Volume (vph)	477	899	26	11	1030	127	39	45	10	100	76	548
Future Volume (vph)	477	899	26	11	1030	127	39	45	10	100	76	548
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	6.0		6.0	6.0			5.5			5.5	5.5
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	1.00
Frt	1.00	1.00		1.00	0.98			0.99			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.98			0.97	1.00
Satd. Flow (prot)	1787	3559		1787	3515			1816			1848	1615
Flt Permitted	0.07	1.00		0.29	1.00			0.98			0.97	1.00
Satd. Flow (perm)	132	3559		536	3515			1816			1848	1615
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	518	977	28	12	1120	138	42	49	11	109	83	596
RTOR Reduction (vph)	0	1	0	0	7	0	0	3	0	0	0	109
Lane Group Flow (vph)	518	1004	0	12	1251	0	0	99	0	0	192	487
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	0%	0%	0%
Turn Type	pm+pt	NA		Perm	NA		Split	NA		Split	NA	pt+ov
Protected Phases	1	6			2		4	4		3	3	3 1
Permitted Phases	6			2								
Actuated Green, G (s)	100.1	100.1		51.3	51.3			12.6			20.3	63.6
Effective Green, g (s)	100.1	100.1		51.3	51.3			12.6			20.3	63.6
Actuated g/C Ratio	0.67	0.67		0.34	0.34			0.08			0.14	0.42
Clearance Time (s)	5.5	6.0		6.0	6.0			5.5			5.5	
Vehicle Extension (s)	2.0	2.0		2.0	2.0			2.0			2.0	
Lane Grp Cap (vph)	565	2375		183	1202			152			250	684
v/s Ratio Prot	c0.26	0.28		c0.36			c0.05			c0.10	0.30	
v/s Ratio Perm	0.35			0.02								
v/c Ratio	0.92	0.42		0.07	1.04			0.65			0.77	0.71
Uniform Delay, d1	44.5	11.6		33.2	49.4			66.6			62.6	35.6
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	19.4	0.6		0.7	37.3			7.4			12.0	2.9
Delay (s)	63.9	12.1		33.9	86.7			74.0			74.6	38.5
Level of Service	E	B		C	F			E			E	D
Approach Delay (s)		29.7			86.2			74.0			47.3	
Approach LOS		C			F			E			D	
Intersection Summary												
HCM 2000 Control Delay		54.2			HCM 2000 Level of Service			D				
HCM 2000 Volume to Capacity ratio		0.92										
Actuated Cycle Length (s)		150.0			Sum of lost time (s)			22.5				
Intersection Capacity Utilization		87.2%			ICU Level of Service			E				
Analysis Period (min)		15										
c Critical Lane Group												

Queues
1: Weisgarber Rd & Papermill Drive

Build - 2040 AM Unsigned
Papermill Drive Corridor Study



Lane Group	EBL	EBT	EBC	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	193	210	27	267	192	1049	2	341	590	475	348
v/c Ratio	0.73	0.24	0.04	0.57	0.19	1.09	0.01	0.89	0.73	0.59	0.34
Control Delay	81.4	46.2	0.1	35.5	39.4	81.9	21.0	79.4	57.0	33.9	2.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	81.4	46.2	0.1	35.5	39.4	81.9	21.0	79.4	57.0	33.9	2.4
Queue Length 50th (ft)	91	85	0	173	73	~1073	1	312	267	349	0
Queue Length 95th (ft)	#173	130	0	267	108	#1339	6	415	336	443	44
Internal Link Dist (ft)		385			1702			741		1059	
Turn Bay Length (ft)	180		100	250		275	200				
Base Capacity (vph)	263	878	624	494	1030	964	254	459	805	829	1024
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.24	0.04	0.54	0.19	1.09	0.01	0.74	0.73	0.57	0.34

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

1: Weisgarber Rd & Papermill Drive

Build - 2040 AM Unsigned

Papermill Drive Corridor Study

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑↑	↑↑	↑	↑	↑↑	↑	↑↑	↑	↑↑	↑↑	↑	↑
Traffic Volume (vph)	178	193	25	246	177	965	2	295	18	543	437	320
Future Volume (vph)	178	193	25	246	177	965	2	295	18	543	437	320
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.0	6.0	6.5	6.0	6.0	6.0	6.5	6.0	6.5	6.5	6.5
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00	0.97	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3367	3471	1553	1719	3438	1538	1770	1846	3335	1810	1538	
Flt Permitted	0.95	1.00	1.00	0.50	1.00	1.00	0.49	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3367	3471	1553	909	3438	1538	915	1846	3335	1810	1538	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	193	210	27	267	192	1049	2	321	20	590	475	348
RTOR Reduction (vph)	0	0	20	0	0	78	0	2	0	0	0	166
Lane Group Flow (vph)	193	210	7	267	192	971	2	339	0	590	475	182
Heavy Vehicles (%)	4%	4%	4%	5%	5%	5%	2%	2%	2%	5%	5%	5%
Turn Type	Prot	NA	pm+ov	pm+pt	NA	pm+ov	pm+pt	NA	Prot	NA	pm+ov	
Protected Phases	5	2	7	1	6	3	7	4	3	8	5	
Permitted Phases			2	6		6	4				8	
Actuated Green, G (s)	11.4	34.3	37.3	58.9	41.0	76.0	35.6	32.6	35.0	64.6	76.0	
Effective Green, g (s)	11.4	34.3	37.3	58.9	41.0	76.0	35.6	32.6	35.0	64.6	76.0	
Actuated g/C Ratio	0.08	0.24	0.26	0.41	0.28	0.52	0.25	0.22	0.24	0.45	0.52	
Clearance Time (s)	6.5	6.0	6.0	6.5	6.0	6.0	6.0	6.5	6.0	6.5	6.5	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	264	821	463	470	972	869	242	415	805	806	875	
v/s Ratio Prot	0.06	0.06	0.00	c0.07	0.06	c0.27	0.00	c0.18	0.18	0.26	0.02	
v/s Ratio Perm			0.00	0.16		0.36	0.00				0.10	
v/c Ratio	0.73	0.26	0.02	0.57	0.20	1.12	0.01	0.82	0.73	0.59	0.21	
Uniform Delay, d1	65.3	45.0	40.2	30.5	39.5	34.5	41.3	53.4	50.7	30.2	18.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	8.6	0.8	0.0	0.9	0.5	68.1	0.0	11.3	3.0	0.7	0.0	
Delay (s)	74.0	45.7	40.2	31.5	40.0	102.6	41.3	64.7	53.7	30.9	18.5	
Level of Service	E	D	D	C	D	F	D	E	D	C	B	
Approach Delay (s)		58.0			82.0			64.5		37.4		
Approach LOS		E			F			E		D		
Intersection Summary												
HCM 2000 Control Delay			60.5									E
HCM 2000 Volume to Capacity ratio			1.06									
Actuated Cycle Length (s)			145.0									25.0
Intersection Capacity Utilization			97.3%									F
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
2: Westfield Rd & Papermill Drive

Build - 2040 AM Unsignalized
Papermill Drive Corridor Study



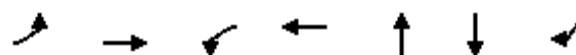
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↓	↖	↗	↖	↗
Traffic Volume (veh/h)	316	4	82	497	0	15
Future Volume (Veh/h)	316	4	82	497	0	15
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	343	4	89	540	0	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL		TWLTL			
Median storage veh)	2		2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume		347		1063	345	
vC1, stage 1 conf vol				345		
vC2, stage 2 conf vol				718		
vCu, unblocked vol		347		1063	345	
tC, single (s)		4.1		6.4	6.2	
tC, 2 stage (s)				5.4		
tF (s)		2.2		3.5	3.3	
p0 queue free %		93		100	98	
cM capacity (veh/h)		1201		414	702	
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	347	89	540	16		
Volume Left	0	89	0	0		
Volume Right	4	0	0	16		
cSH	1700	1201	1700	702		
Volume to Capacity	0.20	0.07	0.32	0.02		
Queue Length 95th (ft)	0	6	0	2		
Control Delay (s)	0.0	8.2	0.0	10.2		
Lane LOS		A		B		
Approach Delay (s)	0.0	1.2		10.2		
Approach LOS				B		
Intersection Summary						
Average Delay		0.9				
Intersection Capacity Utilization		36.2%		ICU Level of Service		A
Analysis Period (min)		15				

Queues

3: Golf Club Rd/Papermill Drive & Kingston Pike (SR1)

Build - 2040 AM Unsigned

Papermill Drive Corridor Study



Lane Group	EBL	EBT	WBL	WBT	NBT	SBT	SBR
Lane Group Flow (vph)	253	765	5	462	74	107	380
v/c Ratio	0.40	0.32	0.01	0.26	0.47	0.70	0.62
Control Delay	8.7	7.7	16.0	15.0	45.1	68.4	6.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.7	7.7	16.0	15.0	45.1	68.4	6.7
Queue Length 50th (ft)	57	101	2	83	37	67	0
Queue Length 95th (ft)	103	149	9	137	80	#140	49
Internal Link Dist (ft)		675		1538	1452	271	
Turn Bay Length (ft)	300		100				
Base Capacity (vph)	684	2364	347	1800	575	166	677
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.37	0.32	0.01	0.26	0.13	0.64	0.56

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
3: Golf Club Rd/Papermill Drive & Kingston Pike (SR1)

Build - 2040 AM Unsigned
Papermill Drive Corridor Study

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑		↑	↑↑			↔		↑	↑	↑
Traffic Volume (vph)	233	685	18	5	376	49	9	44	15	80	18	350
Future Volume (vph)	233	685	18	5	376	49	9	44	15	80	18	350
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	6.0		6.0	6.0			5.5			5.5	5.5
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	1.00
Frt	1.00	1.00		1.00	0.98			0.97			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.96	1.00
Satd. Flow (prot)	1736	3458		1736	3411			1796			1756	1553
Flt Permitted	0.43	1.00		0.36	1.00			0.99			0.96	1.00
Satd. Flow (perm)	778	3458		661	3411			1796			1756	1553
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	253	745	20	5	409	53	10	48	16	87	20	380
RTOR Reduction (vph)	0	1	0	0	6	0	0	13	0	0	0	308
Lane Group Flow (vph)	253	764	0	5	456	0	0	61	0	0	107	72
Heavy Vehicles (%)	4%	4%	4%	4%	4%	4%	2%	2%	2%	4%	4%	4%
Turn Type	pm+pt	NA		Perm	NA		Split	NA		Split	NA	pm+ov
Protected Phases	1	6			2		4	4		3	3	1
Permitted Phases	6				2							3
Actuated Green, G (s)	67.3	67.3		51.5	51.5			7.0			8.7	19.0
Effective Green, g (s)	67.3	67.3		51.5	51.5			7.0			8.7	19.0
Actuated g/C Ratio	0.67	0.67		0.52	0.52			0.07			0.09	0.19
Clearance Time (s)	5.5	6.0		6.0	6.0			5.5			5.5	5.5
Vehicle Extension (s)	2.0	2.0		2.0	2.0			2.0			2.0	2.0
Lane Grp Cap (vph)	622	2327		340	1756			125			152	295
v/s Ratio Prot	c0.04	0.22			0.13			c0.03			c0.06	0.03
v/s Ratio Perm	c0.23				0.01							0.02
v/c Ratio	0.41	0.33		0.01	0.26			0.49			0.70	0.24
Uniform Delay, d1	6.6	6.9		11.9	13.6			44.8			44.4	34.4
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	0.2	0.4		0.1	0.4			1.1			11.4	0.2
Delay (s)	6.8	7.2		11.9	13.9			45.9			55.8	34.6
Level of Service	A	A		B	B			D			E	C
Approach Delay (s)		7.1			13.9			45.9			39.2	
Approach LOS		A			B			D			D	
Intersection Summary												
HCM 2000 Control Delay		17.7									B	
HCM 2000 Volume to Capacity ratio		0.47										
Actuated Cycle Length (s)		100.0									22.5	
Intersection Capacity Utilization		58.6%									B	
Analysis Period (min)		15										
c Critical Lane Group												

Queues
1: Weisgarber Rd & Papermill Drive

Build- 2040 AM MIT Signal
Papermill Drive Corridor Study



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	193	237	267	192	1049	2	341	590	475	348
v/c Ratio	0.86	0.25	0.54	0.32	0.63	0.01	0.85	1.01	0.62	0.41
Control Delay	89.0	35.7	27.3	32.9	13.9	19.0	64.5	90.0	32.5	4.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	89.0	35.7	27.3	32.9	13.9	19.0	64.5	90.0	32.5	4.1
Queue Length 50th (ft)	77	73	132	110	197	1	254	~242	273	0
Queue Length 95th (ft)	#160	123	227	194	323	6	363	#406	465	62
Internal Link Dist (ft)		385		1702			741		1059	
Turn Bay Length (ft)	180		250		275	200				
Base Capacity (vph)	225	961	528	606	1670	315	555	583	776	858
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.86	0.25	0.51	0.32	0.63	0.01	0.61	1.01	0.61	0.41

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

1: Weisgarber Rd & Papermill Drive

Build- 2040 AM MIT Signal

Papermill Drive Corridor Study

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑↑	↑↑		↑	↑	↑↑	↑	↑		↑↑	↑	↑
Traffic Volume (vph)	178	193	25	246	177	965	2	295	18	543	437	320
Future Volume (vph)	178	193	25	246	177	965	2	295	18	543	437	320
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.0		6.5	6.0	6.0	6.0	6.5		6.0	6.5	6.5
Lane Util. Factor	0.97	0.95		1.00	1.00	0.88	1.00	1.00		0.97	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3467	3513		1719	1810	2707	1770	1846		3335	1810	1538
Flt Permitted	0.95	1.00		0.49	1.00	1.00	0.48	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3467	3513		887	1810	2707	895	1846		3335	1810	1538
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	193	210	27	267	192	1049	2	321	20	590	475	348
RTOR Reduction (vph)	0	7	0	0	0	179	0	2	0	0	0	207
Lane Group Flow (vph)	193	230	0	267	192	870	2	339	0	590	475	141
Heavy Vehicles (%)	1%	1%	1%	5%	5%	5%	2%	2%	2%	5%	5%	5%
Turn Type	Prot	NA		pm+pt	NA	pm+ov	pm+pt	NA		Prot	NA	Perm
Protected Phases	5	2		1	6	7	3	8		7	4	
Permitted Phases				6		6	8				4	
Actuated Green, G (s)	7.8	32.7		54.7	40.4	61.5	32.5	31.0		21.1	50.6	50.6
Effective Green, g (s)	7.8	32.7		54.7	40.4	61.5	32.5	31.0		21.1	50.6	50.6
Actuated g/C Ratio	0.06	0.26		0.44	0.32	0.49	0.26	0.25		0.17	0.40	0.40
Clearance Time (s)	6.5	6.0		6.5	6.0	6.0	6.0	6.5		6.0	6.5	6.5
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0
Lane Grp Cap (vph)	215	916		490	583	1458	242	456		561	730	621
v/s Ratio Prot	c0.06	0.07		c0.07	0.11	c0.10	0.00	c0.18		c0.18	0.26	
v/s Ratio Perm				0.17		0.22	0.00				0.09	
v/c Ratio	0.90	0.25		0.54	0.33	0.60	0.01	0.74		1.05	0.65	0.23
Uniform Delay, d1	58.4	36.6		23.8	32.2	23.0	34.4	43.5		52.1	30.2	24.5
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	33.9	0.7		0.7	1.5	0.4	0.0	5.7		52.3	1.6	0.1
Delay (s)	92.3	37.3		24.5	33.7	23.4	34.4	49.2		104.4	31.8	24.6
Level of Service	F	D		C	C	C	C	D		F	C	C
Approach Delay (s)		62.0			24.9			49.1			60.3	
Approach LOS		E			C			D			E	
Intersection Summary												
HCM 2000 Control Delay		45.0									D	
HCM 2000 Volume to Capacity ratio		0.78										
Actuated Cycle Length (s)		125.3									25.0	
Intersection Capacity Utilization		72.8%									C	
Analysis Period (min)		15										
c Critical Lane Group												



Lane Group	EBT	WBL	WBT	NBL
Lane Group Flow (vph)	347	89	540	16
v/c Ratio	0.34	0.14	0.44	0.02
Control Delay	8.8	5.5	8.0	0.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	8.8	5.5	8.0	0.1
Queue Length 50th (ft)	109	14	113	0
Queue Length 95th (ft)	180	29	173	0
Internal Link Dist (ft)	903		1322	1000
Turn Bay Length (ft)		150		
Base Capacity (vph)	1011	663	1234	814
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.34	0.13	0.44	0.02

Intersection Summary



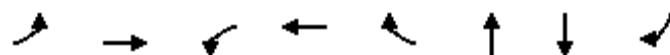
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑		↑	↑	↑	
Traffic Volume (vph)	316	4	82	497	0	15
Future Volume (vph)	316	4	82	497	0	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5	4.5	4.5	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.86	
Flt Protected	1.00		0.95	1.00	1.00	
Satd. Flow (prot)	1878		1787	1881	1644	
Flt Permitted	1.00		0.45	1.00	1.00	
Satd. Flow (perm)	1878		839	1881	1644	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	343	4	89	540	0	16
RTOR Reduction (vph)	0	0	0	0	12	0
Lane Group Flow (vph)	347	0	89	540	4	0
Heavy Vehicles (%)	1%	1%	1%	1%	0%	0%
Turn Type	NA		pm+pt	NA	Prot	
Protected Phases	2		1	6	8	
Permitted Phases			6			
Actuated Green, G (s)	42.2		52.5	52.5	18.5	
Effective Green, g (s)	42.2		52.5	52.5	18.5	
Actuated g/C Ratio	0.53		0.66	0.66	0.23	
Clearance Time (s)	4.5		4.5	4.5	4.5	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	990		619	1234	380	
v/s Ratio Prot	0.18		0.01	c0.29	c0.00	
v/s Ratio Perm			0.08			
v/c Ratio	0.35		0.14	0.44	0.01	
Uniform Delay, d1	11.0		5.5	6.6	23.7	
Progression Factor	0.68		1.00	1.00	1.00	
Incremental Delay, d2	0.9		0.1	1.1	0.0	
Delay (s)	8.4		5.6	7.8	23.7	
Level of Service	A		A	A	C	
Approach Delay (s)	8.4			7.5	23.7	
Approach LOS	A			A	C	
Intersection Summary						
HCM 2000 Control Delay		8.0		HCM 2000 Level of Service		A
HCM 2000 Volume to Capacity ratio		0.35				
Actuated Cycle Length (s)		80.0		Sum of lost time (s)		13.5
Intersection Capacity Utilization		37.8%		ICU Level of Service		A
Analysis Period (min)		15				
c Critical Lane Group						

Queues

3: Golf Club Rd/Papermill Drive & Kingston Pike (SR1)

Build- 2040 AM MIT Signal

Papermill Drive Corridor Study



Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	SBT	SBR
Lane Group Flow (vph)	253	765	5	409	53	74	107	380
v/c Ratio	0.39	0.34	0.02	0.26	0.07	0.40	0.63	0.57
Control Delay	9.2	8.3	17.2	16.7	0.2	34.2	44.8	9.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.2	8.3	17.2	16.7	0.2	34.2	44.8	9.7
Queue Length 50th (ft)	51	90	1	67	0	28	51	74
Queue Length 95th (ft)	97	137	9	118	0	65	#116	140
Internal Link Dist (ft)		675		1538		1452	276	
Turn Bay Length (ft)	300		100		125			
Base Capacity (vph)	694	2239	299	1570	805	420	171	728
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.36	0.34	0.02	0.26	0.07	0.18	0.63	0.52

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

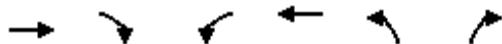
HCM Signalized Intersection Capacity Analysis
3: Golf Club Rd/Papermill Drive & Kingston Pike (SR1)

Build- 2040 AM MIT Signal
Papermill Drive Corridor Study

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑		↑	↑↑	↑	↔	↔		↓	↓	↑
Traffic Volume (vph)	233	685	18	5	376	49	9	44	15	80	18	350
Future Volume (vph)	233	685	18	5	376	49	9	44	15	80	18	350
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	6.0		6.0	6.0	6.0		5.5			5.5	5.5
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00			1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.97			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99			0.96	1.00
Satd. Flow (prot)	1787	3560		1787	3574	1599		1814			1826	1615
Flt Permitted	0.44	1.00		0.36	1.00	1.00		0.99			0.96	1.00
Satd. Flow (perm)	830	3560		680	3574	1599		1814			1826	1615
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	253	745	20	5	409	53	10	48	16	87	20	380
RTOR Reduction (vph)	0	1	0	0	0	30	0	15	0	0	0	304
Lane Group Flow (vph)	253	764	0	5	409	23	0	59	0	0	107	76
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	0%	0%	0%
Turn Type	pm+pt	NA		Perm	NA	Perm	Split	NA		Split	NA	pt+ov
Protected Phases	1	6			2		4	4		3	3	31
Permitted Phases	6			2		2						
Actuated Green, G (s)	50.3	50.3		35.1	35.1	35.1		6.3			6.4	16.1
Effective Green, g (s)	50.3	50.3		35.1	35.1	35.1		6.3			6.4	16.1
Actuated g/C Ratio	0.63	0.63		0.44	0.44	0.44		0.08			0.08	0.20
Clearance Time (s)	5.5	6.0		6.0	6.0	6.0		5.5			5.5	
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0		2.0			2.0	
Lane Grp Cap (vph)	637	2238		298	1568	701		142			146	325
v/s Ratio Prot	c0.05	0.21			0.11			c0.03			c0.06	0.05
v/s Ratio Perm	c0.20			0.01		0.01						
v/c Ratio	0.40	0.34		0.02	0.26	0.03		0.42			0.73	0.24
Uniform Delay, d1	6.7	7.0		12.7	14.2	12.8		35.1			36.0	26.8
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00			0.81	3.77
Incremental Delay, d2	0.1	0.4		0.1	0.4	0.1		0.7			25.5	0.1
Delay (s)	6.8	7.4		12.8	14.6	12.9		35.8			54.6	101.1
Level of Service	A	A		B	B	B		D			D	F
Approach Delay (s)		7.3			14.4			35.8			90.9	
Approach LOS		A			B			D			F	
Intersection Summary												
HCM 2000 Control Delay		29.8			HCM 2000 Level of Service				C			
HCM 2000 Volume to Capacity ratio		0.46										
Actuated Cycle Length (s)		80.0			Sum of lost time (s)				22.5			
Intersection Capacity Utilization		58.6%			ICU Level of Service				B			
Analysis Period (min)		15										
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
20: Papermill Drive

Build- 2040 AM MIT Signal
Papermill Drive Corridor Study



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	→	↓	↖	↑	↖	↗
Traffic Volume (veh/h)	300	31	10	489	45	96
Future Volume (Veh/h)	300	31	10	489	45	96
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	326	34	11	532	49	104
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL		TWLTL			
Median storage veh)	2		2			
Upstream signal (ft)			465			
pX, platoon unblocked				0.92		
vC, conflicting volume		360		897	343	
vC1, stage 1 conf vol				343		
vC2, stage 2 conf vol				554		
vCu, unblocked vol		360		847	343	
tC, single (s)		4.1		6.4	6.2	
tC, 2 stage (s)				5.4		
tF (s)		2.2		3.5	3.3	
p0 queue free %		99		90	85	
cM capacity (veh/h)		1199		505	700	
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	360	11	532	153		
Volume Left	0	11	0	49		
Volume Right	34	0	0	104		
cSH	1700	1199	1700	623		
Volume to Capacity	0.21	0.01	0.31	0.25		
Queue Length 95th (ft)	0	1	0	24		
Control Delay (s)	0.0	8.0	0.0	12.6		
Lane LOS		A		B		
Approach Delay (s)	0.0	0.2		12.6		
Approach LOS				B		
Intersection Summary						
Average Delay		1.9				
Intersection Capacity Utilization		40.8%		ICU Level of Service		A
Analysis Period (min)		15				

