

# Highway 22

## Functional Planning Study Update

Alberta Transportation



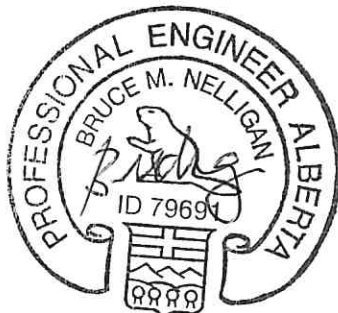
WATT CONSULTING GROUP  
AUGUST 9, 2022

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# HIGHWAY 22

Functional Planning Study Update



Aug. 9, 2022

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## EXECUTIVE SUMMARY

Highway 22 is a prominent north / south corridor which parallels Highway 2 between Crowsnest Pass (Highway 3) and Highway 43 northwest of Edmonton. In addition to providing a regional transportation corridor, the Highway serves as part of the local transportation network for the Town of Cochrane, supporting local traffic and connecting with Highway 1A.

WATT Consulting Group on behalf of a developer, was asked by Alberta Transportation to prepare an update to the Access Management and Functional Planning Report for Highway 22 from the Bow River to south of the Town of Cochrane border. The study is supported by previous reports completed in support of the corridor development with the key objectives of the report defined as follows:

- Evaluation and assessment of existing conditions
- Assessment of future intersection operations
- Development and evaluation of design alternatives and recommendation for Highway 22 and recommendation of a preferred alternative
- Determine staging and ultimate configurations for the preferred scenario
- Provide an assessment of right-of-way and preliminary cost estimate

In support of anticipated development and growth within Rocky View County and the Town of Cochrane by the year 2060, the proposed design for Highway 22 features a six-lane cross section to support the urban expressway divided (UED-614.1-80) classification within the study area. Intersection upgrades within the study limits focus on the intersections of Rolling Range Drive / Highway 22, Fireside Gate / James Walker Trail / Highway 22, and a proposed new South Access signalized intersection, with widening to the east of the current alignment. Lane configuration requirements for these intersections support the proposed six-lane cross section, with details included for an interim (2040) and ultimate (2060) buildout scenario.

Alternative intersection designs were generated and evaluated as part of the design process, with options for standard intersections, roundabouts, and left turn alternatives for signalized intersections (jughandle, displaced left turn and Michigan left turn). Each alternative was assessed using a Multiple Account Evaluation (MAE) process and included the following criteria:



- Traffic Operations
- Right-of-Way Requirements
- Utility Impacts
- Active Modes Accommodation
- Environmental Impact
- Construction Cost
- Driver Expectation and Human Factors
- Safety

Although there is potential to design interchanges at the three study intersections to accommodate traffic in future horizons, this option was not considered due to ROW constraints with existing development and the Town's preference to shift the Highway 22 corridor to a more urban environment within the Town limits.

Several options for widening the existing carriageway were considered, including widening to the east, widening to the west, and widening equally on both sides. Options were evaluated according to the criteria below, with the preferred alternative to widen to the east:

- Net cut / fill requirements
- Overall earthwork requirements
- Ability to stage the widening and overall constructability
- Impact on right-of-way
- Environmental Impact
- Consistency with current plans

Access management strategies for a UED-614.1-80 require that all private and public accesses be concentrated to the three main intersections, with an alternate access provided outside the Highway 22 right-of-way. This includes three private and residential access points within the study area, with River Heights Lane anticipated to be realigned as the east approach to the Rolling Range Drive intersection.

Integration of active modes of transportation was also evaluated, with a discussion of potential pedestrian and cyclist crossing options. While it is possible to accommodate pedestrians at the signalized intersections, the ultimate roadway width will have an impact on the crossing distance and may pose safety and accessibility concerns. Alternatives discussed include an overpass or underpass option, which should be evaluated more thoroughly at the detailed design stage.



A preliminary cost estimate was completed to support the ultimate buildout condition in the 2060 horizon. As summarized in **Table ES-1**, the estimated cost to construct the highway upgrade to the 6-lane cross-section is \$33,220,000.

COST ESTIMATE	
Earthworks	\$ 11,830,000
Surface Improvements - Concrete	\$ 6,630,000
Surface Improvements - Asphalt	\$ 6,280,000
Surface Improvements - Asphalt (Miscellaneous Items)	\$ 810,000
<b>SUBTOTAL - SURFACE IMPROVEMENTS</b>	<b>\$ 25,550,000</b>
<b>CONTINGENCY ALLOWANCE (30%)</b>	<b>\$ 7,670,000</b>
<b>TOTAL</b>	<b>\$ 33,220,000</b>

Based on the analysis and results presented in the body of the report, key recommendations are summarized as follows:

#### **Short-Term Improvements (within 5 years)**

- Acquire right-of-way as development occurs
- Protect right-of-way (70 m) for future twinning
- Realign George Fox Trail and extend twinning of Hwy. 22 south from Glenbow Drive to south of the Bow River
- Signalize and upgrade Highway 22 / Rolling Range Drive intersection (development driven)
- Signalize and upgrade Highway 22 / New South Access (development driven)

#### **Medium-Term Improvements (5-15 years)**

- Expand Highway 22 to 5-lane cross-section from south of the Bow River to south of James Walker Trail (two northbound and three southbound lanes).
- Close private accesses to Highway 22 as required

#### **Long-Term Improvements (>15 years)**

- Expand Highway 22 to 5-lane cross-section from south of James Walker Trail to project limits (two northbound and three southbound lanes)
- When warranted, widen carriageway to the ultimate 6-lane cross-section throughout the study limits



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## 1.0 INTRODUCTION

### 1.1 Background

Highway 22 (Cowboy Trail) is a prominent north / south secondary highway link between the Crowsnest Pass (Highway 3) and Highway 43 northwest of Edmonton. Serving both regional and local traffic this roadway forms a part of the local transportation network for the Town of Cochrane, a community in Southern Alberta approximately 40 km northwest of Calgary. With a current population of approximately 34,500, the Town of Cochrane has experienced significant growth in the past 10 years and has identified an interest in improving access along Highway 22 within the study limits to support anticipated future development.

A Functional Planning Study was completed by McElhanney in 2004 for portions of Highway 22 and 1A in Cochrane. The study included a 15.5 km stretch of Highway 22 within the Town of Cochrane and included the following major scope items:

- Confirmed the long-range function, classification and design standard for Highway 22
- Developed an access management strategy for the corridor
- Developed, reviewed and evaluated alternatives for upgrading Highway 22
- Determined staging and an ultimate configuration for preferred twinning alignments and,
- Defined the basic right-of-way (ROW) requirements for the recommend improvements.

At the time the functional planning study was completed, the Town of Cochrane was in the process of annexing lands along Highway 22, south of the Bow River. Consequently, very little planning work had been done at that time to understand the density and type of land uses within the annexed lands, as well as the need for access to Highway 22. The functional study provided the following recommendations with regards to at-grade access to Highway 22 south of the Bow River:

- Realigning George Fox Trail to cross the Bow River and connect directly to Griffin Road (with closure of current access to Highway 22);
- Closure of at-grade intersection of Highway 22 / Rolling Range Drive.
- A new at-grade intersection close to where the Fireside Drive / James Walker Trail intersection is today
- A new at-grade intersection at TWP 253.



To plan for the further growth in Cochrane, the Town completed a Transportation Master Plan called “Connecting Cochrane” in 2017. This document provided a long-term plan for the Town’s transportation network to support the planned growth up to a population of 60,000 (anticipated by the year 2060). The recommended long-term network for the Town of Cochrane included two new at-grade intersections along Highway 22, south of the Bow River that had not been previously contemplated by Alberta Transportation. The new intersections include:

- Highway 22 / River Heights Lane / Rolling Range Drive
- Highway 22 / new intersection associated with the Southbow Community

Alberta Transportation is supportive of the Town’s growth plans however, to move forward with the ARP, they have requested an update to the Highway 22 Functional Study to accommodate all the growth south of the Bow River. The scope of the Functional Study update was determined by Alberta Transportation and included the following goals:

- Confirm whether the long-range function, classification and design standard for Highway 22 as determined through the previous functional study needs to be modified;
- Confirm the upgrades required at the three proposed at-grade intersections to support the Town’s long-range growth plans;
  - Highway 22 / Rolling Range Drive
  - Highway 22 / Fireside Gate / James Walker Trail
  - Highway 22 / South Access
- Review, update and evaluate alternatives for upgrading Highway 22;
- Determined staging and an ultimate configuration for upgrading Highway 22 to the ultimate configuration; and,
- Defined the basic right-of-way (RoW) requirements for the recommend improvements.

The study limits for the Highway 22 Functional Study Update are from the south side of the Bow River to the first intersection south of the Town of Cochrane boundary, as illustrated in **Figure 1**.

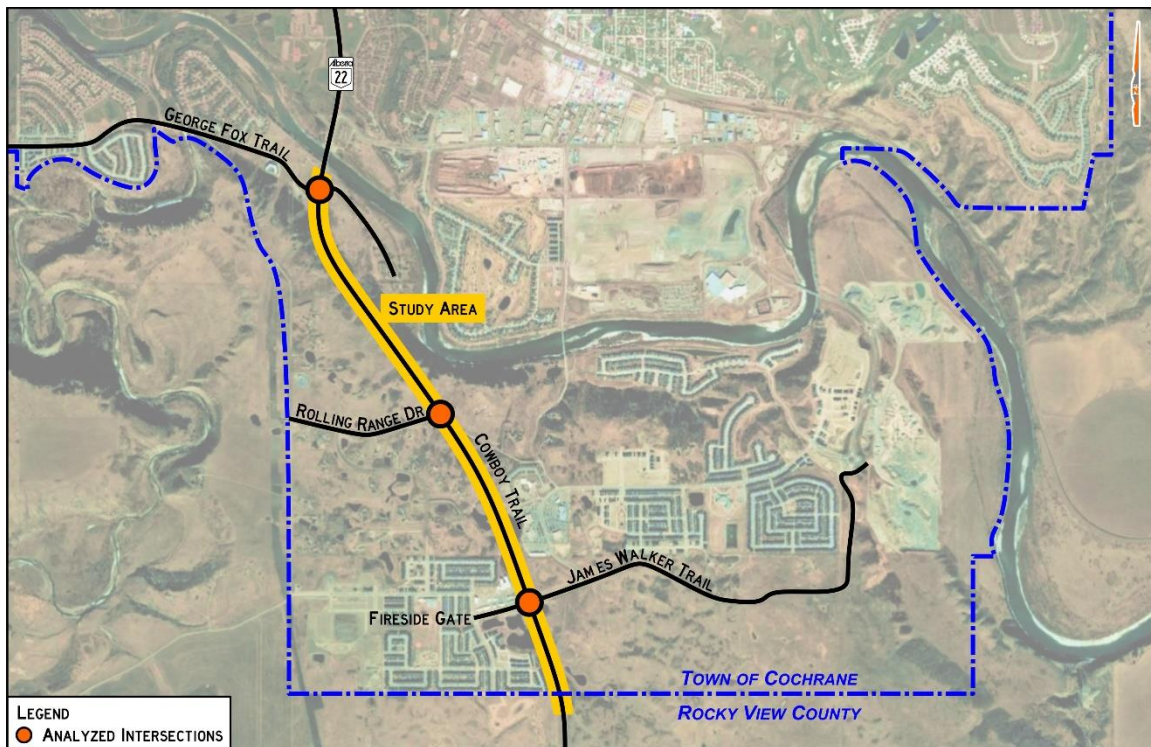


Figure 1 Study Area

## 1.2 Study Objectives

With the overall objective of updating the previous functional study within the bounds of the study area as defined in **Figure 1**, several key elements which support this goal are as follows:

- Evaluation and assessment of existing conditions, including traffic operations, safety statistics, utilities, structures, and stormwater management (drainage).
- Assessment of future intersection operating conditions.
- Development and evaluation of alternative designs for Highway 22 and recommendations of a preferred design.
- Prepare an access management strategy – building on the previous recommendations from the 2004 study.
- Determine staging and ultimate configuration for preferred design scenario.
- Provide an assessment of right-of-way (ROW) requirements and approximate cost estimate for the preferred design option.



### 1.3 Study Scope

The scope of work as determined through discussions with Alberta Transportation included in this report builds on analysis presented in two earlier Memorandums, and includes the following key elements:

- Review of Supporting Information and Reports
- Analysis of Existing Conditions
- Traffic Forecasting and Analysis for the 2060 Horizon
- Evaluation of Design Alternatives
- Staging Options and Strategy of the Recommended Plan
- Access Management Strategy
- Utility Impact Assessment
- Geotechnical Review
- Right-of-Way Plan
- Summary of Public and Stakeholder Engagement
- Planning Level Cost Estimate

### 1.4 Supporting Transportation Studies

Analysis and design presented in this study are supported by four key report documents summarized in the following paragraphs.

#### **Access Management and Functional Planning Study Highway 22:16 and Highway 1A:06**

This report provides comprehensive review of Highway 22 and Highway 1A in the vicinity of the Town of Cochrane. Completed in 2004, the objectives of the study include<sup>1</sup>:

- Confirmation of the long-range function, classification, and design standard for Highway 22 and 1A,
- Development of an Access Management Strategy for the corridors,
- Development, review, and evaluation of alternatives for upgrading Highways 22 and 1A
- Determining the staging and ultimate configuration for preferred twinning alignments

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<sup>1</sup> Functional Planning Study, Highway 22:16 and Highway 1A:06, McElhanney, 2004



- Defining the basic right-of-way (RoW) requirements for the recommended improvements.

The report summarizes the study area by detailing existing traffic volumes, highway performance and classification, safety statistics, access management plan, expected growth for the Town of Cochrane and Rocky View County as well as factors such as utilities, structures, drainage geotechnics and the environment.

Results of analysis include recommendations for the short (1-5 years), medium (5-15 years) and long-term (>15 years). Key improvements to the transportation network involved twinning Highway 1A and Highway 22 south of 1A, rehabilitation of the Bow River Bridge, consolidation and relocation of accesses at the Carlson Trail / Ridge View Place, Ranche Road, Range Road 43 and River Heights, as well as improving operations with signalization, climbing lanes and turning lanes as required.

This is the most recent study for the Highway 22 Corridor south of the Bow River in the Town of Cochrane that A.T. has requested an update to.

### **Highway 22 Functional Planning Study South of Highway 8 to Town of Cochrane South Corporate Limits**

Finalized in 2014, this study outlines interim and ultimate improvements to the Highway 1 / Highway 22 interchange and provides a functional planning and access management plan for the ultimate upgrading of Highway 22 between Highway 8 and the Town of Cochrane<sup>2</sup>.

While the report is primarily focused on improvements south of the Town of Cochrane border, general recommendations for Highway 22 include an upgrading to a four-lane arterial as an interim measure with an ultimate six-lane cross section and access management.

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<sup>2</sup> ISL Engineering and Land Services, Highway 22 Functional Planning Study South of Highway 8 to the Town of Cochrane South Corporate Limits



## Connecting Cochrane

Completed in 2017, the objective of this document was to provide an overall Transportation Master Plan for the Town of Cochrane to support future growth and inform land planning initiatives. The report incorporates numerous planning studies which were completed since the previous 2006 Transportation Master Plan with a focus on the four following themes<sup>3</sup>:

- Inform and support existing plans and policies
- Chart Cochrane's transportation future (explore the possibilities)
- Create plans for the four major modes of transportation (vehicles, bicycles, pedestrians and transit),
- Development implementation priorities and a short – and mid-term implementation plan.

Building on supporting documents, the focus of this report is on anticipated capital projects within the next 20 years which include the key elements of roads, pathways, cycling and transit. The report provides an overview expected population growth and demographics for the Town, and provides a comprehensive review of population density, employment and the existing transportation profile. Analysis and forecasting for existing and future horizons include details on intersection performance and potential upgrades to support future growth. Highway 22 (south of Highway 1A within the current study boundary) is included in the upgrades identified for the Town of Cochrane, with recommendations summarized below:

- Twin to four lanes to accommodate future highway volumes and realignment of the Highway 22 Bridge over the Bow River to improve connections to George Fox Trail and Griffin Road.
- Provide three full-movement at-grade intersections on Highway 22 south of the Bow River at **(Figure 2)**:
  - Rolling Range Drive with a connection to River Heights Lane;
  - Improve the existing connection at James Walker Trail; and,
  - New connection to the future Southbow neighborhood.

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<sup>3</sup> Connecting Cochrane Report, November 2017



Figure 2: New Intersections from Connecting Cochrane

### Memorandum - Rolling Range Transportation Network Assessment

Completed in August 2020, this Memorandum was initiated by the Town of Cochrane and provides technical information related to various intersection options along Highway 22, south of the Bow River. This Memo builds on the previous traffic analysis completed as part of the Connecting Cochrane work. The Memo provides an analysis of three at-grade intersection scenarios along the study corridor as follows:

- 1) Single access to Highway 22 at James Walker Trail/Fireside Gate
- 2) Two accesses to Highway 22 including two sub-scenarios
  - a. James Walker Trail/Fireside Gate and the Southbow access
  - b. James Walker Trail/Fireside Gate and Rolling Range Drive
- 3) Three accesses to Highway 22 (James Walker Trail/Fireside Gate, the Southbow access, and Rolling Range Drive).





The conclusions from this Memo indicated that at least two access points are required along Highway 22, south of the Bow River to service the anticipated growth of Cochrane beyond a population of 65,000 (the existing access at Fireside Gate and one additional access). The author also indicates a “strong preference” to have the additional access at Rolling Range Drive / River Heights Lane since it provides greater connectivity between existing and future development in Cochrane.

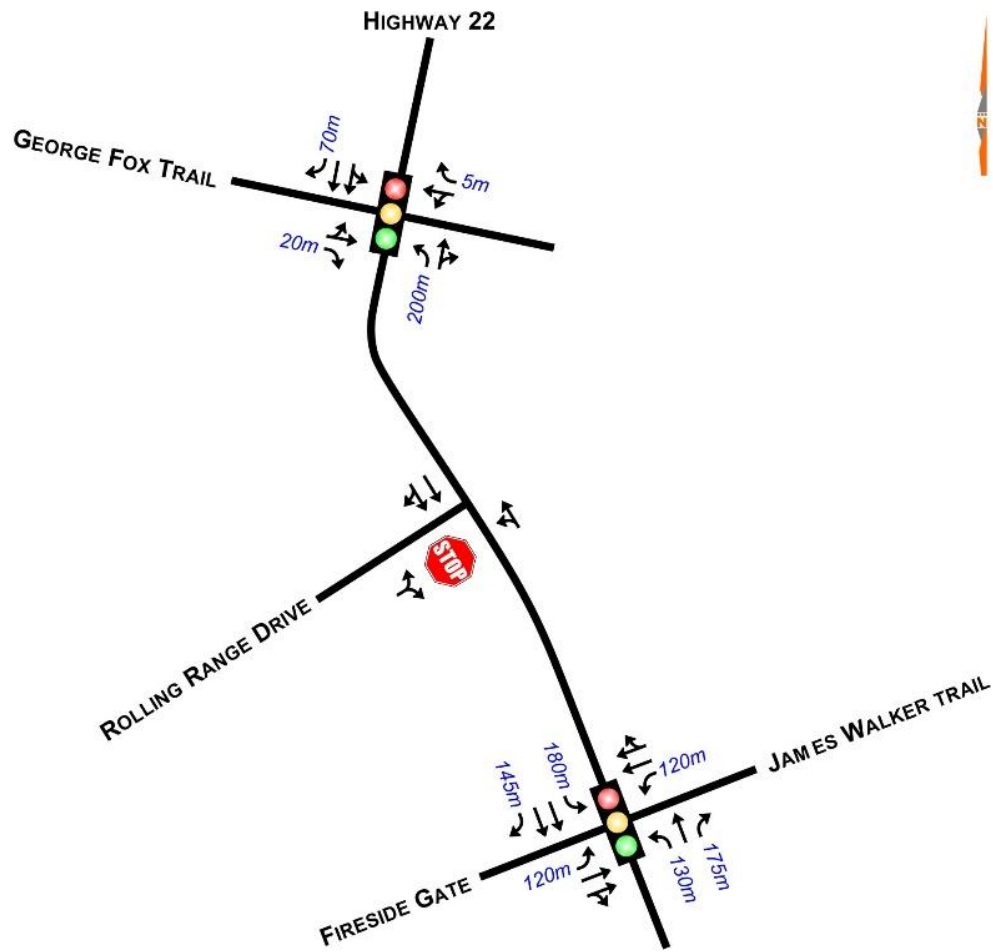


## 2.0 EXISTING CONDITIONS

### 2.1 Existing Road Network

The study boundary includes several key roadways within the Town of Cochrane boundary south of the Bow River. Details for each roadway of interest is provided below, accompanied by **Figure 3** which provides an overview of the existing lane configuration and intersection control.

- **Highway 22 |** is an intra-provincial level 2 highway oriented in a north / south direction within the study area. It is currently classified as a rural arterial undivided highway (RAU) with an anticipated future transition to an urban expressway divided road (UED) within the Town of Cochrane limits with a “multi-lane” roadside management classification. In the vicinity of the study area, Highway 22 is currently a three lane roadway with two southbound lanes and one northbound lane with a posted speed limit of 80 km/h.
- **George Fox Trail |** is a two-lane minor arterial road according to the Connecting Cochrane Transportation Master Plan (TMP). George Fox Trail currently connects with Highway 22 at a four-leg signalized intersection just south of the Bow River.
- **Rolling Range Drive |** is a two-lane secondary collector road according to the Town of Cochrane TMP. Rolling Range Drive currently connects with Highway 22 at a stop controlled T-intersection on the west side.
- **Fireside Gate / James Walker Trail |** is a divided four-lane arterial road within the Town of Cochrane, and currently connects with Highway 22 at a four-leg signalized intersection just north of the town limits. The existing lane configuration and traffic controls are summarized in **Figure 3**. Fireside Gate terminates west of Highway 22 into a roundabout T-intersection at Fireside Boulevard, and James Walker Trail currently continues northward as River Heights Drive at the James Walker Trail / River Heights Drive T-intersection.



**LEGEND:**  
XXm ↪ EFFECTIVE STORAGE LENGTH

**Schematic - Not To Scale**

Figure 3 Existing Lane Configuration and Traffic Controls



## 2.2 Highway Classification

Highway 22 is currently classified as a Level 2 highway within the vicinity of the Town of Cochrane, with a functional classification as a Rural Arterial Undivided (RAU) roadway<sup>45</sup>. Level 2 highways primarily connect provincially significant areas, including population centers over 5,000 and typically support long trips<sup>6</sup>. Highways with the designated RAU functional classification provide uninterrupted flow, supporting vehicular volumes of 500-10,000 vpd and a typical design speed of between 100 – 110 km/h<sup>6</sup>.

## 2.3 Existing Land Use

Areas adjacent to Highway 22 are generally characterized by either undeveloped or greenfield land or country residential developments within the Town of Cochrane. Existing land uses adjacent to Highway 22 within the study area are zoned Residential-Urban Reserve or Public Service (PS) including the communities of Towers Trail, Rolling Range Estates on the west side of Highway 22, and River Heights on the east side of Highway 22. **Figure 4** illustrates the existing land uses in the area.

Exceptions to the above land uses exist at the following locations:

- **George Fox Trail / Highway 22** | St Peter's Lutheran Church occupies the southwest quadrant of the intersection and Rangers Field occupies the northwest quadrant.
- **Fireside Gate / James Walker Trail / Highway 22** | land uses are generally built-out or planned for development as Commercial-Residential Mixed-Use development (C-R) on the northwest quadrant, General Industrial (M-1) and Highway Commercial (C-HWY) on the northeast quadrant and Public Service (PS) south of the intersection. Some General industrial (M-1) and Shopping Centre (C-SC) land uses also exist in the southwest quadrant east of the Public Service zoned area.

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<sup>4</sup> Provincial Highway Service Classification Map, [2017 Hwy Service Class Map.gws \(alberta.ca\)](#)

<sup>5</sup> Functional Classification – Existing Conditions Map, [Functional classification - existing conditions map - Open Government \(alberta.ca\)](#)

<sup>6</sup> Alberta Transportation Highway Geometric Design Guide, September 2020

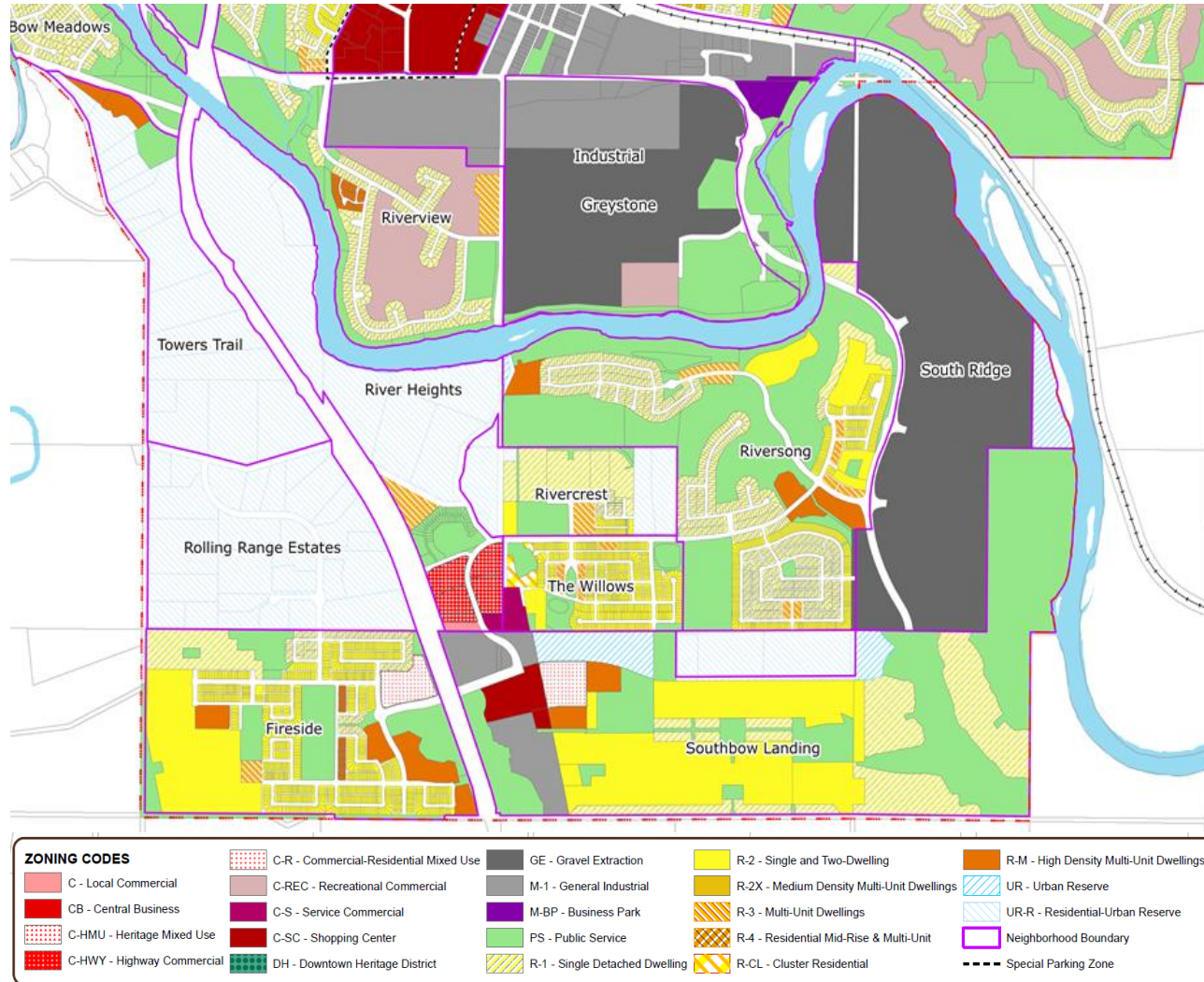


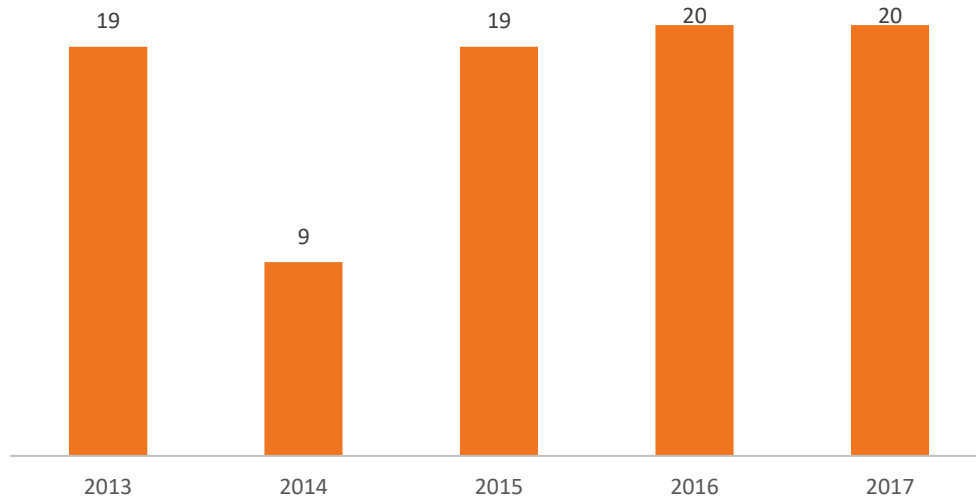
Figure 4 Existing Land Uses (Source: Town of Cochrane)



## 2.4 Safety Assessment

Existing collision data within the limits of the study was evaluated between the years of 2013-2017 (most recent set of data available) to understand the current collision trends within the study area and compare these with typical values for the province of Alberta. It is important to note that collisions with animals were excluded from the data set for analysis purposes.

Collisions by year are illustrated in **Figure 5** and are observed to be relatively consistent between the years of 2013-2017, except for 2014. This decrease in collisions during the year of 2014 is location specific and not observed in comparable statistics for the province of Alberta or the City of Calgary<sup>7</sup>.



**Figure 5: Collisions by Year**

While the collisions by year are noted to be quite consistent, seasonal variation is observed as presented in **Figure 6**, accompanied by typical seasonal variation patterns for the province of Alberta in **Figure 7**. Winter driving conditions during the months of October to February may account for an increased number of collisions, it is interesting to note the peak in February does not have a direct comparison from the province.

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<sup>7</sup> 2019 Traffic Collision Summary, City of Calgary, <https://pub-calgary.escribemeetings.com/filestream.ashx?DocumentId=151817#:~:text=The%20total%20number%20of%20collisions,in%202019%20compared%20to%202018.&text=The%20collision%20rate%20by%20vehicle,2019%20from%20392%20to%20399>.