Queues
1: Weisgarber Rd & Papermill Drive

Build- 2040 PM Unsigned
Papermill Drive Corridor Study



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	309	462	48	135	418	601	22	369	612	322	522
v/c Ratio	0.73	0.35	0.06	0.34	0.38	0.70	0.06	0.88	1.33	0.55	0.65
Control Delay	66.3	31.9	0.1	23.2	35.6	22.4	21.7	69.4	204.7	39.9	10.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	66.3	31.9	0.1	23.2	35.6	22.4	21.7	69.4	204.7	39.9	10.1
Queue Length 50th (ft)	131	150	0	62	143	278	11	298	~343	228	48
Queue Length 95th (ft)	#260	210	0	113	191	424	26	397	#462	305	159
Internal Link Dist (ft)		385			1702				741		1059
Turn Bay Length (ft)	180		100	250		275	200				
Base Capacity (vph)	424	1323	834	408	1097	858	345	512	461	640	831
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.35	0.06	0.33	0.38	0.70	0.06	0.72	1.33	0.50	0.63

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

1: Weisgarber Rd & Papermill Drive

Build- 2040 PM Unsigned

Papermill Drive Corridor Study

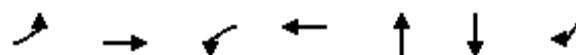
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑↑	↑↑	↑	↑	↑↑	↑	↑	↑	↑	↑↑	↑	↑
Traffic Volume (vph)	284	425	44	124	385	553	20	319	20	563	296	480
Future Volume (vph)	284	425	44	124	385	553	20	319	20	563	296	480
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.0	6.0	6.5	6.0	6.0	6.0	6.5	6.0	6.5	6.5	6.5
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	1.00	0.97	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	1.00	1.00	0.85	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3467	3574	1599	1719	3438	1538	1770	1846	3335	1810	1538	
Flt Permitted	0.95	1.00	1.00	0.48	1.00	1.00	0.55	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3467	3574	1599	872	3438	1538	1020	1846	3335	1810	1538	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	309	462	48	135	418	601	22	347	22	612	322	522
RTOR Reduction (vph)	0	0	28	0	0	93	0	2	0	0	0	299
Lane Group Flow (vph)	309	462	20	135	418	508	22	367	0	612	322	223
Heavy Vehicles (%)	1%	1%	1%	5%	5%	5%	2%	2%	2%	5%	5%	5%
Turn Type	Prot	NA	pm+ov	pm+pt	NA	pm+ov	pm+pt	NA	Prot	NA	Perm	
Protected Phases	5	2	3	1	6	7	3	8	7	4		
Permitted Phases			2	6		6	8				4	
Actuated Green, G (s)	15.9	46.9	53.3	49.6	40.3	58.3	37.2	30.8	18.0	42.4	42.4	
Effective Green, g (s)	15.9	46.9	53.3	49.6	40.3	58.3	37.2	30.8	18.0	42.4	42.4	
Actuated g/C Ratio	0.12	0.36	0.41	0.38	0.31	0.45	0.29	0.24	0.14	0.33	0.33	
Clearance Time (s)	6.5	6.0	6.0	6.5	6.0	6.0	6.0	6.5	6.0	6.5	6.5	
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	424	1289	729	393	1065	760	328	437	461	590	501	
v/s Ratio Prot	c0.09	0.13	0.00	0.02	0.12	c0.09	0.00	c0.20	c0.18	0.18		
v/s Ratio Perm			0.01	0.11		0.24	0.02				0.14	
v/c Ratio	0.73	0.36	0.03	0.34	0.39	0.67	0.07	0.84	1.33	0.55	0.44	
Uniform Delay, d1	55.0	30.5	22.9	27.0	35.2	28.2	33.5	47.3	56.0	35.9	34.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	5.2	0.8	0.0	0.2	1.1	1.7	0.0	13.1	161.8	0.6	0.2	
Delay (s)	60.2	31.3	22.9	27.2	36.3	30.0	33.6	60.4	217.8	36.5	34.8	
Level of Service	E	C	C	C	D	C	C	E	F	D	C	
Approach Delay (s)		41.7			32.0			58.9		112.1		
Approach LOS		D			C			E		F		
Intersection Summary												
HCM 2000 Control Delay			67.3									E
HCM 2000 Volume to Capacity ratio			0.86									
Actuated Cycle Length (s)			130.0									25.0
Intersection Capacity Utilization			76.2%									D
Analysis Period (min)			15									
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
2: Westfield Rd & Papermill Drive

Build- 2040 PM Unsignalized
Papermill Drive Corridor Study



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↓	↖	↗	↖	↗
Traffic Volume (veh/h)	707	13	68	779	5	74
Future Volume (Veh/h)	707	13	68	779	5	74
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	768	14	74	847	5	80
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL		TWLTL			
Median storage veh)	2		2			
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume		782		1770	775	
vC1, stage 1 conf vol				775		
vC2, stage 2 conf vol				995		
vCu, unblocked vol		782		1770	775	
tC, single (s)		4.1		6.4	6.2	
tC, 2 stage (s)				5.4		
tF (s)		2.2		3.5	3.3	
p0 queue free %		91		98	80	
cM capacity (veh/h)		840		272	401	
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	782	74	847	85		
Volume Left	0	74	0	5		
Volume Right	14	0	0	80		
cSH	1700	840	1700	390		
Volume to Capacity	0.46	0.09	0.50	0.22		
Queue Length 95th (ft)	0	7	0	20		
Control Delay (s)	0.0	9.7	0.0	16.8		
Lane LOS		A		C		
Approach Delay (s)	0.0	0.8		16.8		
Approach LOS				C		
Intersection Summary						
Average Delay		1.2				
Intersection Capacity Utilization		56.6%		ICU Level of Service		B
Analysis Period (min)		15				



Lane Group	EBL	EBT	WBL	WBT	NBT	SBT	SBR
Lane Group Flow (vph)	518	1005	12	1258	102	192	596
v/c Ratio	0.92	0.42	0.07	1.04	0.66	0.77	0.75
Control Delay	64.0	12.6	34.9	84.2	84.0	82.7	24.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	64.0	12.6	34.9	84.2	84.0	82.7	24.3
Queue Length 50th (ft)	439	226	8	~697	96	183	241
Queue Length 95th (ft)	#724	300	25	#840	156	#295	355
Internal Link Dist (ft)		675		1538	1452	271	
Turn Bay Length (ft)	300		100				
Base Capacity (vph)	566	2376	183	1209	220	257	800
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.92	0.42	0.07	1.04	0.46	0.75	0.74

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
3: Golf Club Rd/Papermill Drive & Kingston Pike (SR1)

Build- 2040 PM Unsigned
Papermill Drive Corridor Study

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑		↑	↑↑			↔		↑	↑	↑
Traffic Volume (vph)	477	899	26	11	1030	127	39	45	10	100	76	548
Future Volume (vph)	477	899	26	11	1030	127	39	45	10	100	76	548
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	6.0		6.0	6.0			5.5			5.5	5.5
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	1.00
Frt	1.00	1.00		1.00	0.98			0.99			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.98			0.97	1.00
Satd. Flow (prot)	1787	3559		1787	3515			1816			1848	1615
Flt Permitted	0.07	1.00		0.29	1.00			0.98			0.97	1.00
Satd. Flow (perm)	132	3559		536	3515			1816			1848	1615
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	518	977	28	12	1120	138	42	49	11	109	83	596
RTOR Reduction (vph)	0	1	0	0	7	0	0	3	0	0	0	109
Lane Group Flow (vph)	518	1004	0	12	1251	0	0	99	0	0	192	487
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	0%	0%	0%
Turn Type	pm+pt	NA		Perm	NA		Split	NA		Split	NA	pt+ov
Protected Phases	1	6			2		4	4		3	3	3 1
Permitted Phases	6			2								
Actuated Green, G (s)	100.1	100.1		51.3	51.3			12.6			20.3	63.6
Effective Green, g (s)	100.1	100.1		51.3	51.3			12.6			20.3	63.6
Actuated g/C Ratio	0.67	0.67		0.34	0.34			0.08			0.14	0.42
Clearance Time (s)	5.5	6.0		6.0	6.0			5.5			5.5	
Vehicle Extension (s)	2.0	2.0		2.0	2.0			2.0			2.0	
Lane Grp Cap (vph)	565	2375		183	1202			152			250	684
v/s Ratio Prot	c0.26	0.28		c0.36			c0.05			c0.10	0.30	
v/s Ratio Perm	0.35			0.02								
v/c Ratio	0.92	0.42		0.07	1.04			0.65			0.77	0.71
Uniform Delay, d1	44.5	11.6		33.2	49.4			66.6			62.6	35.6
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	19.4	0.6		0.7	37.3			7.4			12.0	2.9
Delay (s)	63.9	12.1		33.9	86.7			74.0			74.6	38.5
Level of Service	E	B		C	F			E			E	D
Approach Delay (s)		29.7			86.2			74.0			47.3	
Approach LOS		C			F			E			D	
Intersection Summary												
HCM 2000 Control Delay		54.2			HCM 2000 Level of Service				D			
HCM 2000 Volume to Capacity ratio		0.92										
Actuated Cycle Length (s)		150.0			Sum of lost time (s)				22.5			
Intersection Capacity Utilization		87.2%			ICU Level of Service				E			
Analysis Period (min)		15										
c Critical Lane Group												

Queues
1: Weisgarber Rd & Papermill Drive

Build- 2040 PM MIT Signal
Papermill Drive Corridor Study



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	309	510	135	418	601	22	369	612	322	522
v/c Ratio	0.73	0.38	0.36	0.71	0.40	0.06	0.88	1.40	0.52	0.64
Control Delay	66.3	31.2	22.8	46.0	10.3	22.1	69.4	236.0	38.4	9.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	66.3	31.2	22.8	46.0	10.3	22.1	69.4	236.0	38.4	9.7
Queue Length 50th (ft)	131	163	61	308	81	11	298	~355	230	46
Queue Length 95th (ft)	#260	227	111	431	128	26	397	#473	309	158
Internal Link Dist (ft)		385		1702			741		1059	
Turn Bay Length (ft)	180		250		275	200				
Base Capacity (vph)	424	1336	393	591	1510	352	512	436	639	832
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.38	0.34	0.71	0.40	0.06	0.72	1.40	0.50	0.63

Intersection Summary

- ~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis

1: Weisgarber Rd & Papermill Drive

Build- 2040 PM MIT Signal

Papermill Drive Corridor Study

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑↑	↑↑		↑	↑	↑↑	↑↑	↑↑		↑↑	↑	↑
Traffic Volume (vph)	284	425	44	124	385	553	20	319	20	563	296	480
Future Volume (vph)	284	425	44	124	385	553	20	319	20	563	296	480
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	6.0		6.5	6.0	6.0	6.0	6.5		6.0	6.5	6.5
Lane Util. Factor	0.97	0.95		1.00	1.00	0.88	1.00	1.00		0.97	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3467	3524		1719	1810	2707	1770	1846		3335	1810	1538
Flt Permitted	0.95	1.00		0.44	1.00	1.00	0.57	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3467	3524		798	1810	2707	1053	1846		3335	1810	1538
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	309	462	48	135	418	601	22	347	22	612	322	522
RTOR Reduction (vph)	0	6	0	0	0	166	0	2	0	0	0	295
Lane Group Flow (vph)	309	504	0	135	418	435	22	367	0	612	322	227
Heavy Vehicles (%)	1%	1%	1%	5%	5%	5%	2%	2%	2%	5%	5%	5%
Turn Type	Prot	NA		pm+pt	NA	pm+ov	pm+pt	NA		Prot	NA	Perm
Protected Phases	5	2		1	6	7	3	8		7	4	
Permitted Phases				6		6	8					4
Actuated Green, G (s)	15.9	46.7		49.4	40.1	57.1	36.8	32.0		17.0	44.2	44.2
Effective Green, g (s)	15.9	46.7		49.4	40.1	57.1	36.8	32.0		17.0	44.2	44.2
Actuated g/C Ratio	0.12	0.36		0.38	0.31	0.44	0.28	0.25		0.13	0.34	0.34
Clearance Time (s)	6.5	6.0		6.5	6.0	6.0	6.0	6.5		6.0	6.5	6.5
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0
Lane Grp Cap (vph)	424	1265		369	558	1313	324	454		436	615	522
v/s Ratio Prot	c0.09	0.14		0.03	c0.23	0.04	0.00	c0.20		c0.18	0.18	
v/s Ratio Perm				0.11		0.12	0.02					0.15
v/c Ratio	0.73	0.40		0.37	0.75	0.33	0.07	0.81		1.40	0.52	0.43
Uniform Delay, d1	55.0	31.1		27.1	40.4	23.9	33.8	46.1		56.5	34.4	33.2
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	5.2	0.9		0.2	8.9	0.1	0.0	9.7		195.0	0.4	0.2
Delay (s)	60.2	32.1		27.4	49.4	24.0	33.9	55.8		251.5	34.8	33.4
Level of Service	E	C		C	D	C	C	E		F	C	C
Approach Delay (s)		42.7			33.6			54.6			125.4	
Approach LOS		D			C			D			F	
Intersection Summary												
HCM 2000 Control Delay		72.7									E	
HCM 2000 Volume to Capacity ratio		0.87										
Actuated Cycle Length (s)		130.0									25.0	
Intersection Capacity Utilization		83.3%									E	
Analysis Period (min)		15										
c Critical Lane Group												



Lane Group	EBT	WBL	WBT	NBL
Lane Group Flow (vph)	782	74	847	85
v/c Ratio	0.58	0.16	0.57	0.28
Control Delay	12.1	4.0	7.4	15.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	12.1	4.0	7.4	15.2
Queue Length 50th (ft)	332	13	262	4
Queue Length 95th (ft)	443	24	344	56
Internal Link Dist (ft)	903		1322	1000
Turn Bay Length (ft)		150		
Base Capacity (vph)	1355	461	1498	305
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.58	0.16	0.57	0.28

Intersection Summary



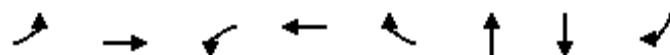
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↓	↖	↑	↖	↗
Traffic Volume (vph)	707	13	68	779	5	74
Future Volume (vph)	707	13	68	779	5	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5	4.5	4.5	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.87	
Flt Protected	1.00		0.95	1.00	1.00	
Satd. Flow (prot)	1877		1787	1881	1654	
Flt Permitted	1.00		0.26	1.00	1.00	
Satd. Flow (perm)	1877		498	1881	1654	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	768	14	74	847	5	80
RTOR Reduction (vph)	1	0	0	0	69	0
Lane Group Flow (vph)	781	0	74	847	16	0
Heavy Vehicles (%)	1%	1%	1%	1%	0%	0%
Turn Type	NA		pm+pt	NA	Prot	
Protected Phases	2			1	6	8
Permitted Phases					6	
Actuated Green, G (s)	108.3		119.5	119.5	21.5	
Effective Green, g (s)	108.3		119.5	119.5	21.5	
Actuated g/C Ratio	0.72		0.80	0.80	0.14	
Clearance Time (s)	4.5		4.5	4.5	4.5	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	1355		454	1498	237	
v/s Ratio Prot	0.42		0.01	c0.45	c0.01	
v/s Ratio Perm			0.12			
v/c Ratio	0.58		0.16	0.57	0.07	
Uniform Delay, d1	9.9		7.1	5.6	55.6	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	1.8		0.2	1.6	0.6	
Delay (s)	11.7		7.2	7.2	56.2	
Level of Service	B		A	A	E	
Approach Delay (s)	11.7			7.2	56.2	
Approach LOS	B			A	E	
Intersection Summary						
HCM 2000 Control Delay		11.5		HCM 2000 Level of Service		B
HCM 2000 Volume to Capacity ratio		0.51				
Actuated Cycle Length (s)		150.0		Sum of lost time (s)		13.5
Intersection Capacity Utilization		58.3%		ICU Level of Service		B
Analysis Period (min)		15				
c Critical Lane Group						

Queues

3: Golf Club Rd/Papermill Drive & Kingston Pike (SR1)

Build- 2040 PM MIT Signal

Papermill Drive Corridor Study



Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	SBT	SBR
Lane Group Flow (vph)	518	1005	12	1120	138	102	192	596
v/c Ratio	0.89	0.43	0.07	0.99	0.24	0.63	0.80	0.73
Control Delay	53.5	12.0	32.7	69.2	9.6	71.2	79.1	19.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	53.5	12.0	32.7	69.2	9.6	71.2	79.1	19.2
Queue Length 50th (ft)	361	200	7	494	15	81	159	172
Queue Length 95th (ft)	#626	273	24	#648	63	137	#282	274
Internal Link Dist (ft)		675		1538		1452		276
Turn Bay Length (ft)	300		100		125			
Base Capacity (vph)	582	2320	169	1129	582	254	240	816
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.89	0.43	0.07	0.99	0.24	0.40	0.80	0.73

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

HCM Signalized Intersection Capacity Analysis
3: Golf Club Rd/Papermill Drive & Kingston Pike (SR1)

Build- 2040 PM MIT Signal
Papermill Drive Corridor Study

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑		↑	↑↑	↑	↔	↔		↑	↑	↑
Traffic Volume (vph)	477	899	26	11	1030	127	39	45	10	100	76	548
Future Volume (vph)	477	899	26	11	1030	127	39	45	10	100	76	548
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.5	6.0		6.0	6.0	6.0		5.5			5.5	5.5
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00			1.00	1.00
Frt	1.00	1.00		1.00	1.00	0.85		0.99			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98			0.97	1.00
Satd. Flow (prot)	1787	3559		1787	3574	1599		1816			1848	1615
Flt Permitted	0.09	1.00		0.29	1.00	1.00		0.98			0.97	1.00
Satd. Flow (perm)	161	3559		536	3574	1599		1816			1848	1615
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	518	977	28	12	1120	138	42	49	11	109	83	596
RTOR Reduction (vph)	0	1	0	0	0	77	0	4	0	0	0	133
Lane Group Flow (vph)	518	1004	0	12	1120	61	0	98	0	0	192	463
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	0%	0%	0%
Turn Type	pm+pt	NA		Perm	NA	Perm	Split	NA		Split	NA	pt+ov
Protected Phases	1	6			2		4	4		3	3	31
Permitted Phases	6			2		2						
Actuated Green, G (s)	84.7	84.7		41.1	41.1	41.1		11.4			16.9	55.0
Effective Green, g (s)	84.7	84.7		41.1	41.1	41.1		11.4			16.9	55.0
Actuated g/C Ratio	0.65	0.65		0.32	0.32	0.32		0.09			0.13	0.42
Clearance Time (s)	5.5	6.0		6.0	6.0	6.0		5.5			5.5	
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0		2.0			2.0	
Lane Grp Cap (vph)	581	2318		169	1129	505		159			240	683
v/s Ratio Prot	c0.26	0.28		c0.31			c0.05			c0.10	0.29	
v/s Ratio Perm	0.32			0.02		0.04						
v/c Ratio	0.89	0.43		0.07	0.99	0.12		0.62			0.80	0.68
Uniform Delay, d1	36.6	11.0		31.1	44.3	31.6		57.2			54.9	30.3
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	1.00
Incremental Delay, d2	15.5	0.6		0.8	24.9	0.5		5.0			23.7	2.1
Delay (s)	52.1	11.6		31.9	69.2	32.1		62.2			78.6	32.4
Level of Service	D	B		C	E	C		E			E	C
Approach Delay (s)		25.4			64.8			62.2			43.7	
Approach LOS		C			E			E			D	
Intersection Summary												
HCM 2000 Control Delay		43.9			HCM 2000 Level of Service				D			
HCM 2000 Volume to Capacity ratio		0.89										
Actuated Cycle Length (s)		130.0			Sum of lost time (s)				22.5			
Intersection Capacity Utilization		83.1%			ICU Level of Service				E			
Analysis Period (min)		15										
c Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
20: Papermill Drive

Build- 2040 PM MIT Signal
Papermill Drive Corridor Study



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑		↑	↑	↑	
Traffic Volume (veh/h)	743	38	43	842	5	10
Future Volume (Veh/h)	743	38	43	842	5	10
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	808	41	47	915	5	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL		TWLTL			
Median storage veh)	2		2			
Upstream signal (ft)			465			
pX, platoon unblocked				0.79		
vC, conflicting volume		849		1838	828	
vC1, stage 1 conf vol				828		
vC2, stage 2 conf vol				1009		
vCu, unblocked vol		849		1925	828	
tC, single (s)		4.1		6.4	6.2	
tC, 2 stage (s)				5.4		
tF (s)		2.2		3.5	3.3	
p0 queue free %		94		98	97	
cM capacity (veh/h)		789		245	371	
Direction, Lane #	EB 1	WB 1	WB 2	NB 1		
Volume Total	849	47	915	16		
Volume Left	0	47	0	5		
Volume Right	41	0	0	11		
cSH	1700	789	1700	319		
Volume to Capacity	0.50	0.06	0.54	0.05		
Queue Length 95th (ft)	0	5	0	4		
Control Delay (s)	0.0	9.9	0.0	16.9		
Lane LOS		A		C		
Approach Delay (s)	0.0	0.5		16.9		
Approach LOS				C		
Intersection Summary						
Average Delay		0.4				
Intersection Capacity Utilization		54.3%		ICU Level of Service		A
Analysis Period (min)		15				

Appendix D

Crash Rate and Summary

COUNTY	=	Knox	Date:	1/11/2022
Route	=	Papermill Drive (04829)		
Location	=	From SR 1 (Kingston Pike) to N. Weisgarber Road		
Highway Type	=	Urban Two-Lane		
FUNCTIONAL CLASS	=	Major Collector		
DATA YEARS	=	2017-2019		
ADT YEARS USED	=	2019		
COMMENTS	=			
ANALYZED BY	=	KAC CDM Smith		

SECTION = MORE THAN 0.10 MILE / SPOT = LESS THAN 0.10 MILE

BLM	ELM	Length	Average AADT	VMT
0.00	0.61	0.61	16,300	9,943
0.00	0.00	0.00	0	0
0.00	0.00	0.00	0	0
0.00	0.00	0.00	0	0
0.00	0.00	0.00	0	0
0.00	0.00	0.00	0	0
0.00	0.00	0.00	0	0
		0.61	16,300	9,943

INTERSECTION

Log Mile	=	0.00	Leg	Traffic AADT
			North	= 0
			East	= 0
			South	= 0
			West	= 0
			Entering AADT =	0

2019

Urban Two-Lane
2017-2019

No. of Crashes	=	120	Total	Fatal	Incap. Injury	*Severe Crashes	Other Injury
			1	0	1	8	
No. of Years	=	3					
SW avg. rate	=	2.334	0.014	0.079	0.093	0.612	

08-10 S/W Rates

Exposure (E)	=	10.8876				
Crash Rate (A)	=	11.022	0.092	0.000	0.092	0.735
Critical Rate (C)	=	3.457				
Severity Index (SI)	=	0.1000				
Actual Rate/SW Average	=	4.72	6.56	0.00	0.99	1.20
Ratio of A/C	=	3.19				

* Severe Crashes are the sum of fatal and incapacitating injury crashes

Revised 4/3/2007

Tennessee Department of Transportation
Statewide Average Crash Rates for Sections and Spots

Study: HSIP 2008 TO 2010

Begin Date: 1/1/2008 End Date: 12/31/2010

Route Type	Rural / Urban	Location Type	Highway Type	Fatal Rate	Incap. Rate	Other Inj. Rate	Pd. Rate	Total Rate	Severe Crash Rate	Total Veh. Miles (in millions)
Interstates and State Routes										
IS & SR	Rural	Section	2 OR 3 LN	0.028	0.100	0.450	1.012	1.590	0.128	25,379
IS & SR	Rural	Section	2 OR 3 LN W/TL	0.015	0.059	0.443	1.292	1.809	0.074	811
IS & SR	Rural	Section	4 OR MORE UNDIV	0.022	0.064	0.387	1.034	1.506	0.086	599
IS & SR	Rural	Section	4 OR MORE DIV	0.010	0.048	0.194	0.482	0.733	0.058	8,640
IS & SR	Rural	Section	4 OR MORE W TL	0.013	0.047	0.233	0.642	0.935	0.060	3,138
IS & SR	Rural	Section	FREEWAY	0.006	0.022	0.103	0.313	0.444	0.028	27,946
IS & SR	Rural	Spot	2 OR 3 LN	0.008	0.028	0.126	0.286	0.448	0.036	92,309
IS & SR	Rural	Spot	2 OR 3 LN W/TL	0.003	0.011	0.081	0.242	0.337	0.014	4,649
IS & SR	Rural	Spot	4 OR MORE UNDIV	0.003	0.012	0.069	0.179	0.264	0.015	3,597
IS & SR	Rural	Spot	4 OR MORE DIV	0.003	0.012	0.051	0.126	0.192	0.015	33,992
IS & SR	Rural	Spot	4 OR MORE W TL	0.003	0.010	0.053	0.149	0.215	0.013	14,285
IS & SR	Rural	Spot	FREEWAY	0.001	0.004	0.017	0.051	0.072	0.005	172,032
IS & SR	Urban	Section	2 OR 3 LN	0.014	0.079	0.612	1.629	2.334	0.093	7,665
IS & SR	Urban	Section	2 OR 3 LN W/TL	0.011	0.066	0.543	1.521	2.142	0.077	1,601
IS & SR	Urban	Section	4 OR MORE UNDIV	0.012	0.081	0.783	2.341	3.216	0.093	2,701
IS & SR	Urban	Section	4 OR MORE DIV	0.009	0.048	0.426	1.294	1.777	0.057	13,681
IS & SR	Urban	Section	4 OR MORE W TL	0.009	0.054	0.604	1.799	2.466	0.063	12,573
IS & SR	Urban	Section	FREEWAY	0.005	0.021	0.239	0.717	0.981	0.026	40,774
IS & SR	Urban	Spot	2 OR 3 LN	0.002	0.013	0.098	0.271	0.384	0.015	52,428
IS & SR	Urban	Spot	2 OR 3 LN W/TL	0.002	0.009	0.079	0.223	0.313	0.011	11,717
IS & SR	Urban	Spot	4 OR MORE UNDIV	0.001	0.008	0.089	0.275	0.373	0.009	30,572
IS & SR	Urban	Spot	4 OR MORE DIV	0.001	0.007	0.060	0.186	0.254	0.008	105,668
IS & SR	Urban	Spot	4 OR MORE W TL	0.001	0.007	0.075	0.223	0.306	0.008	106,136
IS & SR	Urban	Spot	FREEWAY	0.001	0.003	0.029	0.086	0.118	0.004	342,350

Note: Section rates are crashes per million vehicle miles.