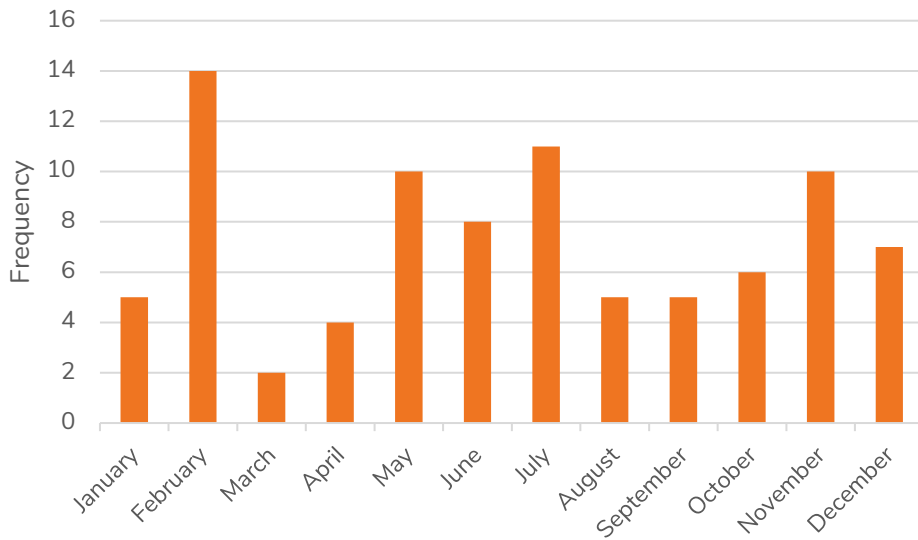


Figure 6: Collisions by Month

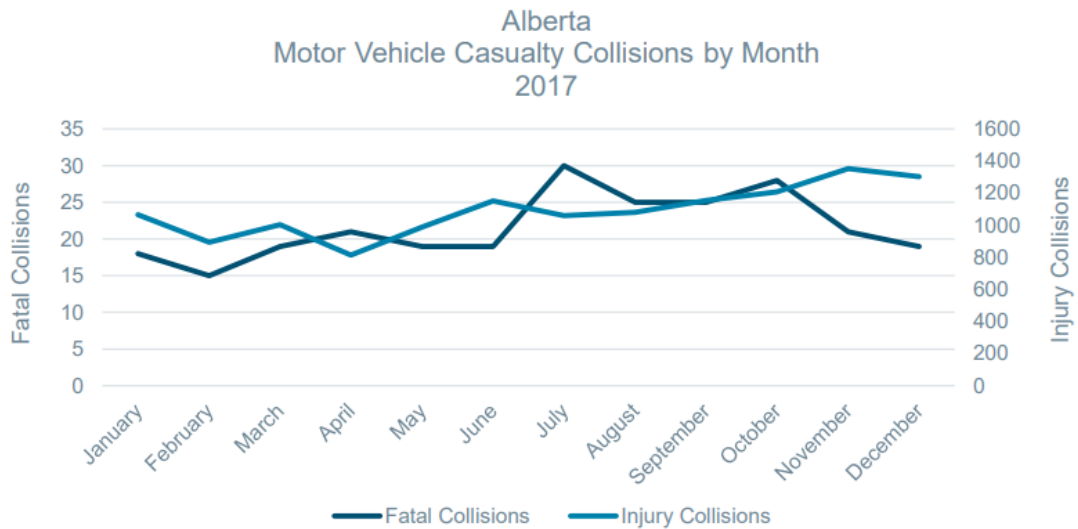
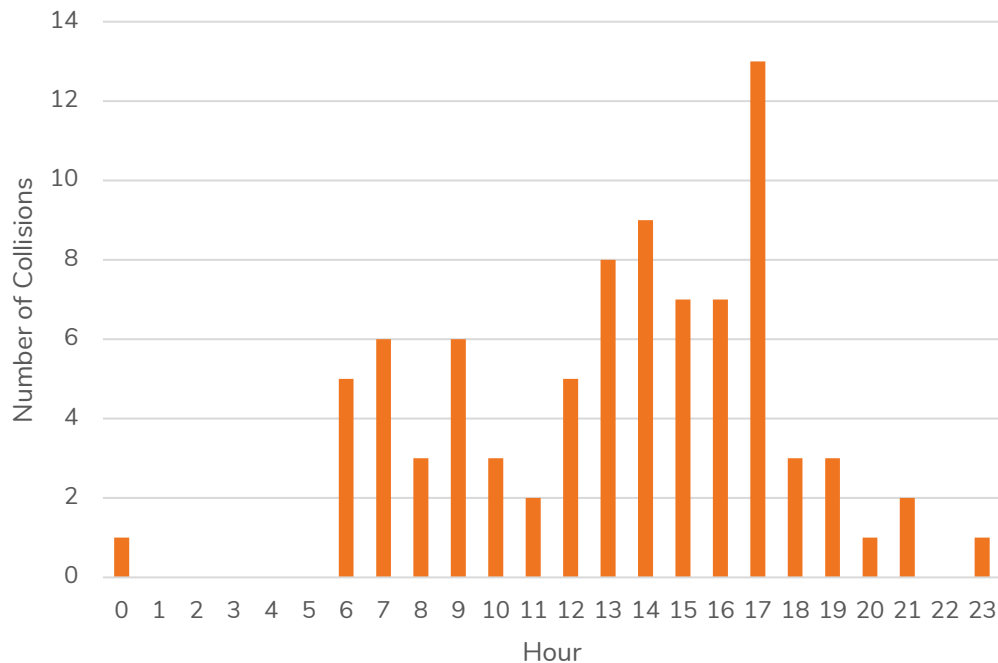


Figure 7: Collisions by Month in Alberta<sup>8</sup>

<sup>8</sup> Alberta Traffic Collision Statistics Summary, 2017, <https://open.alberta.ca/dataset/25020446-adfb-4b57-9aaa-751d13dab72d/resource/0caeccf2-4c4e-48b9-9bda-0dc306042599/download/trans-alberta-traffic-collision-statistics-summary-2017.pdf>



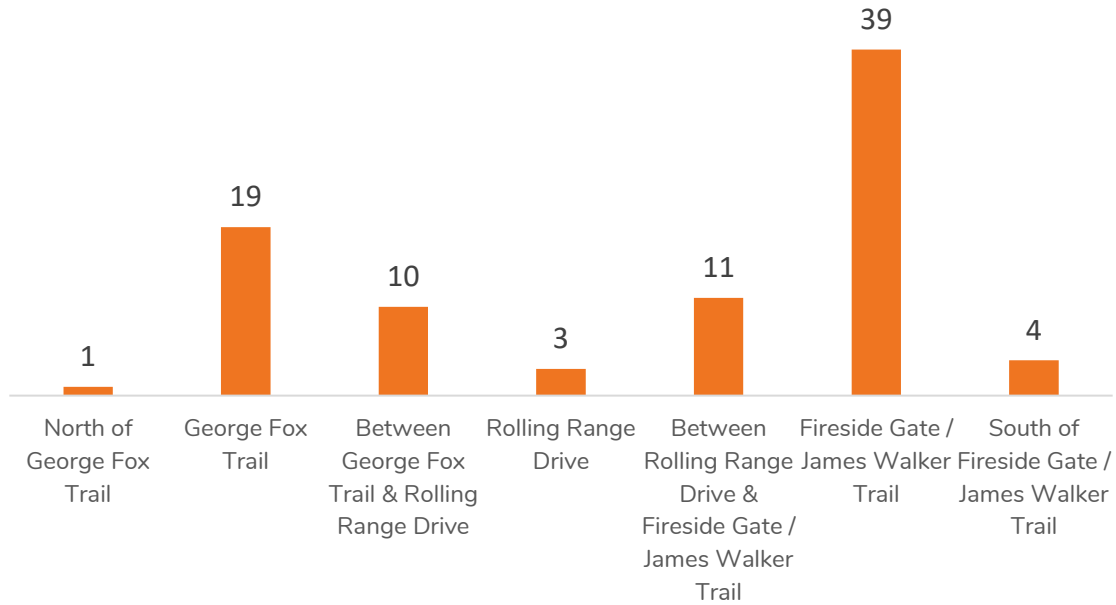
As expected, most collisions occur during the PM peak hour, during a time of low light and increased traffic as observed in **Figure 8**.



**Figure 8: Collisions by Time of Day**

Arranging the collisions by location provides an overall understanding of the distribution of collisions within the study boundary, as summarized in **Figure 9**. Observing the figure, it is interesting to note that the peak number of collisions (45%) occur at the intersection of Highway 22 and James Walker Trail, followed by the intersection of Highway 22 and George Fox Trail (22%). This was expected since these two intersections are signalized and have the highest traffic volumes entering/exiting the highway.





**Figure 9: Collisions by Location**

The collision types that occurred along the study corridor are summarized in **Figure 10**. It is noted that the highest collision type is rear-end followed by left turn opposing type crashes. This distribution pattern is typical for signalized intersections. The frequency of left-turn opposing collisions can be reduced through the use of protected-only left-turn phases at the signalized intersections. This is more critical for the northbound and southbound left-turn movements on Highway 22 where the speed of the opposing vehicles tend to be higher.

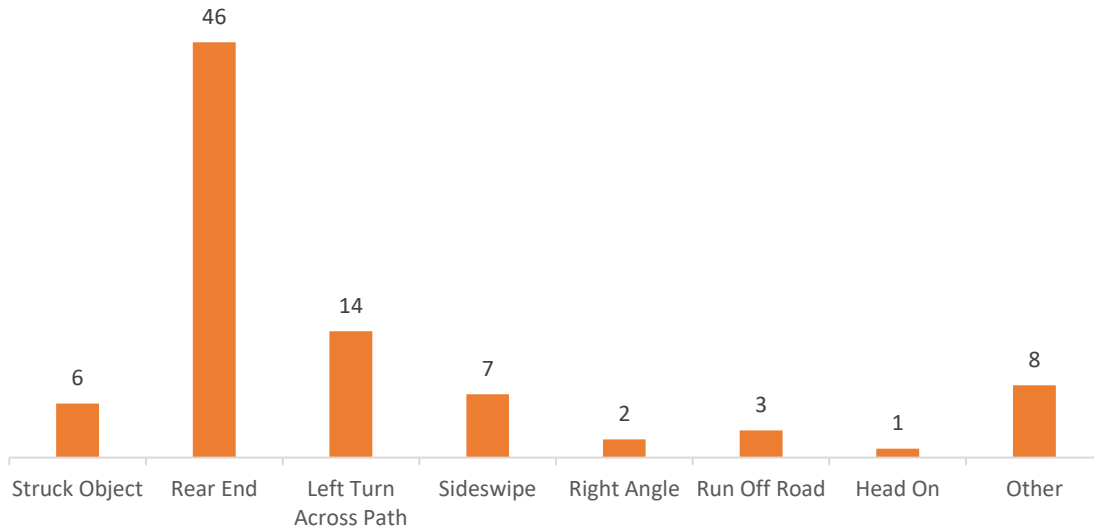


Figure 10: Collisions by Type

Figure 11 summarizes the severity of collisions observed within the study boundary, with 36% reported as injury and 63% property damage only. In contrast, comparable data for the province of Alberta reported 10% injury and 90% property damage only collisions for the same horizon years<sup>3</sup>.

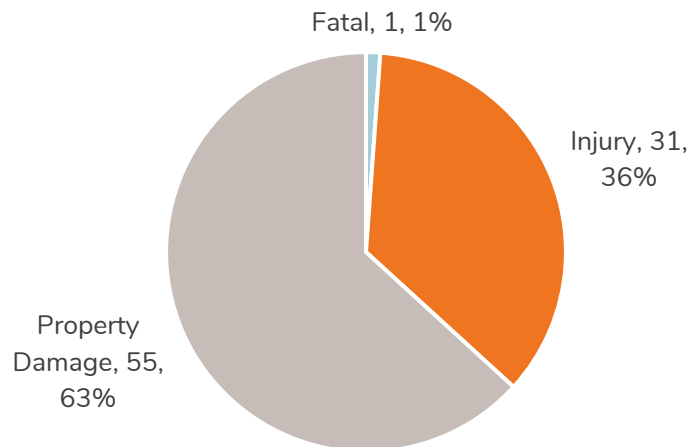


Figure 11: Collision Severity



The collective statistics for the study intersections and predominant collision type as illustrated in **Figure 10**, suggest that the study intersections would benefit from protected left turn phases and a reduced speed limit. Reducing the speed and increasing the number of through lanes is expected to reduce the high number of rear-end collisions.

## 2.5 Utilities

A utility assessment was completed for the updated Functional Planning Study of Hwy 22 based on the information available at the time of the study. From the existing Hwy 22 functional planning study, prepared by McElhanney in 2005, two (2) utility crossing had been identified in the portion of Hwy 22 being further refined in this report. The following is an excerpt from said report.

**Aquila** operates a 3-wire distribution powerline which crosses the highway along the road allowance. Since the line is situated within the road allowance, there is no cost to relocate this powerline.

**Altalink** has a major 5 wire power transmission lines on steel tower which cross the Highway. Relocating the steel tower must be avoided. If required, the cost to move the steel tower is the responsibility of the road authority and the estimated cost is \$140,000. Highway gradeline design should consider maintaining power line vertical clearance of 6.7 m.

At the next stage of the design process, a more comprehensive review of the existing utilities and potential relocation and cost would be required.

## 2.6 Drainage

Stormwater run-off from Highway 22 is divided into two (2) conditions. Drainage along the east side of the roadway generally follows natural drainage conditions and is not conveyed to a common point of discharge. Drainage on the west side of the roadway is conveyed via a ditch to the Bow River.

With the proposed widening of Hwy 22 being adjacent to the existing northbound carriageway, there are limited options for water quality controls to be implemented on the east portion of the right-of-way. Source control measures, such as slope armoring to limit erosion may be the most feasible measures to implement. To limit the volume of untreated water being shed, upstream design measures could be reviewed at the detailed design stage. These would include directing ditch flows to the westside via culvert; where it can be collected and detained in a wet pond (or Oil/Grit separator) prior to being discharged



into the river. A more detailed assessment of the stormwater runoff strategy can be undertaken at the next stage of the design process once the limits of construction are known.

Further review of the specific drainage routes on the east side will be required to determine if roadway drainage is entering any private lots. An increase in run-off volumes could trigger the requirement to obtain landowner permission for any parcels between the highway and the Bow River.

As the primary purpose of the proposed stormwater facility is water quality improvement and not flow attenuation, the design will focus on providing a dead storage volume equivalent to 25mm of run-off from the contributing area (this will include portions of the east carriage way which can be directed to the west ditch via culvert). The proposed stormwater facility will have a HWL footprint equivalent to 2ha as required by Alberta Environment (AENV). Flow out of the pond will be restricted such that proper detention period for sediment settlement can occur without washing into the outfall pipe. The location of the outfall from the pond to the river will need to be determined once the final pond configuration is determined.

## 2.7 Geotechnical Overview

A geotechnical desktop study was conducted as an office review of existing literature and previous geotechnical reports and recommendations. The Geotechnical overview was based on information included in the following reports:

- “Highway 22:16 and Highway 1A:06, Town of Cochrane Access Management and Functional Planning Study” prepared by McElhanney Consulting Services Ltd March 15, 2005, File No. 2511-00019-0;
- “Geotechnical Functional Planning Study, Highway 22:16 And Highway 1A:06, Cochrane, Alberta” prepared by EBA Engineering Consultants Ltd. October 10, 2003, File No. 5100626.002.

The above noted literature, satellite imagery of the area and street view images were reviewed. Updated geotechnical issues and potential areas of concern include:

### **Slope Stability and Active Sliding Movement**

- McElhanney report 2511-00019-0 identifies areas with existing sloughing and ongoing active slide movement. Specific areas noted on this report include km 10.00 to 10.30 and the approach to the Bow River on the east side of the existing highway. A significant amount of time has passed since the previous study



identifying the active slide, indicating there may have been additional movement of the slope.

- Prior to detailed design, slope inclinometer data should be reviewed to determine amount and extents of slope movement.
- Areas with large cuts or fills should have a stability analysis completed to ensure a satisfactory factor of safety is maintained with design geometry. Flatter slopes or retaining structures may be required in areas with active movement. Previous recommendations for backslope cut and fill slopes are 3H:1V.

### **Material Suitability**

- To prevent excessive or differential settlement to the existing highway, all sloughed material must be removed. Material to be removed includes any organics, topsoil, soft, loose, or wet material and material with excessive clay content.
- Areas with large cuts should be reviewed by qualified geotechnical personnel to determine material suitability as engineered fill.

Upon reviewing relevant existing geotechnical reports, geological data and imagery, it has been concluded the two main geotechnical challenges with design and construction of the Highway 22 expansion will be slope stability concerns and material suitability. All sloughed material must be removed to prevent excessive settlement and material used for fill placement must be inspected and approved before use.

## **3.0 FUTURE CONDITIONS**

### **3.1 Anticipated Land Development & Growth**

Considering the rapid population growth experienced by the Town of Cochrane in the past years, areas of current and future development are planned along both sides of the Highway 22 corridor from the Bow River to the southern boundary of the Town as illustrated in **Figure 12**<sup>9</sup>.

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<sup>9</sup> Town of Cochrane Municipal Development Plan, October 2008,  
<https://www.cochrane.ca/818/Neighbourhoods-documents-plans-maps>

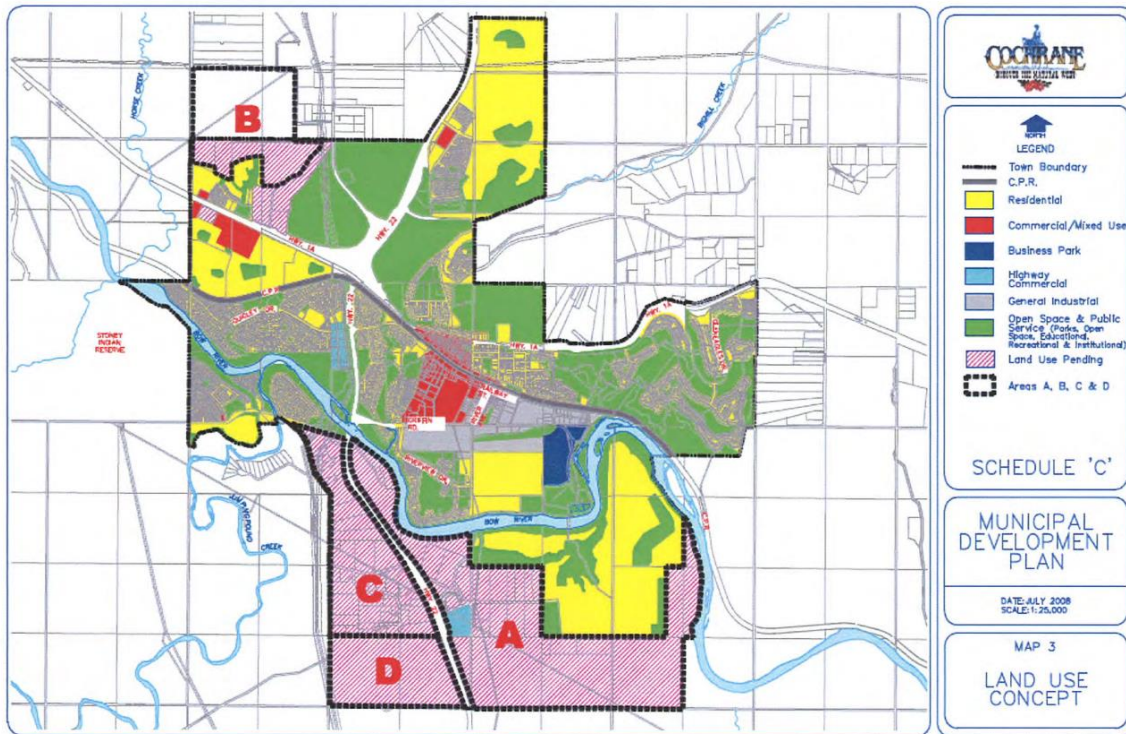


Figure 12: Town of Cochrane Future Growth

According to the proposed Rocky View County Municipal Development Plan, areas to the south of the Town of Cochrane border are identified as areas for future growth. **Figure 13**<sup>10</sup> provides an overview of these planned development areas, indicating that the areas between the study site and Calgary have been fully planned for anticipated development in the near future.

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<sup>10</sup> Municipal Development Plan, April 2011, Rocky View County, <https://www.rockyview.ca/new-municipal-development-plan>

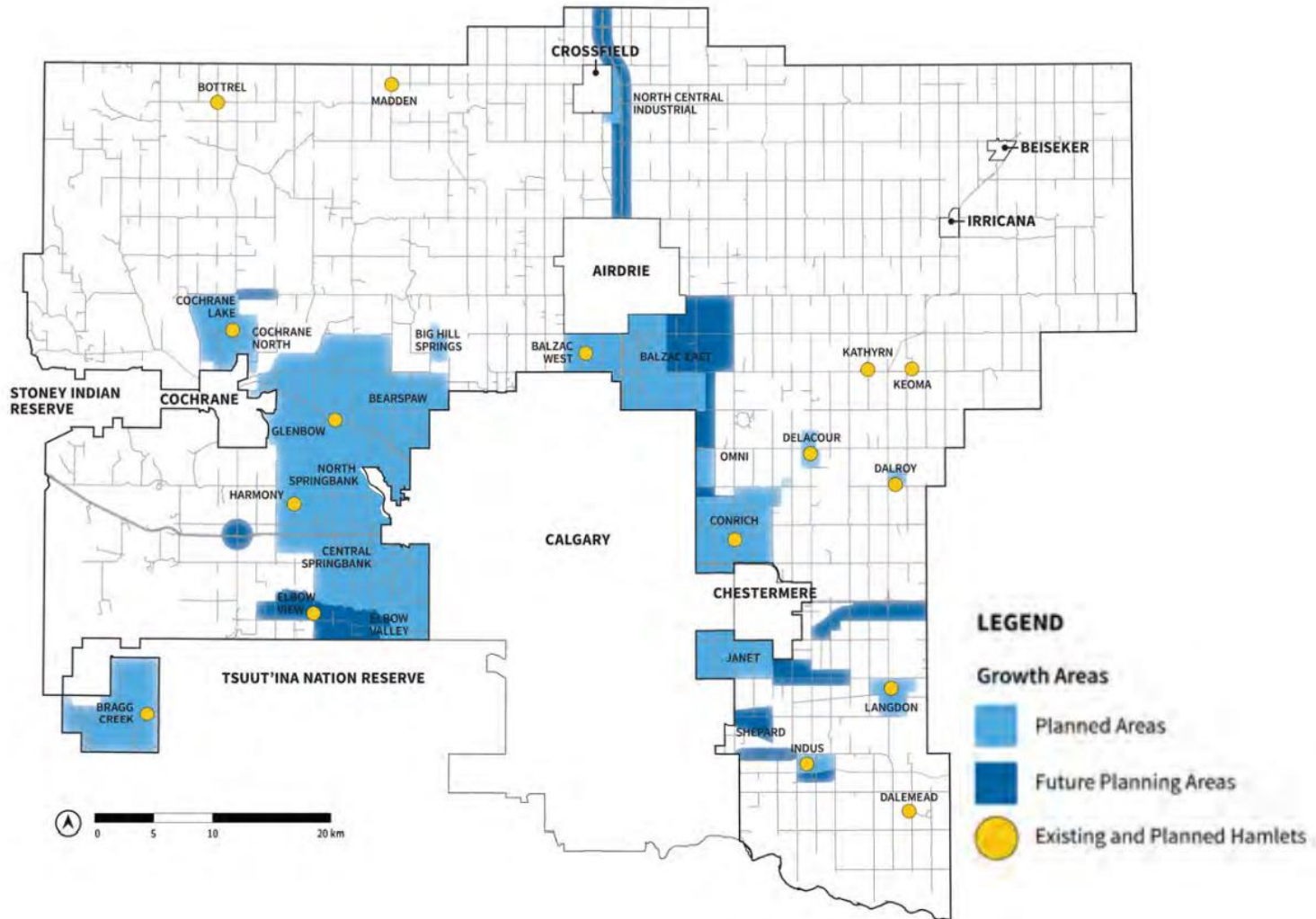


Figure 13: Rocky View County Growth Priority Area



### 3.2 Forecast Demand Model

A turning movement volume forecast was obtained from the forecast demand model for the Town of Cochrane<sup>11</sup> originally developed for the Connecting Cochrane TMP in 2014 and updated to include land use information from the Rolling Trails development.

The demand model assumes the following network improvements<sup>12</sup>:

- A new 4-lane Jack Tennant Bridge over the Bow River
- Highway 22 widened to 4-lanes throughout Cochrane
- Realignment of George Fox Trail at Highway 22 with Griffin Road (north of the Bow River)
- Installation of a Highway 22 and Highway 1A interchange (underway)
- Closure of Towers Trail connection to George Fox Trail
- New Towers Trail connection to new south access near the south Town Boundary
- New at-grade access at Highway 22 / Rolling Range Drive / River Heights Lane

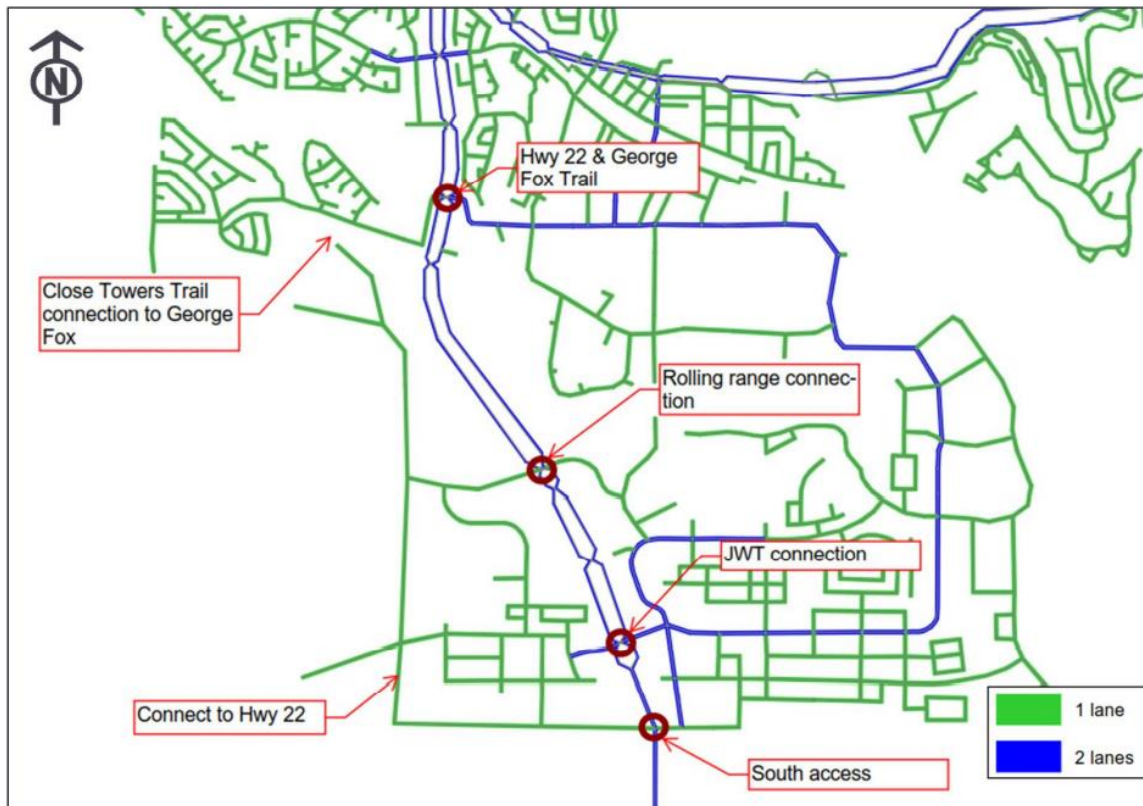
In addition, the updated network also assumes that Highway 22 intersections with Rolling Range Drive, and a new south access will be in place as 4-legged intersections with a 4-lane cross-section. It is also assumed that the existing Fireside Gate / James Walker Trail intersection would have a 4-lane cross-section. An overview of the traffic demand model network is illustrated in **Figure 14**. It is noted that the location of the South Access is now proposed beyond the Town of Cochrane limits as illustrated in the design drawings (**Appendix E**).

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<sup>11</sup> Urban Systems, June 2021, Highway 22 Traffic Volume Forecast

<sup>12</sup> Combined assumptions from the Connecting Cochrane document and Urban Systems Memo





**Figure 14 Town of Cochrane Travel Demand Network (Source: Urban Systems)**

The original 2014 TMP model assumed a long-term population of 65,000 people which was based on the Town of Cochrane Growth Management Strategy<sup>13</sup> and anticipated to occur by 2061. In August 2020 the land use assumptions in the original model were updated with land use information for all of the undeveloped lands in Cochrane south of the Bow River. This assessment includes additional build-out of lands outside of the Town's Growth Management Strategy, and no updates to the network were added to the model at this time. The new land uses suggest the full build-out of the Town would reach a population closer to 81,000.

In May 2021, updated land use assumptions for the proposed Rolling Trails redevelopment were provided by WATT to Urban Systems to update the land use characteristics of the existing Rolling Range Estates area. The model's network was also updated to close the Towers Trail connection at George Fox Trail and a new connection

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<sup>13</sup> May 2013



between Towers Trail and the South Access road. The updated model includes network improvements to Highway 22 intersections at Rolling Range Drive, James Walker Trail, and the future south access. The land use assumptions for the Rolling Trails development is included in **Table 1**. The resulting population and employment numbers due to the updated Rolling Trails land uses were estimated to be 6,893 people and 203 jobs in total.

**Table 1: Rolling Trails Land Use**

LAND USE	QUANTITY	UNIT
Single Family	1,560	Dwelling Units
Multi Family	1,056	Dwelling Units
Commercial (Retail)	50,000	sq. ft
Office/Light Industrial	3	Acres
Hotel	100	Rooms

Overall, the long term population assumed for the model increased from 65,000 people to 81,000 people as a result of the proposed developments in South Cochrane. The model was then run, and model growth from 2015 was applied to 2015 traffic volumes from the Connecting Cochrane TMP in order to determine future PM peak hour volumes. AM peak hour volumes were developed by taking the reciprocal of PM volumes at the intersection as per patterns from a review of Alberta Transportation traffic volumes. The long term peak hour traffic volumes developed from the model are provided in the Urban Systems memo as shown in **Appendix D**.

The updated model run by Urban Systems assumed that Cochrane’s long term growth would occur between 2050 and 2070. For this analysis, it was assumed the long term growth projection would be reached by 2050. Therefore, a growth factor equal to 3.5% annual growth over 10 years was applied to the northbound and southbound through movements, to reflect the additional growth projected to occur over the 10-year period from 2050 to 2060. The growth rate of 3.5% was chosen, which conservatively surpasses the annual growth rates of 3% to 1.5% assumed in the Town of Cochrane Growth Management Strategy after 2020, and is within the expected annual growth rate of 2-4% in the Connecting Cochrane TMP. 3.5% annual growth is also between the historic 5 and 10-year growth rates as shown in Section 3.0. Given the increase in population in the updated Town of Cochrane travel demand model from 65,000 to 81,000, no additional growth was assumed for all other movements, and build-out to this long-term population was assumed to occur by 2060.



The updated traffic demand model was used to estimate the future PM peak hour intersection turning movement volumes. AM peak hour volumes were developed by taking the reciprocal of PM volumes at the intersection as per patterns from a review of Alberta Transportation traffic volumes. The long term peak hour traffic volumes developed from the model are provided in **Appendix A**.

### 3.3 Historical Growth Rates

Historical average annual daily traffic (AADT) volumes for Highway 22 were collected from Alberta Transportation and a 5-year and 10-year annual growth rate was calculated. **Table 2** summarizes the calculated annual traffic growth rates from historical AADT at certain locations along the corridor. The growth rate including 2020 saw negative or flat growth in terms of the 5-year growth rate (2016-2020), and a 1.5% drop in the 10-year annual growth rate (2011-2020) compared to 2010-2019, due to the COVID-19 pandemic.

Without 2020, 10-year growth rates (2010-2019) ranged around 3-4% growth per year, 5-year growth rates (2015-2019) were lower at 2-3%, likely due to the 2015-2016 recession in Alberta. Further analysis was performed with the oldest available AADT data for Highway 22 for the study area, south and north of George Fox Trail. The 17-year growth rates (2003-2019) ranged around 4-5%, suggesting overall strong long-term growth despite recent growth trends.

**Table 2: Historical Annual Traffic Growth Rates for Highway 22**

LOCATION	10 YEAR GROWTH RATE		5 YEAR GROWTH RATE		17 YEAR GROWTH RATE
	2010-2019	2011-2020	2015-2019	2016-2020	2003-2019
South of Fireside Gate & James Walker Trail	N/A	N/A	1.94%	-0.81%	N/A
North of Fireside Gate & James Walker Trail	N/A	N/A	2.82%	-0.02%	N/A
South of George Fox Trail	4.43%	2.91%	3.12%	0.25%	5.42%
North of George Fox Trail	3.17%	1.77%	1.81%	-0.91%	4.53%



## 4.0 TRAFFIC ANALYSIS

### 4.1 Existing Traffic Operations

#### Traffic Volumes

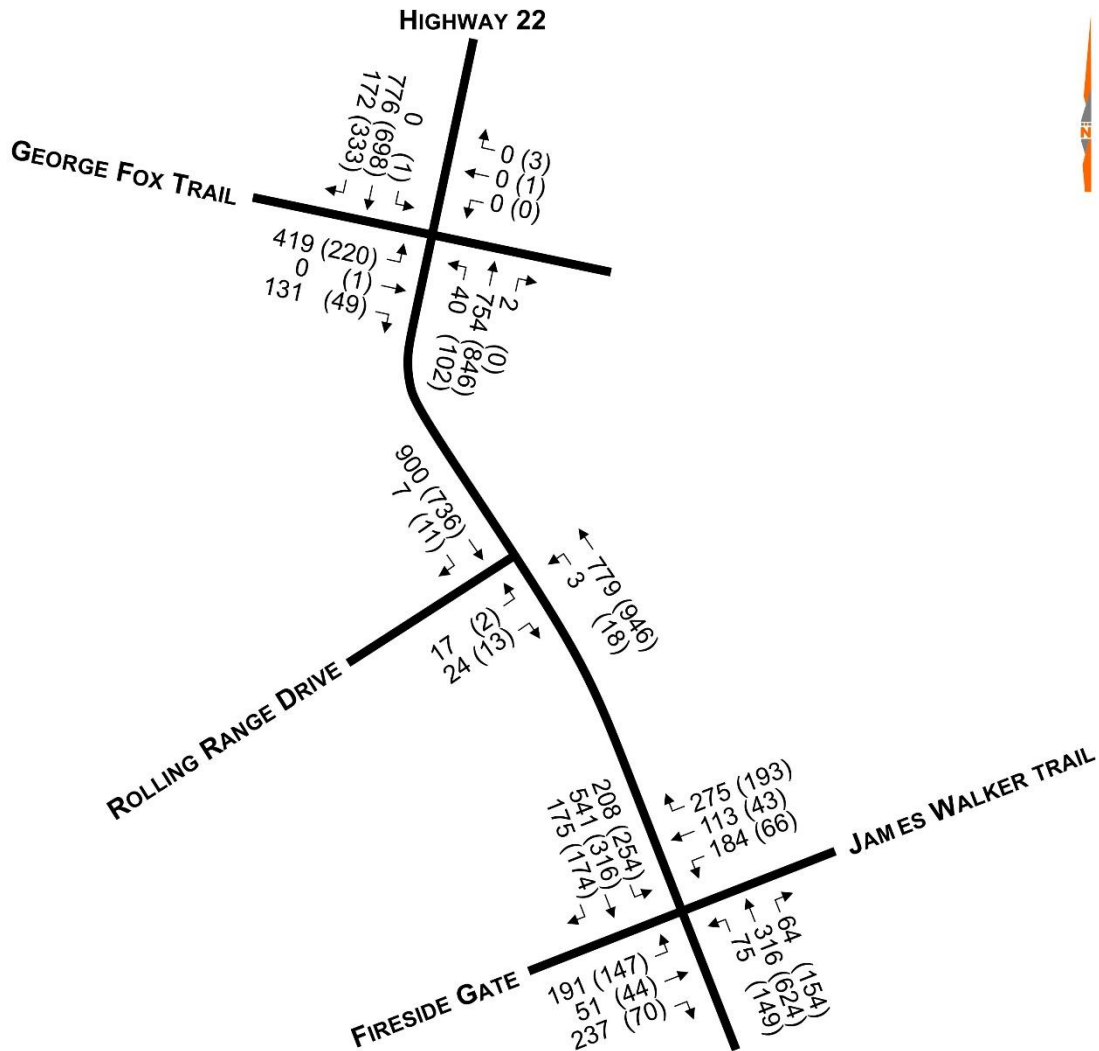
Existing peak hour turning volumes are based on information available from Alberta Transportation traffic counts and recent traffic studies completed in the area. A review of factored 2020 Alberta Transportation (AT) counts at George Fox Drive / Highway 22 showed a small decrease in traffic compared to 2019 AT factored counts due to the COVID-19 pandemic. To develop a conservative set of existing counts, the 2019 AT traffic counts at George Fox Trail and available 2019 turning movements at Rolling Range Drive and Fireside Gate / James Walker Trail were assumed to represent existing conditions. These turning movement volumes were balanced between the study intersections, with resulting turning movement volumes presented in **Figure 15**, complemented by complete counts in **Appendix B**.

**Table 2** illustrates the existing 2019 average annual daily traffic (AADT) volumes in vehicles per day (vpd) obtained from the AT and WATT turning movement counts.

**Table 3: Daily Traffic Volumes**

SEGMENT	EXISTING AADT (vpd)
North of George Fox Trail	20,860
George Fox Trail to Rolling Range Drive	16,690
Rolling Range Drive to Fireside Gate	15,260
South of Fireside Gate	13,400

The existing AADT currently surpasses the design AADT of 8,500vpd for a maximum tolerable LOS D for a Two-Lane Undivided Highway (Figure A-7-1a) in the Alberta Transportation Highway Geometric Design Guide, assuming 60% passing zones. This suggests that twinning would be warranted. In the case of a two-lane highway, twinning or passing lanes would be reviewed as potential options. As Highway 22 is currently a three-lane undivided road (two lanes southbound, one lane northbound), and is signalized at George Fox Trail and Fireside Gate, an intersection capacity analysis would be a more accurate measure of the need for additional lanes or additional measures such as passing lanes, as operations and LOS at the intersections would govern.



**LEGEND:**  
 XX (YY) → AM (PM) PEAK HOUR VEHICLE TURNING MOVEMENTS

**Schematic - Not To Scale**

Figure 15: Existing Turning Movement Volumes



## Intersection Performance and Evaluation Criteria

Operating conditions at each of the study area intersections were evaluated using Synchro/SimTraffic 11.0, which is based on the methodology outlined in the U.S Highway Capacity Manual<sup>14</sup>. For unsignalized intersections, the Level-of-Service (LOS) is based on the computed delays on each of the critical movements. LOS ‘A’ represents minimal delays for minor street traffic movements, and LOS ‘F’ represents a scenario with an insufficient number of gaps on the major street for minor street motorists to complete their movements without significant delays.

For signalized intersections, the methodology considers the intersection geometry, traffic volumes, the traffic signal phasing/timing plan and also pedestrian and cyclist volumes. The average delay for each lane group is calculated, as well as the delay for the overall intersection. The operating conditions can also be expressed in terms of volume-to-capacity (v/c) ratio. The signalized and unsignalized LOS criteria as summarized in HCM are also shown in **Table 4**.

**Table 4: Level of Service Criteria**

Level of Service (LOS)	Average Delay for UNSIGNALIZED Intersection Movements	Average Delay for SIGNALIZED Intersection Movements
A	0 – 10 seconds per vehicle	0 – 10 seconds per vehicle
B	> 10 – 15 seconds per vehicle	> 10 – 20 seconds per vehicle
C	> 15 – 25 seconds per vehicle	> 20 – 35 seconds per vehicle
D	> 25 – 35 seconds per vehicle	> 35 – 55 seconds per vehicle
E	> 35 – 50 seconds per vehicle	> 55 – 80 seconds per vehicle
F	> 50 seconds per vehicle	> 80 seconds per vehicle

According to the Alberta Transportation Highway Geometric Design Guide, the minimum LOS to be provided for a Level 2 Highway within a Large Metropolitan Area in both rural and urban contexts<sup>15</sup> is LOS D. This would apply to the northbound and southbound through volumes on Highway 22. The maximum Level of Service target for all other movements is LOS E. This maximum LOS was assumed, as driver expectations in an

<sup>14</sup> Transportation Research Board, National Research Council. Highway Capacity Manual 2000. Washington, D.C. 2000.

<sup>15</sup> Table A-6-1a, Alberta Transportation Highway Geometric Design Guide, September 2020



urbanizing or urbanized area would be lower when leaving or entering Alberta’s highway system to and from local roads.

### Existing Operating Conditions

Traffic volumes from **Figure 15** were analyzed on the existing transportation network using the Synchro 11.0 software, with intersection operating conditions presented in **Table 5**.

**Table 5 Existing Traffic Operations**

INTERSECTION / MOVEMENT			AM PEAK HOUR				PM PEAK HOUR			
			v/c Ratio	LOS	Delay (s)	Queue (m)	v/c Ratio	LOS	Delay (s)	Queue (m)
George Fox Trail / Hwy 22 (Signalized)	EB	Left/Through	0.90	D	44	108	0.57	C	25	47
		Right	0.22	A	6	13	0.09	A	1	2
	WB	Left/Through	0.00	A	0	0	0.00	B	15	1
		Right	0.00	A	0	0	0.01	A	0	0
	NB	Left	0.15	B	11	8	0.31	B	10	13
		Through/Right	1.07	E	73	184	1.00	D	50	194
	SB	Left/Through	0.90	D	38	88	0.68	C	22	62
		Right	0.34	A	5	13	0.47	A	4	16
	Intersection Summary			-	D	46	-	C	29	-
Fireside Gate / Hwy 22 (Signalized)	EB	Left	0.81	E	69	83	0.82	F	88	77
		Through/Right	0.63	B	19	23	0.36	C	32	20
	WB	Left	0.78	E	67	79	0.37	E	60	36
		Through/Right	0.78	C	29	38	0.65	C	24	23
	NB	Left	0.19	B	13	18	0.29	B	12	25
		Through	0.46	C	29	110	0.90	E	57	287
	SB	Right	0.10	A	0	0	0.22	A	4	14
		Left	0.39	B	14	45	0.54	C	23	76
		Through	0.34	C	21	74	0.18	B	14	37
	SB	Right	0.22	A	3	14	0.18	A	2	11
		Intersection Summary			-	C	28	-	C	33
Rolling Range Drive / Hwy 22 (Stop-Controlled)	EB	Left	0.36	E	49	12	0.06	C	18	1
		Right	0.36	E	49	12	0.06	C	18	1
	NB	Left/Through	0.00	A	0	0	0.03	A	1	1
		Through	0.38	A	0	0	0.31	A	0	0
	SB	Through/Right	0.20	A	0	0	0.16	A	0	0
		Intersection Summary			-	A	-	-	A	-

As shown in **Table 5**, the study intersections operate at an overall acceptable level of service (LOS), with the signalized intersections operating at LOS D or better, and the unsignalized intersection of Rolling Range Drive operating at LOS A. The lower levels of service at George Fox Trail and James Walker Trail may be caused by the single northbound lane on Highway 22 and traffic volumes in the vicinity of that location.



The northbound through / right movements at George Fox Trail / Highway 22 operate at LOS E in the AM peak hour, and v/c ratios of 1.07 and 1.00 in the AM and PM peak hour suggesting the movement is currently operating at or over capacity. At Fireside Gate / Highway 22, the northbound through lane is operating at LOS E during the PM peak hour, which is most likely due to limited capacity with a single northbound lane. The minor leg movements at the intersections are observed to operate at acceptable LOS for an urban or urbanized setting, with the exception of the eastbound left turn movement at Fireside Gate / Highway 22 which operates at LOS F during the PM peak hour.

Retiming the traffic signal at George Fox Trail / Highway 22 and Fireside Gate from the existing timing can improve the level of service in the northbound through / right lane to an acceptable LOS as presented in **Table 6**.

**Table 6 Existing Traffic Operations – Retimed Signals**

INTERSECTION / MOVEMENT			AM PEAK HOUR				PM PEAK HOUR			
			v/c Ratio	LOS	Delay (s)	Queue (m)	v/c Ratio	LOS	Delay (s)	Queue (m)
George Fox Trail / Hwy 22 (Signalized)	EB	Left/Through	0.96	E	66	155	0.75	D	42	65
		Right	0.24	B	13	24	0.12	A	2	3
	WB	Left/Through	0.00	A	0	0	0.00	B	20	1
		Right	0.00	A	0	0	0.01	A	0	0
	NB	Left	0.12	B	11	9	0.26	A	7	11
		Through/Right	0.91	D	37	231	0.86	C	23	181
	SB	Left/Through	0.82	D	40	109	0.53	B	16	54
		Right	0.32	A	5	15	0.41	A	3	14
	<b>Intersection Summary</b>			-	D	39	-	B	18	-
Fireside Gate / Hwy 22 (Signalized)	EB	Left	0.83	E	68	84	0.76	E	75	68
		Through/Right	0.60	B	17	22	0.34	C	30	19
	WB	Left	0.82	E	68	82	0.35	D	54	33
		Through/Right	0.76	C	26	35	0.63	C	22	22
	NB	Left	0.19	B	12	16	0.28	B	12	25
		Through	0.46	C	27	99	0.88	D	52	286
		Right	0.09	A	0	0	0.22	A	4	15
	SB	Left	0.41	B	13	39	0.58	C	22	70
		Through	0.36	C	20	67	0.19	B	15	37
		Right	0.23	A	3	13	0.19	A	2	12
	<b>Intersection Summary</b>			-	C	27	-	C	31	-

It is noted that the adjusted signal timings have increased the queue lengths, v/c ratio and delay for the minor roadways while the overall LOS and intersection operations have improved. Retiming the traffic signal at Fireside Gate / Highway 22 was found to improve the level of service in the PM peak hour for the eastbound left and northbound through/right lane to an acceptable LOS E and C, with marginal changes to other intersection performance measures.





## 4.2 2060 Traffic Volumes

The Town’s long term transportation model assumed that the population would increase to 81,000 within the 2050 to 2070 time frame. To be conservative, it was assumed it would be achieved by 2050. To estimate the 2060 traffic volumes along Highway 22, a 3.5% annual growth factor was applied over 10 years to the northbound and southbound through movements.

The 3.5% growth rate was chosen based on historical growth patterns along Highway 22 and growth assumptions from the Town’s Growth Management Strategy. This growth rate is also consistent with the expected annual growth rate of 2-4% in the Connecting Cochrane TMP. Given the increase in population in the updated Town of Cochrane travel demand model from 65,000 to 81,000, no additional growth was assumed for all other movements, and build-out to this long-term population was assumed to occur by 2060.

**Table 7** summarizes the anticipated two-way AADT in vehicles per day by 2060 and provides a comparison to existing AADT values along Highway 22.

**Table 7 2060 Daily Volumes**

SEGMENT	Existing AADT (2019)	Future AADT (2060)
North of Rolling Range Drive	16,690	33,000
Rolling Range Drive to Fireside Gate	15,260	26,000
Fireside Gate to South Town Access	13,400	24,000
South of South Town Access	-	26,000

**Figure 16** provides an overview of turning movement volumes applied in the 2060 horizon operating conditions.

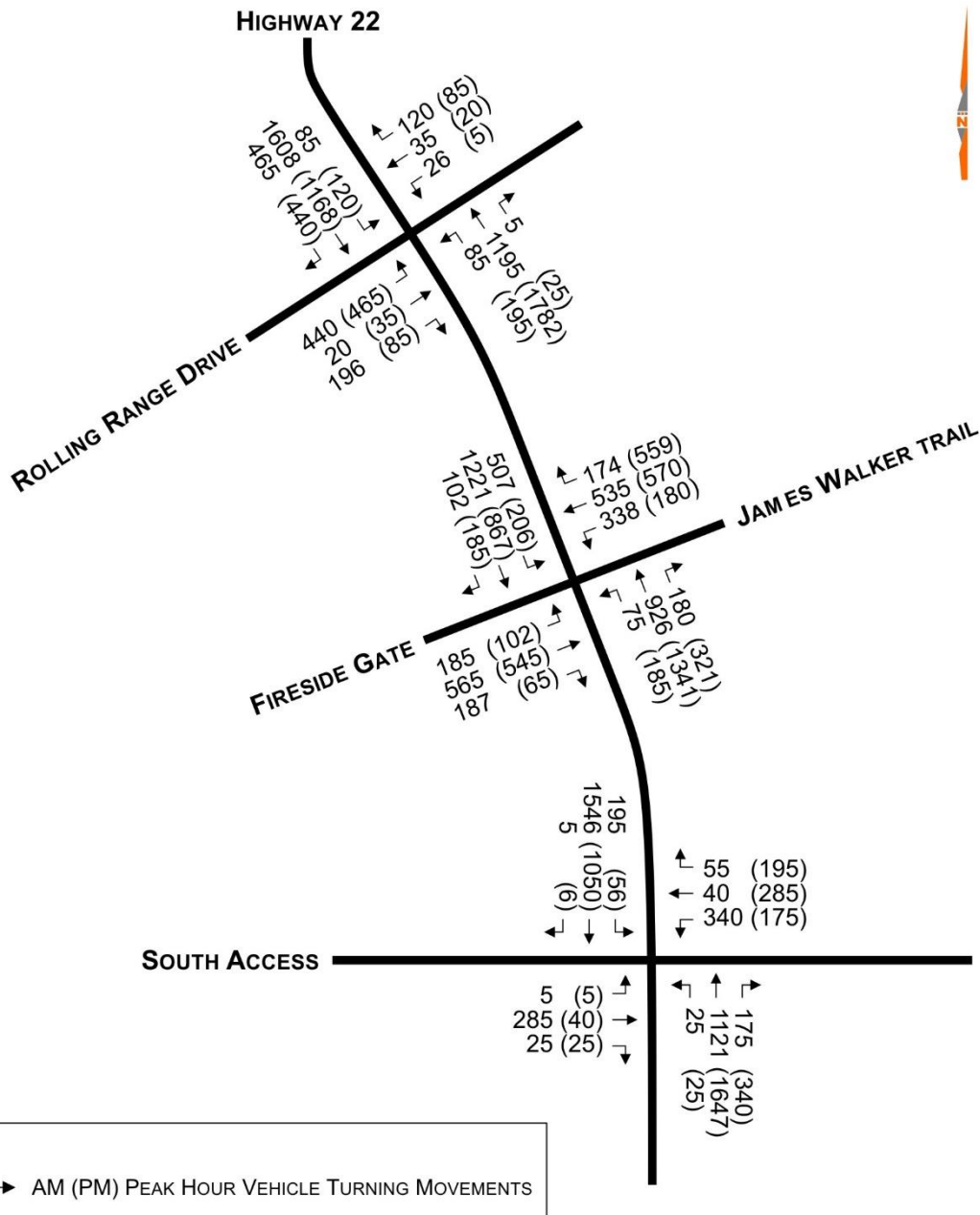


Figure 16 Future Traffic Volume Forecast, 2060 Horizon



### 4.3 2060 Intersection Alternatives

Based on the expected turning movement volumes presented in **Figure 16** for the 2060 horizon, numerous geometric design alternatives were explored for each study intersection to identify the most suitable option. Capacity analysis was completed for each intersection alternative, with the resulting operating conditions evaluated through a multiple account evaluation (**Section 5.3**) to determine the most suitable intersection option. **Sections 4.3.1** through **4.3.3** provide an overview of the analysis results and expected traffic operating conditions for each of the design alternatives.

#### 4.3.1 Signalized Intersections

Signalization was considered as a base scenario for each of the three study intersections. Intersection capacity analysis was evaluated using the Synchro 11.0 software package and turning movement volumes presented in **Figure 16**, on the expected 2060 transportation network as outlined in **Section 3.0**. Results of this analysis are summarized in **Table 8**, with detailed capacity analysis reports in **Appendix B**. Anticipated improvements assumed during the analysis include:

- Six lane cross section along Highway 22.
- All study intersections upgraded to traffic signals.



**Table 8: Ultimate (2060) Traffic Operations**

INTERSECTION / MOVEMENT			AM PEAK HOUR				PM PEAK HOUR				
			v/c Ratio	LOS	Delay (s)	Queue (m)	v/c Ratio	LOS	Delay (s)	Queue (m)	
Fireside Gate / Hwy 22 (Signalized)	EB	Left	0.71	E	79	45	0.48	E	68	26	
		Through	0.87	E	70	118	0.80	E	59	100	
		Right	0.43	B	10	25	0.15	A	1	0	
	WB	Left	0.79	E	74	74	0.68	E	73	42	
		Through	0.65	D	51	101	0.80	E	57	104	
		Right	0.12	A	0	0	0.40	A	1	0	
	NB	Left	0.45	E	71	46	0.51	D	53	83	
		Through	0.82	D	55	124	0.89	D	49	164	
		Right	0.36	A	7	19	0.50	B	12	47	
	SB	Left	0.91	E	77	136	0.42	E	56	46	
		Through	0.80	D	46	153	0.72	D	47	105	
		Right	0.18	A	3	7	0.34	A	6	19	
<b>Intersection Summary</b>			-	<b>D</b>	<b>52</b>	-	-	<b>D</b>	<b>43</b>	-	
Rolling Range Drive / Hwy 22 (Signalized)	EB	Left	0.89	E	79	102	0.88	E	78	106	
		Through	0.05	D	47	14	0.08	D	44	21	
		Right	0.46	A	9	24	0.18	A	2	3	
	WB	Left	0.14	D	40	14	0.03	D	41	5	
		Through	0.31	E	73	24	0.18	E	70	17	
		Right	0.51	B	11	12	0.34	A	3	0	
	NB	Left	0.47	E	71	47	0.62	E	63	90	
		Through	0.60	C	31	135	0.89	D	43	235	
		Right	0.59	E	80	47	0.55	E	70	61	
	SB	Through	0.85	D	41	208	0.67	D	39	139	
		Right	0.33	A	1	0	0.31	A	1	0	
		<b>Intersection Summary</b>			-	<b>D</b>	<b>37</b>	-	-	<b>D</b>	<b>42</b>
South Access / Hwy 22 (Signalized)	EB	Left	0.06	E	62	6	0.07	E	66	6	
		Through	0.82	E	61	120	0.33	D	40	24	
	WB	Left	0.87	E	74	90	0.63	E	70	41	
		Through	0.06	C	26	17	0.75	E	61	110	
		Right	0.09	A	0	0	0.43	A	10	25	
	NB	Left	0.26	E	64	18	0.06	D	45	17	
		Through	0.74	D	41	140	0.96	D	55	216	
		Right	0.30	A	6	18	0.47	A	7	34	
	SB	Left	0.59	E	60	43	0.07	D	44	15	
		Through	0.81	D	37	212	0.61	D	36	113	
	<b>Intersection Summary</b>			-	<b>D</b>	<b>43</b>	-	-	<b>D</b>	<b>44</b>	-

As illustrated in **Table 8**, the study intersections are observed to provide an overall LOS D or better, with select movements experiencing LOS E. A maximum v/c ratio of 0.96 is observed for northbound through traffic at the South Access during the PM peak hour. Results presented in **Table 7** reflect the expected operating conditions under the assumed network improvements. These include the addition of single and dual left turn lanes as required, updates to the phase settings and protected phases.



Thresholds outlined by Alberta Transportation indicate a minimum LOS D be provided for all turning movements at each intersection, with the potential to consider geometric alternatives should any movement experience a LOS below this threshold. Observing **Table 8**, each study intersection is expected to experience movements with LOS E in the 2060 horizon, providing the opportunity to consider alternate intersection configurations.

### Signal Warrants

It is important to note that an analysis of signal warrants at the Rolling Range Drive intersection and proposed new South Access (Southbow) intersection was performed based on the expected 2060 turning movement volumes presented in **Figure 16**. Signal warrant sheets for these two intersections are available in **Appendix C**. Analysis indicates that signals are warranted at both intersections in the 2060 horizon; however, it is recommended that these intersections be assessed as part of future development applications to confirm when the signals would be warranted.

#### 4.3.2 Roundabouts

According to the Alberta Transportation Design Bulletin 68/2010, roundabouts should be considered as a “first option for intersection designs where....a greater degree of traffic control than a two way stop is required on a paved roadway”. Considering the context of the Highway 22 corridor through the Town of Cochrane, roundabouts were explored as a complementary analysis to signalized intersections.

To assess the suitability of roundabouts as alternatives for the at-grade intersections, capacity analysis was completed using the SIDRA software package and turning movement volumes presented in **Figure 16** (see SIDRA reports in **Appendix B**). Analysis suggests that two-lane roundabouts will not meet the minimum LOS during peak hours. Various configurations of roundabouts were considered for each location, including right-turn slip lanes and three-lane roundabout options; however, analysis indicates that minor street traffic experience heavy congestion due to the high north / south through volumes along the corridor. Due to the expected congestion on the east/west approaches, roundabouts were not pursued as a viable alternative to signalization in the long term horizon.



### 4.3.3 Alternative Left Turn Options

Based on the analysis results presented in **Section 4.3.1**, signalized intersections are the preferred option for the three intersections of Rolling Range Drive, Fireside Gate, and the South Access with Highway 22; however, several options exist for accommodating the high left turn volumes and improving overall signal operations. Three alternative left-turn designs were evaluated, including a jughandle, displaced left turn, and a Michigan left turn; each of these are discussed in detail in the following sections. It is noted that the various left-turn treatment options are considered long-term improvements and would not be required until the 25+ year horizon. The purpose of this exercise is to determine whether other innovative left-turn treatments are feasible within the proposed 70m ROW.

#### Jughandle

The first type of displaced left turn considered for the intersections of Rolling Range Drive and the South Access includes a loop ramp, where left turning vehicles travel through the intersection and exit to the right before merging with the opposing traffic stream and completing the left turn movement as illustrated in **Figure 17**.

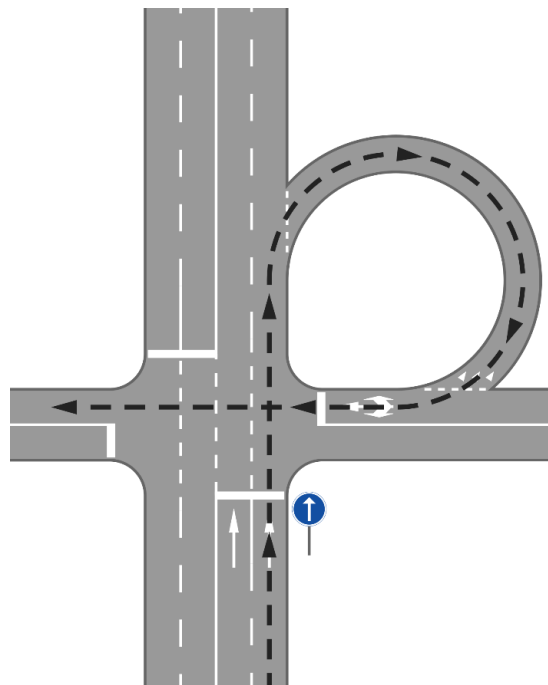


Figure 17: Jughandle Schematic

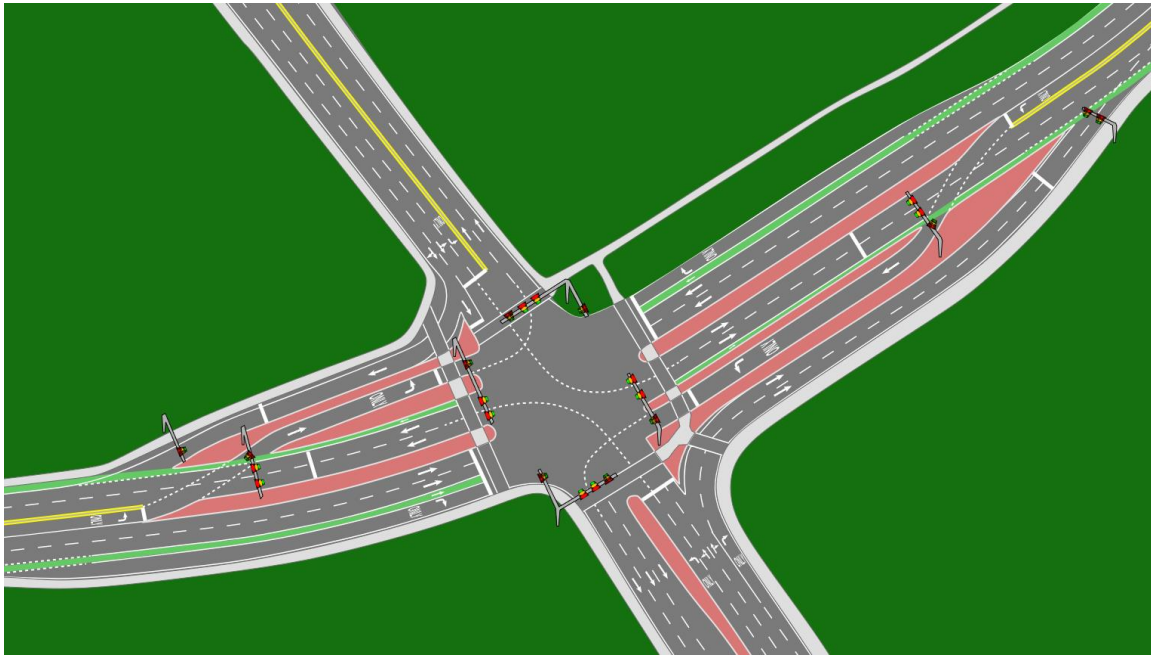


This type of displaced left turn requires a significant amount of ROW which may exceed the anticipated 70 m corridor provided for Highway 22; however, the potential for this type of intersection was considered at the intersections of Rolling Range Drive (eastbound left turn) and the South Access (westbound left turn) since there appeared to be ROW available in the respective intersection quadrants to accommodate a jughandle.

Capacity analysis was completed for the two potential jughandles at the Rolling Range Drive and the South Access. The results indicated that the jughandles would provide traffic operational benefits at both intersections compared to standard intersection configurations, with significant benefits for the South Access (see complete Synchro reports in **Appendix B**).

### **Displaced Left Turn**

The second left turn design alternative considered feasible for all intersections is the displaced left turn, while this type of intersection has not been constructed in Alberta, there are several examples in the United States. The displaced left turn configuration directs left turning vehicles to the far-right side of the roadway, with an upstream signal to meter the queue. Left turning vehicles are then permitted to complete the turn during the green phase for oncoming traffic and are removed from the analysis of the main signal. This type of configuration presents a reduced number of conflict points at the intersection as illustrated in **Figure 18**.



**Figure 18: Displaced Left Turn Schematic**

While this configuration introduces an upstream signal (and associated cost) to direct the left turning traffic, it improves overall intersection operating conditions and safety at the main intersection.

Displaced left turn options along Highway 22 (north and south of the intersection) were considered for all the study intersections, with the intersections of Fireside Gate / James Walker Trail and the South Access observed to experience the most significant improvement to operating conditions compared to the standard intersection control.

At the intersection of Fireside Gate / James Walker Trail, eastbound and westbound left turning traffic are still expected to experience congested conditions (LOS E) during the AM peak hour; however, all other movements operate at a LOS D or above, which indicates an improvement from the standard left-turn design.

Similarly, all turning movements at the South Access operate at a LOS D or above, with an overall LOS C and B in the AM and PM peak hours respectively. A maximum v/c ratio of 0.79 occurring for eastbound through traffic in the AM peak hour, which indicates additional capacity for future traffic.

High north / south through traffic volumes at the intersection of Rolling Range Drive, combined with a high eastbound left turn volume provide opportunity for improving on the standard intersection configuration, with displaced left turns considered along the





north / south approaches as well as on the west approach. While the displaced left turn along the minor road (west approach) is observed to improve operating conditions to a LOS D or better for all movements, it would require additional ROW along the minor road.

Providing a displaced left turn for northbound and southbound left turning vehicles at the intersection of Rolling Range Drive improves the overall intersection to LOS C during the AM and PM peak hours, with only eastbound left and westbound through vehicles experiencing a LOS E during the AM and PM peak hours.

### Michigan Left Turn Option

Given the wide median at the intersections of Fireside Gate / James Walker Trail and the South Access, there is potential to consider a Michigan left turn option as illustrated in **Figure 19**. This left turn alternative directs left turning traffic through the intersection to complete a U-turn and merge with the opposing traffic stream to complete a right turn movement. The U-turn option was analyzed under free-flow condition, where left turning vehicles would yield to the oncoming traffic before weaving to the right to complete the turning movement.