Note: Spot rates are crashes per million vehicles. Spots are sections of roadway less than or equal to .10 mile.

Note: Severe crash rates are the sum of rates for fatal and incapacitating injury crashes.

Master Record	Agency	Agency Tracking Number	County	City	Year	Collision Date	Collision Time	Vehicles Involved	Number Injured	Number Dead	Latitude	Longitude
300327632	KNOXVILLE POLICE DEPT	17-000357	Knox	Knoxville	2017	Wednesday, January 4, 2017	12:12:00 AM	1	0	1	35.93427	-84.0155
300327683	KNOXVILLE POLICE DEPT	16-000325	Knox	Knoxville	2017	Tuesday, January 3, 2017	6:07:00 PM	5	1	0	35.93606	-84.0118
300334597	KNOXVILLE POLICE DEPT	17-005308	Knox	Knoxville	2017	Saturday, February 11, 2017	3:48:00 PM	2	0	0	35.93809	-84.0081
300335557	KNOXVILLE POLICE DEPT	17-005864	Knox	Knoxville	2017	Wednesday, February 15, 2017	7:20:00 PM	2	0	0	35.93773	-84.0087
300339268	KNOXVILLE POLICE DEPT	17-008487	Knox	Knoxville	2017	Tuesday, March 7, 2017	1:57:00 PM	2	1	0	35.93581	-84.0126
300340994	KNOXVILLE POLICE DEPT	17-009609	Knox	Knoxville	2017	Thursday, March 16, 2017	10:31:00 AM	2	0	0	35.93582	-84.0124
300343417	KNOXVILLE POLICE DEPT	17-011333	Knox	Knoxville	2017	Tuesday, March 28, 2017	10:45:00 AM	2	0	0	35.93265	-84.0173
300344516	KNOXVILLE POLICE DEPT	17-011968	Knox	Knoxville	2017	Saturday, April 1, 2017	2:40:00 AM	1	0	0	35.93312	-84.0172
300347402	KNOXVILLE POLICE DEPT	17-013897	Knox	Knoxville	2017	Friday, April 14, 2017	12:57:00 PM	2	0	0	35.93497	-84.0141
300347876	KNOXVILLE POLICE DEPT	17-014126	Knox	Knoxville	2017	Saturday, April 15, 2017	11:40:00 PM	2	0	0	35.93288	-84.0173
300350108	KNOXVILLE POLICE DEPT	17-015227	Knox	Knoxville	2017	Monday, April 24, 2017	5:29:00 PM	2	0	0	35.93661	-84.011
300350581	KNOXVILLE POLICE DEPT	17-015371	Knox	Knoxville	2017	Tuesday, April 25, 2017	3:25:00 PM	2	0	0	35.9382	-84.0078
300356326	KNOXVILLE POLICE DEPT	17-018655	Knox	Knoxville	2017	Wednesday, May 17, 2017	2:17:00 PM	2	0	0	35.93806	-84.0081
300357502	KNOXVILLE POLICE DEPT	17-019400	Knox	Knoxville	2017	Monday, May 22, 2017	4:11:00 PM	2	0	0	35.93606	-84.012
300357801	KNOXVILLE POLICE DEPT	17-019548	Knox	Knoxville	2017	Tuesday, May 23, 2017	4:16:00 PM	2	0	0	35.93579	-84.0126
300358157	KNOXVILLE POLICE DEPT	17-019697	Knox	Knoxville	2017	Wednesday, May 24, 2017	6:56:00 PM	2	0	0	35.9354	-84.0133
300358401	KNOXVILLE POLICE DEPT	17-019937	Knox	Knoxville	2017	Friday, May 26, 2017	12:30:00 PM	2	1	0	35.93799	-84.0084
300363580	KNOXVILLE POLICE DEPT	17-022983	Knox	Knoxville	2017	Friday, June 16, 2017	5:36:00 PM	2	0	0	35.93358	-84.0167
300363990	KNOXVILLE POLICE DEPT	17-022791	Knox	Knoxville	2017	Thursday, June 15, 2017	9:56:00 AM	1	0	0	35.93491	-84.0143
300366834	KNOXVILLE POLICE DEPT	17-024828	Knox	Knoxville	2017	Friday, June 30, 2017	4:22:00 PM	2	0	0	35.93317	-84.0168
300372093	KNOXVILLE POLICE DEPT	17-028084	Knox	Knoxville	2017	Monday, July 24, 2017	2:30:00 PM	2	0	0	35.93741	-84.0081
300374051	KNOXVILLE POLICE DEPT	17-029171	Knox	Knoxville	2017	Tuesday, August 1, 2017	3:10:00 PM	2	0	0	35.97898	-83.9144
300374824	KNOXVILLE POLICE DEPT	17-029694	Knox	Knoxville	2017	Saturday, August 5, 2017	9:35:00 AM	2	0	0	35.93596	-84.012
300375148	KNOXVILLE POLICE DEPT	17-029449	Knox	Knoxville	2017	Thursday, August 3, 2017	5:09:00 PM	2	0	0	35.93755	-84.0092
300377568	KNOXVILLE POLICE DEPT	17-031163	Knox	Knoxville	2017	Wednesday, August 16, 2017	5:34:00 PM	2	0	0	35.93751	-84.0091
300383224	KNOXVILLE POLICE DEPT	17-034161	Knox	Knoxville	2017	Wednesday, September 6, 2017	11:29:00 AM	3	0	0	35.93771	-84.0089
300386163	KNOXVILLE POLICE DEPT	17-035369	Knox	Knoxville	2017	Thursday, September 14, 2017	1:23:00 PM	2	0	0	35.93771	-84.0089
300387304	KNOXVILLE POLICE DEPT	17-036623	Knox	Knoxville	2017	Friday, September 22, 2017	4:22:00 PM	3	0	0	35.9358	-84.0126
300388092	KNOXVILLE POLICE DEPT	17-037029	Knox	Knoxville	2017	Monday, September 25, 2017	1:40:00 PM	2	0	0	35.93573	-84.0127
300390455	KNOXVILLE POLICE DEPT	17-038415	Knox	Knoxville	2017	Wednesday, October 4, 2017	1:42:00 PM	2	0	0	35.9377	-84.009
300398208	KNOXVILLE POLICE DEPT	17-042456	Knox	Knoxville	2017	Tuesday, October 31, 2017	5:00:00 AM	1	0	0	35.93222	-84.0231
300407725	KNOXVILLE POLICE DEPT	17-047906	Knox	Knoxville	2017	Thursday, December 7, 2017	5:40:00 PM	2	0	0	35.9353	-84.0134
300410286	KNOXVILLE POLICE DEPT	17-049731	Knox	Knoxville	2017	Wednesday, December 20, 2017	5:50:00 PM	2	0	0	35.93591	-84.0123
300411367	KNOXVILLE POLICE DEPT	17-050277	Knox	Knoxville	2017	Sunday, December 24, 2017	6:58:00 PM	2	0	0	35.93262	-84.0175
300412977	KNOXVILLE POLICE DEPT	18-000204	Knox	Knoxville	2018	Tuesday, January 2, 2018	7:25:00 PM	2	0	0	35.9377	-84.0089
300413285	KNOXVILLE POLICE DEPT	18-000307	Knox	Knoxville	2018	Wednesday, January 3, 2018	4:48:00 PM	2	0	0	35.93497	-84.0142
300413876	KNOXVILLE POLICE DEPT	18-000655	Knox	Knoxville	2018	Saturday, January 6, 2018	3:19:00 PM	2	0	0	35.93578	-84.0126
300417039	KNOXVILLE POLICE DEPT	18-002260	Knox	Knoxville	2018	Friday, January 19, 2018	7:21:00 PM	2	0	0	35.93764	-84.0084
300417354	KNOXVILLE POLICE DEPT	18-002366	Knox	Knoxville	2018	Saturday, January 20, 2018	3:20:00 PM	2	0	0	35.93842	-84.0077
300420355	KNOXVILLE POLICE DEPT	18-004379	Knox	Knoxville	2018	Sunday, February 4, 2018	11:50:00 AM	2	0	0	35.93774	-84.0088
300425015	KNOXVILLE POLICE DEPT	18-007465	Knox	Knoxville	2018	Saturday, February 24, 2018	2:23:00 PM	2	0	0	35.93674	-84.0104
300429238	KNOXVILLE POLICE DEPT	18-010106	Knox	Knoxville	2018	Wednesday, March 14, 2018	8:06:00 AM	2	0	0	35.93972	-84.008
300433966	KNOXVILLE POLICE DEPT	18-012739	Knox	Knoxville	2018	Saturday, March 31, 2018	12:14:00 PM	2	2	0	35.93773	-84.009
300434504	KNOXVILLE POLICE DEPT	18-013348	Knox	Knoxville	2018	Wednesday, April 4, 2018	12:29:00 PM	2	0	0	35.93281	-84.0174
300435293	KNOXVILLE POLICE DEPT	18-013864	Knox	Knoxville	2018	Saturday, April 7, 2018	2:30:00 PM	2	0	0	35.93576	-84.0125

Master Record	Agency	Agency Tracking Number	County	City	Year	Collision Date	Collision Time	Vehicles Involved	Number Injured	Number Dead	Latitude	Longitude
300435643	KNOXVILLE POLICE DEPT	18-014030	Knox	Knoxville	2018	Sunday, April 8, 2018	6:15:00 PM	2	0	0	35.93263	-84.0175
300437059	KNOXVILLE POLICE DEPT	18-014931	Knox	Knoxville	2018	Saturday, April 14, 2018	5:05:00 PM	2	0	0	35.93408	-84.0157
300437175	KNOXVILLE POLICE DEPT	18-015068	Knox	Knoxville	2018	Sunday, April 15, 2018	4:40:00 PM	2	0	0	35.93579	-84.0125
300438628	KNOXVILLE POLICE DEPT	18-015880	Knox	Knoxville	2018	Friday, April 20, 2018	8:48:00 PM	2	0	0	35.9326	-84.0175
300439740	KNOXVILLE POLICE DEPT	18-016440	Knox	Knoxville	2018	Tuesday, April 24, 2018	4:56:00 PM	2	0	0	35.93899	-84.006
300440332	KNOXVILLE POLICE DEPT	18-016767	Knox	Knoxville	2018	Thursday, April 26, 2018	2:51:00 PM	2	0	0	35.93291	-84.0172
300441187	KNOXVILLE POLICE DEPT	18-017360	Knox	Knoxville	2018	Monday, April 30, 2018	12:43:00 PM	2	0	0	35.93596	-84.0122
300442873	KNOXVILLE POLICE DEPT	18-017944	Knox	Knoxville	2018	Friday, May 4, 2018	11:07:00 AM	2	0	0	35.93724	-84.0083
300443544	KNOXVILLE POLICE DEPT	18-018554	Knox	Knoxville	2018	Tuesday, May 8, 2018	12:49:00 PM	2	0	0	35.93322	-84.0171
300447751	KNOXVILLE POLICE DEPT	18-021205	Knox	Knoxville	2018	Thursday, May 24, 2018	11:29:00 PM	2	0	0	35.93746	-84.0091
300448865	KNOXVILLE POLICE DEPT	18-021892	Knox	Knoxville	2018	Tuesday, May 29, 2018	6:54:00 PM	2	0	0	35.93576	-84.0127
300449483	KNOXVILLE POLICE DEPT	18-022111	Knox	Knoxville	2018	Thursday, May 31, 2018	9:33:00 AM	2	0	0	35.92925	-84.0412
300453827	KNOXVILLE POLICE DEPT	18-024678	Knox	Knoxville	2018	Monday, June 18, 2018	8:11:00 AM	2	0	0	35.93252	-84.0176
300454014	KNOXVILLE POLICE DEPT	18-024896	Knox	Knoxville	2018	Tuesday, June 19, 2018	2:52:00 PM	2	0	0	35.93253	-84.0176
300455175	KNOXVILLE POLICE DEPT	18-025541	Knox	Knoxville	2018	Saturday, June 23, 2018	2:57:00 PM	2	0	0	35.93637	-84.0113
300460195	KNOXVILLE POLICE DEPT	18-028580	Knox	Knoxville	2018	Sunday, July 15, 2018	12:35:00 PM	2	0	0	35.93717	-84.0098
300460745	KNOXVILLE POLICE DEPT	18-028892	Knox	Knoxville	2018	Tuesday, July 17, 2018	5:40:00 PM	2	0	0	35.9348	-84.0143
300461065	KNOXVILLE POLICE DEPT	18-028986	Knox	Knoxville	2018	Wednesday, July 18, 2018	11:03:00 AM	2	0	0	35.93779	-84.0086
300461956	KNOXVILLE POLICE DEPT	18-029519	Knox	Knoxville	2018	Sunday, July 22, 2018	2:45:00 PM	3	1	0	35.93575	-84.0126
300463531	KNOXVILLE POLICE DEPT	18-030152	Knox	Knoxville	2018	Friday, July 27, 2018	9:49:00 AM	2	0	0	35.93667	-84.0108
300464647	KNOXVILLE POLICE DEPT	18-031047	Knox	Knoxville	2018	Thursday, August 2, 2018	5:21:00 PM	2	0	0	35.93773	-84.0089
300472392	KNOXVILLE POLICE DEPT	18-035704	Knox	Knoxville	2018	Monday, September 3, 2018	12:41:00 PM	2	0	0	35.93391	-84.0162
300479049	KNOXVILLE POLICE DEPT	18-039224	Knox	Knoxville	2018	Thursday, September 27, 2018	1:33:00 PM	2	0	0	35.93713	-84.0089
300481514	KNOXVILLE POLICE DEPT	18-040415	Knox	Knoxville	2018	Friday, October 5, 2018	7:55:00 AM	2	0	0	35.93806	-84.0081
300482024	KNOXVILLE POLICE DEPT	18-041061	Knox	Knoxville	2018	Tuesday, October 9, 2018	4:18:00 PM	2	0	0	35.93252	-84.0176
300485349	KNOXVILLE POLICE DEPT	18-043076	Knox	Knoxville	2018	Monday, October 22, 2018	3:34:00 PM	2	0	0	35.9371	-84.0101
300487492	KNOXVILLE POLICE DEPT	18-044331	Knox	Knoxville	2018	Monday, October 29, 2018	10:30:00 PM	1	1	0	35.93554	-84.0121
300488146	KNOXVILLE POLICE DEPT	18-044574	Knox	Knoxville	2018	Wednesday, October 31, 2018	1:45:00 PM	2	0	0	35.93732	-84.0082
300491915	KNOXVILLE POLICE DEPT	18-046760	Knox	Knoxville	2018	Tuesday, November 13, 2018	4:45:00 PM	2	0	0	35.9357	-84.0126
300493848	KNOXVILLE POLICE DEPT	18-047874	Knox	Knoxville	2018	Tuesday, November 20, 2018	7:20:00 PM	2	0	0	35.93391	-84.0167
300493932	KNOXVILLE POLICE DEPT	18-047772	Knox	Knoxville	2018	Tuesday, November 20, 2018	8:57:00 AM	2	0	0	35.94346	-84.001
300499022	KNOXVILLE POLICE DEPT	18-050786	Knox	Knoxville	2018	Friday, December 7, 2018	5:22:00 PM	2	0	0	35.93923	-84.0049
300499123	KNOXVILLE POLICE DEPT	18-050923	Knox	Knoxville	2018	Saturday, December 8, 2018	5:21:00 PM	2	0	0	35.93509	-84.0139
300501796	KNOXVILLE POLICE DEPT	18-052492	Knox	Knoxville	2018	Tuesday, December 18, 2018	3:31:00 PM	2	0	0	35.93717	-84.0092
300502050	KNOXVILLE POLICE DEPT	18-052600	Knox	Knoxville	2018	Wednesday, December 19, 2018	10:27:00 AM	2	0	0	35.93576	-84.0125
300503085	KNOXVILLE POLICE DEPT	18-053197	Knox	Knoxville	2018	Saturday, December 22, 2018	5:51:00 PM	2	0	0	35.93267	-84.0175
300503185	KNOXVILLE POLICE DEPT	18-053040	Knox	Knoxville	2018	Friday, December 21, 2018	6:01:00 PM	2	0	0	35.93771	-84.0089
300503206	KNOXVILLE POLICE DEPT	18-052968	Knox	Knoxville	2018	Friday, December 21, 2018	12:58:00 PM	3	0	0	35.93372	-84.0164
300504487	KNOXVILLE POLICE DEPT	18-054184	Knox	Knoxville	2018	Sunday, December 30, 2018	1:15:00 PM	2	0	0	35.93324	-84.0168
300504892	KNOXVILLE POLICE DEPT	18-054313	Knox	Knoxville	2018	Monday, December 31, 2018	12:25:00 PM	1	0	0	35.93648	-84.011
300506147	KNOXVILLE POLICE DEPT	19-000521	Knox	Knoxville	2019	Friday, January 4, 2019	2:14:00 PM	3	0	0	35.93802	-84.0082
300510138	KNOXVILLE POLICE DEPT	19-003415	Knox	Knoxville	2019	Wednesday, January 23, 2019	3:32:00 PM	2	3	0	35.92856	-84.0377
300512918	KNOXVILLE POLICE DEPT	19-005250	Knox	Knoxville	2019	Tuesday, February 5, 2019	8:05:00 PM	2	0	0	35.9351	-84.014
300512978	KNOXVILLE POLICE DEPT	19-005225	Knox	Knoxville	2019	Tuesday, February 5, 2019	4:26:00 PM	2	0	0	35.94185	-84.0114
300512993	KNOXVILLE POLICE DEPT	19-005181	Knox	Knoxville	2019	Tuesday, February 5, 2019	11:32:00 AM	2	0	0	35.93683	-84.0105
300518847	KNOXVILLE POLICE DEPT	19-008588	Knox	Knoxville	2019	Thursday, February 28, 2019	4:03:00 PM	2	3	0	35.93114	-84.0274

Master Record	Agency	Agency Tracking Number	County	City	Year	Collision Date	Collision Time	Vehicles Involved	Number Inj	Number Dead	Latitude	Longitude
300525779	KNOXVILLE POLICE DEPT	19-012919	Knox	Knoxville	2019	Thursday, March 28, 2019	3:16:00 PM	2	0	0	35.93267	-84.0174
300526081	KNOXVILLE POLICE DEPT	19-013226	Knox	Knoxville	2019	Saturday, March 30, 2019	2:47:00 PM	2	0	0	35.9353	-84.0133
300530498	KNOXVILLE POLICE DEPT	19-015675	Knox	Knoxville	2019	Monday, April 15, 2019	1:36:00 PM	2	0	0	35.93775	-84.0088
300531406	KNOXVILLE POLICE DEPT	19-016099	Knox	Knoxville	2019	Thursday, April 18, 2019	11:00:00 AM	2	0	0	35.93722	-84.0083
300532207	KNOXVILLE POLICE DEPT	19-016287	Knox	Knoxville	2019	Friday, April 19, 2019	12:35:00 PM	2	0	0	35.93898	-84.0056
300535188	KNOXVILLE POLICE DEPT	19-018246	Knox	Knoxville	2019	Thursday, May 2, 2019	4:29:00 PM	2	0	0	35.93739	-84.0082
300537652	KNOXVILLE POLICE DEPT	19-019482	Knox	Knoxville	2019	Friday, May 10, 2019	3:50:00 PM	3	0	0	35.93315	-84.0143
300539522	KNOXVILLE POLICE DEPT	19-020653	Knox	Knoxville	2019	Saturday, May 18, 2019	10:42:00 AM	2	0	0	35.93263	-84.0175
300544895	KNOXVILLE POLICE DEPT	19-023663	Knox	Knoxville	2019	Friday, June 7, 2019	12:00:00 PM	2	0	0	35.93777	-84.0085
300545907	KNOXVILLE POLICE DEPT	19-024485	Knox	Knoxville	2019	Thursday, June 13, 2019	12:31:00 PM	2	0	0	35.93741	-84.0095
300551589	KNOXVILLE POLICE DEPT	19-027714	Knox	Knoxville	2019	Saturday, July 6, 2019	2:15:00 PM	2	0	0	35.93578	-84.0126
300555466	KNOXVILLE POLICE DEPT	19-030377	Knox	Knoxville	2019	Wednesday, July 24, 2019	1:17:00 PM	2	0	0	35.93727	-84.0082
300565694	KNOXVILLE POLICE DEPT	19-036604	Knox	Knoxville	2019	Wednesday, September 4, 2019	5:48:00 PM	2	0	0	35.93292	-84.0165
300565742	KNOXVILLE POLICE DEPT	19-036569	Knox	Knoxville	2019	Wednesday, September 4, 2019	2:19:00 PM	3	0	0	35.91349	-84.0838
300567796	KNOXVILLE POLICE DEPT	19-037728	Knox	Knoxville	2019	Thursday, September 12, 2019	12:13:00 PM	2	0	0	35.94145	-84.0424
300568255	KNOXVILLE POLICE DEPT	19-038000	Knox	Knoxville	2019	Friday, September 13, 2019	6:41:00 PM	2	0	0	35.93771	-84.0087
300568672	KNOXVILLE POLICE DEPT	19-038347	Knox	Knoxville	2019	Monday, September 16, 2019	4:10:00 PM	2	0	0	35.93761	-84.0091
300573112	KNOXVILLE POLICE DEPT	19-040919	Knox	Knoxville	2019	Thursday, October 3, 2019	12:34:00 PM	2	0	0	35.93779	-84.0087
300576036	KNOXVILLE POLICE DEPT	19-042028	Knox	Knoxville	2019	Thursday, October 10, 2019	5:39:00 PM	2	0	0	35.93786	-84.0086
300576878	KNOXVILLE POLICE DEPT	19-043063	Knox	Knoxville	2019	Thursday, October 17, 2019	8:58:00 AM	2	0	0	35.93547	-84.0374
300578258	KNOXVILLE POLICE DEPT	19-043848	Knox	Knoxville	2019	Tuesday, October 22, 2019	5:27:00 PM	2	0	0	35.93763	-84.009
300578259	KNOXVILLE POLICE DEPT	19-043840	Knox	Knoxville	2019	Tuesday, October 22, 2019	4:47:00 PM	3	0	0	35.9358	-84.0126
300579829	KNOXVILLE POLICE DEPT	19-044725	Knox	Knoxville	2019	Monday, October 28, 2019	8:04:00 AM	2	0	0	35.93794	-84.0084
300585017	KNOXVILLE POLICE DEPT	19-047589	Knox	Knoxville	2019	Friday, November 15, 2019	9:16:00 PM	2	0	0	35.93793	-84.0085
300585309	KNOXVILLE POLICE DEPT	19-047491	Knox	Knoxville	2019	Friday, November 15, 2019	12:36:00 PM	2	0	0	35.93346	-84.0169
300592270	KNOXVILLE POLICE DEPT	19-051370	Knox	Knoxville	2019	Wednesday, December 11, 2019	5:10:00 PM	2	0	0	35.93638	-84.0114
300592566	KNOXVILLE POLICE DEPT	19-051502	Knox	Knoxville	2019	Thursday, December 12, 2019	3:52:00 PM	2	0	0	35.93762	-84.009
300592733	KNOXVILLE POLICE DEPT	19-051489	Knox	Knoxville	2019	Thursday, December 12, 2019	1:55:00 PM	2	0	0	35.93339	-84.0169
300596085	KNOXVILLE POLICE DEPT	19-053340	Knox	Knoxville	2019	Tuesday, December 24, 2019	11:55:00 PM	2	0	0	35.92588	-84.0523

Master Record	Roadway Name	Roadway Suffix	Roadway Number	Roadway Local Id	Distance From Reference	Miles-Feet	Direction f	Intersection Road Name	Intersectio	Intersectio	Intersectio	Mile Mark	Intersectio
300327632	Papermill Dr Northwest					300	Feet	West	Westfield	RD			0 N
300327683	Papermill Dr Northwest					25	Feet	South	Westfield	RD			0 N
300334597	Papermill Dr Northwest		SR6230			10	Feet	East	N Weisgarber	RD			0 Y
300335557	Papermill Dr Northwest					0			N Weisgarber	RD			0 Y
300339268	Papermill Dr Northwest					0			Papermill Place	WAY			0 Y
300340994	Papermill Dr Northwest					300	Feet	East	Westfield	RD			0 N
300343417	Papermill Dr Northwest					0			Kingston	PIKE			0 Y
300344516	Papermill	DR				20	Feet	North	Kingston	PIKE			0 N
300347402	Papermill Dr Northwest					25	Feet	East	Westfield	RD			0 N
300347876	Papermill	DR				0			Kingston	PIKE			0 Y
300350108	Papermill Dr Northwest		SR6408			15	Feet	West	N Weisgarber	RD			0 N
300350581	Papermill Dr Northwest					500	Feet	West	Weisgarber	RD			0 N
300356326	Papermill	DR				200	Feet	East	Weisgarber	RD			0 N
300357502	Papermill	DR				50	Feet	East	Papermill Place	WAY			0 N
300357801	Papermill Place	WAY				0			Papermill	DR			0 Y
300358157	Papermill	DR	SR6700			15	Feet	East	Westfield	RD			0 Y
300358401	Papermill	DR				0			Weisgarber	RD			0 Y
300363580	Papermill	DR				50	Feet	North	Kingston	PIKE			0 N
300363990	Papermill	RD				0			Westfield	RD			0 Y
300366834	Papermill	DR				50	Feet	East	Kingston	PIKE			0 Y
300372093	Papermill	DR				20	Feet	West	Weisgarber	RD			0 Y
300374051	Papermill	DR				300	Feet	East	Westfield	RD			0 N
300374824	Papermill	DR				0			Papermill	DR			0 Y
300375148	Papermill	DR				0			Weisgarber	RD			0 Y
300377568	Papermill	DR				10	Feet	West	Weisgarber	RD			0 Y
300383224	Papermill	DR				0.25	Miles	West	Weisgarber	RD			0 N
300386163	Papermill	DR				500	Feet	West	Weisgarber	RD			0 Y
300387304	Papermill	DR				10	Feet	East	Papermill Place	WAY			0 N
300388092	Papermill	DR				0			Papermill Place	WAY			0 Y
300390455	Papermill	DR				200	Feet	East	Weisgarber	RD			0 N
300398208	Papermill	DR				0			Weisgarber	RD			0 Y
300407725	Papermill	DR				200	Feet	East	Westfield	RD			0 N
300410286	Papermill	DR				10	Feet	East	Papermill	PL			0 N
300411367	Papermill	DR				0			Kingston	PIKE			0 Y
300412977	Papermill	DR	SR6230			0			N Weisgarber	RD			0 Y
300413285	Papermill	DR				0			Westfield	RD			0 Y
300413876	Papermill	DR				0			Papermill Place	WAY			0 Y
300417039	Papermill	DR				5	Feet	East	Weisgarber	RD			0 Y
300417354	Papermill	DR				50	Feet	East	Weisgarber	RD			0 Y
300420355	Papermill	DR				20	Feet	East	Weisgarber	RD			0 Y
300425015	Papermill	DR				100	Feet	South	Papermill place	WAY			0 N
300429238	Papermill	DR				15	Feet	East	Weisgarber	RD			0 N
300433966	Papermill	DR				0			Papermill	DR			0 Y
300434504	Papermill	DR				15	Feet	East	Kingston	PIKE			0 N
300435293	Papermill	DR				0			Papermill Place	WAY			0 Y

Master Record	Roadway Name	Roadway Suffix	Roadway Number	Roadway Local Id	Distance From Reference	Miles-Feet	Direction fr	Intersection Road Name	Intersectio	Intersectio	Intersectio	Mile Mark	Intersectio
300435643	Papermill	DR				40	Feet	North	Kingston	PIKE			O Y
300437059	Papermill	DR				300	Feet	West	Westfield	RD			O N
300437175	Papermill Place	WAY				0			Papermill	DR			O Y
300438628	Papermill	DR				50	Feet	East	Kingston	PIKE			O N
300439740	Papermill	DR				300	Feet	East	Weisgarber	RD			O N
300440332	Papermill	DR				100	Feet	East	Kingston	PIKE			O N
300441187	Papermill	DR				50	Feet	East	Papermill Place	WAY			O N
300442873	Papermill	DR				20	Feet	East	Weisgarber	RD			O N
300443544	Papermill	DR				100	Feet	North	Kingston	PIKE			O N
300447751	Papermill	DR				0			Weisgarber	RD			O Y
300448865	Papermill	DR				0			Papermill Place	WAY			O Y
300449483	Papermill	DR				10	Feet	East	Kingston Pk	RD			O N
300453827	Papermill	DR				30	Feet	East	Kingston	PIKE			O Y
300454014	Papermill	DR				0			Kingston	PIKE			O Y
300455175	Papermill	DR				1000	Feet	East	Papermill Place	WAY			O N
300460195	Papermill	DR				200	Feet	West	Weisgarber	RD			O N
300460745	Papermill	DR				30	Feet	West	Westfield	RD			O N
300461065	Papermill	DR				0			Weisgarber	RD			O Y
300461956	Papermill Place	WAY				20	Feet	North	Papermill	DR			O N
300463531	Papermill	DR				10	Feet	East	Papermill	DR			O N
300464647	Papermill	DR				20	Feet	East	Weisgarber	RD			O Y
300472392	Papermill	DR				200	Feet	West	Westfield	RD			O N
300479049	Papermill	DR				10	Feet	South	Weisgarber	RD			O Y
300481514	Papermill	DR				200	Feet	East	Weisgarber	RD			O N
300482024	Papermill	DR				10	Feet	West	Kingston	PIKE			O Y
300485349	Papermill	DR				150	Feet	West	Weisgarber	RD			O N
300487492	Papermill	DR				10	Feet	East	Papermill Place	WAY			O N
300488146	Papermill	DR				10	Feet	East	Kingston	PIKE			O Y
300491915	Papermill Place	WAY				10	Feet	South	Papermill	DR			O N
300493848	Papermill	DR				0.5	Miles	East	Kingston	PIKE			O N
300493932	Papermill	DR				10	Feet	North	Weisgarber	RD			O Y
300499022	Papermill	DR				400	Feet	East	Weisgarber	RD			O N
300499123	Papermill	DR				50	Feet	East	Westfield	RD			O N
300501796	Papermill	DR				50	Feet	East	Weisgarber	RD			O Y
300502050	Papermill	DR				0			Papermill Place	WAY			O Y
300503085	Papermill	DR				0			Kingston	PIKE			O Y
300503185	Papermill	DR				0			Weisgarber	RD			O Y
300503206	Papermill	DR				200	Feet	East	Kingston	PIKE			O N
300504487	Papermill	DR				50	Feet	North	Kingston	PIKE			O N
300504892	Papermill	DR				200	Feet	West	Weisgarber	RD			O N
300506147	PAPERMILL	DR				150	Feet	East	WEISGARBER	RD			O N
300510138	PAPERMILL	DR				0			Westfield	RD			O Y
300512918	Papermill	DR				10	Feet	East	Westfield	RD			O N
300512978	Papermill	DR				100	Feet	East	Weisgarber	RD			O N
300512993	Papermill	DR				200	Feet	West	Weisgarber	DR			O N
300518847	Papermill	DR				100	Feet	West	Weisgarber	RD			O N

Master Record	Roadway Name	Roadway Suffix	Roadway Number	Roadway Local Id	Distance From Reference	Miles-Feet	Direction fr	Intersection Road Name	Intersectio	Intersectio	Intersectio	Mile Mark	Intersectio
300525779	Papermill	DR				0		Kingston	PIKE				O Y
300526081	Papermill	DR				50	Feet	East	Westfield	RD			O N
300530498	Papermill	DR				0		Weisgarber	RD				O Y
300531406	Papermill	DR				100	Feet	West	Weisgarber				O N
300532207	PAPERMILL	DR				0		WEISGARBER	RD				O Y
300535188	Papermill	DR				75	Feet	East	Weisgarber	RD			O N
300537652	Papermill	DR				100	Feet	North	Weisgarber				O N
300539522	Papermill	DR				5	Feet	North	Kingston	PIKE			O Y
300544895	Papermill	DR				50	Feet	East	Weisgarber	RD			O N
300545907	Papermill	DR				30	Feet	West	Weisgarber	RD			O N
300551589	Papermill	DR				0	Feet	East	Papermill Place	WAY			O Y
300555466	Papermill	DR				10	Feet	East	Kingston	PIKE			O Y
300565694	Papermill	DR				50	Feet	East	Kingston	PIKE			O Y
300565742	PAPERMILL	DR				0		WEISGARBER	RD				O Y
300567796	Papermill	DR				300	Feet	North	Kingston	PIKE			O Y
300568255	Papermill	DR				0		Weisgarber	RD				O Y
300568672	Papermill	DR				40	Feet	West	Weisgarber	RD			O N
300573112	Papermill	DR				0		Weisgarber	RD				O Y
300576036	Papermill	DR				200	Feet	East	Weisgarber	RD			O N
300576878	Papermill	DR				25	Feet	North	Kingston	PIKE			O Y
300578258	Papermill	DR				100	Feet	West	Weisgarber	RD			O Y
300578259	Papermill	DR				0		Papermill Place	WAY				O Y
300579829	Papermill	DR				0		Papermill	DR				O Y
300585017	Papermill	DR				50	Feet	East	Weisgarber	RD			O Y
300585309	Papermill	DR				100	Feet	East	Kingston	PIKE			O N
300592270	Papermill	DR				0.25	Miles	East	Papermill Place	WAY			O N
300592566	Papermill	DR				0		Weisgarber	RD				O Y
300592733	Papermill	DR				400	Feet	East	Kingston	PIKE			O N
300596085	Papermill	DR	SR6220			25	Feet	East	North Weisgarber	RD			O N

Master Record	Intersect Type	Intercha	Relation To Junction	Work Zone	Constructi	Constructi	Fatal Case	Officer Firs	Officer Last	Weather Conditi	Manner of Collision	I	K
300327632	Not at Intersection	N	Non-Junction	None			17-0006	Knoxville	PD	Rain	Not collision with motor vehicle in transport		Y
300327683	Not at Intersection	N	Non-Junction	None				Knoxville	PD	Clear	Front to rear	Y	
300334597	Four-Way	N	Intersection-Related	None				Knoxville	PD	Clear	Front to rear		
300335557	Four-Way	N	Intersection	None				Knoxville	PD	Clear	Angle		
300339268	T-Intersection	N	Intersection	None				Knoxville	PD	Rain	Front to rear	Y	
300340994	Not at Intersection	N	Non-Junction	None				Knoxville	PD	Clear	Front to rear		
300343417	Four-Way	N	Intersection	None				Knoxville	PD	Clear	Front to rear		
300344516	Not at Intersection	N	Non-Junction	None				Knoxville	PD	Clear	Not collision with motor vehicle in transport		
300347402	Not at Intersection	N	Non-Junction	None				Knoxville	PD	Clear	Front to rear		
300347876	Four-Way	N	Intersection	None				Knoxville	PD	Clear	Front to rear		
300350108	Not at Intersection	N	Non-Junction	None				Knoxville	PD	Clear	Front to rear		
300350581	Not at Intersection	N	Non-Junction	None				Knoxville	PD	Clear	Front to rear		
300356326	Not at Intersection	N	Non-Junction	None				Knoxville	PD	Clear	Sideswipe, Opposite Direction		
300357502	Not at Intersection	N	Non-Junction	None				Knoxville	PD	Clear	Front to rear		
300357801	T-Intersection	N	Intersection	None				Knoxville	PD	Cloudy	Angle		
300358157	T-Intersection	N	Intersection-Related	None				Knoxville	PD	Clear	Front to rear		
300358401	Four-Way	N	Intersection	None						Clear	Front to rear	Y	
300363580	Not at Intersection	N	Non-Junction	None						Clear	Angle		
300363990	T-Intersection	N	Intersection	None						Clear	Not collision with motor vehicle in transport		
300366834	Four-Way	N	Intersection-Related	None						Cloudy	Angle		
300372093	Four-Way	N	Intersection-Related	None						Clear	Front to rear		
300374051	Not at Intersection	N	Non-Junction	None						Cloudy	Sideswipe, Same Direction		
300374824	T-Intersection	N	Intersection	None						Clear	Front to rear		
300375148	Four-Way	N	Intersection	None						Clear	Sideswipe, Same Direction		
300377568	Four-Way	N	Intersection-Related	None						Clear	Front to rear		
300383224	Not at Intersection	N	Driveway, Alley Access, etc	None						Clear	Front to rear		
300386163	Four-Way	N	Intersection-Related	None						Clear	Front to rear		
300387304	Not at Intersection	N	AccelDecelLane	None						Clear	Front to rear		
300388092	T-Intersection	N	Intersection	None						Clear	Angle		
300390455	Not at Intersection	N	Non-Junction	None						Clear	Front to rear		
300398208	Four-Way	N	Intersection	None						Clear	Not collision with motor vehicle in transport		
300407725	Not at Intersection	N	Non-Junction	None						Clear	Sideswipe, Opposite Direction		
300410286	Not at Intersection	N	Non-Junction	None						Rain	Sideswipe, Opposite Direction		
300411367	Four-Way	N	Intersection	None						Blowing Sand/Soil/Dirt	Sideswipe, Same Direction		
300412977	Four-Way	N	Intersection	None						Clear	Angle		
300413285	T-Intersection	N	Intersection	None						Clear	Front to rear		
300413876	T-Intersection	N	Intersection	None						Clear	Angle		
300417039	Four-Way	N	Intersection	None						Clear	Angle		
300417354	Four-Way	N	Intersection	None						Clear	Angle		
300420355	Four-Way	N	Intersection-Related	None						Rain	Front to rear		
300425015	Not at Intersection	N	Non-Junction	None						Rain	Front to rear		
300429238	Not at Intersection	Y	Entrance/Exit Ramp Related	None						Clear	Sideswipe, Same Direction		
300433966	Four-Way	N	Intersection	None						Clear	Front to rear	Y	
300434504	Not at Intersection	N	Non-Junction	None						Clear	Front to rear		
300435293	T-Intersection	N	Intersection	None						Rain	Angle		

Master Record	Intersect Type	Intercha	Relation To Junction	Work Zone	Constructi	Constructi	Fatal Case	Officer Firs	Officer Last	Weather Conditi	Manner of Collision	I	K
300435643	Four-Way	N	Intersection-Related	None						Cloudy	Front to rear		
300437059	Not at Intersection	N	Non-Junction	None						Cloudy	Front to rear		
300437175	T-Intersection	N	Intersection	None						Rain	Angle		
300438628	Not at Intersection	N	Non-Junction	None						Clear	Front to rear		
300439740	Not at Intersection	N	Non-Junction	None						Rain	Front to rear		
300440332	Not at Intersection	N	Non-Junction	None						Rain	Angle		
300441187	Not at Intersection	N	Non-Junction	None						Clear	Front to rear		
300442873	Not at Intersection	N	Non-Junction	None						Clear	Angle		
300443544	Not at Intersection	N	Driveway, Alley Access, etc	None						Clear	Angle		
300447751	Four-Way	N	Intersection	None						Clear	Angle		
300448865	T-Intersection	N	Intersection	None						Rain	Front to rear		
300449483	Not at Intersection	N	Non-Junction	None						Cloudy	Front to rear		
300453827	Four-Way	N	Intersection-Related	None						Clear	Front to rear		
300454014	Four-Way	N	Intersection	None						Clear	Front to rear		
300455175	Not at Intersection	N	Non-Junction	None						Clear	Front to rear		
300460195	Not at Intersection	N	Non-Junction	None						Clear	Front to rear		
300460745	Not at Intersection	N	Non-Junction	None						Cloudy	Front to rear		
300461065	Four-Way	N	Intersection	None						Clear	Front to rear		
300461956	Not at Intersection	N	AccelDecelLane	None						Clear	Front to rear	Y	
300463531	Not at Intersection	N	Non-Junction	None						Clear	Front to rear		
300464647	Four-Way	N	Intersection-Related	None						Rain	Sideswipe, Same Direction		
300472392	Not at Intersection	N	AccelDecelLane	None						Clear	Angle		
300479049	Four-Way	N	Intersection-Related	None						Rain	Angle		
300481514	Not at Intersection	N	Non-Junction	None						Clear	Angle		
300482024	Four-Way	N	Intersection	None						Clear	Front to rear		
300485349	Not at Intersection	N	Non-Junction	None						Clear	Front to rear		
300487492	Not at Intersection	N	Non-Junction	None						Clear	Not collision with motor vehicle in transport	Y	
300488146	Four-Way	N	Intersection	None						Clear	Front to rear		
300491915	Not at Intersection	N	Non-Junction	None						Clear	Angle		
300493848	Not at Intersection	N	Non-Junction	None						Clear	Front to rear		
300493932	T-Intersection	N	Intersection-Related	None						Cloudy	Angle		
300499022	Not at Intersection	N	Non-Junction	None						Clear	Front to rear		
300499123	Not at Intersection	N	Non-Junction	None						Rain	Front to rear		
300501796	Four-Way	N	Intersection	None						Clear	Front to rear		
300502050	T-Intersection	N	Intersection	None						Clear	Front to rear		
300503085	Four-Way	N	Intersection	None						Clear	Other		
300503185	Four-Way	N	Intersection	None						Rain	Angle		
300503206	Not at Intersection	N	Non-Junction	None						Rain	Angle		
300504487	Not at Intersection	N	Non-Junction	None						Clear	Sideswipe, Opposite Direction		
300504892	Not at Intersection	N	Non-Junction	None						Clear	Not collision with motor vehicle in transport		
300506147	Not at Intersection	N	Non-Junction	None						Clear	Front to rear		
300510138	T-Intersection	N	Intersection	None						Rain	Head On	Y	
300512918	Not at Intersection	N	Non-Junction	None						Clear	Angle		
300512978	Not at Intersection	N	Non-Junction	None						Clear	Angle		
300512993	Not at Intersection	N	Non-Junction	None						Clear	Front to rear		
300518847	Not at Intersection	N	Non-Junction	None						Rain	Angle	Y	

Master Record	Intersect Type	Intercha	Relation To Junction	Work Zone	Constructio	Constructio	Fatal Case	Officer Firs	Officer Last	Weather Conditi	Manner of Collision	I	K
300525779	Four-Way	N	Intersection	None						Clear	Front to rear		
300526081	Not at Intersection	N	Non-Junction	None						Clear	Front to rear		
300530498	Four-Way	N	Intersection	None						Clear	Front to rear		
300531406	Not at Intersection	N	Non-Junction	None						Clear	Angle		
300532207	Four-Way	N	Intersection	None						Rain	Front to rear		
300535188	Not at Intersection	N	Non-Junction	None						Clear	Angle		
300537652	Not at Intersection	N	Non-Junction	None						Clear	Front to rear		
300539522	Four-Way	N	Intersection-Related	None						Clear	Front to rear		
300544895	Not at Intersection	N	Non-Junction	None						Rain	Front to rear		
300545907	Not at Intersection	N	Non-Junction	None						Clear	Front to rear		
300551589	T-Intersection	N	Intersection	None						Clear	Angle		
300555466	T-Intersection	N	Intersection	None						Clear	Front to rear		
300565694	T-Intersection	N	Intersection	None						Clear	Angle		
300565742	Four-Way	N	Intersection	None						Clear	Front to rear		
300567796	T-Intersection	N	Intersection-Related	None						Clear	Angle		
300568255	Four-Way	N	Intersection	None						Clear	Angle		
300568672	Not at Intersection	N	Non-Junction	None						Clear	Front to rear		
300573112	Four-Way	N	Intersection	None						Clear	Front to rear		
300576036	Not at Intersection	N	Non-Junction	None						Clear	Angle		
300576878	Four-Way	N	Intersection-Related	None						Clear	Front to rear		
300578258	Four-Way	N	Intersection-Related	None						Clear	Sideswipe, Same Direction		
300578259	T-Intersection	N	Intersection	None						Clear	Front to rear		
300579829	Four-Way	N	Intersection	None						Clear	Front to rear		
300585017	Four-Way	N	Intersection	None						Clear	Front to rear		
300585309	Not at Intersection	N	Non-Junction	None						Clear	Angle		
300592270	Not at Intersection	N	Non-Junction	None						Clear	Front to rear		
300592566	Four-Way	N	Intersection	None						Clear	Angle		
300592733	Not at Intersection	N	Non-Junction	None						Clear	Angle		
300596085	Not at Intersection	N	Non-Junction	None						Clear	Not collision with motor vehicle in transport		

Appendix E

Crash Diagrams

LEGEND

- (○) Injury
- (□) Fixed Object
- (→) Path of Motor Vehicle
- (→) Off Road
- (→) Angle
- (→) Angle

Pavement: D=Dry I=Icy W=Wet
Weather: C=Clear F=Fog R=Rain
SL=Sleet S=Snow
Time of Day: DL=Day Light DSK=Dusk
Dte: 00-00-00=Month-Day-Year
Time: A=AM P=PM