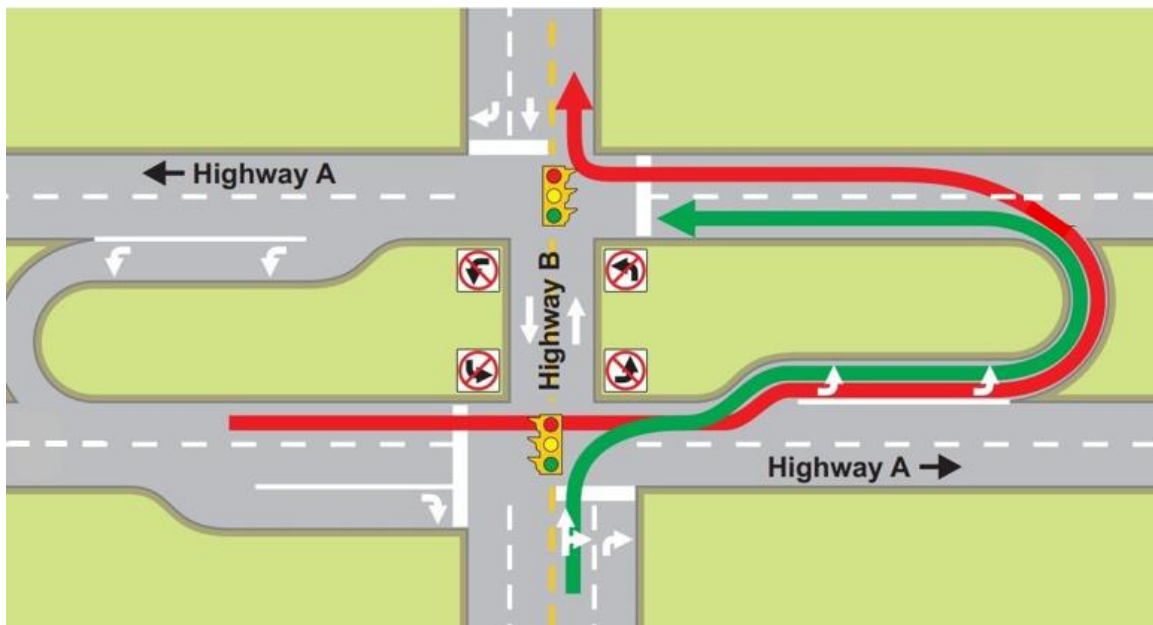


Figure 19: Michigan Left Turn

As illustrated in **Figure 19**, this option increases the through volume at the main intersection, with all left turning vehicles along Highway 22 directed through the intersection to a U-turn, before traveling back through a weaving section and completing



a right turn movement. Observing the expected high north / south through volumes along the corridor, the Michigan left turn option as applied both north and south of the intersection is not observed to improve operating conditions at either Fireside Gate / James Walker Trail or the South Access.

#### 4.3.4 Interchanges

Although there is potential to design interchanges at the three study intersections to accommodate traffic in future horizons, this option was not considered due to ROW constraints with existing development and the Town's preference to shift Highway 22 corridor to a more urban environment within the Town limits.

Additionally, interchanges are not required at any of the proposed access locations to meet A.T.'s traffic operational requirements. The at-grade intersections are more conducive to an urban environment and are more consistent with the Town's long-term transportation network as indicated in *Connecting Cochrane*.



## 5.0 DEVELOPMENT AND EVALUATION OF ALTERNATIVES

### 5.1 Design Criteria

Within the limits of the study area, Highway 22 is currently classified as a rural arterial undivided (RAU) level 2 highway. The future designation of Highway 22 is anticipated to be an urban expressway divided (UED) road within the Cochrane town limits.

A UED-614.1-80 design classification was chosen based on the future designation. The design criteria are provided in **Table 9**.

**Table 9: Highway 22 Design Criteria**

ITEM	HIGHWAY 22
<b>General</b>	
Design Classification - Ultimate	UED-614.1-80
Design Speed (km/h)	80
Posted Speed (km/h)	70
Largest Design Vehicle	WB-36
<b>Horizontal Geometry</b>	
Centre Radius (m) per Table B.3.5.3b (AT Highway Geometric Design Guide)	400 minimum
Curve radius at the intersection is based on the turning template of the design vehicle.	
<b>Vertical Geometry</b>	
Max. Grade (%)	6
Min. Stopping Sight Distance (m) per Table B.2.3A (AT Highway Geometric Design Guide)	130
Min. Decision Sight Distance (m) per Table B.2.4 (AT Highway Geometric Design Guide)	270 - 315
Min. Crest Curve (k value)	26
Min. Sag Curve (k value)	17
<b>Cross Section Elements</b>	
Through Lane (m)	3.7
Shoulder Width (m)	3 (outside)
Median (m)	6
Sideslope Ratio	4:1

In alignment with the standards outlined by Alberta Transportation, designs include a 70 m right-of-way and a barrier style median of 6 m.

The ultimate cross-section is provided in **Figure 20**.

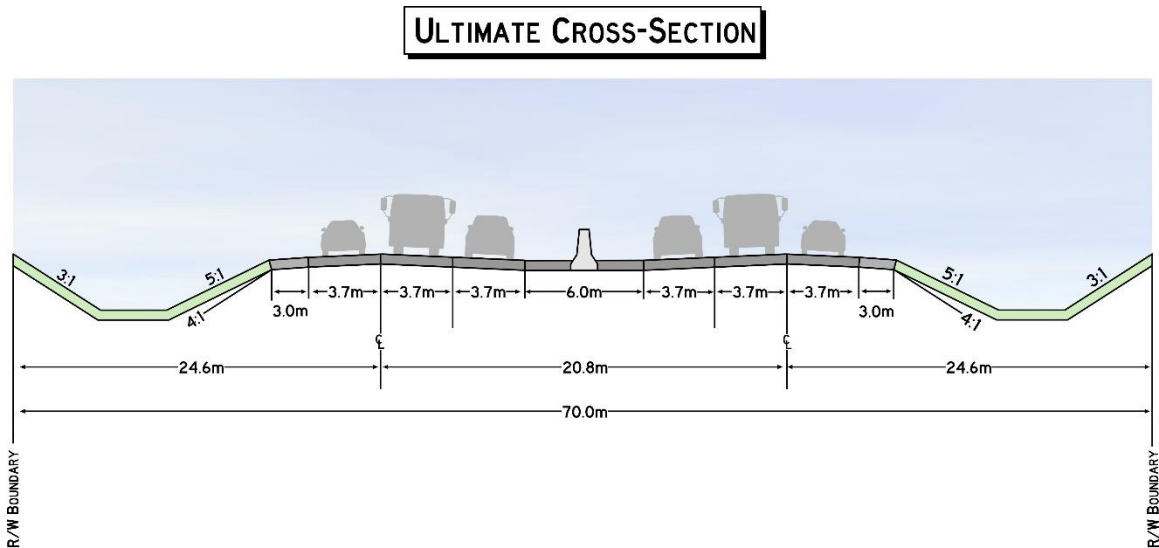


Figure 20: Ultimate Cross Section

## 5.2 Horizontal Alignment Options

To expand the roadway from its current three-lane undivided configuration to an ultimate 6-lane divided cross-section, three different horizontal alignment concepts were developed as described below.

**Option 1** -Widening on both sides: The existing Highway 22 carriageway would be widened on both sides of the centreline.

**Option 2** – Widening on east side: The existing Highway 22 carriageway would be retained as the southbound lanes, and twinning/widening of the northbound lanes would occur on the east side.

**Option 3** – Widening on west side: The existing Highway 22 carriageway would be retained as the northbound lanes, and twinning/widening of the southbound lanes would occur on the west side.

A schematic of the concepts is provided in **Figure 21**. Please note that this figure is illustrative only.

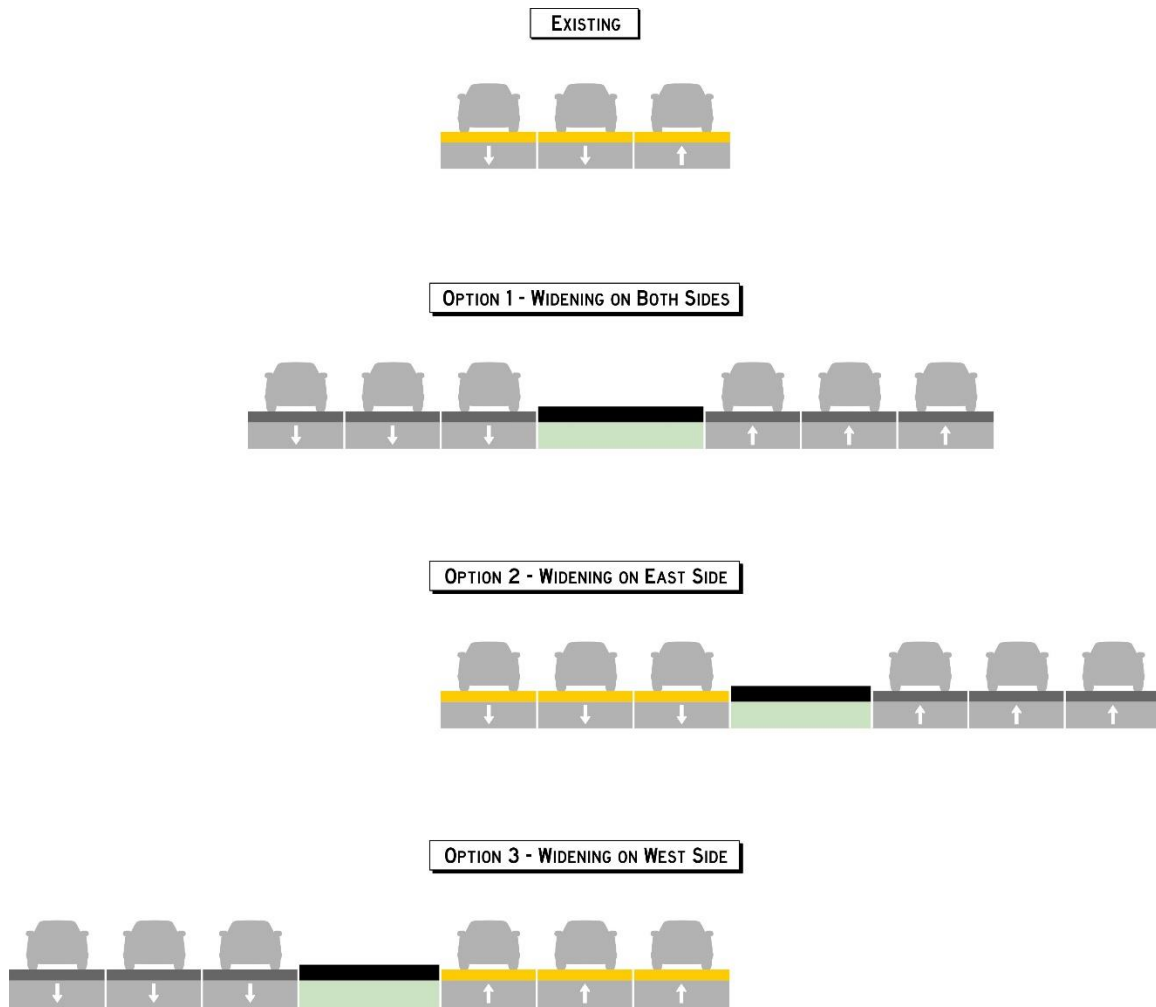


Figure 21: Schematic of Options 1, 2, 3

The three widening options were evaluated based on the following four criteria:

- 1) Net Cut/Fill requirements
- 2) Overall earthworks requirements
- 3) Ability to stage the widening and overall constructability
- 4) Impact on right-of-way
- 5) Environmental Impact
- 6) Consistency with current plans

The net cut/fill and overall earthworks were evaluated by reviewing cross-sections at 30m intervals along the corridor for all three original options. The results of the analysis are summarized in **Table 10**, and reflect quantities calculated in the initial design. It is



important to note that the quantities detailed in **Table 10** are not directly reflected in the current design; however, updates would be consistent through each of the three options. It is noted that Option 3 had the lowest amount of net cut/fill requirements and Option 2 had the lowest overall amount of earthworks required. Considering the comparable surface width, all three options are expected to have a similar environmental impact and minimizing the cut / fill in the design will minimize the haul requirements and reduce the environmental impact during construction.

**Table 10: Cut and Fill Comparison**

	Option 1	Option 2	Option 3
	widening on both sides	widening on east side	widening on west side
Cut (m <sup>3</sup> )	107,360	66,790	150,530
Fill (m <sup>3</sup> )	185,110	151,770	105,020
Net (m <sup>3</sup> )	- 77,750	- 84,980	45,510
Total Earthworks (m <sup>3</sup> )	292,470	218,560	255,550
	Fill Required	Fill Required	Excess soil

From a staging perspective, widening on one side is easier to construct and stage since there would be minimal disruptions to the current traffic flows with the least amount of detours required. From a safety perspective, the exposure of construction crews would also be minimized with widening to one side or the other. With Option 2, the northbound 2-lane carriageway could be constructed while maintaining the existing three lanes as the southbound lanes. Although the three southbound lanes would provide more capacity than what is needed, the additional southbound lane would help overall operations and safety by providing a climbing lane for heavy trucks.

From a right-of-way perspective, either Option 1 or Option 2 were preferred as both have minimal land requirements and can mostly be built within the existing right-of-way. Option 3 required additional land on the west side of the corridor.

In terms of consistency with previous planning, the bridge over the Bow River has been planned to occur east of the current alignment. Therefore, to reduce the cost of construction and to be consistent with previous planning work, widening the corridor to the east is preferred.

When considering all the evaluation criteria described above, Option 2 (widening to the east) is the preferred option. This is consistent with what was recommended in the 2004 functional study.



### 5.3 Multiple Account Evaluation

Intersection alternatives and left turn options were evaluated based on a multiple account evaluation technique which considers several factors as contributing to the overall functionality and feasibility of the intersection options. Categories selected for this evaluation are summarized in **Table 11**, with a description of each category for context.

**Table 11: Multiple Account Evaluation Criteria**

MULTIPLE ACCOUNT EVALUATION	
Right-of-Way	Fits within the current ROW
Traffic Operations	Overall performance and individual movements above minimum LOS
Utility Impacts	Ease of placement of utilities and maintenance access
Active Modes Accomodation	Crossing distance, number of conflict points
Environmental Impact	Pavement area, loss of natural / green space, emissions
Construction Cost	Initial cost
Driver Experience	Familiarity with similar intersections in the surrounding area
Human Factors	Is the intersection intuitive / Can drivers navigate easily
Safety	Driver decision load, number of conflict points and probability of collision

Based on the categories outlined in **Table 11**, each of the possible left turn options was assessed for the three study intersections as presented in **Tables 12** through **14**. Each category assessment was represented with a circle (filled, half-filled or unfilled) indicating a positive, neutral, or negative impact to the overall feasibility.



**Table 12: Multiple Account Evaluation - Rolling Range Drive**

MULTIPLE ACCOUNT EVALUATION	STANDARD INTERSECTION	JUGHANDLE	DISPLACED LEFT TURN
Right-of-Way			
Traffic Operations			
Utility Impacts			
Active Modes Accomodation			
Environmental Impact			
Construction Cost			
Driver Experience			
Human Factors			
Safety			
<b>Ranking</b>	<b>5.5</b>	<b>4.5</b>	<b>5.5</b>

The MAE evaluation suggests that all three options for left-turn treatments at Rolling Range Drive provide similar results. Given the reduced level of confidence in traffic projections beyond the 20-year horizon, it is recommended that the ROW be planned for the standard left-turn geometry. This evaluation suggests that alternate left-turn treatments could be evaluated and potentially constructed in the future and if additional ROW is required, it could be obtained at that time.





**Table 13: Multiple Account Evaluation – Fireside Gate**

MULTIPLE ACCOUNT EVALUATION	STANDARD INTERSECTION	DISPLACED LEFT TURN	MICHIGAN LEFT TURN
Right-of-Way			
Traffic Operations			
Utility Impacts			
Active Modes Accomodation			
Environmental Impact			
Construction Cost			
Driver Experience			
Human Factors			
Safety			
<b>Ranking</b>	<b>6.5</b>	<b>6.5</b>	<b>6</b>

**Table 13** indicates a comparable overall performance between the displaced left turn option and standard intersection at Fireside Gate, with the standard left-turn design offering a slightly better overall evaluation. Given that the standard left-turn treatment offers the best MAE evaluation, alternative left-turn treatments are not recommended for the intersection of Highway 22 and Fireside Gate.



**Table 14: Multiple Account Evaluation - South Access**

MULTIPLE ACCOUNT EVALUATION	STANDARD INTERSECTION	JUGHANDLE	DISPLACED LEFT TURN	MICHIGAN LEFT TURN
Right-of-Way	●	○	◐	●
Traffic Operations	◐	◐	●	◐
Utility Impacts	◐	◐	◐	◐
Active Modes Accomodation	◐	●	●	●
Environmental Impact	◐	●	●	●
Construction Cost	◐	○	◐	◐
Driver Experience	●	●	○	○
Human Factors	●	◐	◐	◐
Safety	◐	◐	●	◐
<b>Ranking</b>	<b>6</b>	<b>5</b>	<b>6</b>	<b>5.5</b>

The MAE evaluation of the left-turn treatment for the South Access indicates that the standard intersection and the displaced left-turns are similar. Although a full functional design of the displaced left-turn treatment has not been prepared, it could likely fit within the overall 70m ROW with some modifications to drainage and backslopes.

Overall, it is recommended that the standard intersection design be retained for all intersections.

The assessment of the various left-turn treatments is a long-term horizon (30+ years) and the results of the operational analysis will likely change based on the density and distribution of development along the corridor. Therefore, it is difficult to recommend one specific treatment at this time over the others. However, the displaced left-turn treatment appears to provide the most operational benefits as compared to the Michigan lefts and the Jughandles. In reviewing the intersection plans, the 70m ROW for the corridor would be sufficient to accommodate the displaced left-turns at all three intersections if required. To fit within the 70m ROW, the corridor would need to be converted from a rural to an urban style corridor by removing the ditches and introducing curb and gutter as illustrated in **Figure 23**. It is important to note that a dual left turn was included as a conservative cross section requirement near the traffic signal, to be verified as warranted by future analysis.

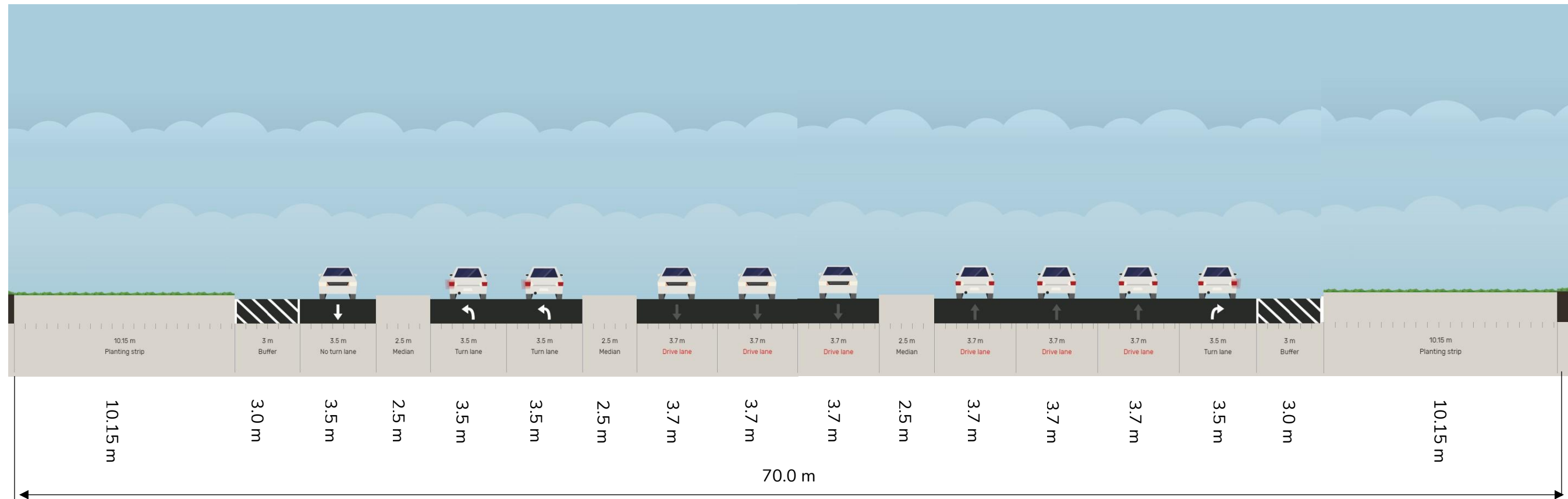


Figure 22: Displaced Left Turn Cross Section - At Signal



## 5.4 Pedestrian Crossings

With the intention of maintaining an acceptable level of service for vehicular traffic in the ultimate 2060 horizon year, Highway 22 is anticipated to feature a 6-lane cross section, 70 m ROW and wide intersections. While this infrastructure is anticipated to provide adequate accommodation for vehicular traffic, the wide pedestrian crossings may pose a barrier to active modes of transportation. It is important to consider the integration of safety and mobility for pedestrian and cyclists along the corridor, with the potential to consider the alternative of grade separated pedestrian crossings.

Three possible types of pedestrian crossings exist for application to the study corridor, including crosswalks at the signalized intersections, overpasses, and underpasses. A cursory evaluation of each of these options is provided below; however, it is important to note that the type of pedestrian crossings feasible for the study corridor should be confirmed in the detailed design stage.

Integration of pedestrian crosswalks with the signalized intersections presents the most economic option of accommodating active modes in the corridor design. While the ultimate 6 lane cross section extends the crossing distance for pedestrians in the 2060 horizon, various left turn options for the study intersections may reduce this crossing distance by removing left turn lanes and condensing the intersection. For channelized right turns, it may be beneficial to consider smart right turns to improve the safety for pedestrians and reduce vehicle speeds.

Given the urban setting of the study corridor, opportunity exists to consider a pedestrian overpass or underpass to accommodate active modes of transportation across Highway 22 and reduce potential conflicts with vehicular traffic. While these options present an increased construction cost, separating pedestrians from vehicular traffic improves the safety and utility of active transportation facilities. While the location and placement of an underpass / overpass will require a detailed evaluation of existing and proposed active transportation connections, several benefits and challenges are evident for each alternative. Pedestrian overpasses improve the safety of pedestrians by separating them from vehicular traffic; however, the elevation change may present a barrier to accessibility. In contrast, pedestrian underpasses present an improved barrier free alternative, but may be perceived as a safety risk and should incorporate the principals of crime prevention through environmental design (CPTED).



## 5.5 Access Management and Network Improvements

Access to the upgraded Highway 22 should be limited to public roadways as per the requirements from Alberta Transportation and the classification of the highway. Furthermore, the specific requirements for this class of roadway include the following characteristics:

- Minimum spacing of 1.6 km required for public roads
- Private accesses may be temporarily retained if minimum spacing is met, but must be removed when highway upgrading occurs
- New accesses are not permitted unless minimum spacing is achieved, provided the new access meets requirements in the ultimate access management plan
- Direct access for commercial and industrial developments is not permitted, and the developments may be accessed at ultimate service interchange locations

Given the above guidelines, all existing private access roads intersecting Highway 22 within the study corridor are considered temporary and are anticipated to be consolidated when the highway is upgraded to the staged cross-section.

### Rolling Range Drive

Rolling Range Drive currently exists as a T-intersection with Highway 22, providing an unsignalized access for residents to the west of Highway 22. In the ultimate design, the intersection is expected to develop into a four-leg, signalized intersection, connecting to communities on the east side of Highway 22 via River Heights Lane. Although the spacing between this intersection and James Walker Trail is 1.2km (less than the recommended minimum in the Alberta Design Guide), the analysis presented in this report indicates that the intersection can operate satisfactorily as a signalized intersection and meet the Province's design guidelines for grades and sight distance. It is expected that this intersection will remain as an at-grade intersection in the ultimate horizon, based on the analysis of sight lines and intersection grades. Evaluation of the sight lines and grades were evaluated as part of an earlier Memorandum prepared in 2020<sup>16</sup> and attached in **Appendix D**.

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<sup>16</sup> WATT Consulting Group, Rolling Trails Development – Hwy 22 Grades / Sight Distance



## Private Accesses

Numerous private access roads exist along the study corridor that are expected to be consolidated to support the ultimate design. As listed in **Table 15**, these primarily include accesses to agricultural lands or private residences; however, the potential access location with River Heights Drive is of particular interest. While this location has the potential to be developed into a right-in-right-out emergency access, accommodation of emergency vehicles is accommodated at the future intersections of Rolling Range Drive / River Heights Lane and James Walker Trail. Illustration of the private accesses and associated chainage locations are provided in the profile drawings in **Appendix E**.

**Table 15: Access Closure Summary**

CHAINAGE	ACCESS TYPE	ALTERNATIVE ACCESS(S)
0+160	Farm Access	Closed, with alternate access
0+650	Field	Closed, with alternate access provided via James Walker Trail (?)
1+850	Residential	Closed, with access for emergency vehicles provided by the new connection to River Heights Lane or at the intersection of James Walker Trail S.
2+400	Cul-de-sac	Remove cul-de-sac and realign to connect with the intersection of Rolling Range Drive.

## 5.6 Climbing Lanes

A climbing lane warrant for multi-lane highways was performed as per Section B.5.3.2 of the Alberta Transportation Highway Geometric Design Guide. The warrant is satisfied when the following is met:

- Upgrade volume is greater than 1,000 vehicles per hour (vph) per lane, regardless of grades or heavy vehicle percentage
- Design Truck experiences a speed reduction greater than 15km/h
- Reduction of at least one level of service from the approach segment to the upgrade

The current layout of two lanes southbound on the upgrade was assumed during this analysis. The upgrade volume with existing traffic is less than 1,000vph per lane so an additional lane is not warranted based on existing traffic. Similar to current conditions, the 2060 horizon upgrade volume is not expected to exceed 1,000 vph per lane, assuming three lanes in the southbound direction.



Considering the climbing lane warrant requirements in relation to the existing and expected 2060 horizon volumes, an additional climbing lane is not warranted, and the proposed six-lane cross section is anticipated to support future traffic volumes and the needs of heavy trucks.

### 5.7 Advanced Warning Flashers

Installation of advanced warning flashers (AWF) before the intersection of Highway 22 and the South Access was evaluated according to the standards outlined in the Manual of Traffic Control<sup>17</sup> for the current intersection context. Criteria which may require an advanced warning flasher are compared with current site conditions are presented in **Table 16**<sup>17</sup>.

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<sup>17</sup> Manual of Uniform Traffic Control Devices for Canada, Chapter A3, Advanced Warning Signs, A3.6.5



**Table 16: Advanced Warning Flasher Criteria**

FACTOR	ASSESSMENT CRITERIA	SITE CONDITIONS
Limited Sight Distance	where sight distance of first primary signal is less than the stopping site distance	Horizontal = N/A Vertical = 275-315 m
Minimum Speed	intersections with approach speed greater than or equal to 70 km/h	Design Speed = 80 km/h
Gateway	first signalized intersection along a road transitioning from rural to urbanized	Yes
Approach Grade	<ul style="list-style-type: none"> <li>- 60 km/h posted speed a downhill grade of 7 percent or more</li> <li>- 50 km/h posted speed approaches where the downhill grade is 12 percent or more</li> <li>- speeds of 70 km/h or more, any downhill grade would contribute to the application of an AWF</li> </ul>	Speed < 70 km/h
Truck Traffic	<ul style="list-style-type: none"> <li>high percentage of truck traffic</li> <li>- 10-15 percent heavy trucks: consider AWFs if other conditions present<sup>2</sup></li> <li>- 16 percent or more heavy trucks: strongly consider AWFs if other conditions present<sup>2</sup></li> </ul>	Percent Heavy Vehicles = Approximately 2% <sup>3</sup>
Collision History	applicable to retrofit intersections with an over-representation of correctable collision types (including collisions occurring during the amber and all-red phases of the signal)	To be reviewed after opening day.
Minor Road Traffic Volume	AADT > 13,000 vpd	AADT (2060 minor street) = 10,900 vpd

<sup>1</sup>Manual of Uniform Traffic Control Devices for Canada

<sup>2</sup>Advance Warning Flashers: Guidelines for Application and Instalation, Hamilton Associates, 2004

<sup>3</sup>Based on a traffic count from Alberta Transportation (2019) for the intersection of Fireside Gate / Hwy 22 / James Walker Trail





Observing the intersection conditions outlined in **Table 16**, supporting guidance<sup>18</sup> suggests that intersection approaches with speeds greater than 100 km/h located as a gateway between a rural and urban context should feature advanced warning flashers. While collision statistics are to be reviewed after the opening of the intersection, other qualifying factors indicate that it is recommended an advanced warning flasher be installed in advance of the South Access intersection when that access is constructed. The advanced warning flashers would help transition drivers from the rural 100 km/hr speed limit in Rocky View County to the more urban environment in the Town of Cochrane.

## 6.0 PUBLIC CONSULTATION

In addition to various consultation between the City of Cochrane and Alberta Transportation, a public engagement session for residents of Cochrane was provided to generate discussion and feedback to support the Highway 22 Functional Study. Results of this open house are summarized below, with a complete what-we-heard report included in **Appendix F**.

### 6.1 Open House

**Date** | December 7, 2021

**Location** | St. Mary's Catholic Parish

**Advertised** |

A variety of resources and outreach methods were followed to ensure community awareness of the public engagement and long-term plans, these included:

- Project Website
- Mailers
- Email Invitations to Stakeholders
- Geotargeted Facebook Advertisements
- Road Signs
- Print Advertisements in the Cochrane Eagle and Cochrane Times
- News Article on CochraneNow.com

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<sup>18</sup> Advanced Warning Flashers: Guidelines for Application and Installation, Hamilton Associates, 2004



### Engagement Activities |

- Project Email Address – 8 emails received
- Online Survey – 6 surveys completed
- Public Open House – 45 attendees and 7 feedback forms completed

### Feedback and Comments |

- Traffic volume and congestion concerns under current conditions along the corridor during peak hours.
- Intersection concerns include incorporating turning lanes to alleviate existing safety concern at Rolling Range Drive, the potential for an alternate intersection design such as an interchange or roundabout to facilitate free-flow and reducing grade on approach to the Rolling Range Drive intersection.
- Incorporation of active transportation measures (particularly cyclist and pedestrian safety) measures at all intersections, with wide shoulders to support cyclists.
- Possibility of a pedestrian bridge over Highway 22 to be considered within the study area.
- Concerns regarding the current Bow River Bridge include pedestrian safety and increased bridge width / number of lanes.

## 7.0 PREFERRED ALTERNATIVE

### 7.1 Design Overview

The recommended design generally follows the same alignment as was previously recommended as part of the 2004 Functional Study with the widening occurring on the east side. The assessment of widening to the east, west or both sides was a high-level evaluation to ensure that excessive fill or cuts were not required. The goal was to follow the previous design as much as possible and maintain the recommended right-of-way. This design with widening to the east also aligned with the functional study for the Hwy. 22 across the Bow River which has been planned to occur to the east of the existing bridge location.

One of the key design elements of the plan includes the addition of a new at-grade intersection at Rolling Range Drive. This intersection is located approximately 1,220 m from James Walker Trail (the closest at-grade intersection). Although the spacing of the intersections does not meet A.T.'s 1.6km spacing requirement for at-grade intersections,



the analysis conducted as part of this study indicates that interchanges are not required and therefore the spacing between intersections can be reduced to meet the TAC requirements.

Detailed functional plans for standard intersection configurations at each of the study sections along Highway 22 (based on the Option 2 alignment) are provided in **Appendix E**, with left turn alternatives to be considered at the detailed design stage. The design criteria and cross-section from Section 4.1 was applied.