04/08/2018 06:15PM Su
Light Cloudy

04/04/2018 12:29PM We
Light Clear

04/15/2017 10:40PM Sa
Dark Clear

03/28/2017 10:45AM Tu
Light Clear

04/26/2018 2:51PM Th
Light Rain

04/01/2017 2:40AM Sa
Dark Clear

05/31/2018 09:33AM Th
Light Cloudy

10/09/2018 04:18PM Tu
Light Clear

10/31/2018 01:45PM We
Light Clear

11/20/2018 07:20PM Tu
Dark Clear

06/18/2018 08:11AM Mo
Light Clear

04/20/2018 08:48PM Fr
Dark Clear

12/22/2018 05:51PM Sa
Dusk Clear

03/28/2019 03:16PM Th
Light Clear

10/17/2019 08:58AM Th
Light Clear

06/19/2018 02:52PM Tu
Light Clear

05/18/2019 10:42AM Sa
Light Clear

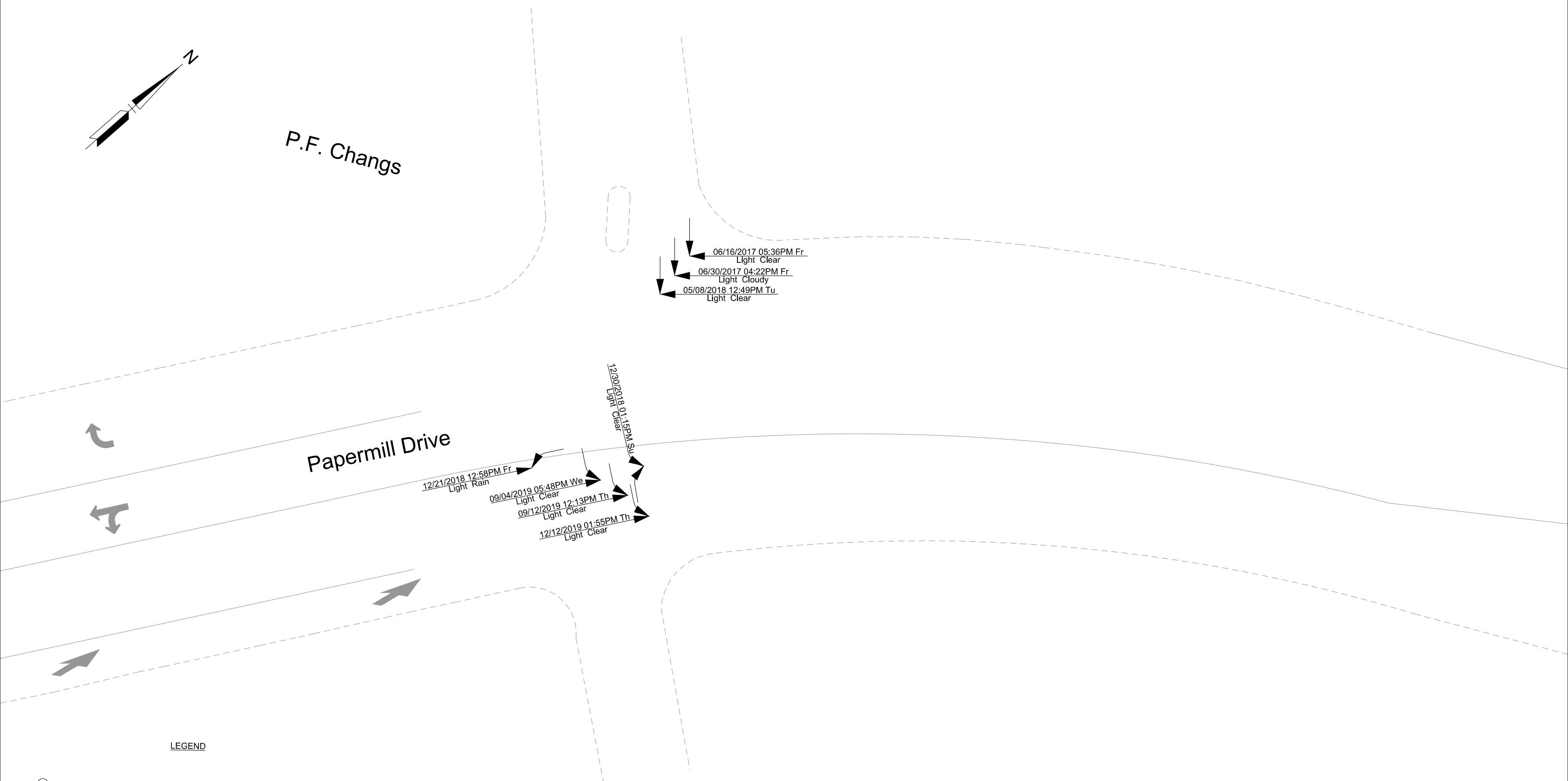
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Light Clear

Papermill Drive

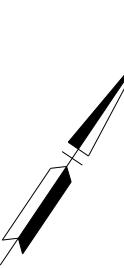
N

11/15/2019 12:36PM Fr
Light Clear

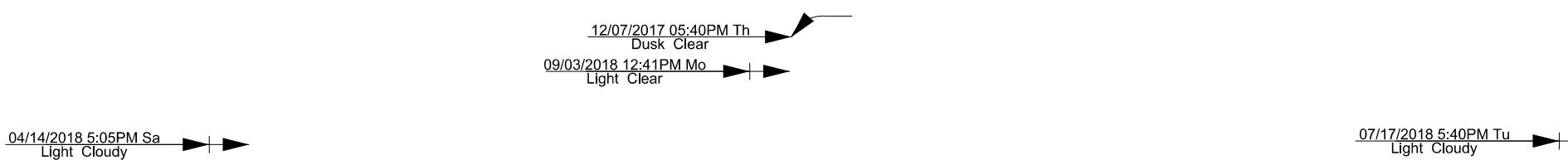
Kingston Pike



Pavement: D=Dry I=Icy W=Wet
 Weather: C=Clear F=Fog R=Rain
 SL=Sleet S=Snow
 Time: of Day: DL=Day Light DSK=Dusk
 Dte: 00-00-00=Month-Day-Year
 Time: A=AM P=PM



Papermill Drive



LEGEND

- Injury
 - Fixed Object
 - Path of Motor Vehicle
 - Off Road
 - Angle
 - Angle
- Pavement: D=Dry I=Icy W=Wet
Weather: C=Clear F=Fog R=Rain
SL=Sleet S=Snow
Time of Day: DL=Day Light DSK=Dusk
Dte: 00-00-00=Month-Day-Year
Time: A=AM P=PM

02/05/2019 08:05PM Tu
Dark Clear

06/15/2017 9:56AM Th
Light Clear

01/03/2017 06:07PM Tu
Dusk Clear

04/14/2017 12:57PM Fr
Light Clear

05/24/2017 6:56PM We
Dusk Clear

01/03/2018 4:48PM We
Dusk Clear

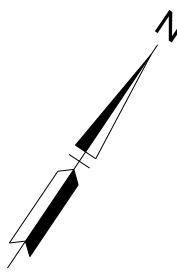
12/08/2018 05:21PM Sa
Dusk Rainy

03/30/2019 02:47PM Sa
Light Clear

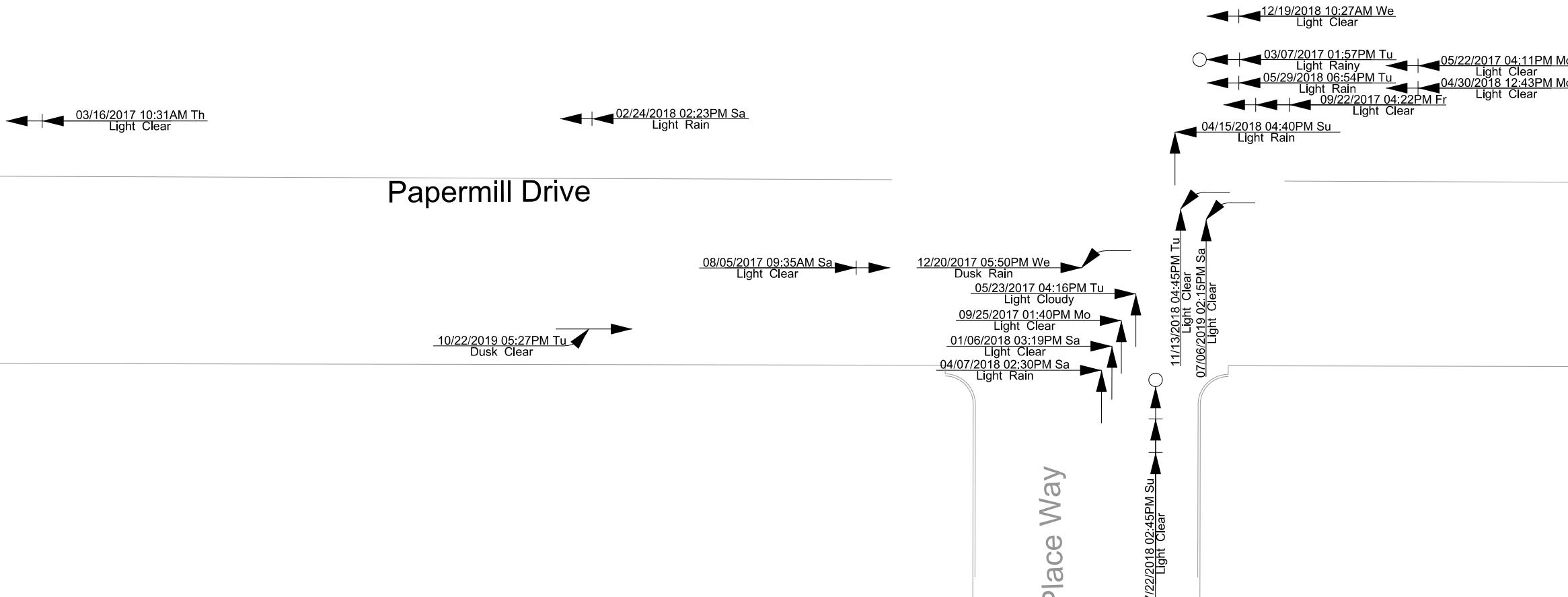
01/23/2019 03:32PM We
Light Rainy

Westfield Road

08/01/2017 03:10PM Tu
Light Cloudy



Papermill Drive

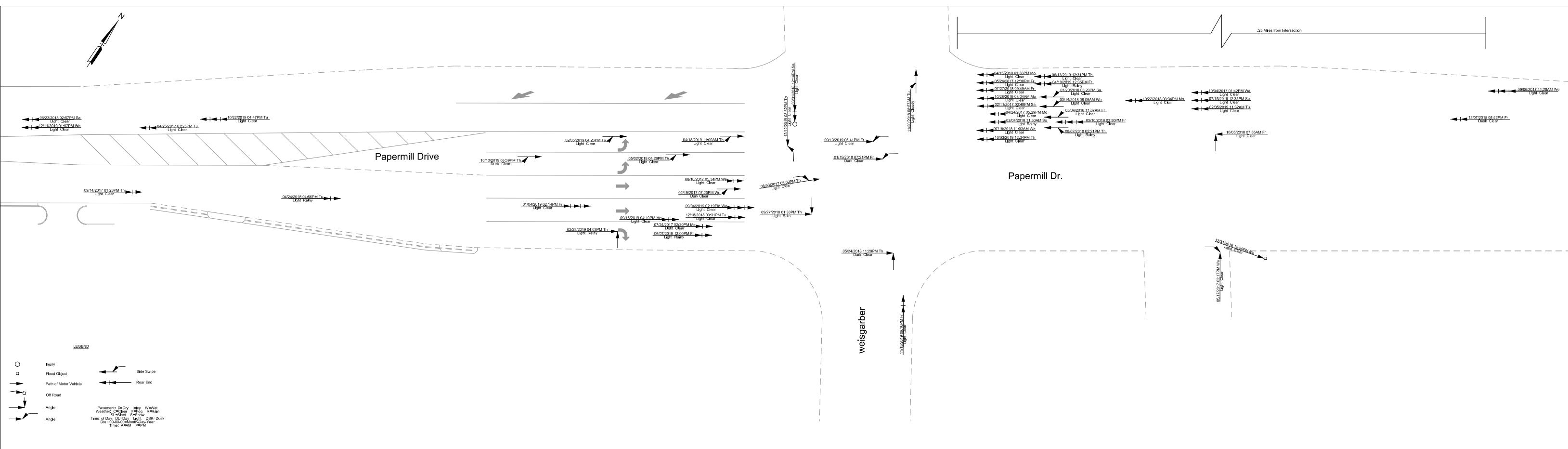


LEGEND

○	Injury
□	Fixed Object
→	Path of Motor Vehicle
→□	Off Road
→ ↗	Angle
→ ↘	Angle

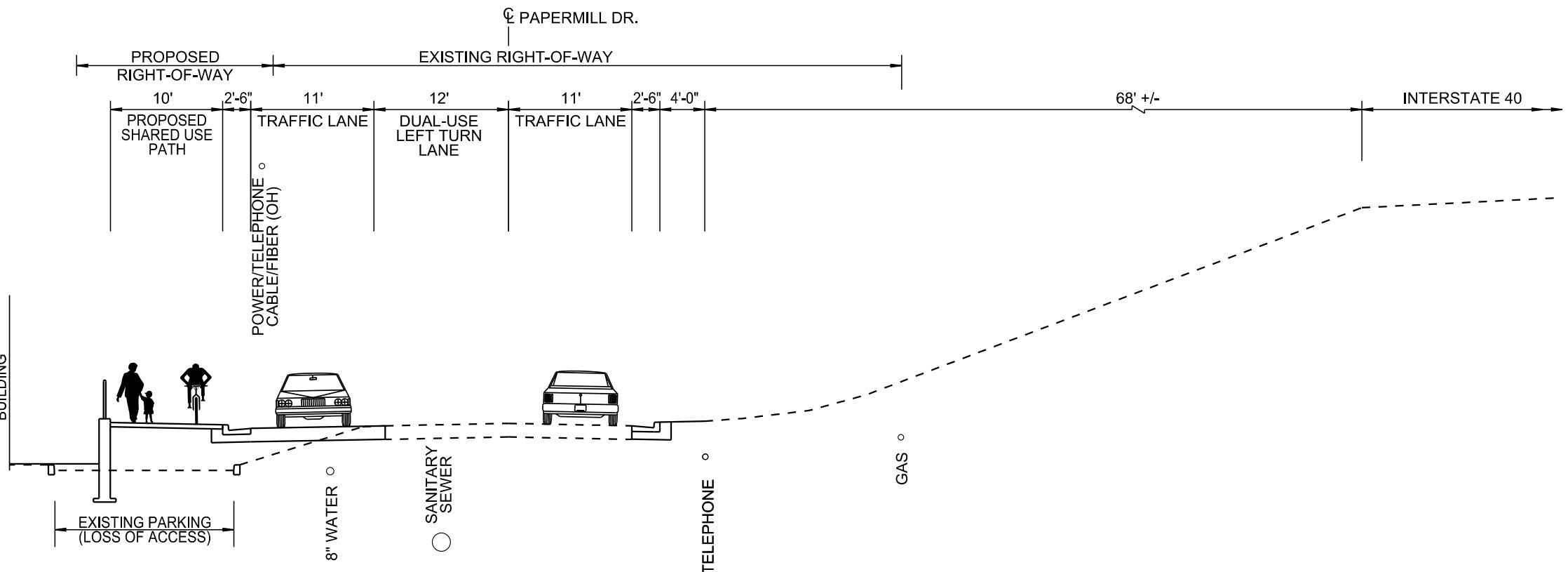
Pavement: D=Dry I=Icy W=Wet
Weather: C=Clear F=Fog R=Rain
SL=Sleet S=Snow
Time of Day: DL=Day Light DSK=Dusk
Dte: 00-00-00=Month-Day-Year
Time: A=AM P=PM