### **Active Modes**

The Highway 22 Functional Planning Study – South of Highway 8 to Town of Cochrane South Corporate Limits (ISL, 2014) identified a bikeway alignment on the west side of Highway 22 as requested by Rocky View County. Although not accounted for in this functional design, accommodating a regional pathway along the west side of the corridor could be achieved within the highway right-of-way. This could be either through a reduction of the median width or by acquiring the necessary right-of-way along the west side from the adjacent land owners. Another alternative would be to have the pathway run outside of the highway right-of-way within the Town of Cochrane and RVC. Further discussions between the Town of Cochrane, Rocky View County and Alberta Transportation are required at the detailed design stage to determine whether the pathway is preferred and if so, the best way to accommodate it.

To facilitate pedestrian movements across the existing and future at-grade intersections along Highway 22, pedestrian crosswalks, signals and a network of sidewalks and pathways should be provided. The accommodation of pedestrians across the highway is consistent with the Town of Cochrane’s policies to encourage more active transportation, with potential to consider pedestrian overpasses or underpasses in the future.



## 7.2 Staging Plan

The traffic analysis suggests that the ultimate six-lane cross-section for Highway 22 will not be needed until the 2040 - 2060 timeframe depending on the pace of development along the corridor. The existing capacity analysis suggests that additional capacity in the northbound direction is warranted along the corridor based on the PM peak hour operating conditions at George Fox Trail and Fireside Gate. In the interim, the Province could consider upgrades along the corridor depending on provincial priorities and availability of funding. These upgrades could build on the current Hwy 1A / Hwy. 22 interchange project that is currently underway. The interchange project includes twinning of Hwy. 22 from the interchange to Glenbow Dr. and a logical progression of the twinning could extend south from Glenbow Dr.

Based on the analysis conducted as part of this study and a review of the staging recommendations from the previous functional study the following staging options could be considered by Alberta Transportation.

### Short-Term Improvements (within 5 years)

- Acquire right-of-way as development occurs
- Protect right-of-way for future twinning (70 m)
- Realign George Fox Trail and extend twinning of Hwy. 22 south from Glenbow Drive to south of the Bow River
- Signalize and upgrade Highway 22 / Rolling Range Drive intersection (development driven)
- Signalize and upgrade Highway 22 / New South Access (development driven)

### Medium-Term Improvements (5-15 years)

- Expand Highway 22 to 5-lane cross-section from south of the Bow River to south of James Walker Trail (two northbound and three southbound lanes – see **Figure 21**)
- Close private accesses to Highway 22 as required

### Long-Term Improvements (>15 years)

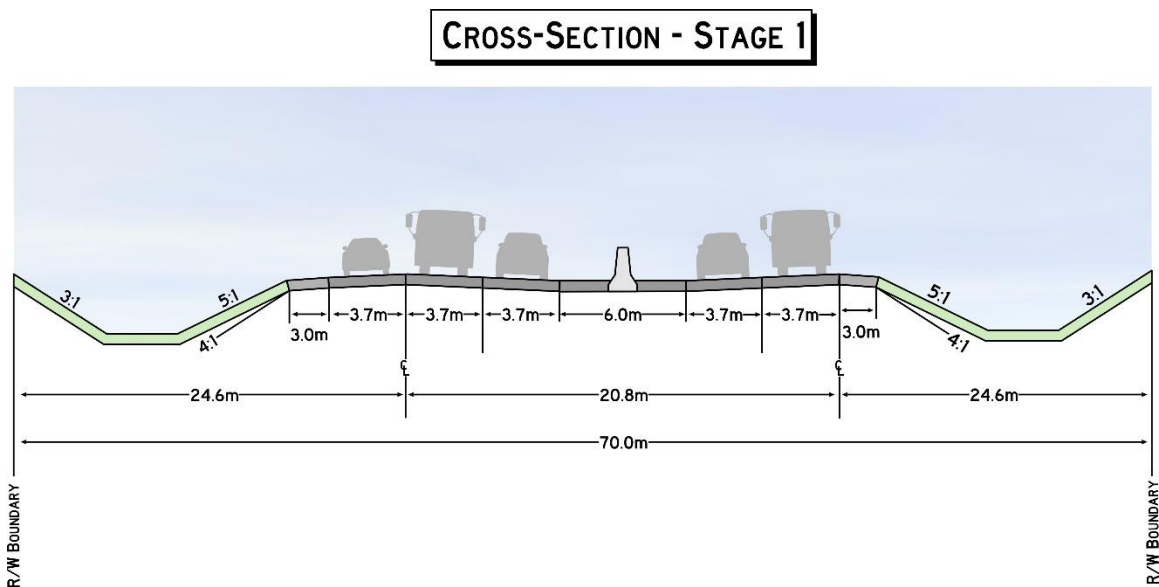
- Expand Highway 22 to 5-lane cross-section from south of James Walker Trail to project limits (two northbound and three southbound lanes)
- When warranted, widen carriageway to the ultimate 6-lane cross-section throughout the study limits



Depending on the availability of funding and project priorities, Alberta Transportation could consider extending the expansion of Highway 22 further south in the short-term. As a minimum the expansion should extend south across the Bow River to the point where the horizontal alignment matches the current carriageway.

The proposed Staged 5-lane cross-section is modified from the ultimate 6-lane design, with widening to occur to the inside. In this case, a 5-lane cross section is proposed for Stage 1, with the existing Highway 22 carriageway making up the three southbound lanes and two new northbound lanes constructed on the east side as illustrated in **Figure 23**, accompanied by anticipated lane configurations in **Figures 24** through **26**. However, Stage 1 could include either 4 or 5 lanes (widened to the outside) and should be reviewed closer to the 2040 horizon.

It is important to note that in an effort to maintain an acceptable LOS D or above for each movement during the AM and PM peak hours, left turn options presented in **Section 4.3.3** could be required by the 2040 interim horizon for the intersection of Fireside Gate / Hwy 22.



**Figure 23: Stage 1 Cross-Section**

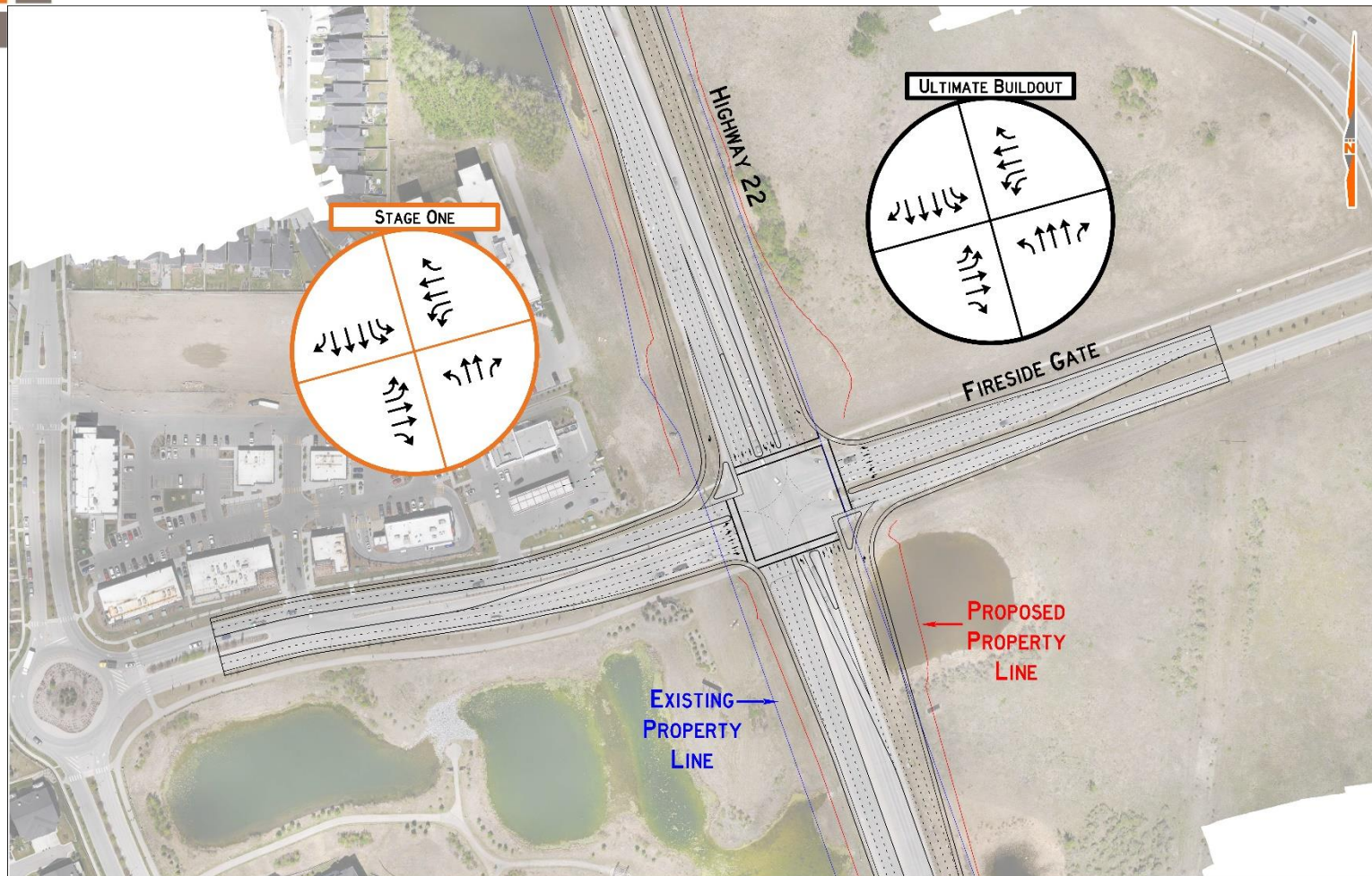
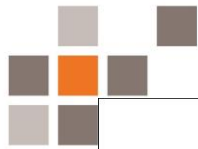


Figure 24: Intersection Staging - Fireside Gate / Highway 22

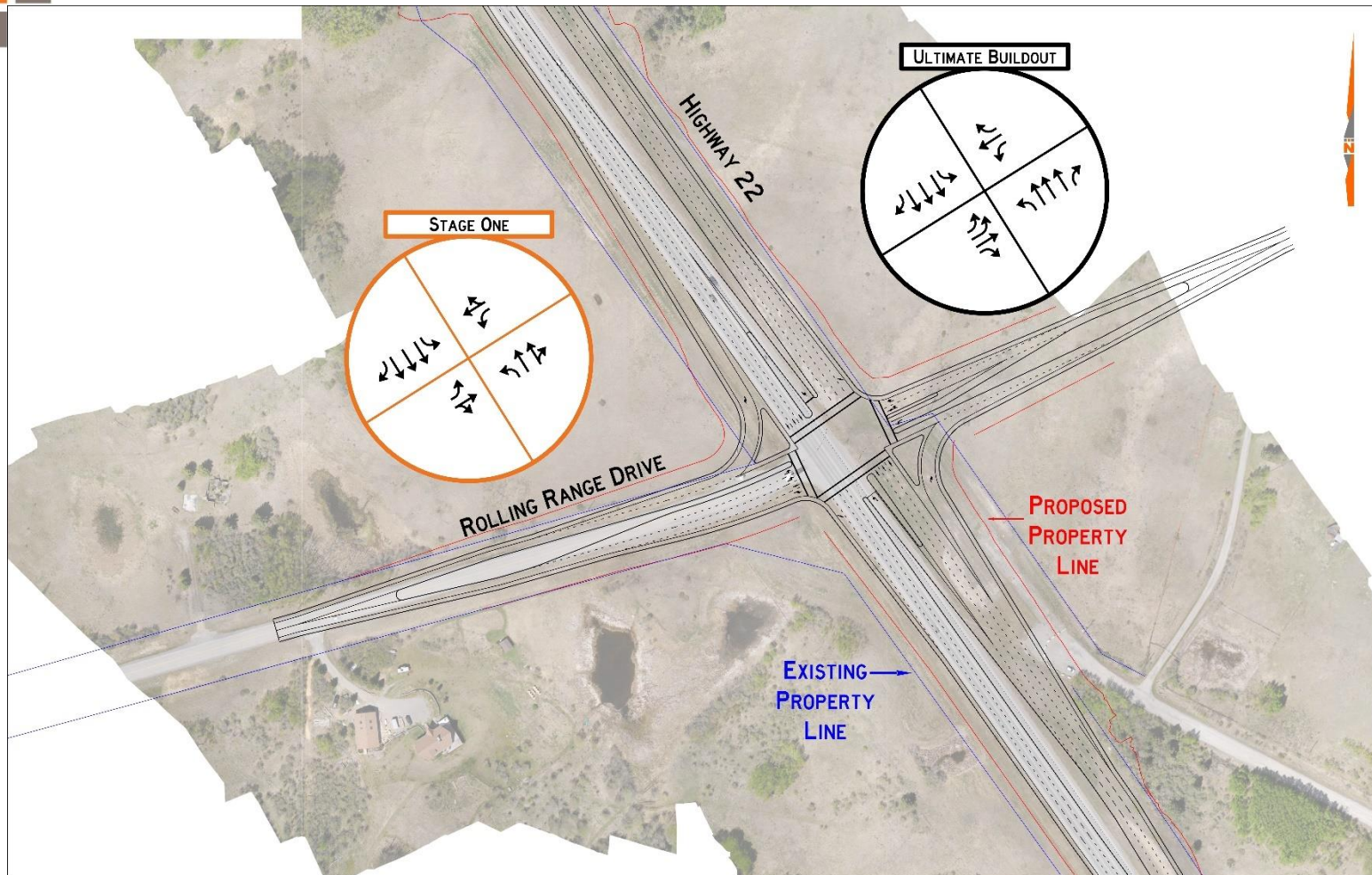


Figure 25: Intersection Staging - Rolling Range Drive / Highway 22

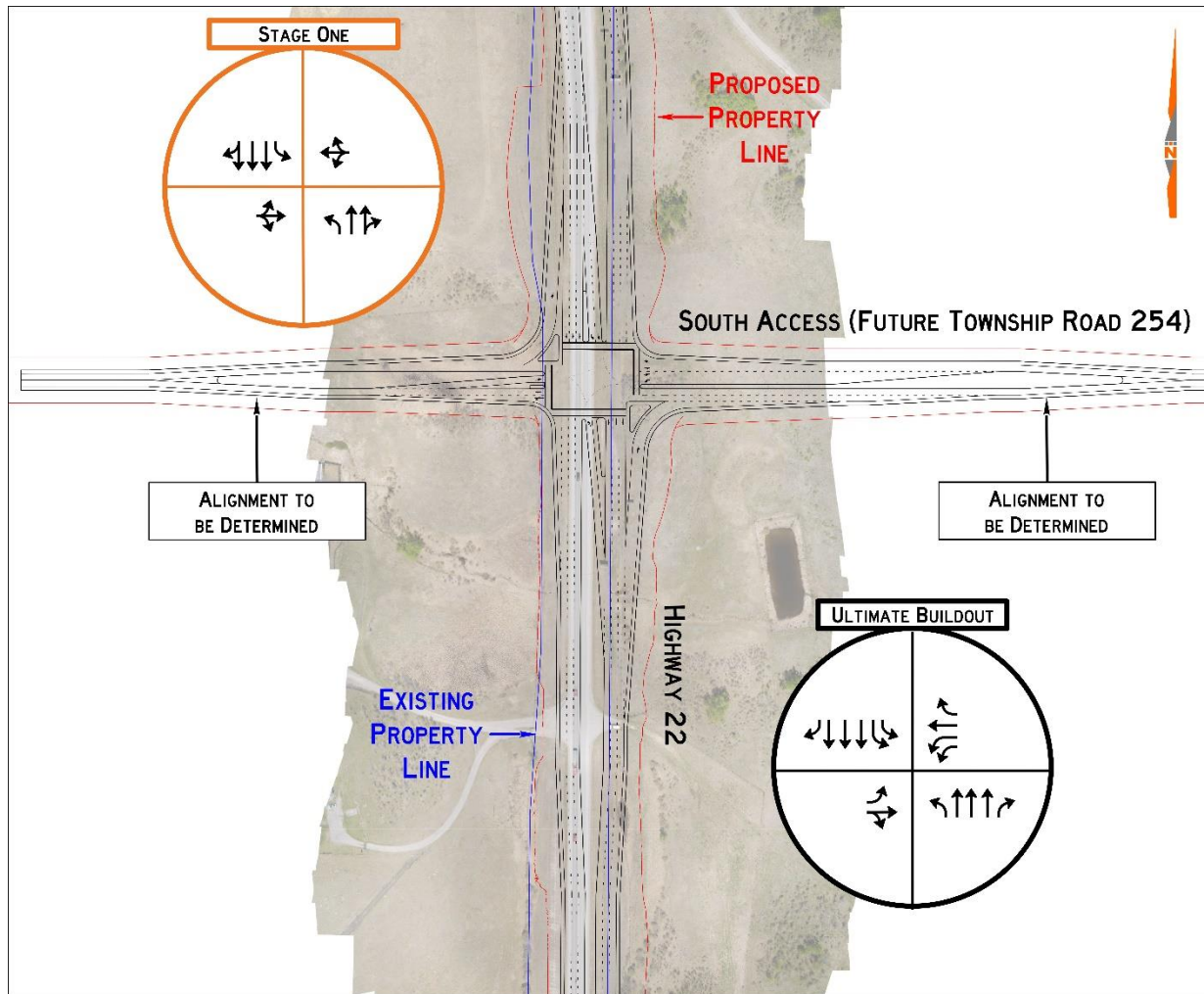


Figure 26: Intersection Staging - South Access / Highway 22





### 2040 Horizon Daily Traffic

The traffic volumes anticipated by 2040 were estimating using a straight line pattern between the existing and 2060 traffic volumes. Using the estimated 2040 volumes, the proposed interim 5-lane cross-section will be sufficient to maintain adequate levels of service at the intersections during the peak hours. This is based on an average capacity of 800-900 vehicles per lane and an expected northbound volume of 1,600 vph in the 2040 horizon.

### 7.3 Arterial / Collector Road Network

To limit local traffic on Highway 22, a conceptual network of arterial/collector roads was prepared. The intent of this network is to encourage more trips within the Town of Cochrane on local roads and to limit the use of Highway 22 for these trips. The conceptual arterial road network is shown in **Figure 27**.

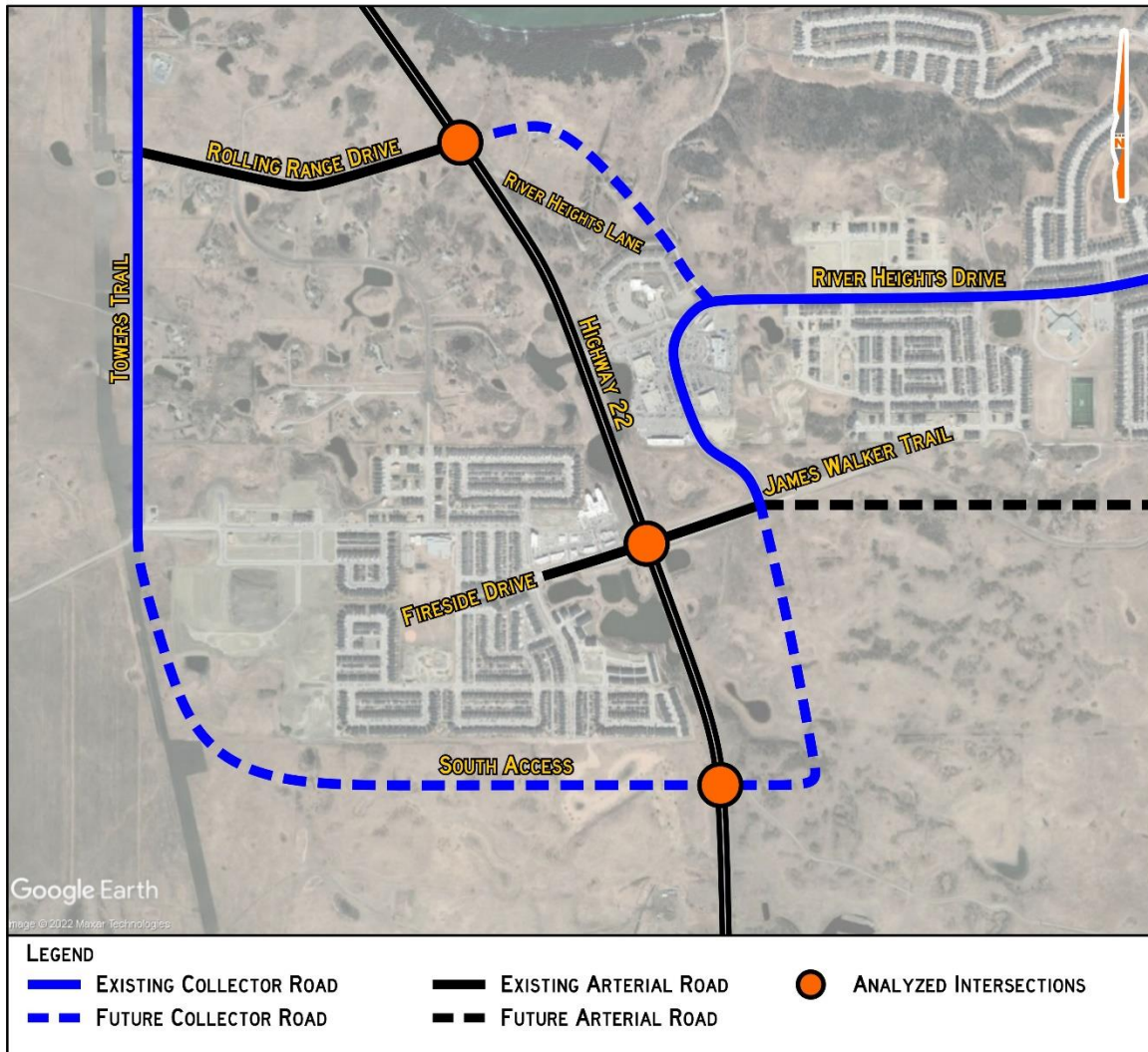


Figure 27: Arterial Road Network

On the west side, the arterial network includes an extension of Tower Trail to the south, and eventually heading east to connect with the new at-grade south access. The final alignment of this arterial road will depend on development activity in the Town of Cochrane and negotiations with landowners to acquire the necessary right-of-way. Similarly, the arterial road network on the east side of Highway 22 is more developed than the west side. The new at-grade access at Rolling Range Drive will help limit traffic on Highway 22 by giving drivers an alternate route from River Heights to the Rolling Trails ARP area. At the south end, a conceptual plan to connect the new South Access to James Walker Trail and River Heights Drive is shown but again, right-of-way would need to be



acquired through the development process to facilitate this alignment and connection. Recommendations on lane configurations, intersection control and placement, vertical and horizontal alignments will need to be confirmed as part of the detailed design process.

#### 7.4 Right-Of-Way Requirements

Building on the previous functional study, a right-of-way plan has been created to accommodate the ultimate cross-section (70 m) along the study corridor. A.T. should continue to acquire the required right-of-way as per the plans shown in **Appendix E** as opportunities arise and through the development process.

#### 7.5 Preliminary Cost Estimate

Preliminary construction cost estimates were prepared with 2022-unit rates and summarized in **Table 17**, accompanied by a detailed estimate in **Appendix G**. It is noted that this preliminary cost estimate is based on the information and assumptions available at this stage in the design and should be reviewed at subsequent stages of the project.

**Table 17: Preliminary Cost Estimate**

COST ESTIMATE	
Earthworks	\$ 11,830,000
Surface Improvements - Concrete	\$ 6,630,000
Surface Improvements - Asphalt	\$ 6,280,000
Surface Improvements - Asphalt (Miscellaneous Items)	\$ 810,000
<b>SUBTOTAL - SURFACE IMPROVEMENTS</b>	<b>\$ 25,550,000</b>
CONTINGENCY ALLOWANCE (30%)	\$ 7,670,000
<b>TOTAL</b>	<b>\$ 33,220,000</b>



## 8.0 CONCLUSION

The previous functional study for the study portion of Highway 22 did not contemplate the Town's Growth Strategy and new development along this corridor, south of the Bow River. To accommodate the Town's growth plans up to full build-out of the Town's current boundary, more access to Highway 22 is required.

This update to the previous functional study confirms that the three planned at-grade intersections along Highway 22 (as outlined in *Connecting Cochrane*) at Rolling Range Drive / River Heights Lane, Fireside/James Walker Trail and the new South Access will be sufficient to accommodate the Town's growth within the current boundaries up to the year 2060. The analysis conducted as part of this functional study shows that the proposed configuration of the three at-grade intersections can provide satisfactory traffic operations.

Given the uncertainty in traffic projections beyond the 20-year horizon, it is recommended that the ROW be planned for the standard left-turn geometry at all intersections, with the potential to explore a displaced left turn option in future horizons as warranted by traffic operations.

Furthermore, the new at-grade intersection at Rolling Range Drive / River Heights Lane can remain as an at-grade intersection and meet A.T.'s horizontal and vertical geometric design requirements.

Another conclusion from the study is that interchanges are not required at any of the proposed access locations to meet A.T.'s traffic operational requirements. The at-grade intersections are more conducive to an urban environment and are more consistent with the Town's long-term transportation network as indicated in *Connecting Cochrane*.



## 9.0 RECOMMENDATIONS

Based on the analysis and results presented in the report, key recommendations are summarized as follows:

### Short-Term Improvements (within 5 years)

- Acquire right-of-way as development occurs
- Protect right-of-way for future twinning
- Realign George Fox Trail and extend twinning of Hwy. 22 south from Glenbow Drive to south of the Bow River
- Signalize and upgrade Highway 22 / Rolling Range Drive intersection (development driven)
- Signalize and upgrade Highway 22 / New South Access (development driven)

### Medium-Term Improvements (5-15 years)

- Expand Highway 22 to 5-lane cross-section from south of the Bow River to south of James Walker Trail (two northbound and three southbound lanes).
- Close private accesses to Highway 22 as required

### Long-Term Improvements (>15 years)

- Expand Highway 22 to 5-lane cross-section from south of James Walker Trail to project limits (two northbound and three southbound lanes)
- When warranted, widen carriageway to the ultimate 6-lane cross-section throughout the study limits



## APPENDIX A: FORECAST INFORMATION

# MEMORANDUM

Date: June 9, 2021  
To: Bruce Nelligan (Watt Consulting Group)  
cc: Ryan Stewart (Town of Cochrane), Marcia Eng (Urban Systems)  
From: Ming Xia (Urban Systems)  
File: 2670.0002.01  
Subject: Highway 22 Traffic Volume Forecast (Final)

## 1.0 BACKGROUND

The purpose of this study is to provide an update on forecasted traffic volumes at the following four study intersections along Highway 22 south of the Bow River to the south Cochrane boundary.

- George Fox Trail
- Rolling Range Drive
- James Walker Trail
- South Town access

This memorandum documents the process, key land use and network assumptions and the estimated future traffic volumes at these four study intersections. The land use for the Rolling Range development area was updated to reflect new land use information provided by the developer.

## 2.0 ASSUMPTIONS

This section summarizes the key network and land use assumptions used for this assignment.

### 2.1. NETWORK

The Town's future build-out scenario assumes a long-term population of over 81,000 people. Assuming the annual growth rates align with the Growth Management Strategy, then the long-term population would occur at the approximate 50-year horizon (2070+). If the Town's rate of growth continues at the higher existing growth rate, the long-term build-out population would occur earlier at an approximate 30-year horizon (2050).

Under the future Town build-out scenario, it is assumed that the future network will incorporate all the proposed major road network improvements described in the Town's Master Transportation Plan (TMP), *Connecting Cochrane*<sup>1</sup>. The major network improvements, which are included are:

1. New Jack Tennant Bridge (4-lanes) connecting the east side of Downtown Cochrane and South Cochrane.
2. Highway 22 widening (4-lanes) throughout Cochrane.
3. Realignment of Griffin Road and George Fox Trail at Highway 22 (Griffin Road and George Fox Trail to be realigned into one intersection).
4. Highway 22 and Highway 1A interchange <sup>2</sup> (Included in the model as a planned Alberta Transportation's initiative to start construction in 2021-2022).

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<sup>1</sup> Prepared by Urban Systems in 2017.

<sup>2</sup> While the exact laning of the new interchange is not included in the model at this time, the node delay at the "intersection" was assumed as zero for modelling purpose to simulate a free flow intersection.

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Based on previous conversations with the Town, the following network assumptions are also included (Figure 1):

1. Close Towers Trail connection to George Fox Trail.
2. Connect Towers Trail to Highway 22, south of Fireside, near the south Town boundary.
3. Assume Rolling Range Drive, James Walker Trail and the South Town intersection access onto Highway 22 will be in place. All accesses are assumed to have both west and east connections. James Walker Trail is assumed to be a 4-lane cross-section.

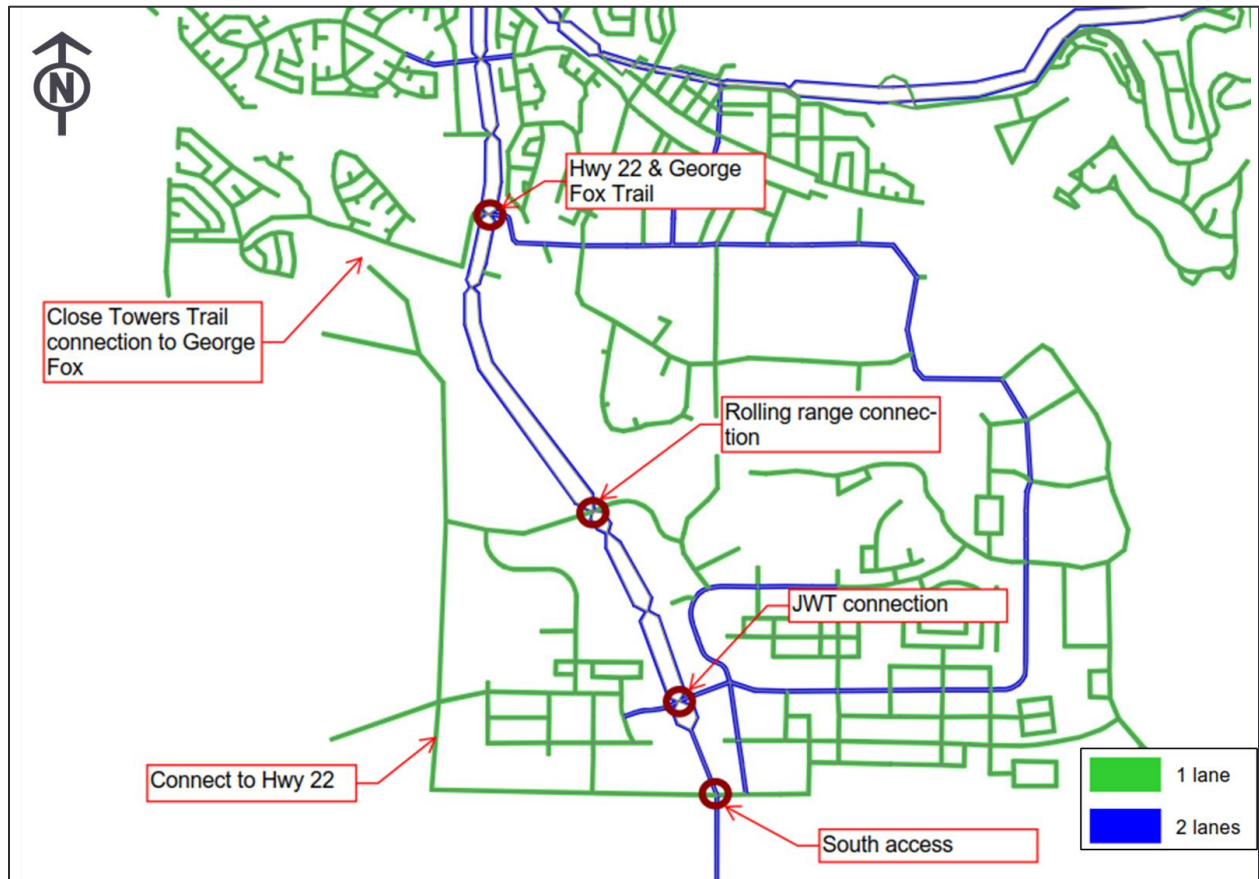


Figure 1: Future Network Assumptions and Access

A link type map is provided in Appendix A for more detailed information on road classification.



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**2.2. LAND USE****2.2.1. Rolling Range**

The updated land use for the Rolling Range ASP development was provided by Watt Consulting Group on May 20, 2021 (Table 1).

*Table 1: Land Use Assumptions (Rolling Range)*

Land use	Quantity	Unit
Single Family	1,560	Dwelling unit
Multi Family	1,056	Dwelling unit
Commercial (Retail)	50	KSF
Office/Light Industrial	3	Acre
Hotel	100	Rooms

The land use information was converted to population and employment for modelling purposes. For residential land uses, a density of 3.2 people per dwelling units and 1.8 people per dwelling units were used for single-family and multi-family units, respectively. The rates are consistent with the 2014 TMP's assumptions. These rates are also comparable to the ITE trip generation rates when comparing the number of trips per dwelling unit. Please note that the Town has used a blended density rate of 2.6 people per dwelling units for other planning purposes, not differentiating between single family and multi-family.

For commercial land uses, the same afternoon peak (PM) trip rates from the 2014 TMP work were used. A factor of 1.93 job per thousand square feet (KSF) was derived using rates of 5.8 trips per KSF and 3 trips per job.

For office/light industrial lands, the buildable KSF was first developed to be approximately 26% of total lands based on Watt's trip rate of 7.26 trips per acre during the afternoon peak period and an ITE trip rate of 0.63 trips per KSF. Then a conversion factor between employment and KSF was developed as 1.1 job per KSF.

Similarly, the employment per hotel room was derived using a factor of 0.67 job per room. The factor was developed based on the ITE PM trip rate of 0.60 trips per room and 0.89 trips per job.

The population and employment assumptions are summarized in Table 2 using the conversion factors described above.

*Table 2: Population and Employment (Rolling Range)*

LAND USE	QUANTITY
Single-family population	4,992 people
Multi-family population	1,901 people
<b>Total Population</b>	<b>6,893 people</b>
Commercial/retail employment	97 jobs
Office/light industrial employment	39 jobs
Hotel	67 <sup>3</sup> jobs
<b>Total Employment</b>	<b>203 jobs</b>

<sup>3</sup> As the transportation demand model does not have a specific category for hotel, the employment of hotel was added to commercial/retail due to its similar distribution splits. The hotel employment was adjusted accordingly based on the associated trip generation rates for trip generation in the model.

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**2.2.2. South Cochrane**

The rest of South Cochrane's land use assumptions remain unchanged from the previous work, Rolling Range Transportation Network Assessment, prepared by Urban Systems in August 2020.

Table 3 summarizes the population assumptions (rounded to the nearest 5) for each of the communities from the Connecting Cochrane Transportation Master Plan (TMP) for the 2015 and the future 65,000 population (2060+) horizons, and for the updated land use for the future Town Build-Out scenario (2050/2070). A map illustrating each of the South Cochrane communities is provided in Appendix B.

Table 3: Population Summary (South Cochrane)

COMMUNITY	Connecting Cochrane (TMP) (people)		UPDATED FUTURE BUILD- OUT (people)
	2015 Existing Horizon	~65,000 population Horizon (2060+)	
Riversong (Phases 1 to 10)	1,780	3,990	4,105
Precedence (Riversong Phase 11 to 15)	0	1,525	1,525
Willows	270	2,760	1,875
RHD Commercial	90	75	75
Fireside (Stage 1)	1,280	2,240	2,155
Fireside (Stage 2)	5	3,835	4,665
Summit of Riversong	605	1,210	1,205
Southbow Landing	0	5,270	6,095
Rivercrest	15	1,800	2,405
McIver lands	15	970	955
Rolling Range	230	230	6,895
Greendrop lands (Southridge)	35	4,490	11,710
<b>Total</b>	<b>4,330</b>	<b>28,395</b>	<b>43,655</b>

Note: Land use assumptions for Updated Future Build-out from approved and/or under review Area Structure Plans (ASPs)

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**2.2.3. Cochrane**

Table 4 summarizes a population comparison of Cochrane, Southwest Cochrane and Southeast Cochrane under each scenario.

*Table 4: Population Comparison (Cochrane)*

STUDY HORIZON	COCHRANE (people)	SOUTH COCHRANE (people)		
		SE COCHRANE	SW COCHRANE	SOUTH COCHRANE TOTAL
Connecting Cochrane (2015 Existing Horizon)	26,110	2,815	1,515	4,330
Connecting Cochrane (~65,000 population Horizon, 2060)	65,810	22,095	6,305	28,395
Updated Future Build-out (2050/2070)	81,075	29,945	13,710	43,655

Compared to the Town’s 2015 population, the population in Cochrane will see an increase of approximately 55,000 people in the next 30 to 50 years (from 26,110 people to 81,075 people). This is approximately a 210% increase overall. The population increase in South Cochrane is approximately 37,800 from 4,330 in 2015 to 43,655 for the updated future build-out. Approximately two-thirds of the population growth in South Cochrane is located on the east side of Highway 22.

Compared to the Town’s 2015 employment<sup>4</sup> information from the Connecting Cochrane TMP, the forecast employment assumption assumed an increase of approximately 10,790 jobs (from 5,550 jobs to 16,340 jobs). The previous forecast employment assumptions are based on approved and/or under review Area Structure Plans (ASPs). For Southbow Landing, this includes proposed employment uses of 107,000 square feet of commercial uses, 682,000 square feet of office uses, 477,000 square feet of industrial uses and three schools with a total of 1,600 students. For Fireside Stage 2, this includes approximately 41,500 square feet of commercial uses and two schools with a total of 1,200 students. It was assumed that there would be one school in Southridge.

The updated build-out scenario with the Rolling Range land use added another 200 jobs to the previously updated build-out scenario from the previous *Rolling Range Transportation Network Assessment* memo.

**3.0 FORECAST TRAFFIC VOLUMES**

The transportation forecast demand model developed from the 2014 TMP work was utilized with the updated land use assumptions. Network coding such as connectors was reviewed to ensure that they can reasonably represent the updated network assumptions, especially the closure of Towers Trail at George Fox Trail. Road classifications and the number of lanes were also considered when developing the future build-out volumes to ensure that traffic flows are reasonably distributed.

The future PM volumes were developed by applying the model growth (future vs. 2015) to the 2015 traffic volumes from the 2014 Connection Cochrane TMP volumes. For AM volumes, the 100<sup>th</sup> highest peak hour traffic volumes (2015) from Alberta Transportation were reviewed to determine the relationship between AM and PM peak hour volumes. For example, whether the southbound right turn

<sup>4</sup> Home office (approximately 400-500) is not included.

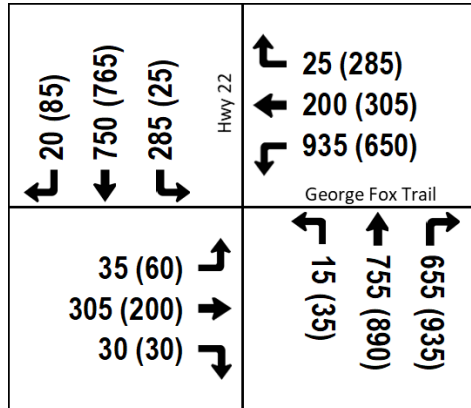
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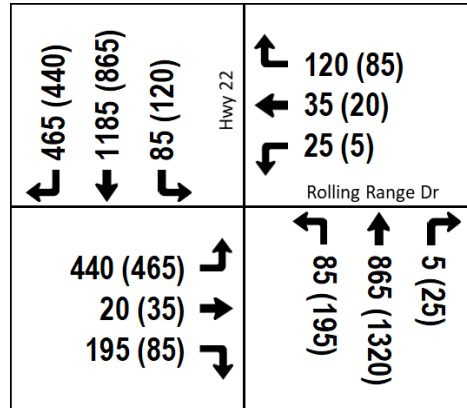


AM volumes are comparable to the northbound left PM volumes. The review indicates that the AM peak hour turning movement traffic volumes are generally a reciprocal of PM peak hour turning movement volumes (within 10% of difference on Highway 22). Hence the future AM peak hour turning movement volumes were developed by combining the reciprocal PM growth to existing AM volumes. Figure 2 illustrates the estimated future volumes at the four study intersections.

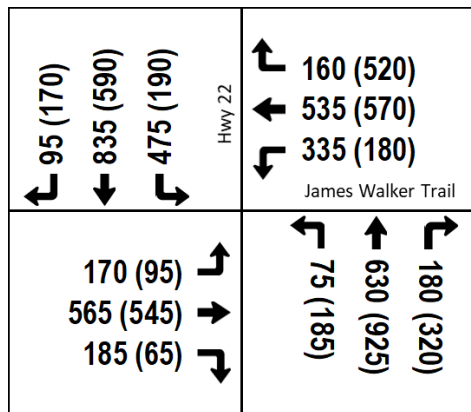
**Hwy 22 & George Fox Trail/Griffin Road**



**Hwy 22 & Rolling Range Dr**



**Hwy 22 & James Walker Trail**



**Hwy 22 & South Access**

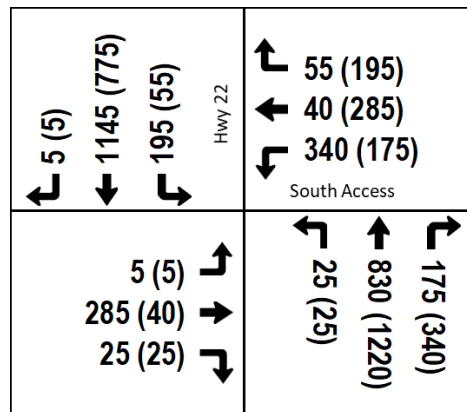


Figure 2: AM (PM) Peak Hour Forecast Traffic Volumes

**4.0 CONCLUSION**

The updated land use assumptions were provided by Watt Consulting Group for the Rolling Range development area, which also includes Towers Trail area north of Rolling Range. The land use assumption for this development includes 1,560 single-family units and 1,056 multi-family units, as well as 50 KSF of commercial (retail), 3 acres of office/light industrial lands and 100 hotel rooms. The land use information was converted into population and employment (approximately 6,900 people and 200 jobs). The rest of South Cochrane's land use assumptions remain unchanged since the previous Rolling Range update for the Town in August 2020.

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Based on these assumptions, the Town will see an increase population of approximately 55,000 people from 26,110 people in 2015 to 81,075 people in the Town build-out horizon. This is approximately a 210% increase overall. The population increase in South Cochrane between the 2015 horizon year and the build-out horizon is approximately 37,800 people from 4,330 people to 43,655 people. Approximately two-third of the South Cochrane population growth is anticipated to be located on the east side of Highway 22. The build-out horizon is anticipated to occur in the next 30 to 50 years.

Future traffic volumes were developed by utilizing the transportation demand model developed for the Town's 2014 TMP and reviewing relevant traffic information from Alberta Transportation. A few network assumptions were also included in the model including closing Towers Trail at George Fox Trail, providing east and west connections at Rolling Range Drive/River Heights Lane and the South Town access. Model results were reviewed to ensure that the coding reflects the proposed networks and trip distribution is also reasonably assigned based on road classifications. The AM peak hour volumes were developed by taking the reciprocal PM turning movement volumes based on a review of Alberta Transportation's traffic volume profiles. Future build-out traffic volumes were then developed for the four study intersections on Highway 22 at George Fox Trail, Rolling Range Drive, James Walker Trail and the South Town access.

**URBAN SYSTEMS LTD.**

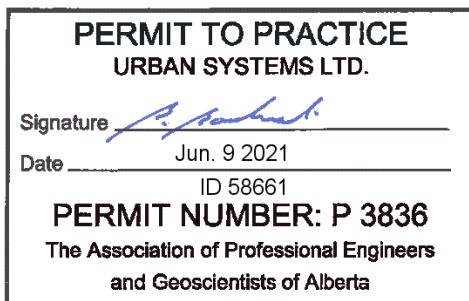
Prepared by:

Reviewed by:

Ming Xia, P.Eng., PTOE  
Transportation Engineer



Marcia Eng, P.Eng.  
Senior Transportation Engineer



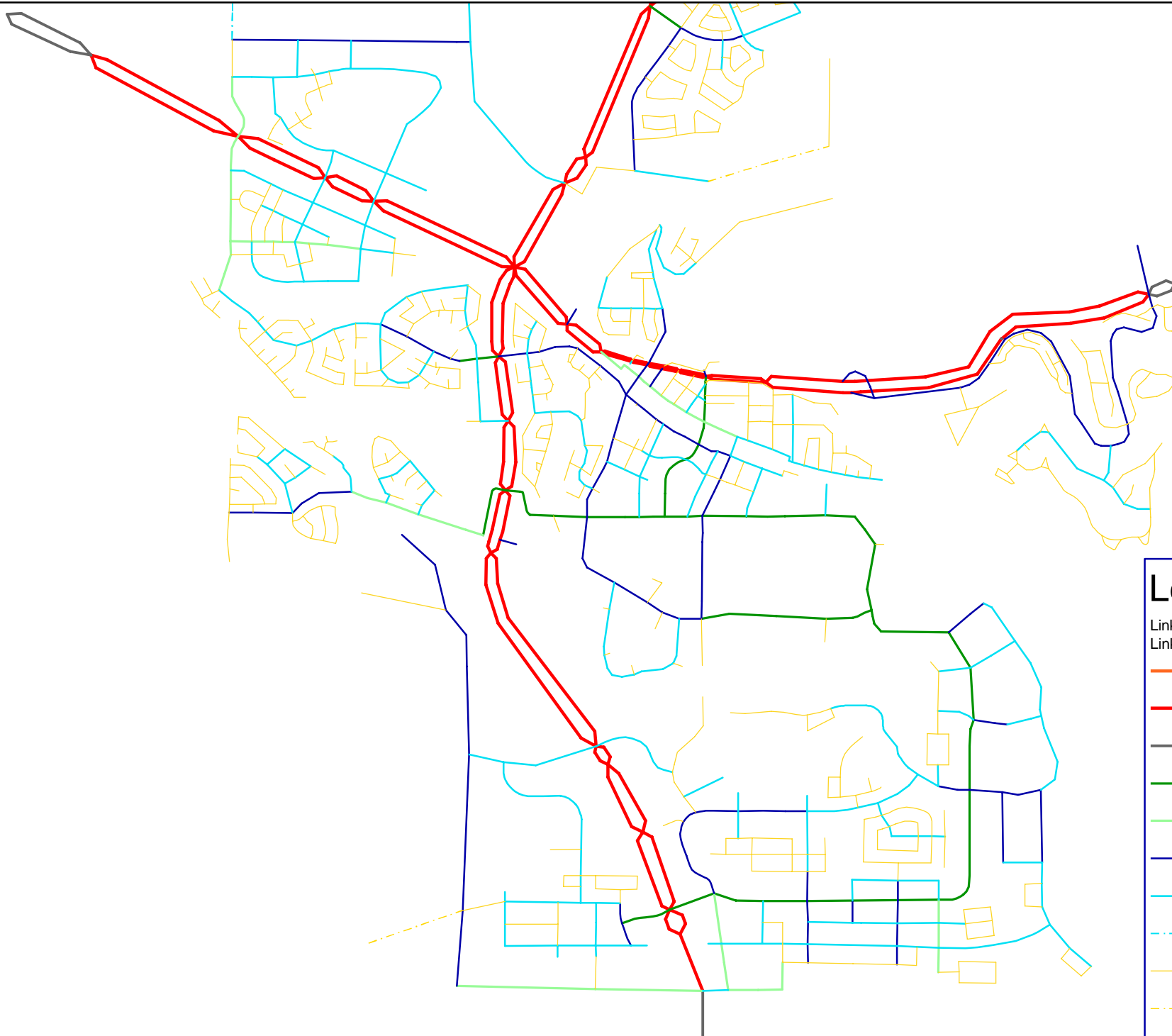
cc: Ryan Stewart, Town of Cochrane

Enclosures  
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# Appendix A

Model Link Type



### Legend

Links  
Link type\Name

- Ramp
- Highway
- Highway - Rural
- Arterial
- Minor Arterial - Paved
- Primary Collector - Paved
- Secondary Collector - Paved
- Secondary Collector - Gravel
- Local - Paved
- Local - Gravel

# Appendix B

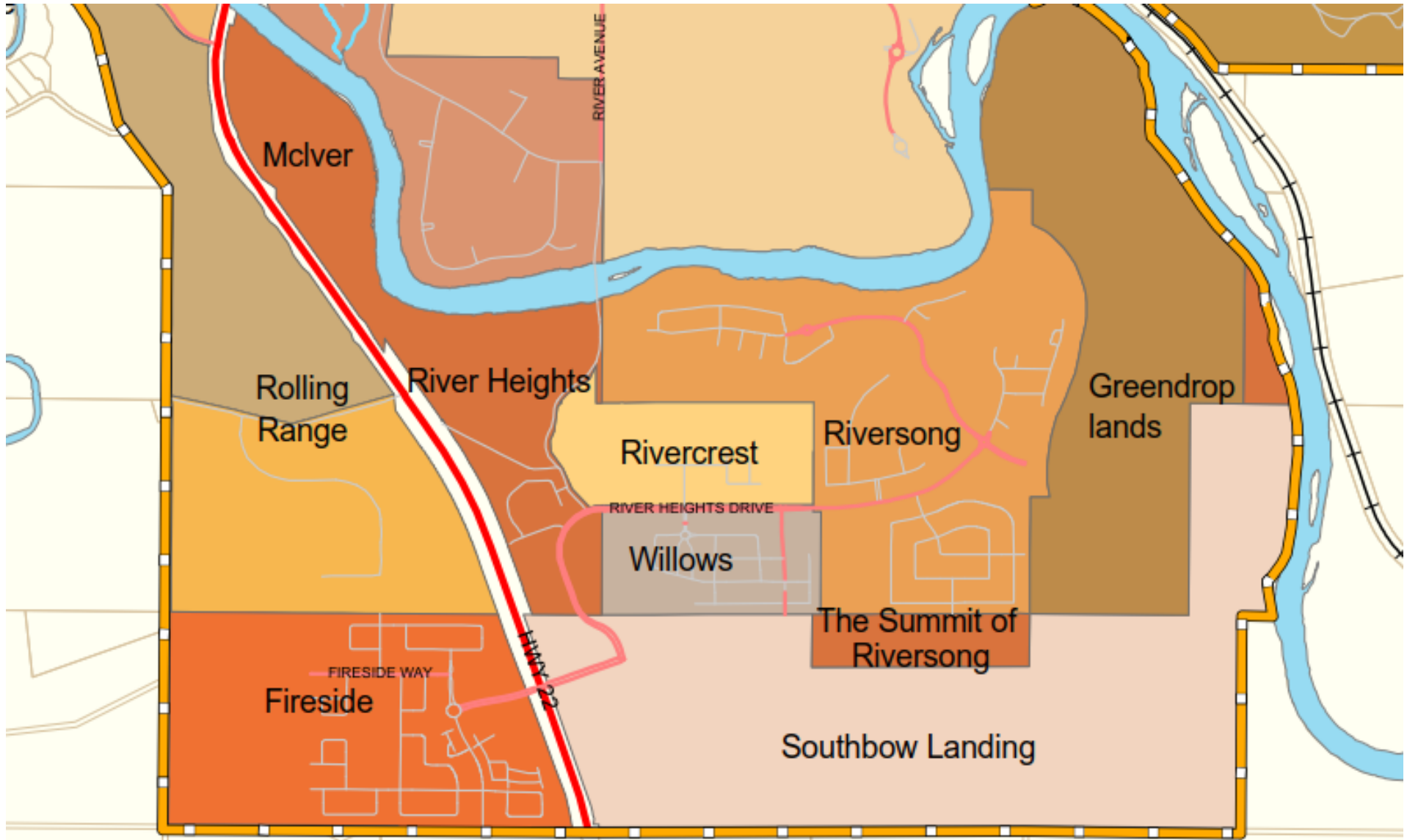
South Cochrane Community (Image Source: Town of Cochrane<sup>1</sup>)

Neighbourhood names have been modified for this assignment

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<sup>1</sup> <https://www.cochrane.ca/DocumentCenter/View/154/Neighbourhoods?bidId=>







## APPENDIX B: TRAFFIC ANALYSIS

Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate

Existing  
AM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	191	51	237	184	113	275	75	316	64	208	541	175
Future Volume (vph)	191	51	237	184	113	275	75	316	64	208	541	175
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	120.0		0.0	120.0		0.0	130.0		150.0	160.0		140.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	60.0			50.0			100.0			100.0		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	0.95	1.00
Frt		0.876			0.894				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1674	2961	0	1643	3042	0	1555	1542	1367	1627	3138	1430
Flt Permitted	0.305			0.303			0.430			0.430		
Satd. Flow (perm)	537	2961	0	524	3042	0	704	1542	1367	737	3138	1430
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		258			299				125			190
Link Speed (k/h)		50			50			80				80
Link Distance (m)		229.7			296.3			426.5				318.2
Travel Time (s)		16.5			21.3			19.2				14.3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	5%	4%	4%	7%	4%	3%	13%	20%	15%	8%	12%	10%
Adj. Flow (vph)	208	55	258	200	123	299	82	343	70	226	588	190
Shared Lane Traffic (%)												
Lane Group Flow (vph)	208	313	0	200	422	0	82	343	70	226	588	190
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	3	8		7	4		5	2		1	6	

Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate

Existing  
AM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	8			4			2		2	6		6
Detector Phase	3	8		7	4		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	10.0		7.0	20.0	20.0	7.0	20.0	20.0
Minimum Split (s)	11.5	49.5		11.5	49.5		14.0	47.0	47.0	14.0	47.0	47.0
Total Split (s)	21.5	49.5		21.5	49.5		27.0	50.0	50.0	27.0	50.0	50.0
Total Split (%)	14.5%	33.4%		14.5%	33.4%		18.2%	33.8%	33.8%	18.2%	33.8%	33.8%
Maximum Green (s)	15.0	43.0		15.0	43.0		20.0	43.0	43.0	20.0	43.0	43.0
Yellow Time (s)	3.5	3.5		3.5	3.5		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	3.0	3.0		3.0	3.0		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5		6.5	6.5		7.0	7.0	7.0	7.0	7.0	7.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Min	C-Min	None	C-Min	C-Min
Walk Time (s)		7.0			7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)		36.0			36.0			33.0	33.0		33.0	33.0
Pedestrian Calls (#/hr)		0			0			0	0		0	0
Act Effct Green (s)	31.7	13.1		32.0	13.2		81.0	72.3	72.3	95.4	80.5	80.5
Actuated g/C Ratio	0.21	0.09		0.22	0.09		0.55	0.49	0.49	0.64	0.54	0.54
v/c Ratio	0.81	0.63		0.78	0.78		0.19	0.46	0.10	0.39	0.34	0.22
Control Delay	69.4	19.0		67.4	29.2		12.7	29.4	0.3	13.5	20.7	3.2
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	69.4	19.0		67.4	29.2		12.7	29.4	0.3	13.5	20.7	3.2
LOS	E	B		E	C		B	C	A	B	C	A
Approach Delay		39.1			41.5			22.5			15.8	
Approach LOS		D			D			C			B	
Queue Length 50th (m)	54.6	8.5		52.3	19.4		8.9	69.4	0.0	26.9	52.0	0.0
Queue Length 95th (m)	#82.7	23.4		#78.9	37.7		17.6	110.1	0.0	44.5	74.4	13.5
Internal Link Dist (m)		205.7			272.3			402.5			294.2	
Turn Bay Length (m)	120.0			120.0			130.0		150.0	160.0		140.0
Base Capacity (vph)	260	1043		257	1095		551	753	731	599	1705	864
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	0.80	0.30		0.78	0.39		0.15	0.46	0.10	0.38	0.34	0.22

Intersection Summary

Area Type:	Other
Cycle Length:	148
Actuated Cycle Length:	148
Offset:	109 (74%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle:	125
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.81
Intersection Signal Delay:	27.7
Intersection LOS:	C
Intersection Capacity Utilization:	74.6%
ICU Level of Service:	D
Analysis Period (min):	15

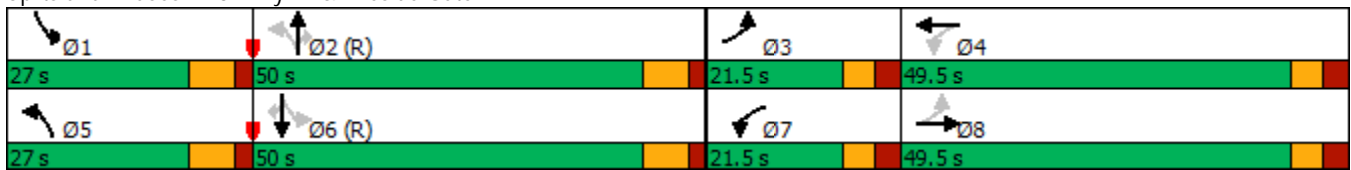
# Lanes, Volumes, Timings

## 3: Hwy 22 & Fireside Gate

Existing  
AM

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

Splits and Phases: 3: Hwy 22 & Fireside Gate



Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

Existing  
AM



Lane Group	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Volume (vph)	17	24	900	7	3	779
Future Volume (vph)	17	24	900	7	3	779
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850
Lane Util. Factor	1.00	1.00	0.95	0.95	1.00	1.00
Frt	0.920		0.999			
Flt Protected	0.980					
Satd. Flow (prot)	1394	0	3110	0	0	1667
Flt Permitted	0.980					
Satd. Flow (perm)	1394	0	3110	0	0	1667
Link Speed (k/h)	50		80			80
Link Distance (m)	170.2		208.4			165.8
Travel Time (s)	12.3		9.4			7.5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	12%	25%	13%	2%	2%	11%
Adj. Flow (vph)	18	26	978	8	3	847
Shared Lane Traffic (%)						
Lane Group Flow (vph)	44	0	986	0	0	850
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	54.6%
Analysis Period (min)	15
	ICU Level of Service A

# HCM Unsignalized Intersection Capacity Analysis

## 8: Hwy 22 & Rolling Range Drive

Existing  
AM



Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Volume (veh/h)	17	24	900	7	3	779
Future Volume (Veh/h)	17	24	900	7	3	779
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	18	26	978	8	3	847
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1835	493			986	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1835	493			986	
tC, single (s)	7.0	7.4			4.1	
tC, 2 stage (s)						
tF (s)	3.6	3.5			2.2	
p0 queue free %	70	94			100	
cM capacity (veh/h)	60	465			696	
Direction, Lane #	EB 1	SE 1	SE 2	NW 1		
Volume Total	44	652	334	850		
Volume Left	18	0	0	3		
Volume Right	26	0	8	0		
cSH	124	1700	1700	696		
Volume to Capacity	0.36	0.38	0.20	0.00		
Queue Length 95th (m)	11.6	0.0	0.0	0.1		
Control Delay (s)	49.4	0.0	0.0	0.1		
Lane LOS	E			A		
Approach Delay (s)	49.4	0.0		0.1		
Approach LOS	E					
Intersection Summary						
Average Delay			1.2			
Intersection Capacity Utilization			54.6%		ICU Level of Service	A
Analysis Period (min)			15			

Lanes, Volumes, Timings  
20: Hwy 22 & George Fox Trail

Existing  
AM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗		↕	↗	↗	↗			↕↕	↗
Traffic Volume (vph)	419	0	131	0	0	0	40	754	2	0	776	172
Future Volume (vph)	419	0	131	0	0	0	40	754	2	0	776	172
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	0.0		5.0	0.0		5.0	200.0		0.0	0.0		65.0
Storage Lanes	0		1	0		1	1		0	0		1
Taper Length (m)	7.5			7.5			80.0			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt			0.850									0.850
Flt Protected		0.950					0.950					
Satd. Flow (prot)	0	1674	1527	0	1814	1814	1598	1698	0	0	3255	1470
Flt Permitted		0.757					0.174					
Satd. Flow (perm)	0	1334	1527	0	1814	1814	293	1698	0	0	3255	1470
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			107									187
Link Speed (k/h)		50			50			50				50
Link Distance (m)		128.6			88.5			205.2				145.1
Travel Time (s)		9.3			6.4			14.8				10.4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	5%	2%	3%	2%	2%	2%	10%	9%	2%	2%	8%	7%
Adj. Flow (vph)	455	0	142	0	0	0	43	820	2	0	843	187
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	455	142	0	0	0	43	822	0	0	843	187
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	Perm	NA	Perm			Perm	pm+pt	NA			NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8		8	2		6			6
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	11.0	22.5		22.5	22.5	22.5
Total Split (s)	30.5	30.5	30.5	30.5	30.5	30.5	11.0	35.5		24.5	24.5	24.5
Total Split (%)	46.2%	46.2%	46.2%	46.2%	46.2%	46.2%	16.7%	53.8%		37.1%	37.1%	37.1%
Maximum Green (s)	25.0	25.0	25.0	25.0	25.0	25.0	7.0	30.0		19.0	19.0	19.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.5	2.0		2.0	2.0	2.0
Lost Time Adjust (s)		0.0	0.0		0.0	0.0	0.0	0.0			0.0	0.0
Total Lost Time (s)		5.5	5.5		5.5	5.5	4.0	5.5			5.5	5.5
Lead/Lag							Lead			Lag	Lag	Lag
Lead-Lag Optimize?							Yes			Yes	Yes	Yes
Act Effect Green (s)		25.0	25.0				31.5	30.0			19.0	19.0
Actuated g/C Ratio		0.38	0.38				0.48	0.45			0.29	0.29
v/c Ratio		0.90	0.22				0.15	1.07			0.90	0.34
Control Delay		44.2	5.9				10.7	72.9			37.6	5.2
Queue Delay		0.0	0.0				0.0	0.0			0.0	0.0



Lanes, Volumes, Timings  
20: Hwy 22 & George Fox Trail

Existing  
AM

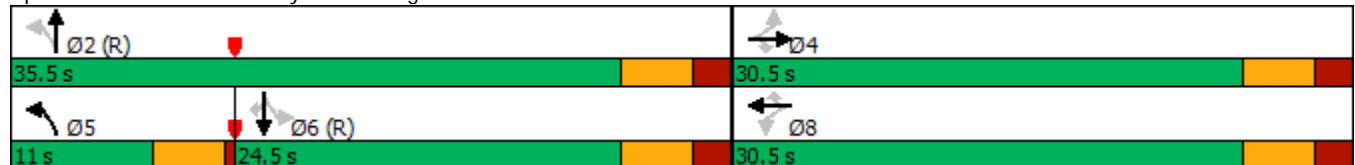


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay		44.2	5.9				10.7	72.9			37.6	5.2
LOS		D	A				B	E			D	A
Approach Delay		35.1						69.8			31.7	
Approach LOS		D						E			C	
Queue Length 50th (m)		53.8	2.8				2.8	~120.3			54.5	0.0
Queue Length 95th (m)		#107.7	13.0				7.6	#184.0			#88.1	13.1
Internal Link Dist (m)		104.6			64.5			181.2			121.1	
Turn Bay Length (m)			5.0				200.0					65.0
Base Capacity (vph)		505	644				278	771			937	556
Starvation Cap Reductn		0	0				0	0			0	0
Spillback Cap Reductn		0	0				0	0			0	0
Storage Cap Reductn		0	0				0	0			0	0
Reduced v/c Ratio		0.90	0.22				0.15	1.07			0.90	0.34

Intersection Summary

Area Type: Other  
 Cycle Length: 66  
 Actuated Cycle Length: 66  
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green  
 Natural Cycle: 90  
 Control Type: Pretimed  
 Maximum v/c Ratio: 1.07  
 Intersection Signal Delay: 45.7  
 Intersection LOS: D  
 Intersection Capacity Utilization 73.9%  
 ICU Level of Service D  
 Analysis Period (min) 15  
 ~ 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.