McKay's



Appendix F

Typical Sections

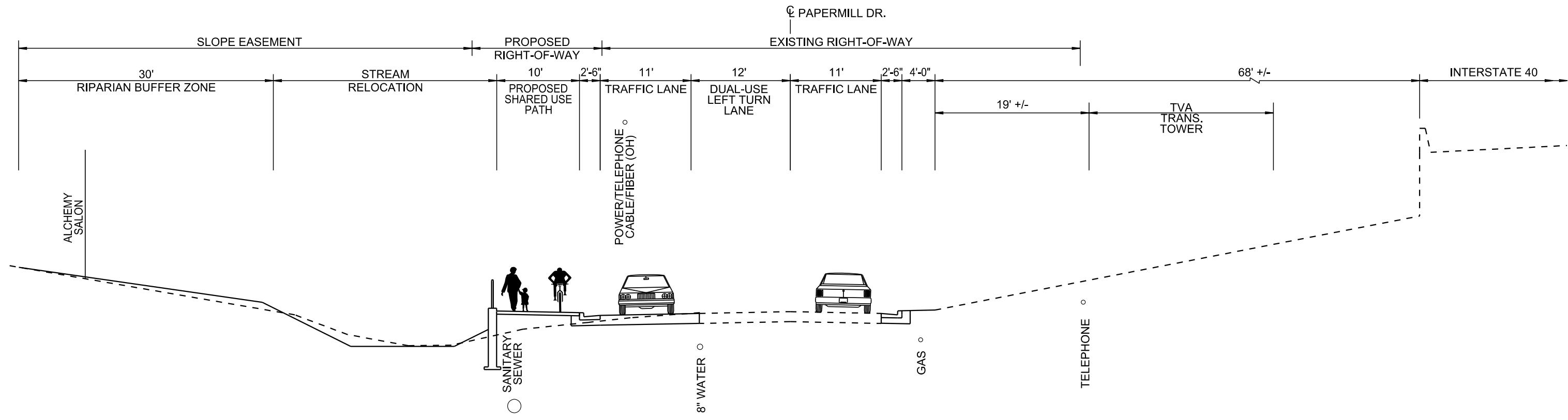


**TYPICAL SECTION
A-A**

**PAPER MILL DRIVE
OPTION 1**



**CDM
Smith**

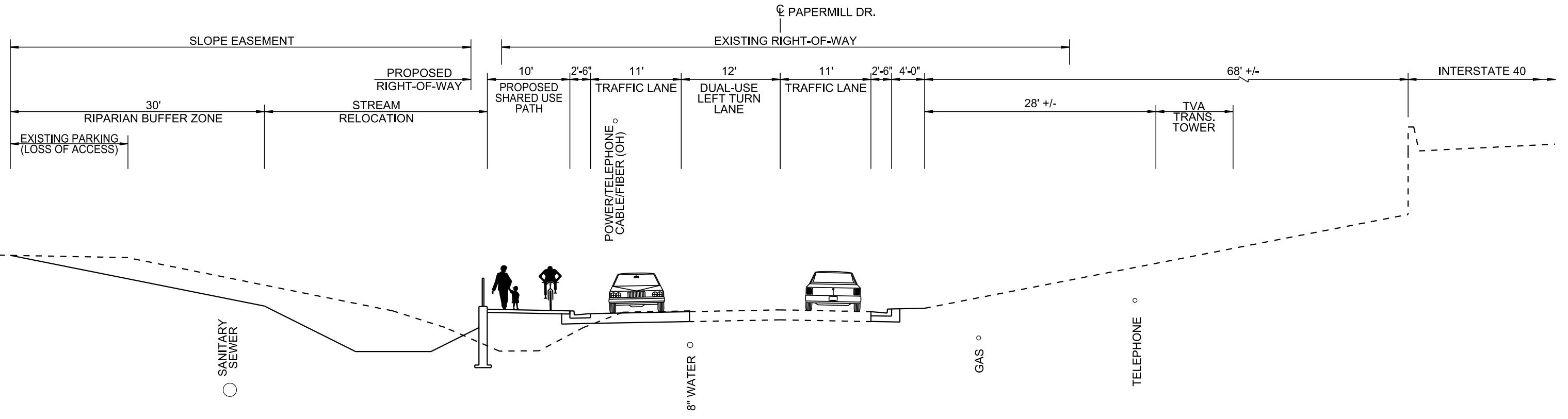


TYPICAL SECTION B-B

PAPERMILL DRIVE
OPTION 1



CDM
Smith

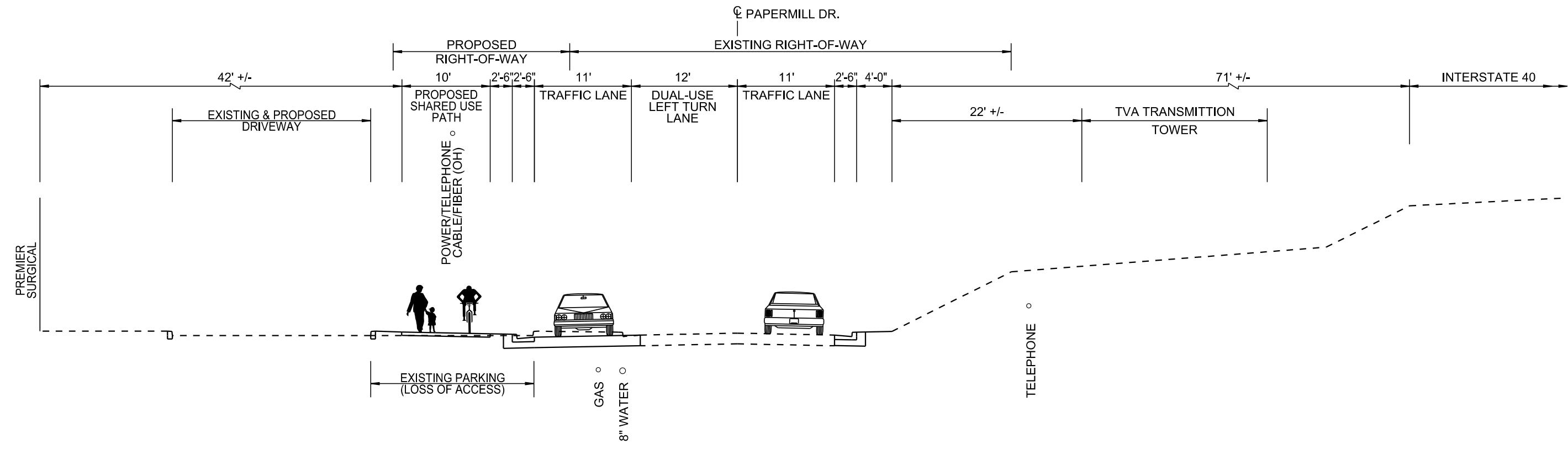


TYPICAL SECTION C-C

**PAPERMILL DRIVE
OPTION 1**



**CDM
Smith**

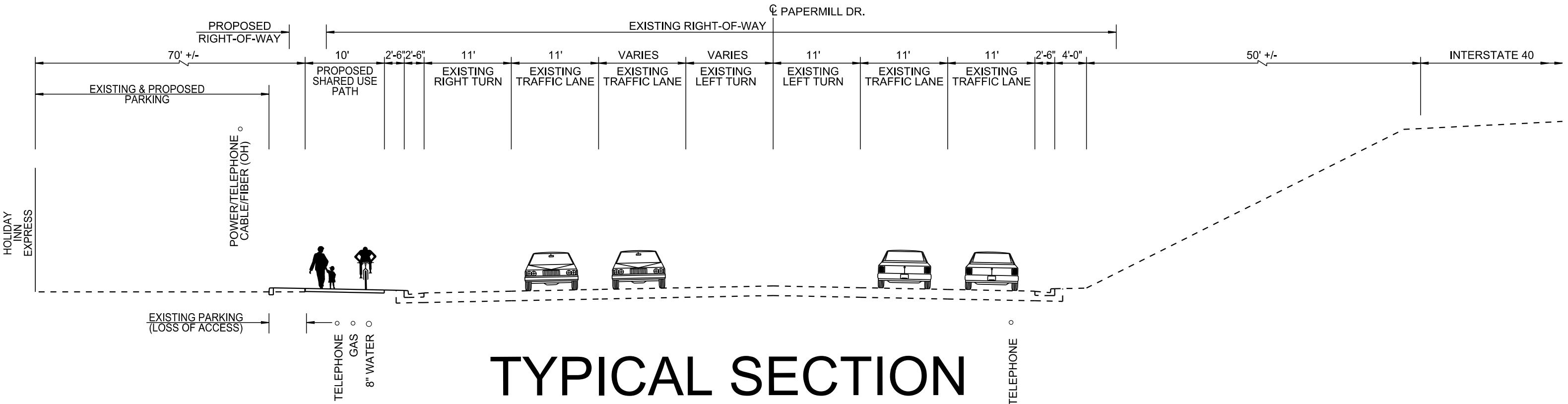


**TYPICAL SECTION
D-D**

**PAPERMILL DRIVE
OPTION 1**



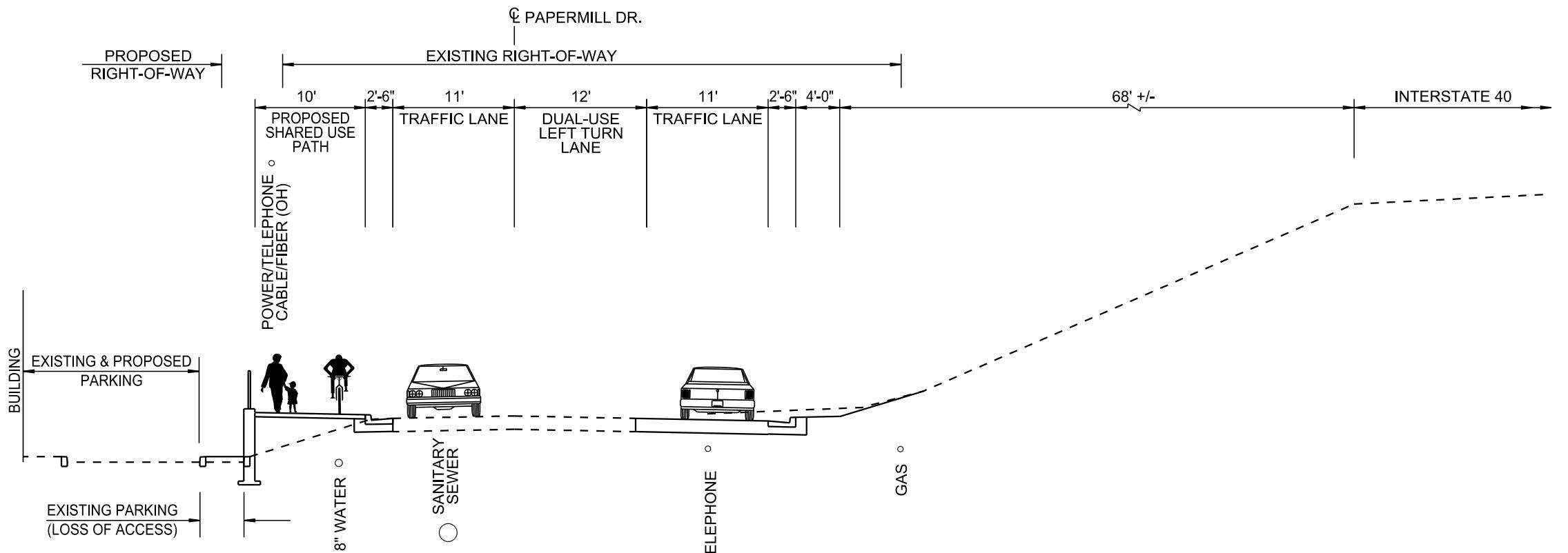
**CDM
Smith**



PAPER MILL DRIVE OPTION 1



CDM
Smith

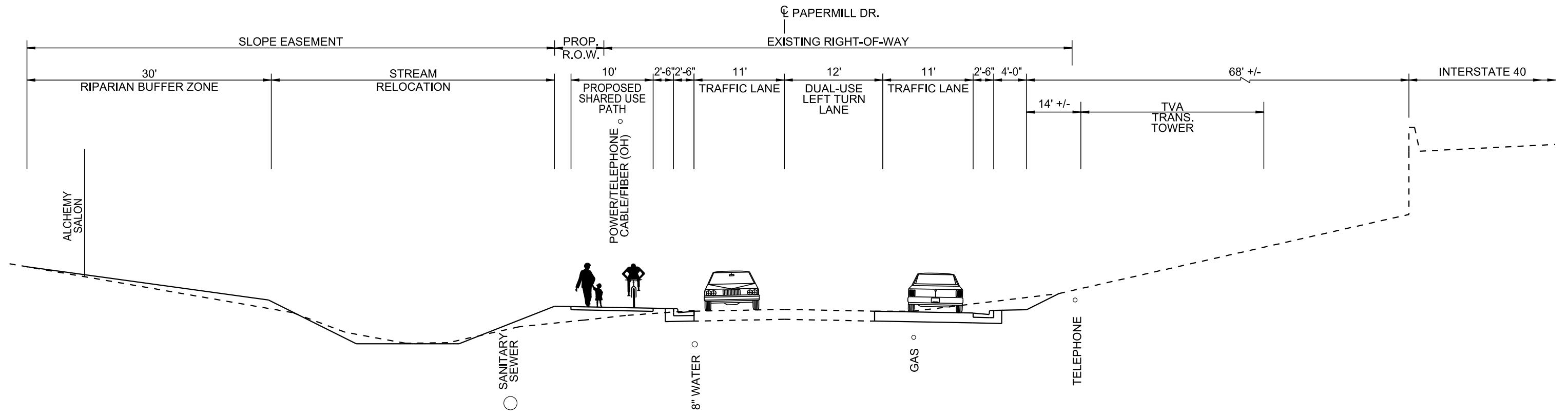


TYPICAL SECTION A-A

**PAPER MILL DRIVE
OPTION 2**



**CDM
Smith**

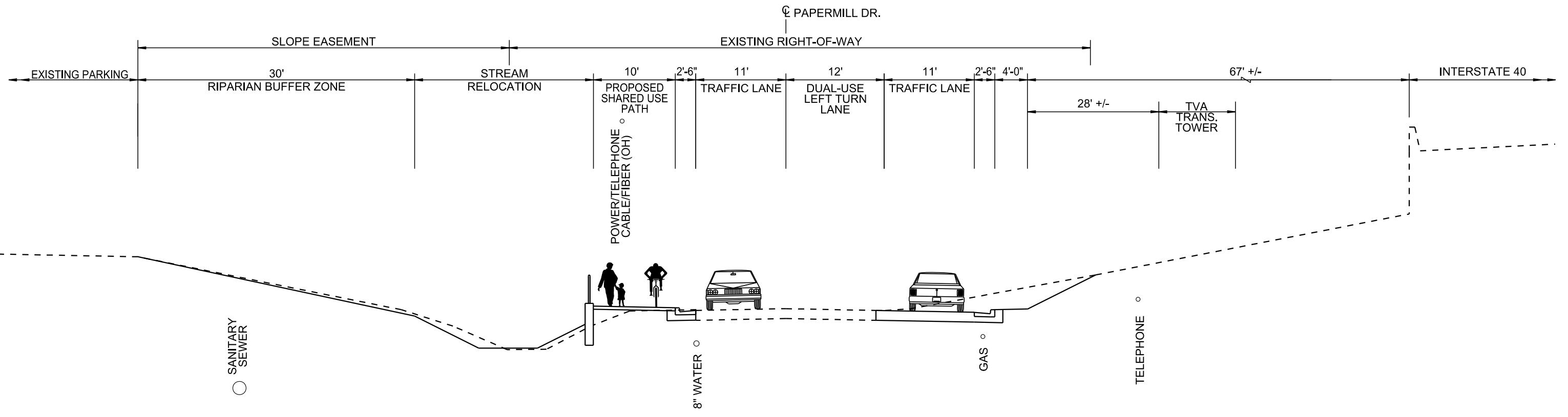


TYPICAL SECTION B-B

PAPER MILL DRIVE
OPTION 2



CDM
Smith

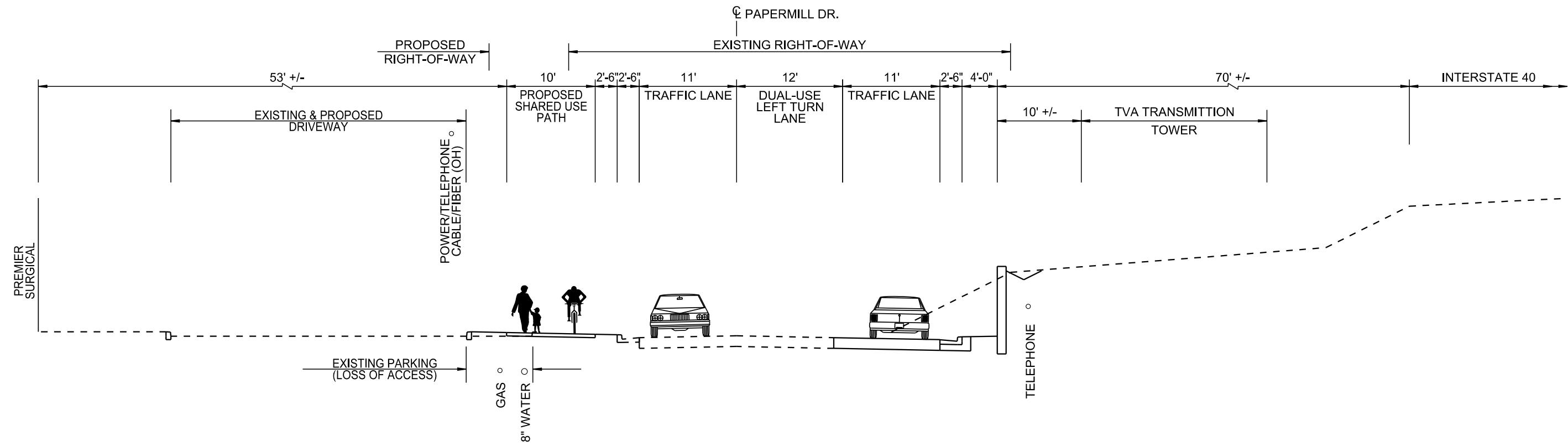


TYPICAL SECTION C-C

PAPER MILL DRIVE
OPTION 2



CDM
Smith

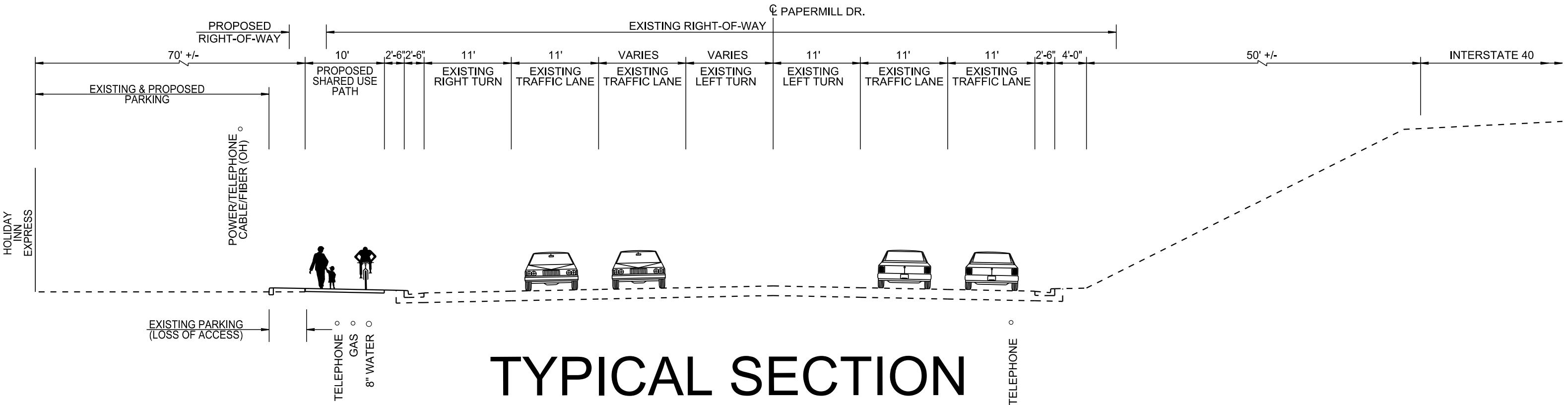


TYPICAL SECTION D-D

**PAPERMILL DRIVE
OPTION 2**



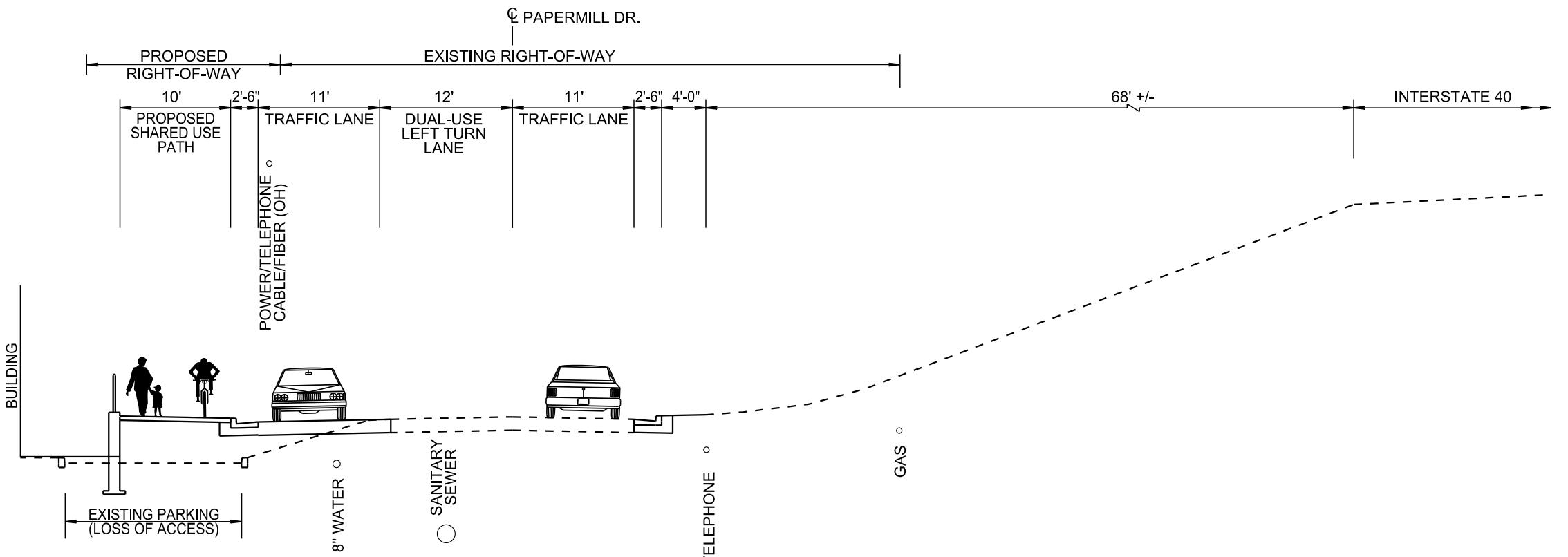
**CDM
Smith**



PAPER MILL DRIVE OPTION 2



CDM
Smith

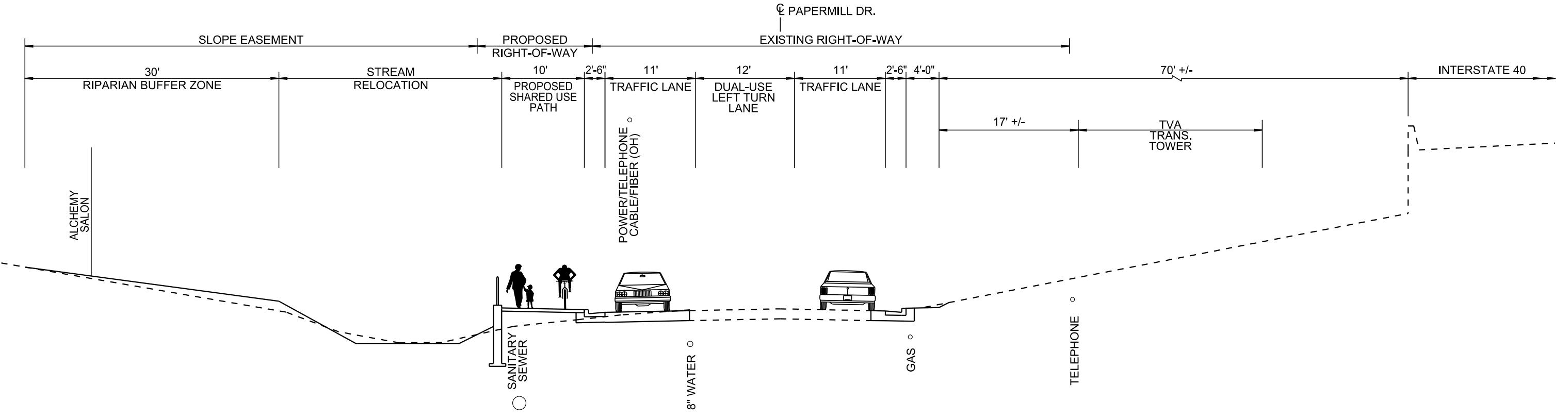


TYPICAL SECTION A-A

PAPERMILL DRIVE
OPTION 3



CDM
Smith

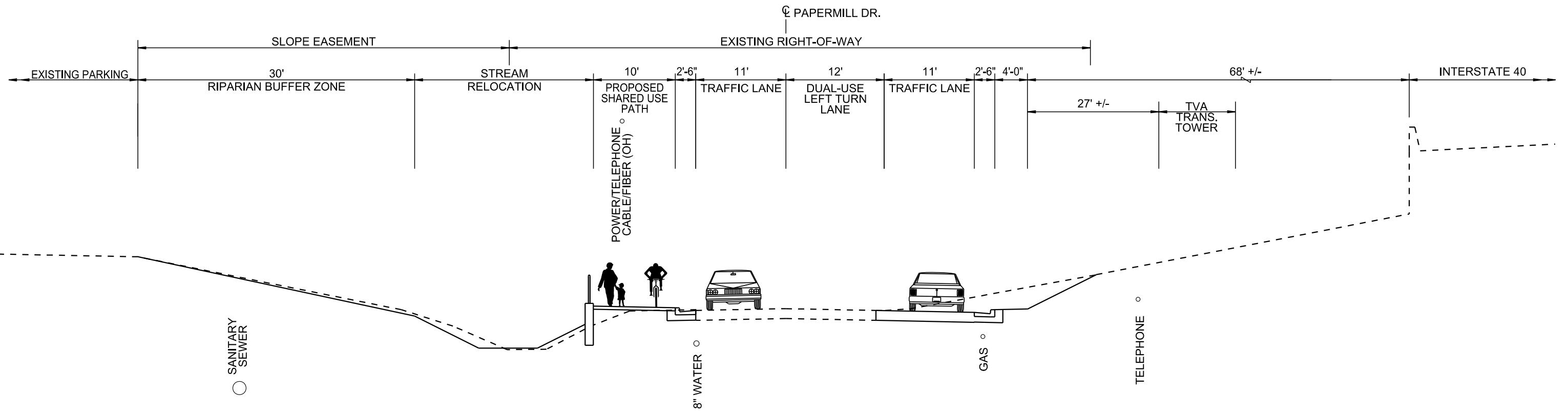


TYPICAL SECTION B-B

PAPER MILL DRIVE
OPTION 3



CDM
Smith

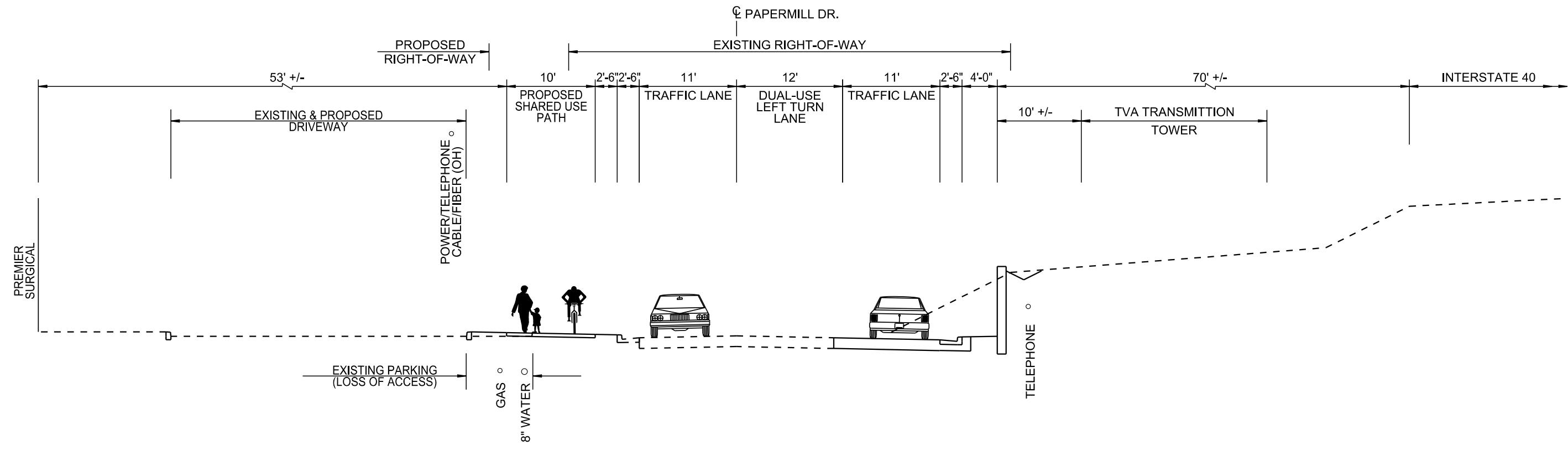


TYPICAL SECTION C-C

PAPER MILL DRIVE
OPTION 3



CDM
Smith

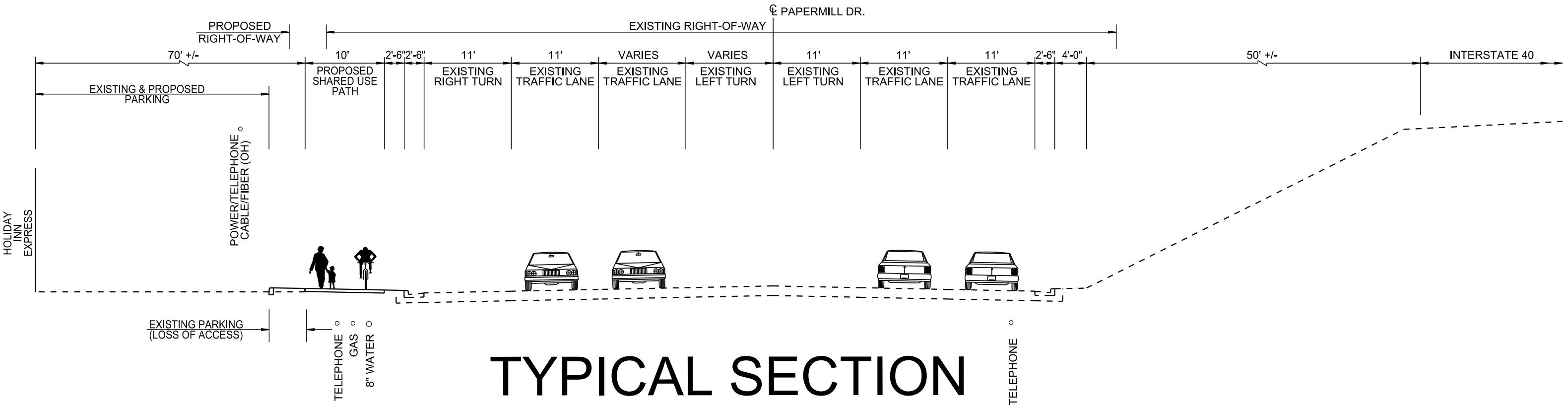


TYPICAL SECTION D-D

PAPERMILL DRIVE
OPTION 3



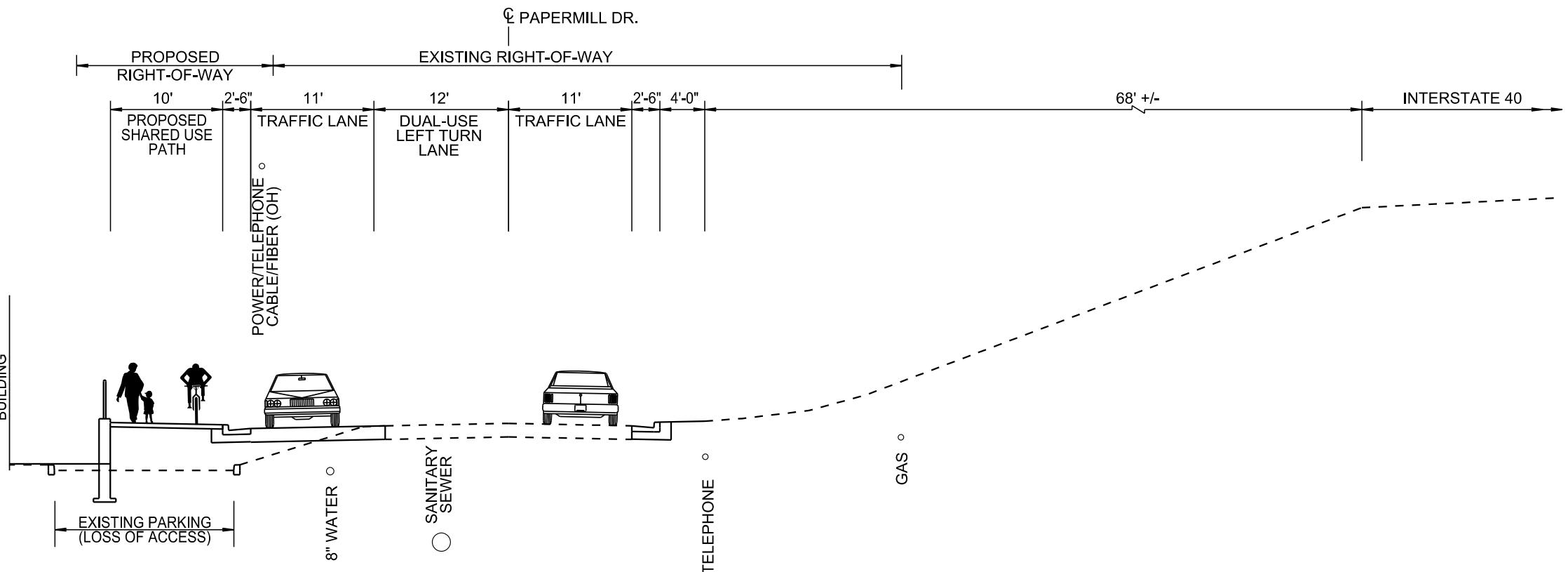
CDM
Smith



PAPER MILL DRIVE OPTION 3



CDM
Smith