Splits and Phases: 20: Hwy 22 & George Fox Trail



Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate

Existing  
PM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	147	44	70	66	43	193	149	624	154	259	316	174
Future Volume (vph)	147	44	70	66	43	193	149	624	154	259	316	174
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	120.0		0.0	120.0		0.0	130.0		150.0	160.0		140.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	60.0			50.0			100.0			100.0		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	0.95	1.00
Frt		0.908			0.877				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1690	3092	0	1674	2982	0	1723	1713	1498	1706	3111	1542
Flt Permitted	0.284			0.673			0.546			0.126		
Satd. Flow (perm)	505	3092	0	1186	2982	0	990	1713	1498	226	3111	1542
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		76			210				167			189
Link Speed (k/h)		50			50			80				80
Link Distance (m)		229.7			296.3			426.5				318.2
Travel Time (s)		16.5			21.3			19.2				14.3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	4%	2%	4%	5%	5%	3%	2%	8%	5%	3%	13%	2%
Adj. Flow (vph)	160	48	76	72	47	210	162	678	167	282	343	189
Shared Lane Traffic (%)												
Lane Group Flow (vph)	160	124	0	72	257	0	162	678	167	282	343	189
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	3	8		7	4		5	2		1	6	

Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate

Existing  
PM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	8			4			2		2	6		6
Detector Phase	3	8		7	4		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		7.0	20.0	20.0	7.0	20.0	20.0
Minimum Split (s)	11.5	49.5		11.5	49.5		23.5	47.0	47.0	12.5	47.0	47.0
Total Split (s)	21.5	49.5		21.5	49.5		34.0	69.0	69.0	21.0	56.0	56.0
Total Split (%)	13.4%	30.7%		13.4%	30.7%		21.1%	42.9%	42.9%	13.0%	34.8%	34.8%
Maximum Green (s)	15.0	43.0		15.0	43.0		28.5	62.0	62.0	15.5	49.0	49.0
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	5.0	5.0	3.5	5.0	5.0
All-Red Time (s)	3.0	3.0		3.0	3.0		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5		6.5	6.5		5.5	7.0	7.0	5.5	7.0	7.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Min	C-Min	None	C-Min	C-Min
Walk Time (s)		7.0			7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)		36.0			36.0			33.0	33.0		33.0	33.0
Pedestrian Calls (#/hr)		0			0			0	0		0	0
Act Effct Green (s)	28.6	14.1		22.0	10.8		82.8	71.1	71.1	117.2	100.1	100.1
Actuated g/C Ratio	0.18	0.09		0.14	0.07		0.51	0.44	0.44	0.73	0.62	0.62
v/c Ratio	0.82	0.36		0.37	0.65		0.29	0.90	0.22	0.54	0.18	0.18
Control Delay	87.7	32.2		59.5	23.9		12.2	56.9	4.0	23.0	13.7	2.1
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	87.7	32.2		59.5	23.9		12.2	56.9	4.0	23.0	13.7	2.1
LOS	F	C		E	C		B	E	A	C	B	A
Approach Delay		63.4			31.7			40.9			14.3	
Approach LOS		E			C			D			B	
Queue Length 50th (m)	48.5	8.0		20.7	8.1		14.9	199.6	0.0	40.4	24.5	0.0
Queue Length 95th (m)	#76.7	19.5		35.7	23.3		25.0	#286.5	14.4	76.3	36.5	11.1
Internal Link Dist (m)		205.7			272.3			402.5			294.2	
Turn Bay Length (m)	120.0			120.0			130.0		150.0	160.0		140.0
Base Capacity (vph)	201	881		235	950		751	756	755	523	1933	1029
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	0.80	0.14		0.31	0.27		0.22	0.90	0.22	0.54	0.18	0.18

Intersection Summary

Area Type:	Other
Cycle Length:	161
Actuated Cycle Length:	161
Offset:	106 (66%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle:	145
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.90
Intersection Signal Delay:	33.4
Intersection LOS:	C
Intersection Capacity Utilization:	86.4%
ICU Level of Service:	E
Analysis Period (min):	15

# Lanes, Volumes, Timings

## 3: Hwy 22 & Fireside Gate

Existing  
PM

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

Splits and Phases: 3: Hwy 22 & Fireside Gate



Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

Existing  
PM



Lane Group	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Volume (vph)	2	13	736	11	18	946
Future Volume (vph)	2	13	736	11	18	946
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850
Lane Util. Factor	1.00	1.00	0.95	0.95	1.00	1.00
Frt	0.882		0.998			
Flt Protected	0.994					0.999
Satd. Flow (prot)	1590	0	3311	0	0	1728
Flt Permitted	0.994					0.999
Satd. Flow (perm)	1590	0	3311	0	0	1728
Link Speed (k/h)	50		80			80
Link Distance (m)	170.2		208.4			165.8
Travel Time (s)	12.3		9.4			7.5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	6%	2%	5%	7%
Adj. Flow (vph)	2	14	800	12	20	1028
Shared Lane Traffic (%)						
Lane Group Flow (vph)	16	0	812	0	0	1048
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.6		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	4.8		4.8			4.8
Two way Left Turn Lane						
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	75.9%
Analysis Period (min)	15
	ICU Level of Service D

# HCM Unsignalized Intersection Capacity Analysis

## 8: Hwy 22 & Rolling Range Drive

Existing  
PM



Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Volume (veh/h)	2	13	736	11	18	946
Future Volume (Veh/h)	2	13	736	11	18	946
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	14	800	12	20	1028
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None		None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1874	406			812	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1874	406			812	
tC, single (s)	6.8	6.9			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	97	98			97	
cM capacity (veh/h)	62	594			791	
Direction, Lane #	EB 1	SE 1	SE 2	NW 1		
Volume Total	16	533	279	1048		
Volume Left	2	0	0	20		
Volume Right	14	0	12	0		
cSH	286	1700	1700	791		
Volume to Capacity	0.06	0.31	0.16	0.03		
Queue Length 95th (m)	1.4	0.0	0.0	0.6		
Control Delay (s)	18.3	0.0	0.0	0.8		
Lane LOS	C			A		
Approach Delay (s)	18.3	0.0		0.8		
Approach LOS	C					
Intersection Summary						
Average Delay			0.6			
Intersection Capacity Utilization			75.9%		ICU Level of Service	D
Analysis Period (min)			15			

Lanes, Volumes, Timings  
20: Hwy 22 & George Fox Trail

Existing  
PM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕	↗		↕	↗	↗	↗			↕↕	↗
Traffic Volume (vph)	220	1	49	0	1	3	102	846	0	1	698	333
Future Volume (vph)	220	1	49	0	1	3	102	846	0	1	698	333
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	0.0		5.0	0.0		5.0	200.0		0.0	0.0		65.0
Storage Lanes	0		1	0		1	1		0	0		1
Taper Length (m)	7.5			7.5			80.0			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt			0.850			0.850						0.850
Flt Protected		0.953					0.950					
Satd. Flow (prot)	0	1728	1542	0	1814	1542	1723	1779	0	0	3413	1542
Flt Permitted		0.727					0.218				0.942	
Satd. Flow (perm)	0	1319	1542	0	1814	1542	395	1779	0	0	3215	1542
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			107			107						362
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		128.6			88.5			205.2			145.1	
Travel Time (s)		9.3			6.4			9.2			6.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	4%	2%	2%	3%	2%
Adj. Flow (vph)	239	1	53	0	1	3	111	920	0	1	759	362
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	240	53	0	1	3	111	920	0	0	760	362
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	Perm	NA	Perm		NA	Perm	pm+pt	NA		Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8		8	2			6		6
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	11.0	22.5		22.5	22.5	22.5
Total Split (s)	26.5	26.5	26.5	26.5	26.5	26.5	11.0	39.5		28.5	28.5	28.5
Total Split (%)	40.2%	40.2%	40.2%	40.2%	40.2%	40.2%	16.7%	59.8%		43.2%	43.2%	43.2%
Maximum Green (s)	21.0	21.0	21.0	21.0	21.0	21.0	7.0	34.0		23.0	23.0	23.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.5	2.0		2.0	2.0	2.0
Lost Time Adjust (s)		0.0	0.0		0.0	0.0	0.0	0.0			0.0	0.0
Total Lost Time (s)		5.5	5.5		5.5	5.5	4.0	5.5			5.5	5.5
Lead/Lag							Lead			Lag	Lag	Lag
Lead-Lag Optimize?							Yes			Yes	Yes	Yes
Act Effect Green (s)		21.0	21.0		21.0	21.0	35.5	34.0			23.0	23.0
Actuated g/C Ratio		0.32	0.32		0.32	0.32	0.54	0.52			0.35	0.35
v/c Ratio		0.57	0.09		0.00	0.01	0.31	1.00			0.68	0.47
Control Delay		25.2	1.2		15.0	0.0	10.1	49.8			22.1	4.3
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0			0.0	0.0

Lanes, Volumes, Timings  
20: Hwy 22 & George Fox Trail

Existing  
PM

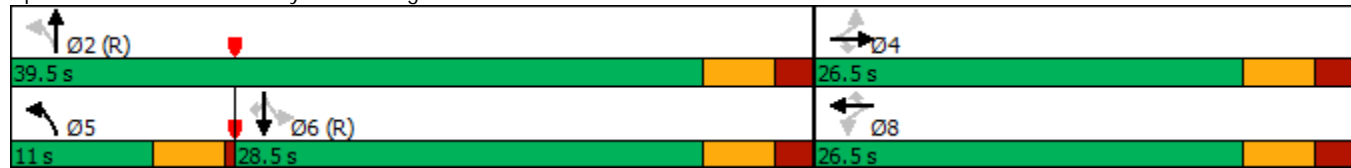


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay		25.2	1.2		15.0	0.0	10.1	49.8			22.1	4.3
LOS		C	A		B	A	B	D			C	A
Approach Delay		20.9			3.8			45.5			16.3	
Approach LOS		C			A			D			B	
Queue Length 50th (m)		25.5	0.0		0.1	0.0	6.5	-111.1			43.1	0.0
Queue Length 95th (m)		47.1	1.8		1.0	0.0	13.4	#193.5			61.6	15.9
Internal Link Dist (m)		104.6			64.5			181.2			121.1	
Turn Bay Length (m)			5.0			5.0	200.0					65.0
Base Capacity (vph)		419	563		577	563	353	916			1120	773
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		0.57	0.09		0.00	0.01	0.31	1.00			0.68	0.47

Intersection Summary

Area Type: Other  
 Cycle Length: 66  
 Actuated Cycle Length: 66  
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green  
 Natural Cycle: 70  
 Control Type: Pretimed  
 Maximum v/c Ratio: 1.00  
 Intersection Signal Delay: 29.1  
 Intersection LOS: C  
 Intersection Capacity Utilization 98.6%  
 ICU Level of Service F  
 Analysis Period (min) 15  
 ~ 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.

Splits and Phases: 20: Hwy 22 & George Fox Trail





Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate

Existing-Retimed Signals  
AM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	191	51	237	184	113	275	75	316	64	208	541	175
Future Volume (vph)	191	51	237	184	113	275	75	316	64	208	541	175
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	120.0		0.0	120.0		0.0	130.0		150.0	160.0		140.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	60.0			50.0			100.0			100.0		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	0.95	1.00
Frt		0.876			0.894				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1674	2961	0	1643	3042	0	1555	1542	1367	1627	3138	1430
Flt Permitted	0.303			0.326			0.422			0.440		
Satd. Flow (perm)	534	2961	0	564	3042	0	691	1542	1367	754	3138	1430
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		258			299				194			190
Link Speed (k/h)		50			50			80				80
Link Distance (m)		229.7			296.3			426.5				318.2
Travel Time (s)		16.5			21.3			19.2				14.3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	5%	4%	4%	7%	4%	3%	13%	20%	15%	8%	12%	10%
Adj. Flow (vph)	208	55	258	200	123	299	82	343	70	226	588	190
Shared Lane Traffic (%)												
Lane Group Flow (vph)	208	313	0	200	422	0	82	343	70	226	588	190
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4				9.4
Detector 2 Size(m)		0.6			0.6			0.6				0.6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	3	8		7	4		5	2		1		6

Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate

Existing-Retimed Signals  
AM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	8			4			2		2	6		6
Detector Phase	3	8		7	4		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	10.0		7.0	20.0	20.0	7.0	20.0	20.0
Minimum Split (s)	11.5	49.5		11.5	49.5		14.0	47.0	47.0	25.0	47.0	47.0
Total Split (s)	13.0	50.3		12.2	49.5		14.0	47.5	47.5	25.0	58.5	58.5
Total Split (%)	9.6%	37.3%		9.0%	36.7%		10.4%	35.2%	35.2%	18.5%	43.3%	43.3%
Maximum Green (s)	6.5	43.8		5.7	43.0		7.0	40.5	40.5	18.0	51.5	51.5
Yellow Time (s)	3.5	3.5		3.5	3.5		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	3.0	3.0		3.0	3.0		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5		6.5	6.5		7.0	7.0	7.0	7.0	7.0	7.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Min	C-Min	None	C-Min	C-Min
Walk Time (s)		7.0			7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)		36.0			36.0			33.0	33.0		33.0	33.0
Pedestrian Calls (#/hr)		0			0			0	0		0	0
Act Effct Green (s)	29.3	13.1		28.6	12.8		73.9	65.4	65.4	84.1	70.5	70.5
Actuated g/C Ratio	0.22	0.10		0.21	0.09		0.55	0.48	0.48	0.62	0.52	0.52
v/c Ratio	0.83	0.60		0.82	0.76		0.19	0.46	0.09	0.41	0.36	0.23
Control Delay	68.4	16.8		68.2	26.3		11.9	27.2	0.2	13.2	20.4	3.1
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	68.4	16.8		68.2	26.3		11.9	27.2	0.2	13.2	20.4	3.1
LOS	E	B		E	C		B	C	A	B	C	A
Approach Delay		37.4			39.8			20.8			15.5	
Approach LOS		D			D			C			B	
Queue Length 50th (m)	48.7	7.7		46.6	17.6		8.6	63.8	0.0	26.0	50.5	0.0
Queue Length 95th (m)	#84.4	21.6		#81.8	34.8		15.6	98.6	0.0	39.4	67.2	12.6
Internal Link Dist (m)		205.7			272.3			402.5			294.2	
Turn Bay Length (m)	120.0			120.0			130.0		150.0	160.0		140.0
Base Capacity (vph)	252	1134		245	1172		432	746	761	597	1639	837
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	0.83	0.28		0.82	0.36		0.19	0.46	0.09	0.38	0.36	0.23

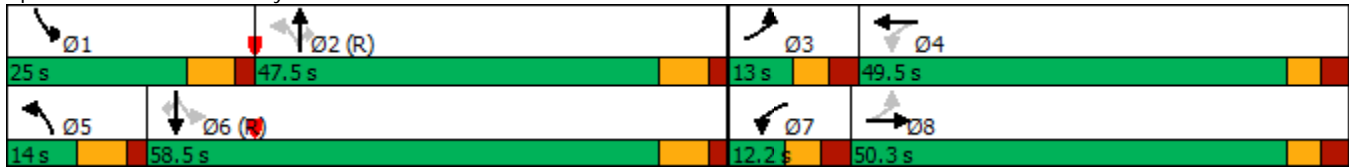
Intersection Summary

Area Type:	Other
Cycle Length:	135
Actuated Cycle Length:	135
Offset:	0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle:	135
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.83
Intersection Signal Delay:	26.5
Intersection LOS:	C
Intersection Capacity Utilization:	74.6%
ICU Level of Service:	D
Analysis Period (min):	15

Lanes, Volumes, Timings  
 3: Hwy 22 & Fireside Gate





















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

Splits and Phases: 3: Hwy 22 & Fireside Gate



Lanes, Volumes, Timings  
20: Hwy 22 & George Fox Trail

Existing-Retimed Signals  
AM

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	419	0	131	0	0	0	40	754	2	0	776	172
Future Volume (vph)	419	0	131	0	0	0	40	754	2	0	776	172
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	0.0		5.0	0.0		5.0	200.0		0.0	0.0		65.0
Storage Lanes	0		1	0		1	1		0	0		1
Taper Length (m)	7.5			7.5			80.0			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt			0.850									0.850
Flt Protected		0.950					0.950					
Satd. Flow (prot)	0	1674	1527	0	1814	1814	1598	1698	0	0	3255	1470
Flt Permitted		0.757					0.138					
Satd. Flow (perm)	0	1334	1527	0	1814	1814	232	1698	0	0	3255	1470
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			71									187
Link Speed (k/h)		50			50			80				80
Link Distance (m)		128.6			88.5			205.2				145.1
Travel Time (s)		9.3			6.4			14.8				10.4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	5%	2%	3%	2%	2%	2%	10%	9%	2%	2%	8%	7%
Adj. Flow (vph)	455	0	142	0	0	0	43	820	2	0	843	187
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	455	142	0	0	0	43	822	0	0	843	187
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	Perm	NA	Perm			Perm	pm+pt	NA			NA	Perm
Protected Phases		4			8		5	2				6
Permitted Phases	4		4	8		8	2			6		6
Minimum Split (s)	23.5	23.5	23.5	23.5	23.5	23.5	22.0	23.5		23.5	23.5	23.5
Total Split (s)	41.0	41.0	41.0	41.0	41.0	41.0	22.0	59.0		37.0	37.0	37.0
Total Split (%)	41.0%	41.0%	41.0%	41.0%	41.0%	41.0%	22.0%	59.0%		37.0%	37.0%	37.0%
Maximum Green (s)	35.5	35.5	35.5	35.5	35.5	35.5	18.0	53.5		31.5	31.5	31.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.5	2.0		2.0	2.0	2.0
Lost Time Adjust (s)		0.0	0.0		0.0	0.0	0.0	0.0			0.0	0.0
Total Lost Time (s)		5.5	5.5		5.5	5.5	4.0	5.5			5.5	5.5
Lead/Lag							Lead			Lag	Lag	Lag
Lead-Lag Optimize?							Yes			Yes	Yes	Yes
Act Effect Green (s)		35.5	35.5				55.0	53.5			31.5	31.5
Actuated g/C Ratio		0.36	0.36				0.55	0.54			0.32	0.32
v/c Ratio		0.96	0.24				0.12	0.91			0.82	0.32
Control Delay		66.2	13.0				11.2	36.5			39.7	5.4
Queue Delay		0.0	0.0				0.0	0.0			0.0	0.0

Lanes, Volumes, Timings  
20: Hwy 22 & George Fox Trail

Existing-Retimed Signals  
AM

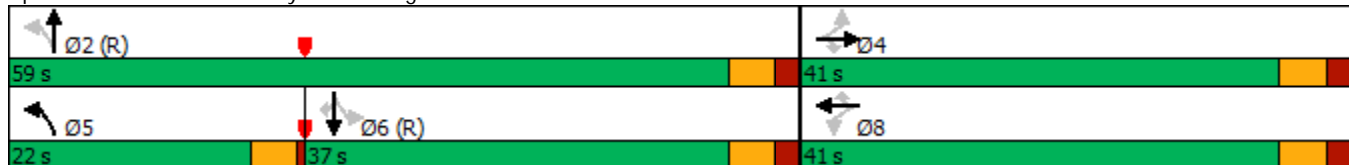


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay		66.2	13.0				11.2	36.5			39.7	5.4
LOS		E	B				B	D			D	A
Approach Delay		53.5						35.3			33.4	
Approach LOS		D						D			C	
Queue Length 50th (m)		89.8	9.7				3.8	143.5			83.1	0.0
Queue Length 95th (m)		#154.6	23.9				9.0	#230.9			108.2	15.4
Internal Link Dist (m)		104.6			64.5			181.2			121.1	
Turn Bay Length (m)			5.0				200.0					65.0
Base Capacity (vph)		473	587				373	908			1025	591
Starvation Cap Reductn		0	0				0	0			0	0
Spillback Cap Reductn		0	0				0	0			0	0
Storage Cap Reductn		0	0				0	0			0	0
Reduced v/c Ratio		0.96	0.24				0.12	0.91			0.82	0.32

Intersection Summary























Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green  
 Natural Cycle: 90  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.96  
 Intersection Signal Delay: 38.9  
 Intersection LOS: D  
 Intersection Capacity Utilization 73.9%  
 ICU Level of Service D  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 20: Hwy 22 & George Fox Trail



Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate

Existing-Signals Retimed  
PM

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	147	44	70	66	43	193	149	624	154	259	316	174
Future Volume (vph)	147	44	70	66	43	193	149	624	154	259	316	174
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	120.0		0.0	120.0		0.0	130.0		150.0	160.0		140.0
Storage Lanes	1		0	1		0	1		1	1		1
Taper Length (m)	60.0			50.0			100.0			100.0		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	0.95	1.00
Frt		0.908			0.877				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1690	3092	0	1674	2982	0	1723	1713	1498	1706	3111	1542
Flt Permitted	0.280			0.673			0.546			0.136		
Satd. Flow (perm)	498	3092	0	1186	2982	0	990	1713	1498	244	3111	1542
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		76			210				167			189
Link Speed (k/h)		50			50			80				80
Link Distance (m)		229.7			296.3			426.5				318.2
Travel Time (s)		16.5			21.3			19.2				14.3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	4%	2%	4%	5%	5%	3%	2%	8%	5%	3%	13%	2%
Adj. Flow (vph)	160	48	76	72	47	210	162	678	167	282	343	189
Shared Lane Traffic (%)												
Lane Group Flow (vph)	160	124	0	72	257	0	162	678	167	282	343	189
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases	3	8		7	4		5	2		1	6	

Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate

Existing-Signals Retimed  
PM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	8			4			2		2	6		6
Detector Phase	3	8		7	4		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		7.0	20.0	20.0	7.0	20.0	20.0
Minimum Split (s)	11.5	49.5		11.5	49.5		23.5	47.0	47.0	12.5	47.0	47.0
Total Split (s)	21.6	49.6		21.6	49.6		23.5	55.0	55.0	23.8	55.3	55.3
Total Split (%)	14.4%	33.1%		14.4%	33.1%		15.7%	36.7%	36.7%	15.9%	36.9%	36.9%
Maximum Green (s)	15.1	43.1		15.1	43.1		18.0	48.0	48.0	18.3	48.3	48.3
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	5.0	5.0	3.5	5.0	5.0
All-Red Time (s)	3.0	3.0		3.0	3.0		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5		6.5	6.5		5.5	7.0	7.0	5.5	7.0	7.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		None	C-Min	C-Min	None	C-Min	C-Min
Walk Time (s)		7.0			7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)		36.0			36.0			33.0	33.0		33.0	33.0
Pedestrian Calls (#/hr)		0			0			0	0		0	0
Act Effct Green (s)	28.8	14.3		21.5	10.7		78.9	67.3	67.3	106.4	89.3	89.3
Actuated g/C Ratio	0.19	0.10		0.14	0.07		0.53	0.45	0.45	0.71	0.60	0.60
v/c Ratio	0.76	0.34		0.35	0.63		0.28	0.88	0.22	0.58	0.19	0.19
Control Delay	74.9	29.5		53.6	22.2		11.5	52.3	4.2	21.6	14.7	2.4
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	74.9	29.5		53.6	22.2		11.5	52.3	4.2	21.6	14.7	2.4
LOS	E	C		D	C		B	D	A	C	B	A
Approach Delay		55.0			29.0			37.8			14.2	
Approach LOS		E			C			D			B	
Queue Length 50th (m)	44.2	7.4		18.8	7.4		15.0	187.8	0.0	35.9	24.6	0.0
Queue Length 95th (m)	#68.0	18.5		33.0	22.0		25.3	#285.5	14.6	69.9	36.9	11.6
Internal Link Dist (m)		205.7			272.3			402.5			294.2	
Turn Bay Length (m)	120.0			120.0			130.0		150.0	160.0		140.0
Base Capacity (vph)	216	942		253	1006		661	768	764	485	1851	994
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	0.74	0.13		0.28	0.26		0.25	0.88	0.22	0.58	0.19	0.19

Intersection Summary









Area Type: Other  
 Cycle Length: 150  
 Actuated Cycle Length: 150  
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green  
 Natural Cycle: 145  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.88  
 Intersection Signal Delay: 30.7  
 Intersection LOS: C  
 Intersection Capacity Utilization 86.4%  
 ICU Level of Service E  
 Analysis Period (min) 15

Lanes, Volumes, Timings  
 3: Hwy 22 & Fireside Gate

Existing-Signals Retimed  
 PM

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





















Splits and Phases: 3: Hwy 22 & Fireside Gate

 Ø1	 Ø2 (R)	 Ø3	 Ø4
23.8 s	55 s	21.6 s	49.6 s
 Ø5	 Ø6 (R)	 Ø7	 Ø8
23.5 s	55.3 s	21.6 s	49.6 s



Lanes, Volumes, Timings  
20: Hwy 22 & George Fox Trail

Existing-Signals Retimed  
PM

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	220	1	49	0	1	3	102	846	0	1	698	333
Future Volume (vph)	220	1	49	0	1	3	102	846	0	1	698	333
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	0.0		5.0	0.0		5.0	200.0		0.0	0.0		65.0
Storage Lanes	0		1	0		1	1		0	0		1
Taper Length (m)	7.5			7.5			80.0			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt			0.850			0.850						0.850
Flt Protected		0.953					0.950					
Satd. Flow (prot)	0	1728	1542	0	1814	1542	1723	1779	0	0	3413	1542
Flt Permitted		0.727					0.263				0.954	
Satd. Flow (perm)	0	1319	1542	0	1814	1542	477	1779	0	0	3256	1542
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			101			101						362
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		128.6			88.5			205.2			145.1	
Travel Time (s)		9.3			6.4			9.2			6.5	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	4%	2%	2%	3%	2%
Adj. Flow (vph)	239	1	53	0	1	3	111	920	0	1	759	362
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	240	53	0	1	3	111	920	0	0	760	362
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	Perm	NA	Perm		NA	Perm	pm+pt	NA		Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8		8	2			6		6
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	11.0	22.5		22.5	22.5	22.5
Total Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	11.0	47.5		36.5	36.5	36.5
Total Split (%)	32.1%	32.1%	32.1%	32.1%	32.1%	32.1%	15.7%	67.9%		52.1%	52.1%	52.1%
Maximum Green (s)	17.0	17.0	17.0	17.0	17.0	17.0	7.0	42.0		31.0	31.0	31.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5	3.5
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	0.5	2.0		2.0	2.0	2.0
Lost Time Adjust (s)		0.0	0.0		0.0	0.0	0.0	0.0			0.0	0.0
Total Lost Time (s)		5.5	5.5		5.5	5.5	4.0	5.5			5.5	5.5
Lead/Lag							Lead			Lag	Lag	Lag
Lead-Lag Optimize?							Yes			Yes	Yes	Yes
Act Effect Green (s)		17.0	17.0		17.0	17.0	43.5	42.0			31.0	31.0
Actuated g/C Ratio		0.24	0.24		0.24	0.24	0.62	0.60			0.44	0.44
v/c Ratio		0.75	0.12		0.00	0.01	0.26	0.86			0.53	0.41
Control Delay		41.7	1.9		20.0	0.0	7.0	22.5			15.8	3.1
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0			0.0	0.0

Lanes, Volumes, Timings  
20: Hwy 22 & George Fox Trail

Existing-Signals Retimed  
PM



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Delay		41.7	1.9		20.0	0.0	7.0	22.5			15.8	3.1
LOS		D	A		B	A	A	C			B	A
Approach Delay		34.5			5.0			20.8			11.7	
Approach LOS		C			A			C			B	
Queue Length 50th (m)		30.6	0.0		0.1	0.0	5.4	93.3			38.2	0.0
Queue Length 95th (m)		#64.8	2.6		1.3	0.0	11.0	#180.9			54.0	13.6
Internal Link Dist (m)		104.6			64.5			181.2			121.1	
Turn Bay Length (m)			5.0			5.0	200.0					65.0
Base Capacity (vph)		320	450		440	450	421	1067			1441	884
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		0.75	0.12		0.00	0.01	0.26	0.86			0.53	0.41

Intersection Summary

Area Type: Other  
 Cycle Length: 70  
 Actuated Cycle Length: 70  
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green  
 Natural Cycle: 70  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.86  
 Intersection Signal Delay: 18.3  
 Intersection LOS: B  
 Intersection Capacity Utilization 98.6%  
 ICU Level of Service F  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.





























Splits and Phases: 20: Hwy 22 & George Fox Trail



Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate/James Walker Tr

2060 Horizon Improved - AM Peak Hour

05/31/2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 	 			  				
Traffic Volume (vph)	185	565	187	338	535	174	75	926	180	507	1221	102
Future Volume (vph)	185	565	187	338	535	174	75	926	180	507	1221	102
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	120.0		30.0	120.0		30.0	130.0		150.0	160.0		140.0
Storage Lanes	2		1	2		1	1		1	2		1
Taper Length (m)	60.0			50.0			100.0			100.0		
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3247	3380	1512	3186	3380	1527	1555	4209	1367	3157	4509	1430
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3247	3380	1512	3186	3380	1527	1555	4209	1367	3157	4509	1430
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			193			234			196			141
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		229.7			296.3			254.3			318.2	
Travel Time (s)		16.5			21.3			11.4			14.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	5%	4%	4%	7%	4%	3%	13%	20%	15%	8%	12%	10%
Adj. Flow (vph)	201	614	203	367	582	189	82	1007	196	551	1327	111
Shared Lane Traffic (%)												
Lane Group Flow (vph)	201	614	203	367	582	189	82	1007	196	551	1327	111
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			7.2			7.2	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	8		7	4		5	2		1	6	

Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate/James Walker Tr

2060 Horizon Improved - AM Peak Hour  
05/31/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	8			Free			2			6		
Detector Phase	3	8	8	7	4		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0		5.0	20.0	20.0	5.0	20.0	20.0
Minimum Split (s)	10.5	15.5	15.5	10.5	48.5		12.0	47.0	47.0	12.0	58.0	58.0
Total Split (s)	19.1	38.1	38.1	29.5	48.5		18.2	50.0	50.0	29.0	60.8	60.8
Total Split (%)	13.0%	26.0%	26.0%	20.1%	33.1%		12.4%	34.1%	34.1%	19.8%	41.5%	41.5%
Maximum Green (s)	13.6	32.6	32.6	24.0	43.0		12.7	43.0	43.0	23.5	53.8	53.8
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	5.0	5.0	3.5	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5		5.5	7.0	7.0	5.5	7.0	7.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	Min	Min	None	Min		Max	C-Max	C-Max	Max	C-Max	C-Max
Walk Time (s)					7.0					7.0	7.0	7.0
Flash Dont Walk (s)					36.0					33.0	33.0	33.0
Pedestrian Calls (#/hr)					0					0	0	0
Act Effct Green (s)	12.8	30.6	30.6	21.3	39.1	146.6	17.4	43.0	43.0	28.2	53.8	53.8
Actuated g/C Ratio	0.09	0.21	0.21	0.15	0.27	1.00	0.12	0.29	0.29	0.19	0.37	0.37
v/c Ratio	0.71	0.87	0.43	0.79	0.65	0.12	0.45	0.82	0.36	0.91	0.80	0.18
Control Delay	79.3	69.8	10.3	73.6	50.8	0.2	70.8	54.5	6.9	77.3	46.2	2.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	79.3	69.8	10.3	73.6	50.8	0.2	70.8	54.5	6.9	77.3	46.2	2.7
LOS	E	E	B	E	D	A	E	D	A	E	D	A
Approach Delay	59.8					49.8	48.3			52.4		
Approach LOS	E					D	D			D		
Queue Length 50th (m)	31.1	94.8	2.4	56.3	81.9	0.0	24.2	105.1	0.0	~88.4	132.9	0.0
Queue Length 95th (m)	45.4	118.4	24.7	73.8	100.9	0.0	#46.1	124.1	19.4	#135.6	152.9	7.1
Internal Link Dist (m)	205.7		272.3			230.3			294.2			
Turn Bay Length (m)	120.0	30.0		120.0	30.0		130.0	150.0		160.0	140.0	
Base Capacity (vph)	301	751	486	521	991	1527	184	1234	539	607	1654	614
Starvation Cap Reductn	0	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	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.67	0.82	0.42	0.70	0.59	0.12	0.45	0.82	0.36	0.91	0.80	0.18

Intersection Summary

Area Type:	Other
Cycle Length:	146.6
Actuated Cycle Length:	146.6
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	140
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.91
Intersection Signal Delay:	52.3
Intersection LOS:	D
Intersection Capacity Utilization:	78.8%
ICU Level of Service:	D
Analysis Period (min):	15

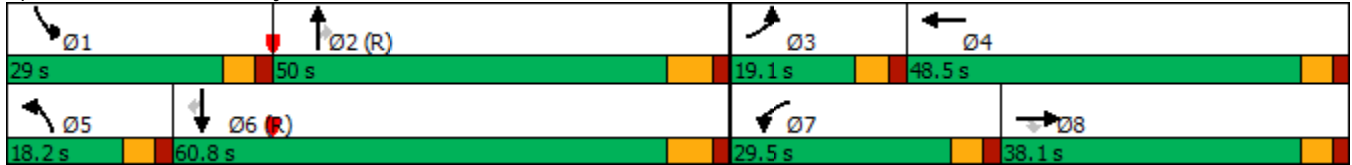
Lanes, Volumes, Timings  
 3: Hwy 22 & Fireside Gate/James Walker Tr

2060 Horizon Improved - AM Peak Hour

05/31/2022

- ~ 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.





