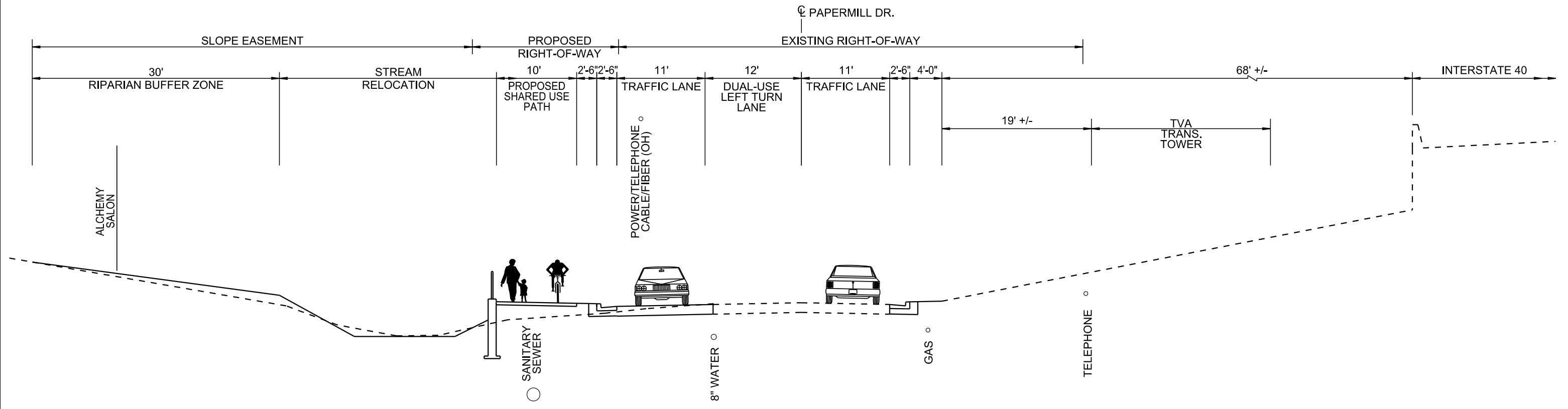


TYPICAL SECTION A-A

PAPERMILL DRIVE
OPTION 4



CDM
Smith

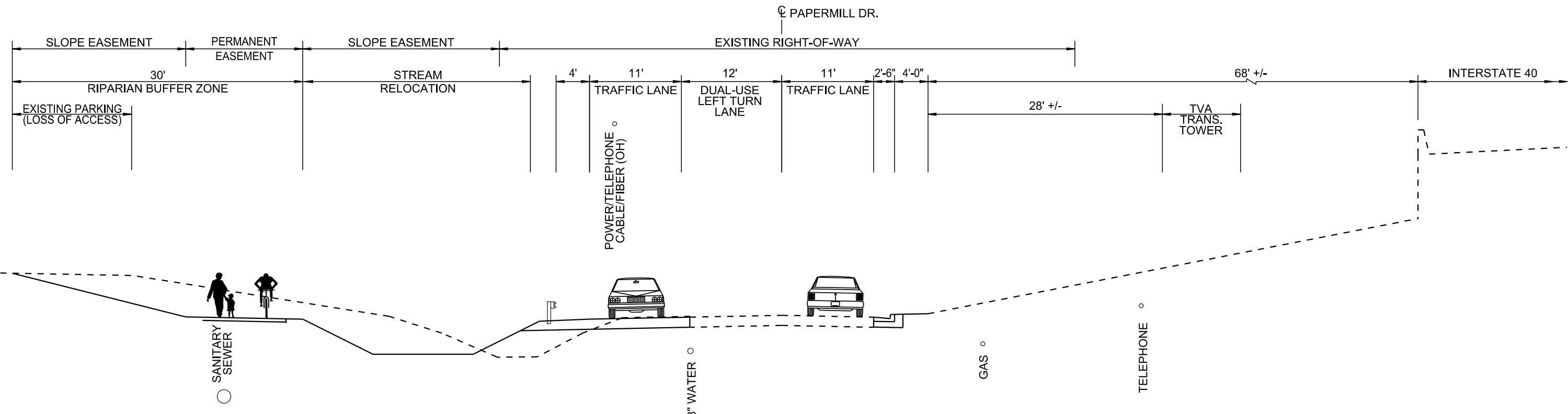


TYPICAL SECTION B-B

**PAPER MILL DRIVE
OPTION 4**



**CDM
Smith**

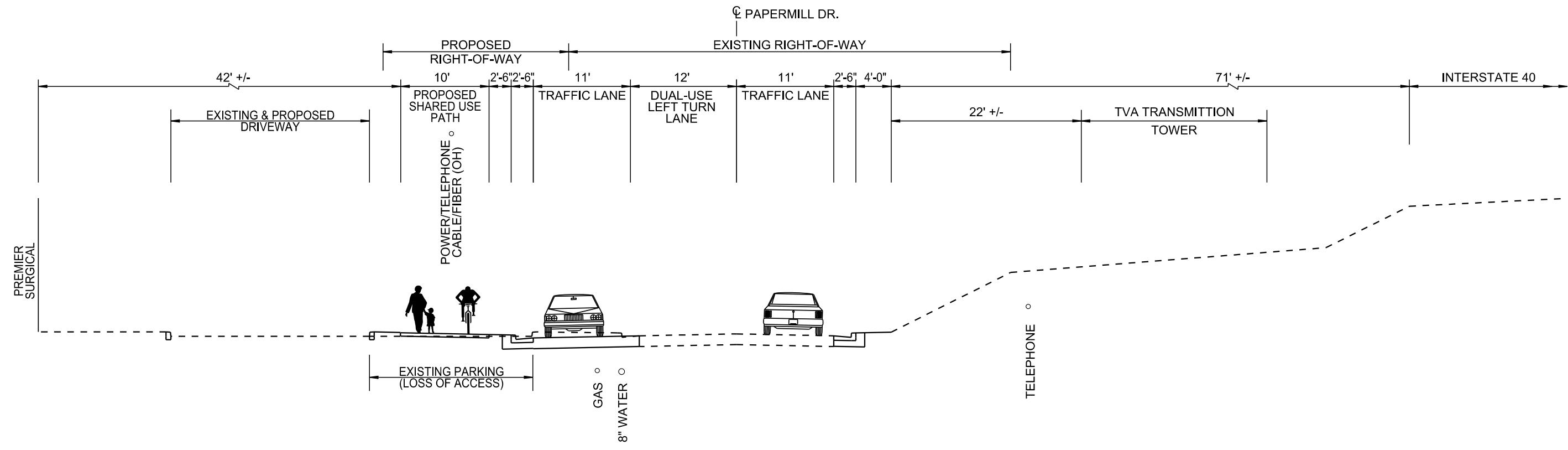


TYPICAL SECTION C-C

PAPERMILL DRIVE
OPTION 4



CDM
Smith

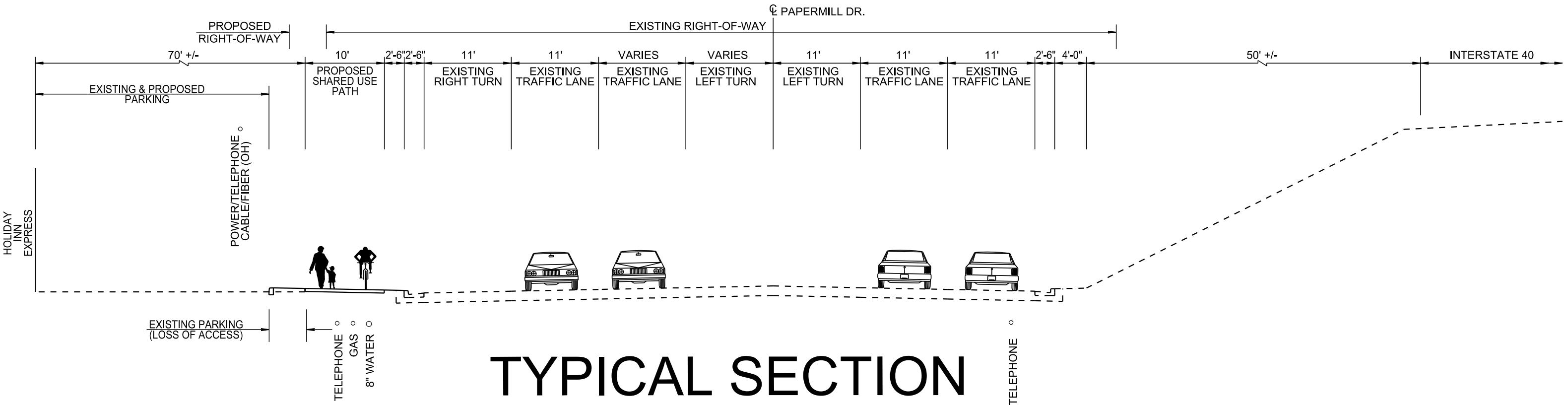


TYPICAL SECTION D-D

PAPERMILL DRIVE
OPTION 4



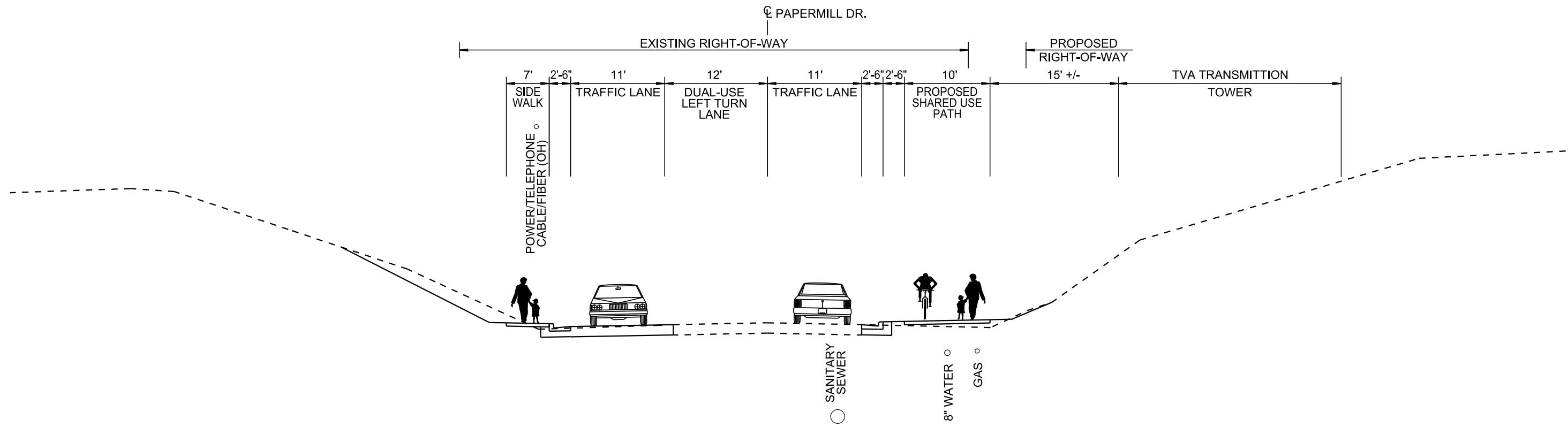
CDM
Smith



PAPER MILL DRIVE OPTION 4



CDM
Smith

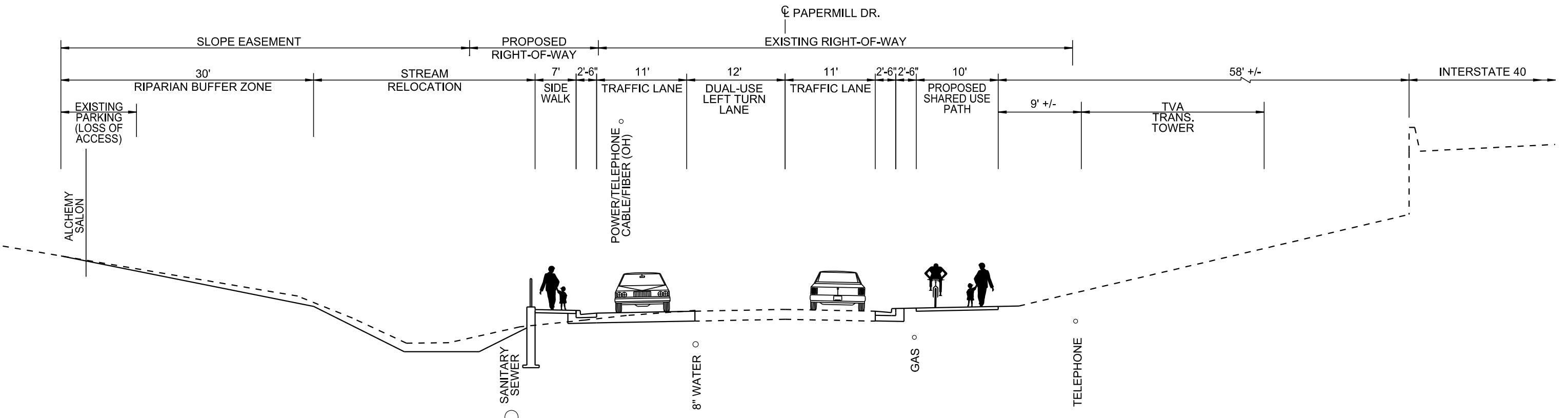


TYPICAL SECTION A-A

PAPER MILL DRIVE
OPTION 5



CDM
Smith

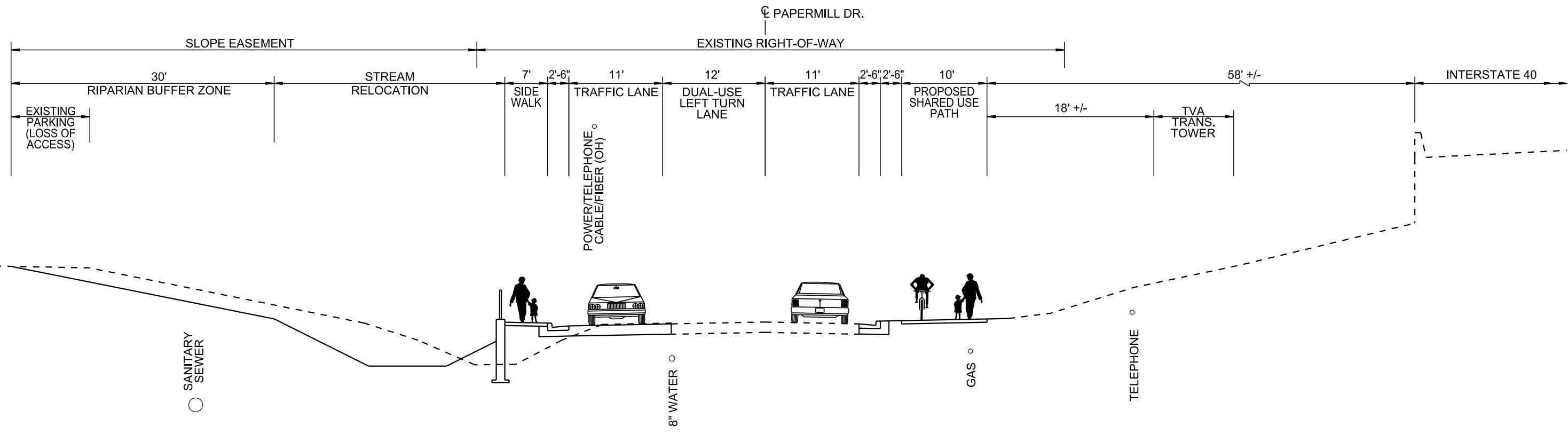


TYPICAL SECTION B-B

PAPERMILL DRIVE
OPTION 5



CDM
Smith

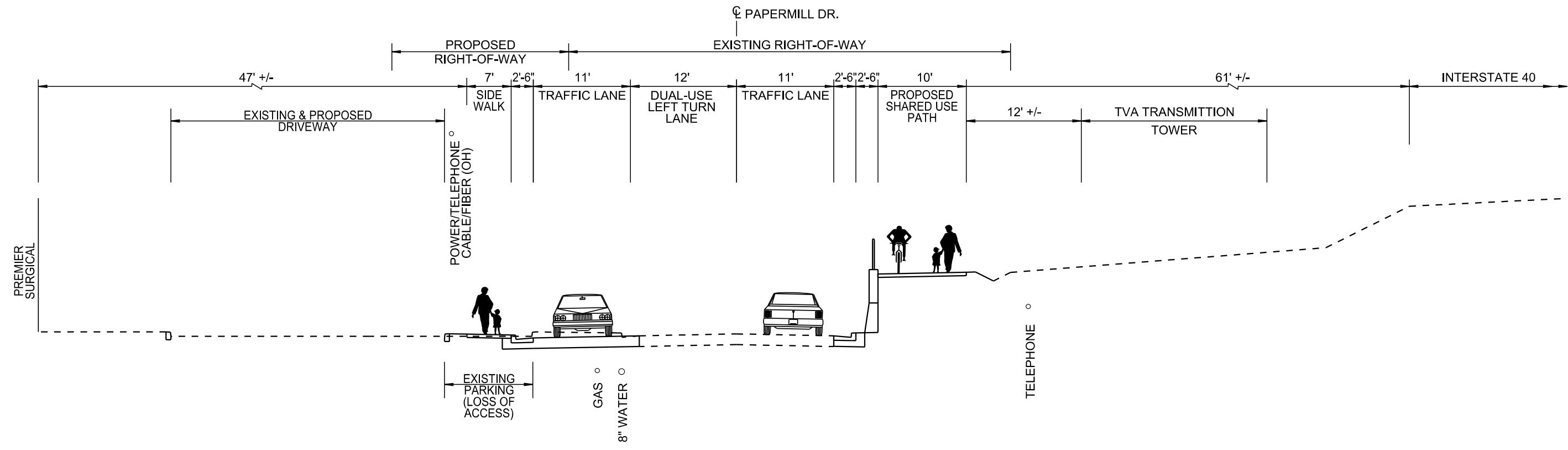


TYPICAL SECTION C-C

PAPERMILL DRIVE
OPTION 5



CDM
Smith

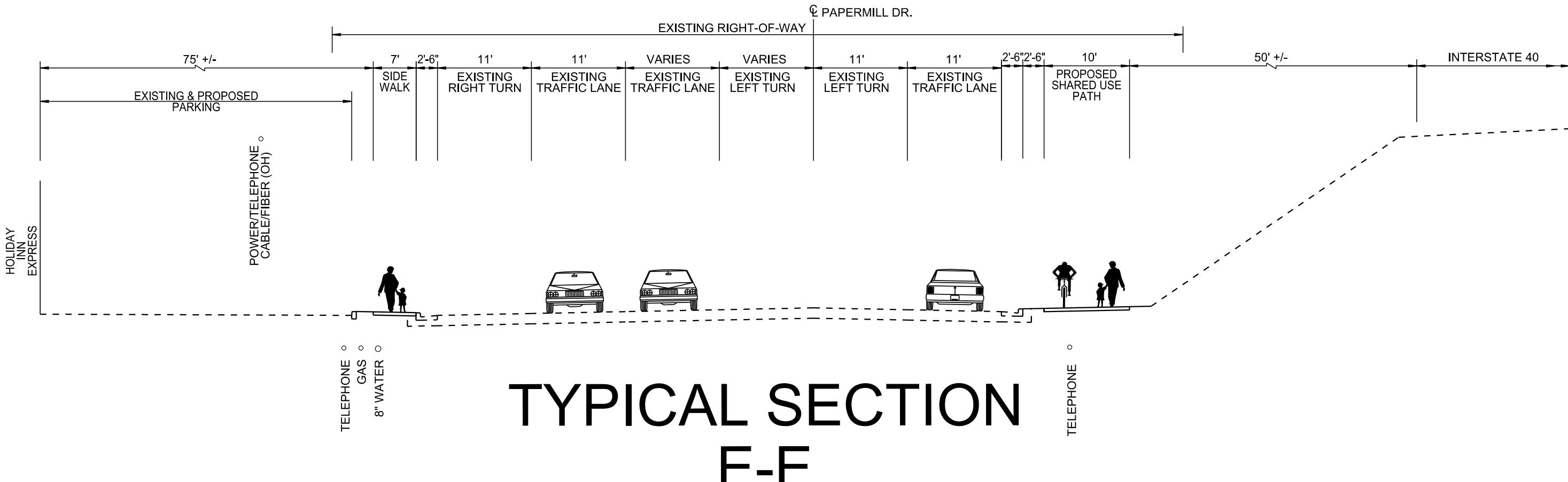


**TYPICAL SECTION
D-D**

**PAPERMILL DRIVE
OPTION 5**



**CDM
Smith**



**PAPER MILL DRIVE
OPTION 5**



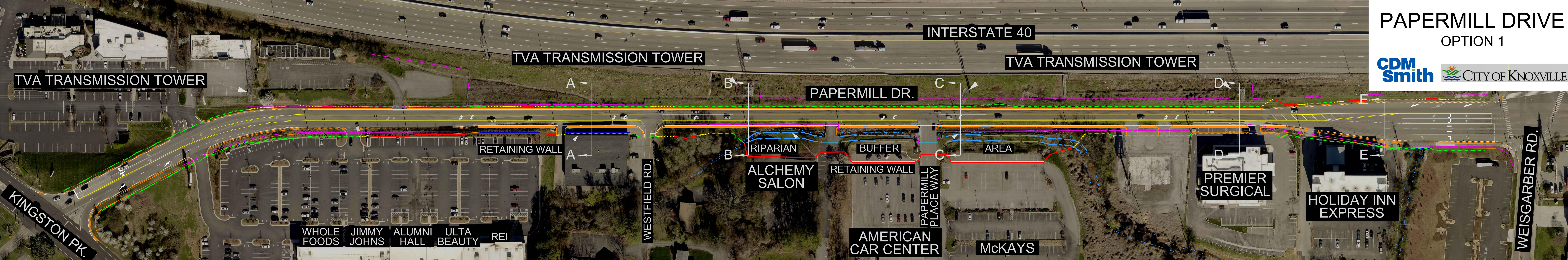
**CDM
Smith**

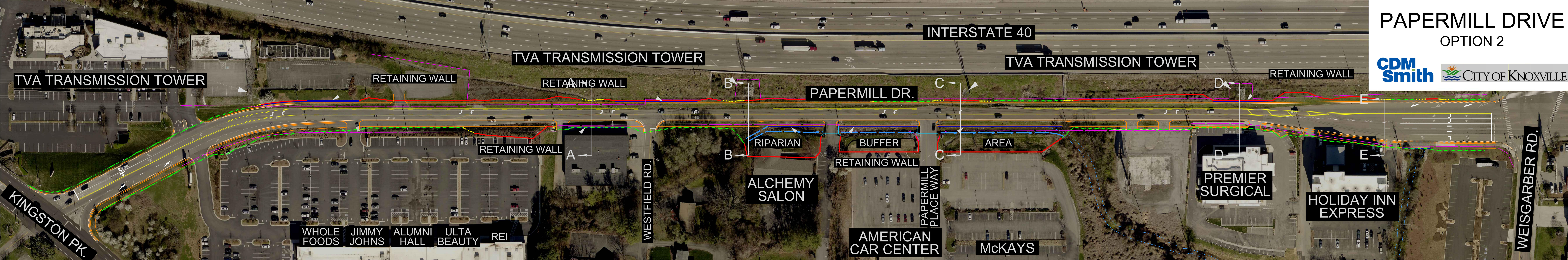
Appendix G

Alternative Concept Plans

PAPER MILL DRIVE OPTION 1

**CDM
Smith**



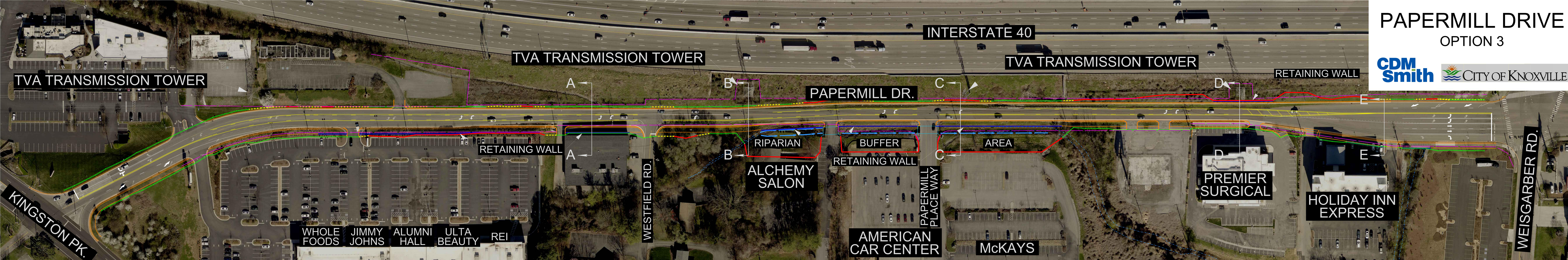


An aerial photograph of a multi-lane highway. The road has a dark grey asphalt surface with white dashed lines marking the lanes. Two cars are visible in the center lanes: a dark-colored SUV on the left and a silver sedan on the right. The surrounding area is a mix of light green and brown, suggesting a rural or semi-rural landscape. The perspective is from above, looking down the length of the highway.

100

RETAIN





An aerial photograph of a multi-lane highway. The road has a dark grey surface with white dashed lines marking the lanes. A solid yellow line runs across the center. Three cars are visible: one dark-colored car in the upper left lane, another dark-colored car in the upper right lane, and a white car with a dark roof in the lower left lane. The background shows a flat landscape with some distant trees and buildings.



An aerial photograph of a two-lane asphalt road. A solid yellow line runs horizontally across the center of the road. A white car is positioned in the upper center lane, facing away from the camera towards the horizon. The surrounding area is a mix of light-colored ground and some darker vegetation or buildings in the distance.

TVA TRANSMISSIONS

A photograph of a grassy field. A white arrow points from the top-left towards the center. A white cone is positioned near the center. Four horizontal magenta lines are overlaid on the image, spanning the width of the frame.

BUFFER

An aerial photograph of a parking lot with several cars parked in a grid pattern. A thick red arrow originates from the top left corner and points diagonally down towards the center of the image, highlighting the area where a retaining wall would be located.

An aerial photograph showing a straight road with a white dashed center line. Five cars are parked along the right side of the road. From left to right, the colors of the cars are black, white, red, blue, and black. The background consists of a light-colored, textured surface, likely sand or gravel.



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A close-up photograph showing a curved orange path or boundary line on a grassy hillside. The path is marked by a dashed white line and solid orange segments. The background consists of green grass and some bushes.

An aerial photograph of a road with a curved dashed line. The road curves from the top left towards the bottom right. A thick orange dashed line follows the curve of the road. A green dashed line runs parallel to the orange one, slightly above it. A yellow dashed line runs parallel to the orange one, slightly below it. In the bottom left corner, there is a black rectangular sign with white text that reads "N PKY.". The background shows a mix of asphalt roads, green trees, and some buildings.

TRANSMISSION TOWER

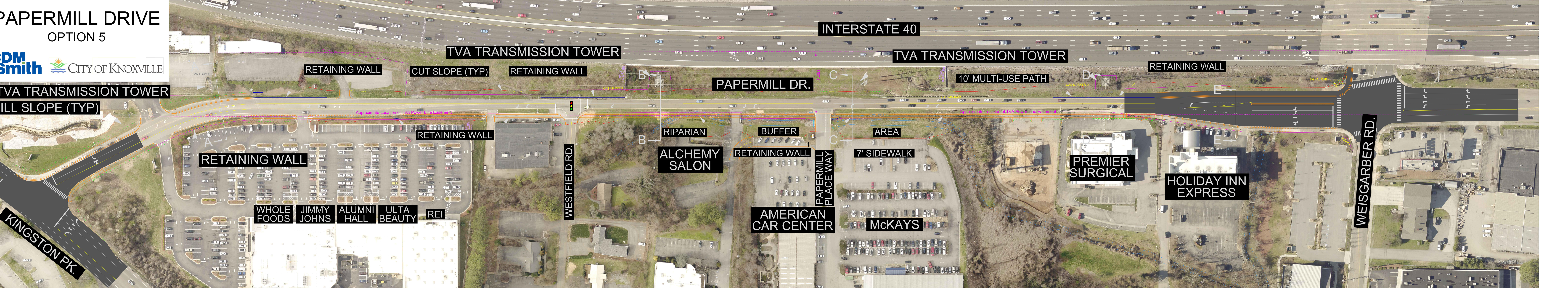
An aerial photograph of a two-lane road curving through a green landscape. A dashed orange line runs along the right edge of the road. A black rectangular banner with white text is positioned across the road. The text on the banner is partially visible, showing "GSTON".

PAPER MILL DRIVE OPTION 5

**CDM
Smith**



TVA TRANSMISSION TOWER
FILL SLOPE (TYP)



INTERSTATE 40

TVA TRANSMISSION TOWER

RETAINING WALL

PAPER MILL DR.

10' MULTI-USE PATH

GAS MARKER

SIGNAL CAB

GAS MARKER

SIGNAL

7' SIDEWALK

PAPER MILL PLACE WAY

BUFFER AREA

ALCHEMY SALON

PREMIER SURGICAL

HOLIDAY INN EXPRESS

AMERICAN CAR CENTER

McKAYS

WEISGARBER RD.

WESTFIELD RD.

Appendix H

Cost Estimates

Papermill Drive Option 5

By CDM Smith 3-17-22
Prepared by NCK

*****PRELIMINARY*** Opinion of Probable Costs**

Item	Unit	Unit/Cost	Unit Quantity	Total Cost
CONSTRUCTION STAKES, LINES AND GRADES	LS	\$15,000.00	1	\$15,000
CLEARING AND GRUBBING	LS	\$50,000.00	1	\$50,000
UNDERCUTTING	CY	\$30	2,000	\$60,000
SELECT MATERIAL	Tons	\$10	4000	\$40,000
REMOVAL OF ASPHALT PAVEMENT	SY	\$25	1800	\$45,000
REMOVAL OF RIGID PVMT, SIDEWALK, ETC.	SY	\$27	250	\$6,750
REMOVAL OF CURB AND GUTTER	LF	\$20	900	\$18,000
ROAD AND DRAINAGE EXCAVATION (UNCLASS)	CY	\$15	25000	\$375,000
FURNISHING AND SPREADING TOPSOIL	CY	\$35	1500	\$52,500
SODDING (NEW SOD)	SY	\$8	9000	\$72,000
LANDSCAPING (ALLOWANCE FOR 10,000SF)	LS	\$150,000	1	\$150,000
1.5" SURFACE GRADING "D"	Tons	\$105	12020	\$1,262,100
2" BITUMINOUS BINDER COURSE	Tons	\$95	315	\$29,925
3" BITUMINOUS BASE COURSE	Tons	\$85	480	\$40,800
12" GRADED AGGREGATE BASE	Tons	\$35	1880	\$65,800
PRIME COAT / TACK COAT	Tons	\$700	10	\$7,000
COLD PLANING BITUMINOUS PAVEMENT	CY	\$75	600	\$45,000
SAW CUTTING ASPHALT PAVEMENT	LF	\$4	3900	\$15,600
RETAINING WALL	SF	\$75	10700	\$802,500
CONCRETE DRAINAGE PIPE	LF	\$85	4400	\$374,000
CATCH BASINS	EACH	\$4,500	15	\$67,500
AREA DRAINS	EACH	\$3,500	10	\$35,000
STORM MANHOLES	EACH	\$4,000	5	\$20,000
BOX CULVERT BRIDGE (MCKAYS DW)	EACH	\$45,000	1	\$45,000
BOX CULVERT BRIDGE (ALCHEMY SALON DW)	EACH	\$45,000	1	\$45,000
CONCRETE ENDWALLS	EACH	\$3,000	5	\$15,000
CONCRETE SIDEWALK (6")	SF	\$12	18200	\$218,400
CONCRETE MULTIUSE PATH (6")	SF	\$12	31000	\$372,000
CONCRETE CURB AND GUTTER (6-30)	LF	\$35	3900	\$136,500
CONCRETE VERTICAL CURB	LF	\$20	400	\$8,000
BIKE / PED SAFETY RAIL	LF	\$140	1600	\$224,000
VEHICLE / PED SAFETY RAIL	LF	\$195	1000	\$195,000
ENERGY ABSORPTION TERMINALS	EACH	\$8,000	4	\$32,000
REPLACE STREETLIGHTS (ALLOWANCE)	LS	\$320,000	1	\$320,000
ACCESS CONTROL FENCE (CHAIN LINK)	LF	\$20	700	\$14,000
SIGNAGE	LS	\$30,000	1	\$30,000
TRAFFIC SIGNALIZED INTERSECTION	LS	\$275,000	1	\$275,000
MODIFY TRAFFIC SIGNALIZED INTERSECTION	LS	\$75,000	1	\$75,000
TRAFFIC CONTROL	LS	\$180,000	1	\$180,000
EROSION CONTROL	LS	\$195,000	1	\$195,000
STREAM RELOCATION AND RESTORATION (ALLOWANCE)	LS	\$400,000	1	\$400,000
PAVEMENT MARKING	LS	\$40,000	1	\$40,000
MOBILIZATION	LS	\$35,000	1	\$35,000

ITEMS TOTAL	\$6,439,375
7% MISC APPURTEANANCES	\$450,756
15% CONTINGENCY	\$965,906
GRAND CONSTRUCTION TOTAL	\$7,856,038
ENGINEERING COSTS	\$1,050,000
CEI COSTS	\$1,200,000
ROW ACQUISITION COSTS	\$5,000,000
ESTIMATE TOTAL	\$15,106,038

OPINION OF PROBABLE COST \$15,100,000.00

*Allowances for estimating purposes only and not based on quantified information.

Assumptions

Property acquisition costs per City of Knoxville Real Estate Manager
No utility relocation costs are included.
Assumes no rock removal.

*****PRELIMINARY*** Utilities Opinion of Probable Cost**

Item	Unit	Unit/Cost	Unit Quantity	Total Cost
Relocate TVA Tower / Lines	Each	\$500,000	4	\$2,000,000
Relocate Gas	LF	\$80	4200	\$336,000
Relocate Waterline	LF	\$90	4300	\$387,000
Relocate Overhead Electric	LS	\$190,000	1	\$190,000
Relocate Sanitary Line	LF	\$130	1200	\$156,000
Relocate Underground Telephone Fiber MCI	LS	\$180,000	1	\$180,000
Relocate Overhead Cable	LS	\$120,000	1	\$120,000
Relocate Overhead Fiber	LS	\$90,000	1	\$90,000
Relocate Overhead Telephone	LS	\$120,000	1	\$120,000
Relocate Underground Fiber IRIS	LS	\$180,000	1	\$180,000
		TOTAL		\$3,759,000
		7% MISC APPURTENANCES		\$263,130
		15% CONTINGENCY		\$563,850
		GRAND TOTAL		\$4,585,980
		ESTIMATE TOTAL		\$4,600,000

Calculations

Mobilization

Engineering judgement to estimate allowance

Traffic Control

Engineering judgement to estimate allowance

Undercutting

2000 CY

Erosion Control

Engineering judgement to estimate allowance

Pavement Marking

Engineering judgement to estimate allowance

Select Material (Granular)

2000 CY x 2.03 Tons/CY = 4060 Tons (2.03 Tons/CY from TDOT Design Guidelines for granular select material)
Round to 4000 Tons

4060

2" Bituminous Binder

Area (S.Y.) x Lb. per S.Y. per inch thickness =Tons
2,000 Lb./ Ton

(From TDOT Design Guidelines)

307-01-06	PG 64-22 BASE MIXES (GRADING B)	4068	113
307-01-07	PG 64-22 BASE MIXES (GRADING B-M)	4068	113
307-01-08	PG 64-22 BASE MIXES (GRADING B-MZ)	4068	113

(From TDOT Design Guidelines)

1.5" Surface Course Grade "D"

Area (S.Y.) x Lb per SY per inch thickness =Tons
2,000 Lb./ Ton

(From TDOT Design Guidelines)

GRADING D SURFACE (PG 64-22)	3816	106
------------------------------	------	-----

(From TDOT Design Guidelines)

Prime Coat/Tack Coat

Item No. 402-01 Bituminous Material for Prime Coat (PC)
Surface area (Sq. Yd.) x *Rate (Gal./Sq. Yd.) =Tons
**231 Gal./ Ton

(From TDOT Design Guidelines)

* Rate 0.30 – 0.35 Gal./Sq. Yd.

<u>Retaining Wall</u>	Average Wall height 6ft	<u>Undercut Assumptions</u>	<u>Drainage pipe</u>	<u>Drainage Structures</u>	<u>Sidewalk 6ft</u>	<u>Multiuse Trail</u>
263		16000 sf Area	2071 lf	14.5 catch basins every 300ft	2600 lf	3100 lf
101	SF of wall = 10638	3 ft Depth	2071 lf	15 total catch basins	7 width	10 width
197	Round	48000 cf volume	200 lf	10 Area Drains North Side of Sheet	18200 square feet	31000 square ft
27		1777.778 cy		5 Misc. Storm Manhole		
141		2000 cy Round	4342 lf	5 Headwalls		
197			4350 Average			
129						
263						
193						
68						
47						
147						
1773						
<u>Curb & Gutter</u>	<u>Vertical Curb</u>	<u>Bike Ped Safety Rail (most fill slopes)</u>	<u>Vehicle Ped Safety Rail</u>	<u>Access Control Fence (chain)</u>	<u>Mill 2.0" Average</u>	0.125 in ft
2000 lf	400 lf	330 lf	384 lf	680 lf	113,000 sf pavement to mill	
30 lf		345 lf	175 lf	700 round	14125 cf pavement	
36 lf		196 lf	263 lf		523.1481 cy pavement milled	
200 lf		173 lf	158 lf		600 round	
194 lf		195 lf	980 lf			
395 lf		100 lf	1000 round			
225 lf		213 lf				
780 lf		1552				
		1600 round				
3860 lf						
3900 round						
<u>Signage Replaced (1500 sign Average)</u>	<u>Pavement Marking</u>	<u>SOD</u>	<u>TOPSOIL</u>			
25 Approximate number	32 Specialty (Assume 300 each)	53900	9000 AREA SY		0.166667	
30000	8000 approximate length of stripping (@ .65 lf)	14200	ASSUME 6" DEPTH			
30000 round	9600 Specialty \$	4000	1500 CY			
	6000 line \$	3200				
	22000 crosswalks thermo	2700				
	37600 Total	2600				
	40000 round	806000 SF				
		8955.556 SY				
		9000 ROUND				
<u>REMOVE ASPHALT</u>	<u>Removal of rigid pavement</u>	<u>Removal of Curb and gutter</u>	<u>Surface course</u>			
1200 SF	2200 sf	520 lf	25000 sf ---full depth area	(15333 SY x 106 x 1.5 layers) / 2000 LB/Ton = 1219 Tons		
5100 SF	244.4444 sy	190 lf	113000 sf ---milled area			
2000 SF	250 round	170 lf	138000 sf	1219 tons		
1700 SF		880 lf	15333.33 sy	1220 round		
6000 SF		900 round				
16000 SF						
1777.778 SY						
1800 ROUND						
<u>3" Bituminous Base</u>	<u>2" Bituminous Binder</u>	<u>12" Aggregate Base</u>				
3" = 0.25 FT		12" = 1 FT				
0.25 FT x 25000 SF = 6250 CF (rounded)	6250	1 FT x 25000 SF = 926 CY (rounded)		925.9259		
6250 CF = 232 CY	231.4815	926CY x 2.03 Tons/CY = 1880 Tons (2.03 Tons/CY from TDOT Design Guidelines)				
Assume Density is 4,140 LB / CY (From TDOT Design Guidelines)						
(232 CY x 4140 LB / CY) / (2,000 LB / Ton) = 480 Tons	480.24					
Round to 480 Tons						

Prime coat/tack coat
(2778 SY x 0.35 Gal./Sq. Yd.) / 231 Gal. / Ton = 4.2 Tons
Round up to 10 Tons x2

Earthwork
60400 sf--north
80100 sf--south

241600 cf --north
320400 cf --south
562000 cf --total
20814.81 cy

Streetlight Assumes 20 poles and lights
wood pole and light 6000
120000 poles and lights
200000 Electric line
320000

Stream relocation and mitigation
800 lf of stream
400000 500 \$ a linear foot

Traffic Control
5000 ft
125 drums @ 40ft
375 3 replacements
11250 drums and lights
10000 arrow boards

80 hours 2 flaggers
2560 32 weeks schedule

166400 65

Erosion Control
10000 lf ---silt fence
25 structures to protect
9000 sy -- erosion control blanket
1 coffer dam

12	120000
300	7500
3	27000
40000	40000

194500

187650

Appendix I

eTRIMS Route Features

County	KNOX	Route	04829	Spcl. Cse.	0-NONE	Cnty. Seq.	1
From:		To:		<input type="button" value="Find Now"/>			

Route Feature		Road Segment	Traffic	Roadway Description	Geometrics	Road History	Road System	Maintenance Feature	Maintenance Inventory	Elevation	
Log Mile	Item Code	Item Code Order	Route Feature Description			Desc Code	Milepost	MP Suffix	Latitude	Longitude	Elevation
.000	3-STATE HWY	0	SR-1 KINGSTON PK. RT. & LT.			310...			35.932491	-84.017553	919.2
.000	0-OTHER-MAJOR	1	BEGIN PAPER MILL RD.			920...			35.932491	-84.017553	919.2
.000	9-OTHER-MINOR	2	TRAFFIC SIGNAL			905...			35.932491	-84.017553	919.2
.000	9-OTHER-MINOR	3	BEGIN 40 MPH			932...			35.932491	-84.017553	919.2
.000	9-OTHER-MINOR	4	BEGIN ILLUMINATION			930...			35.932491	-84.017553	919.2
.020	7-RAMP	0	RAMP FROM SR-1 KINGSTON PK. RT.			714...			35.932755	-84.017383	
.255	5-CO. RD./CITY S...	0	A399 WESTFIELD RD. RT.			520...			35.934945	-84.014302	883.5
.328	5-CO. RD./CITY S...	0	A400 CIRCLE LN. RT.			520...			35.935522	-84.013201	876.3
.546	9-OTHER-MINOR	0	TRAFFIC COUNT STATION 433			959...			35.937221	-84.009915	
.560	2-BRIDGE/UP/OH	0	BRIDGE: FOURTH CREEK			205...			35.937319	-84.009718	
.610	9-OTHER-MINOR	0	TRAFFIC SIGNAL			905...			35.937695	-84.008958	872
.610	4-FUNCT. CLASS...	1	5289 WEISGARBER RD. RT. & LT.			410...			35.937695	-84.008958	872
.820	9-OTHER-MINOR	0	CULVERT: DRAINAGE			980...			35.939217	-84.005434	
.950	9-OTHER-MINOR	0	TRAFFIC SIGNAL			905...			35.939711	-84.003284	887.7
.950	3-STATE HWY	1	SR-332 NORTHSORE DR. RT.			320...			35.939711	-84.003284	887.7
.950	7-RAMP	2	RAMP FROM I-40 EB LNS. LT.			706...			35.939711	-84.003284	887.7
.950	3-STATE HWY	3	SR-332 PAPER MILL RD. FRONT			340...			35.939711	-84.003284	887.7

Appendix J

Left-turn Lane Warrants

TDOT - ROADWAY DESIGN GUIDELINES

English

Revised: 08/15/08

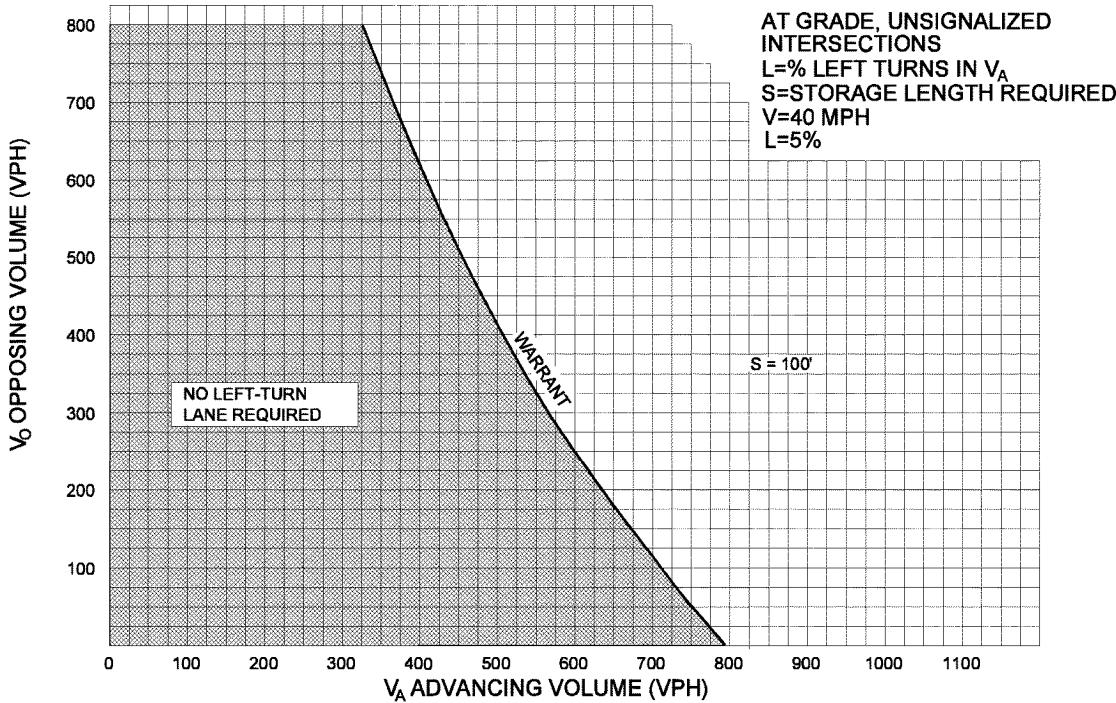


Figure 2-14a
Warrant for Left-Turn Storage Lanes on Two-Lane Highways ($V = 40$ mph and $L = 5\%$)

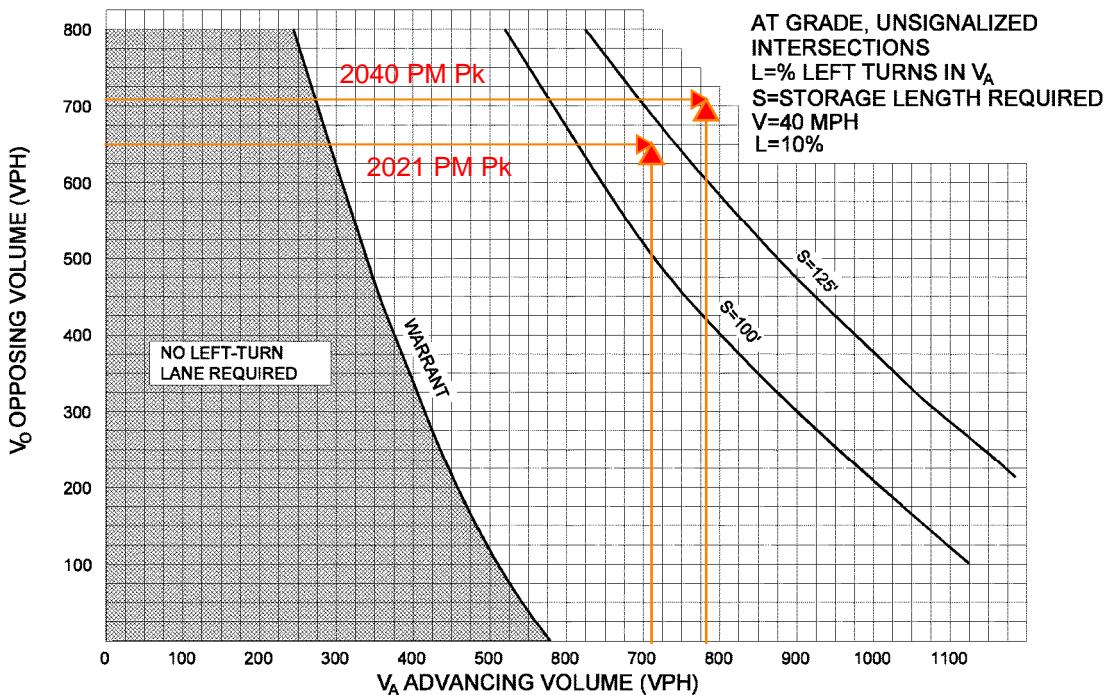


Figure 2-14b
Warrant for Left-Turn Storage Lanes on Two-Lane Highways ($V = 40$ mph and $L = 10\%$)



CDM
Smith

The logo consists of the letters "CDM" in a large, bold, blue sans-serif font. Below "CDM", the word "Smith" is written in a slightly smaller, bold, blue sans-serif font. A small, horizontal green bar is positioned above the letter "i" in "Smith".