Splits and Phases: 3: Hwy 22 & Fireside Gate/James Walker Tr



Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Improved - AM Peak Hour

05/31/2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 							  			  	
Traffic Volume (vph)	440	20	196	26	35	120	85	1195	5	85	1608	465
Future Volume (vph)	440	20	196	26	35	120	85	1195	5	85	1608	465
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	125.0		50.0	30.0		30.0	50.0		30.0	45.0		50.0
Storage Lanes	2		1	1		1	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt			0.850			0.850		0.999				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3044	1814	1258	1723	1814	1542	1723	4547	0	1723	4469	1542
Flt Permitted	0.950			0.743			0.950			0.950		
Satd. Flow (perm)	3044	1814	1258	1348	1814	1542	1723	4547	0	1723	4469	1542
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			213			160						207
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		225.2			254.5			172.2			208.4	
Travel Time (s)		16.2			18.3			7.7			9.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	12%	2%	25%	2%	2%	2%	2%	11%	2%	2%	13%	2%
Adj. Flow (vph)	478	22	213	28	38	130	92	1299	5	92	1748	505
Shared Lane Traffic (%)												
Lane Group Flow (vph)	478	22	213	28	38	130	92	1304	0	92	1748	505
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2		1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	Perm	pm+pt	NA	Perm	Prot	NA		Prot	NA	Free
Protected Phases	7	4		3	8		5	2		1	6	

Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Improved - AM Peak Hour

05/31/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4	8		8						Free
Detector Phase	7	4	4	3	8	8	5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	20.0		5.0	20.0	
Minimum Split (s)	11.5	49.5	49.5	9.5	49.5	49.5	12.0	47.0		12.0	47.0	
Total Split (s)	34.5	64.0	64.0	20.0	49.5	49.5	14.0	48.0		18.0	52.0	
Total Split (%)	23.0%	42.7%	42.7%	13.3%	33.0%	33.0%	9.3%	32.0%		12.0%	34.7%	
Maximum Green (s)	28.0	57.5	57.5	15.5	43.0	43.0	7.0	41.0		11.0	45.0	
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	5.0	5.0		5.0	5.0	
All-Red Time (s)	3.0	3.0	3.0	1.0	3.0	3.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.5	6.5	6.5	4.5	6.5	6.5	7.0	7.0		7.0	7.0	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	None	None	None	C-Max		None	C-Max	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	
Flash Dont Walk (s)		36.0	36.0		36.0	36.0		33.0			33.0	
Pedestrian Calls (#/hr)		0	0		0	0		0			0	
Act Effct Green (s)	26.6	35.9	35.9	19.6	10.4	10.4	17.1	72.3		13.7	68.9	150.0
Actuated g/C Ratio	0.18	0.24	0.24	0.13	0.07	0.07	0.11	0.48		0.09	0.46	1.00
v/c Ratio	0.89	0.05	0.46	0.14	0.31	0.51	0.47	0.60		0.59	0.85	0.33
Control Delay	79.0	46.5	9.3	40.1	72.9	11.3	70.6	30.5		79.6	41.4	0.6
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	79.0	46.5	9.3	40.1	72.9	11.3	70.6	30.5		79.6	41.4	0.6
LOS	E	D	A	D	E	B	E	C		E	D	A
Approach Delay		57.2			27.4			33.1			34.1	
Approach LOS		E			C			C			C	
Queue Length 50th (m)	75.3	5.5	0.0	6.2	11.6	0.0	27.6	108.5		28.1	176.2	0.0
Queue Length 95th (m)	#102.0	13.8	23.9	14.1	24.3	12.1	46.6	135.4		46.5	208.4	0.0
Internal Link Dist (m)		201.2			230.5			148.2			184.4	
Turn Bay Length (m)	125.0		50.0	30.0		30.0	50.0			45.0		50.0
Base Capacity (vph)	568	695	613	288	520	556	197	2191		163	2052	1542
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	0.84	0.03	0.35	0.10	0.07	0.23	0.47	0.60		0.56	0.85	0.33

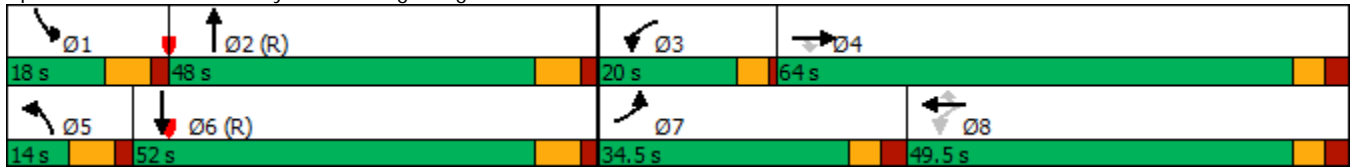
Intersection Summary

Area Type:	Other
Cycle Length:	150
Actuated Cycle Length:	150
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	150
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.89
Intersection Signal Delay:	37.1
Intersection LOS:	D
Intersection Capacity Utilization:	73.4%
ICU Level of Service:	D
Analysis Period (min):	15

Lanes, Volumes, Timings  
 8: Hwy 22 & Rolling Range Drive

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

Splits and Phases: 8: Hwy 22 & Rolling Range Drive




































Lanes, Volumes, Timings  
16: Highway 22 & South Access

2060 Horizon Improved - AM Peak Hour

05/31/2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				 				  		 	  	  
Traffic Volume (vph)	5	285	25	340	40	55	25	1121	175	195	1546	5
Future Volume (vph)	5	285	25	340	40	55	25	1121	175	195	1546	5
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	50.0		50.0	70.0		100.0	50.0		100.0	80.0		100.0
Storage Lanes	1		0	2		1	1		1	2		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	0.97	0.91	0.91
Frt		0.988				0.850			0.850			
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1723	1792	0	3343	1814	1542	1723	4951	1542	3343	4951	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1723	1792	0	3343	1814	1542	1723	4951	1542	3343	4951	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3				127			190			
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		499.2			562.8			301.5			251.2	
Travel Time (s)		35.9			40.5			13.6			11.3	
Peak Hour Factor	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)	5	310	27	370	43	60	27	1218	190	212	1680	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	5	337	0	370	43	60	27	1218	190	212	1685	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			7.2			7.2	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2	1	1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			

Lanes, Volumes, Timings  
16: Highway 22 & South Access

2060 Horizon Improved - AM Peak Hour

05/31/2022

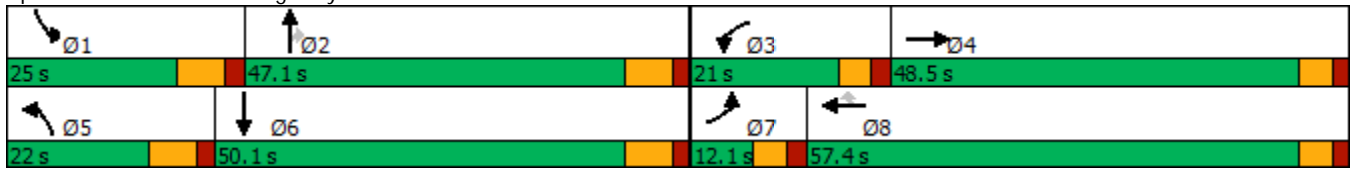


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4		3	8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0	10.0	5.0	20.0	20.0	5.0	20.0	
Minimum Split (s)	10.5	48.5		10.5	48.5	48.5	12.0	47.0	47.0	12.0	47.0	
Total Split (s)	12.1	48.5		21.0	57.4	57.4	22.0	47.1	47.1	25.0	50.1	
Total Split (%)	8.5%	34.3%		14.8%	40.5%	40.5%	15.5%	33.3%	33.3%	17.7%	35.4%	
Maximum Green (s)	6.6	43.0		15.5	51.9	51.9	15.0	40.1	40.1	18.0	43.1	
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	5.0	5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.5	5.5		5.5	5.5	5.5	7.0	7.0	7.0	7.0	7.0	
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None	None	None	Max	Max	None	Max	
Walk Time (s)		7.0			7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		36.0			36.0	36.0		33.0	33.0		33.0	
Pedestrian Calls (#/hr)		0			0	0		0	0		0	
Act Effect Green (s)	5.9	27.9		15.6	46.9	46.9	7.5	40.4	40.4	13.1	51.6	
Actuated g/C Ratio	0.05	0.23		0.13	0.38	0.38	0.06	0.33	0.33	0.11	0.42	
v/c Ratio	0.06	0.82		0.87	0.06	0.09	0.26	0.74	0.30	0.59	0.81	
Control Delay	62.0	61.0		73.9	25.7	0.3	63.8	41.0	6.0	60.2	36.9	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	62.0	61.0		73.9	25.7	0.3	63.8	41.0	6.0	60.2	36.9	
LOS	E	E		E	C	A	E	D	A	E	D	
Approach Delay		61.0			60.2			36.8			39.5	
Approach LOS		E			E			D			D	
Queue Length 50th (m)	1.2	80.0		47.5	6.5	0.0	6.6	98.9	0.0	26.5	144.5	
Queue Length 95th (m)	6.2	119.6		#89.5	17.2	0.0	18.0	140.4	18.4	43.2	#212.2	
Internal Link Dist (m)		475.2			538.8			277.5			227.2	
Turn Bay Length (m)	50.0			70.0		100.0	50.0		100.0	80.0		
Base Capacity (vph)	93	637		427	780	735	213	1637	636	496	2093	
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	0.05	0.53		0.87	0.06	0.08	0.13	0.74	0.30	0.43	0.81	

Intersection Summary

Area Type: Other  
 Cycle Length: 141.6  
 Actuated Cycle Length: 122.1  
 Natural Cycle: 130  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.87  
 Intersection Signal Delay: 42.7  
 Intersection LOS: D  
 Intersection Capacity Utilization 82.7%  
 ICU Level of Service E  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.























Splits and Phases: 16: Highway 22 & South Access



Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Jughandle LT - AM Peak Hour

05- Hwy 22 FPS - Future 2060 Jughandle AM.syn

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	460	196	26	35	120	85	1635	5	85	1608	465
Future Volume (vph)	0	460	196	26	35	120	85	1635	5	85	1608	465
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	125.0		50.0	30.0		30.0	50.0		30.0	45.0		50.0
Storage Lanes	0		1	1		1	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt			0.850			0.850						0.850
Flt Protected				0.950			0.950			0.950		
Satd. Flow (prot)	0	1814	1258	1723	1814	1542	1723	4551	0	1723	4469	1542
Flt Permitted				0.119			0.950			0.950		
Satd. Flow (perm)	0	1814	1258	216	1814	1542	1723	4551	0	1723	4469	1542
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			129			130						183
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		225.2			254.5			172.2			208.4	
Travel Time (s)		16.2			18.3			7.7			9.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	12%	2%	25%	2%	2%	2%	2%	11%	2%	2%	13%	2%
Adj. Flow (vph)	0	500	213	28	38	130	92	1777	5	92	1748	505
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	500	213	28	38	130	92	1782	0	92	1748	505
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors		2	1	1	2	1	1	2		1	2	1
Detector Template		Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (m)		10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	2.0
Trailing Detector (m)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Position(m)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Size(m)		0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	2.0
Detector 1 Type		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type		NA	Perm	pm+pt	NA	Perm	Prot	NA		Prot	NA	Free
Protected Phases		4		3	8		5	2		1	6	

Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Jughandle LT - AM Peak Hour  
05- Hwy 22 FPS - Future 2060 Jughandle AM.syn



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4	8		8						Free
Detector Phase		4	4	3	8	8	5	2		1	6	
Switch Phase												
Minimum Initial (s)		10.0	10.0	5.0	10.0	10.0	5.0	20.0		5.0	20.0	
Minimum Split (s)		49.5	49.5	9.5	49.5	49.5	12.0	47.0		12.0	47.0	
Total Split (s)		49.5	49.5	9.5	59.0	59.0	19.0	53.0		19.0	53.0	
Total Split (%)		37.8%	37.8%	7.3%	45.0%	45.0%	14.5%	40.5%		14.5%	40.5%	
Maximum Green (s)		43.0	43.0	5.0	52.5	52.5	12.0	46.0		12.0	46.0	
Yellow Time (s)		3.5	3.5	3.5	3.5	3.5	5.0	5.0		5.0	5.0	
All-Red Time (s)		3.0	3.0	1.0	3.0	3.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.5	6.5	4.5	6.5	6.5	7.0	7.0		7.0	7.0	
Lead/Lag		Lag	Lag	Lead			Lead	Lag		Lead	Lag	
Lead-Lag Optimize?		Yes	Yes	Yes			Yes	Yes		Yes	Yes	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode		None	None	None	None	None	None	C-Max		None	C-Max	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	
Flash Dont Walk (s)		36.0	36.0		36.0	36.0		33.0			33.0	
Pedestrian Calls (#/hr)		0	0		0	0		0			0	
Act Effct Green (s)		39.6	39.6	47.3	45.3	45.3	10.8	54.3		10.8	54.3	131.0
Actuated g/C Ratio		0.30	0.30	0.36	0.35	0.35	0.08	0.41		0.08	0.41	1.00
v/c Ratio		0.91	0.45	0.21	0.06	0.21	0.65	0.94		0.65	0.94	0.33
Control Delay		65.7	17.0	27.3	25.6	4.9	79.0	49.2		79.0	49.2	0.6
Queue Delay		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay		65.7	17.0	27.3	25.6	4.9	79.0	49.2		79.0	49.2	0.6
LOS		E	B	C	C	A	E	D		E	D	A
Approach Delay		51.1			12.1			50.6				39.9
Approach LOS		D			B			D				D
Queue Length 50th (m)		126.5	16.5	4.5	6.3	0.0	24.3	~202.6		24.3	~198.5	0.0
Queue Length 95th (m)		#184.3	40.1	10.9	13.8	12.7	#43.8	#234.1		#43.8	#230.2	0.0
Internal Link Dist (m)		201.2			230.5			148.2				184.4
Turn Bay Length (m)			50.0	30.0		30.0	50.0			45.0		50.0
Base Capacity (vph)		595	499	135	726	695	158	1887		158	1853	1542
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		0.84	0.43	0.21	0.05	0.19	0.58	0.94		0.58	0.94	0.33

Intersection Summary

Area Type:	Other
Cycle Length:	131
Actuated Cycle Length:	131
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	130
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.94
Intersection Signal Delay:	44.3
Intersection LOS:	D
Intersection Capacity Utilization:	79.3%
ICU Level of Service:	D
Analysis Period (min):	15

Lanes, Volumes, Timings  
 8: Hwy 22 & Rolling Range Drive

2060 Horizon Jughandle LT - AM Peak Hour  
 05- Hwy 22 FPS - Future 2060 Jughandle AM.syn

- ~ 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.























Splits and Phases: 8: Hwy 22 & Rolling Range Drive

↙ Ø1 19 s	↑ Ø2 (R) 53 s	↙ Ø3 9.5 s	→ Ø4 49.5 s
↙ Ø5 19 s	↓ Ø6 (R) 53 s	↙ Ø8 59 s	

Lanes, Volumes, Timings  
16: Highway 22 & South Access

2060 Horizon Jughandle LT - AM Peak Hour

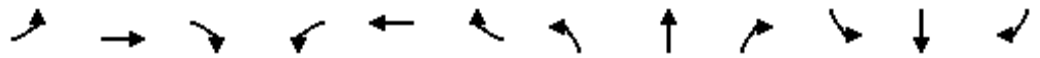
05- Hwy 22 FPS - Future 2060 Jughandle AM.syn

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	285	25	0	380	55	25	1121	175	195	1886	5
Future Volume (vph)	5	285	25	0	380	55	25	1121	175	195	1886	5
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	50.0		50.0	70.0		100.0	50.0		100.0	80.0		100.0
Storage Lanes	1		0	0		1	1		1	2		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	0.91
Frt		0.988				0.850			0.850			
Flt Protected	0.950						0.950			0.950		
Satd. Flow (prot)	1723	1792	0	0	1814	1542	1723	4951	1542	3343	4951	0
Flt Permitted	0.201						0.950			0.950		
Satd. Flow (perm)	365	1792	0	0	1814	1542	1723	4951	1542	3343	4951	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4				106			190			
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		499.2			562.8			301.5			251.2	
Travel Time (s)		35.9			40.5			13.6			11.3	
Peak Hour Factor	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)	5	310	27	0	413	60	27	1218	190	212	2050	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	5	337	0	0	413	60	27	1218	190	212	2055	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			7.2			7.2	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2			2	1	1	2	1	1	2	
Detector Template	Left	Thru			Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0			10.0	2.0	2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6			0.6	2.0	2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA			NA	Perm	Prot	NA	Perm	Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4					8			2			

Lanes, Volumes, Timings  
16: Highway 22 & South Access

2060 Horizon Jughandle LT - AM Peak Hour

05- Hwy 22 FPS - Future 2060 Jughandle AM.syn



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4			8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0			10.0	10.0	5.0	20.0	20.0	5.0	20.0	
Minimum Split (s)	48.5	48.5			48.5	48.5	12.0	47.0	47.0	12.0	47.0	
Total Split (s)	48.5	48.5			48.5	48.5	15.0	47.5	47.5	17.0	49.5	
Total Split (%)	42.9%	42.9%			42.9%	42.9%	13.3%	42.0%	42.0%	15.0%	43.8%	
Maximum Green (s)	43.0	43.0			43.0	43.0	8.0	40.5	40.5	10.0	42.5	
Yellow Time (s)	3.5	3.5			3.5	3.5	5.0	5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.5	5.5			5.5	5.5	7.0	7.0	7.0	7.0	7.0	
Lead/Lag							Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None			None	None	None	Max	Max	None	Max	
Walk Time (s)	7.0	7.0			7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)	36.0	36.0			36.0	36.0		33.0	33.0		33.0	
Pedestrian Calls (#/hr)	0	0			0	0		0	0		0	
Act Effct Green (s)	27.1	27.1			27.1	27.1	6.8	40.7	40.7	9.7	51.9	
Actuated g/C Ratio	0.28	0.28			0.28	0.28	0.07	0.42	0.42	0.10	0.53	
v/c Ratio	0.05	0.67			0.82	0.12	0.22	0.59	0.25	0.64	0.78	
Control Delay	25.4	37.4			46.2	1.3	49.8	24.2	4.2	52.9	23.9	
Queue Delay	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	25.4	37.4			46.2	1.3	49.8	24.2	4.2	52.9	23.9	
LOS	C	D			D	A	D	C	A	D	C	
Approach Delay		37.2			40.5			22.0			26.6	
Approach LOS		D			D			C			C	
Queue Length 50th (m)	0.7	58.3			76.0	0.0	5.1	66.1	0.0	20.9	95.2	
Queue Length 95th (m)	3.5	87.1			110.8	2.0	14.9	98.3	14.5	#38.7	#216.6	
Internal Link Dist (m)		475.2			538.8			277.5			227.2	
Turn Bay Length (m)	50.0					100.0	50.0		100.0	80.0		
Base Capacity (vph)	162	800			807	745	142	2076	757	346	2647	
Starvation Cap Reductn	0	0			0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0			0	0	0	0	0	0	0	
Storage Cap Reductn	0	0			0	0	0	0	0	0	0	
Reduced v/c Ratio	0.03	0.42			0.51	0.08	0.19	0.59	0.25	0.61	0.78	

Intersection Summary

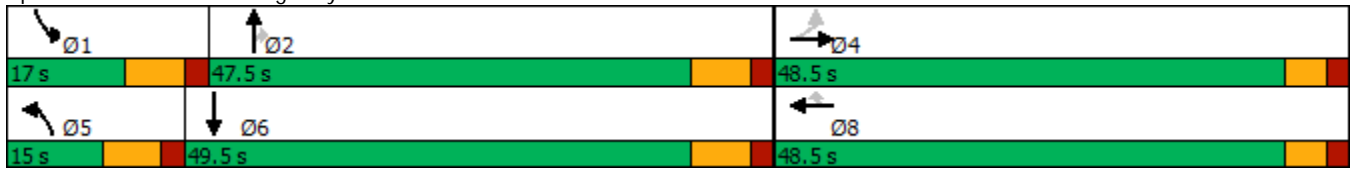
Area Type: Other  
 Cycle Length: 113  
 Actuated Cycle Length: 97.1  
 Natural Cycle: 110  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.82  
 Intersection Signal Delay: 27.4  
 Intersection LOS: C  
 Intersection Capacity Utilization 78.5%  
 ICU Level of Service D  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.



Lanes, Volumes, Timings  
 16: Highway 22 & South Access

2060 Horizon Jughandle LT - AM Peak Hour  
 05- Hwy 22 FPS - Future 2060 Jughandle AM.syn

Splits and Phases: 16: Highway 22 & South Access



Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Displaced LT (Minor) - AM Peak Hour

06/03/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↗	↖	↑	↗	↖	↑↑↑		↖	↑↑↑	↗
Traffic Volume (vph)	0	20	196	26	35	120	85	1195	5	85	1608	465
Future Volume (vph)	0	20	196	26	35	120	85	1195	5	85	1608	465
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	125.0		50.0	30.0		30.0	50.0		30.0	45.0		50.0
Storage Lanes	0		1	1		1	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt			0.850			0.850		0.999				0.850
Flt Protected				0.950			0.950			0.950		
Satd. Flow (prot)	0	1814	1258	1723	1814	1542	1723	4547	0	1723	4469	1542
Flt Permitted				0.535			0.950			0.950		
Satd. Flow (perm)	0	1814	1258	970	1814	1542	1723	4547	0	1723	4469	1542
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			206			126						203
Link Speed (k/h)		50			50			80				80
Link Distance (m)		225.2			254.5			172.2				208.4
Travel Time (s)		16.2			18.3			7.7				9.4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	12%	2%	25%	2%	2%	2%	2%	11%	2%	2%	13%	2%
Adj. Flow (vph)	0	22	213	28	38	130	92	1299	5	92	1748	505
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	22	213	28	38	130	92	1304	0	92	1748	505
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors		2	1	1	2	1	1	2		1	2	1
Detector Template		Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (m)		10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	2.0
Trailing Detector (m)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Position(m)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Size(m)		0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	2.0
Detector 1 Type		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4				9.4
Detector 2 Size(m)		0.6			0.6			0.6				0.6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type		NA	Perm	pm+pt	NA	Perm	Prot	NA		Prot	NA	Free
Protected Phases		4		3	8		5	2		1		6

Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Displaced LT (Minor) - AM Peak Hour

06/03/2022

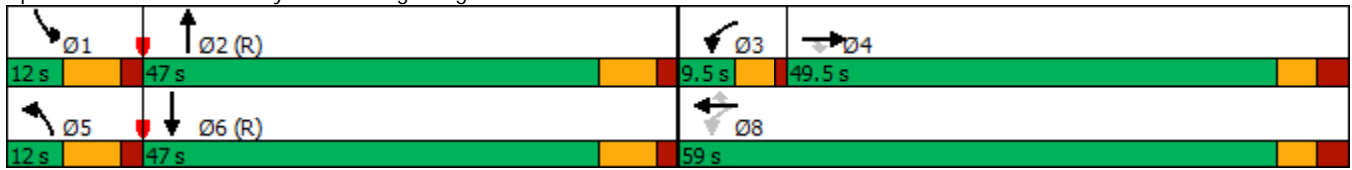


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4	8		8						Free
Detector Phase		4	4	3	8	8	5	2		1	6	
Switch Phase												
Minimum Initial (s)		10.0	10.0	5.0	10.0	10.0	5.0	20.0		5.0	20.0	
Minimum Split (s)		49.5	49.5	9.5	49.5	49.5	12.0	47.0		12.0	47.0	
Total Split (s)		49.5	49.5	9.5	59.0	59.0	12.0	47.0		12.0	47.0	
Total Split (%)		41.9%	41.9%	8.1%	50.0%	50.0%	10.2%	39.8%		10.2%	39.8%	
Maximum Green (s)		43.0	43.0	5.0	52.5	52.5	5.0	40.0		5.0	40.0	
Yellow Time (s)		3.5	3.5	3.5	3.5	3.5	5.0	5.0		5.0	5.0	
All-Red Time (s)		3.0	3.0	1.0	3.0	3.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.5	6.5	4.5	6.5	6.5	7.0	7.0		7.0	7.0	
Lead/Lag		Lag	Lag	Lead			Lead	Lag		Lead	Lag	
Lead-Lag Optimize?		Yes	Yes	Yes			Yes	Yes		Yes	Yes	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode		None	None	None	None	None	None	C-Max		None	C-Max	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	
Flash Dont Walk (s)		36.0	36.0		36.0	36.0		33.0			33.0	
Pedestrian Calls (#/hr)		0	0		0	0		0			0	
Act Effct Green (s)		11.6	11.6	19.3	17.3	17.3	15.5	64.7		15.5	64.7	118.0
Actuated g/C Ratio		0.10	0.10	0.16	0.15	0.15	0.13	0.55		0.13	0.55	1.00
v/c Ratio		0.12	0.69	0.15	0.14	0.39	0.41	0.52		0.41	0.71	0.33
Control Delay		48.6	19.5	40.0	41.7	10.9	53.3	18.8		53.3	23.0	0.6
Queue Delay		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay		48.6	19.5	40.0	41.7	10.9	53.3	18.8		53.3	23.0	0.6
LOS		D	B	D	D	B	D	B		D	C	A
Approach Delay		22.2			21.0			21.1			19.4	
Approach LOS		C			C			C			B	
Queue Length 50th (m)		5.1	1.6	5.7	8.0	0.8	21.1	72.3		21.1	113.6	0.0
Queue Length 95th (m)		12.8	25.7	13.1	16.8	17.0	37.9	101.6		37.9	157.0	0.0
Internal Link Dist (m)		201.2			230.5			148.2			184.4	
Turn Bay Length (m)			50.0	30.0		30.0	50.0			45.0		50.0
Base Capacity (vph)		661	589	190	807	756	225	2493		225	2450	1542
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		0.03	0.36	0.15	0.05	0.17	0.41	0.52		0.41	0.71	0.33

Intersection Summary

Area Type:	Other
Cycle Length:	118
Actuated Cycle Length:	118
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	120
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.71
Intersection Signal Delay:	20.2
Intersection LOS:	C
Intersection Capacity Utilization:	63.5%
ICU Level of Service:	B
Analysis Period (min):	15























Splits and Phases: 8: Hwy 22 & Rolling Range Drive



Lanes, Volumes, Timings  
16: Highway 22 & South Access

2060 Horizon Displaced LT (Minor) - AM Peak Hour

06/03/2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	285	25	0	40	55	25	1121	175	195	1546	5
Future Volume (vph)	5	285	25	0	40	55	25	1121	175	195	1546	5
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	50.0		50.0	70.0		100.0	50.0		100.0	80.0		100.0
Storage Lanes	1		0	0		1	1		1	2		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	0.91
Frt		0.988				0.850			0.850			
Flt Protected	0.950						0.950			0.950		
Satd. Flow (prot)	1723	1792	0	0	1814	1542	1723	4951	1542	3343	4951	0
Flt Permitted	0.950						0.950			0.950		
Satd. Flow (perm)	1723	1792	0	0	1814	1542	1723	4951	1542	3343	4951	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		5				149			190			
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		499.2			562.8			301.5			251.2	
Travel Time (s)		35.9			40.5			13.6			11.3	
Peak Hour Factor	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)	5	310	27	0	43	60	27	1218	190	212	1680	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	5	337	0	0	43	60	27	1218	190	212	1685	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			7.2			7.2	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2			2	1	1	2	1	1	2	
Detector Template	Left	Thru			Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0			10.0	2.0	2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6			0.6	2.0	2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA			NA	Perm	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases						8			2			

Lanes, Volumes, Timings  
16: Highway 22 & South Access

2060 Horizon Displaced LT (Minor) - AM Peak Hour

06/03/2022

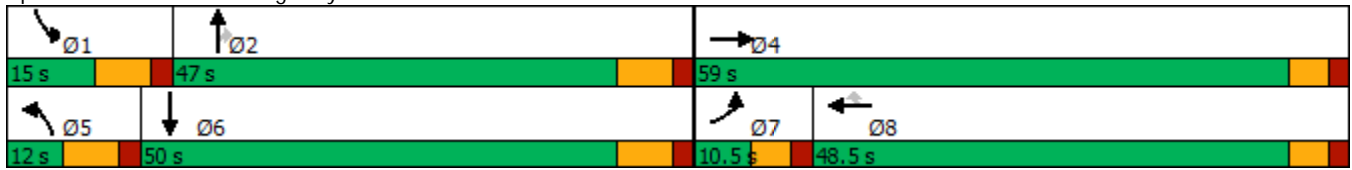


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4			8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0			10.0	10.0	5.0	20.0	20.0	5.0	20.0	
Minimum Split (s)	10.5	48.5			48.5	48.5	12.0	47.0	47.0	12.0	47.0	
Total Split (s)	10.5	59.0			48.5	48.5	12.0	47.0	47.0	15.0	50.0	
Total Split (%)	8.7%	48.8%			40.1%	40.1%	9.9%	38.8%	38.8%	12.4%	41.3%	
Maximum Green (s)	5.0	53.5			43.0	43.0	5.0	40.0	40.0	8.0	43.0	
Yellow Time (s)	3.5	3.5			3.5	3.5	5.0	5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.5	5.5			5.5	5.5	7.0	7.0	7.0	7.0	7.0	
Lead/Lag	Lead				Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes				Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None			None	None	None	Max	Max	None	Max	
Walk Time (s)		7.0			7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		36.0			36.0	36.0		33.0	33.0		33.0	
Pedestrian Calls (#/hr)		0			0	0		0	0		0	
Act Effct Green (s)	5.0	21.5			19.6	19.6	5.0	40.1	40.1	8.0	50.6	
Actuated g/C Ratio	0.06	0.24			0.22	0.22	0.06	0.45	0.45	0.09	0.57	
v/c Ratio	0.05	0.77			0.11	0.13	0.28	0.55	0.24	0.71	0.60	
Control Delay	43.8	43.7			29.5	0.6	50.2	19.8	3.5	54.6	15.9	
Queue Delay	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	43.8	43.7			29.5	0.6	50.2	19.8	3.5	54.6	15.9	
LOS	D	D			C	A	D	B	A	D	B	
Approach Delay		43.7			12.7			18.2			20.3	
Approach LOS		D			B			B			C	
Queue Length 50th (m)	0.9	55.8			6.0	0.0	4.8	56.4	0.0	19.4	57.9	
Queue Length 95th (m)	4.7	85.8			16.6	0.0	14.2	82.2	12.8	#39.3	119.6	
Internal Link Dist (m)		475.2			538.8			277.5			227.2	
Turn Bay Length (m)	50.0					100.0	50.0		100.0	80.0		
Base Capacity (vph)	96	1079			877	822	96	2226	798	300	2810	
Starvation Cap Reductn	0	0			0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0			0	0	0	0	0	0	0	
Storage Cap Reductn	0	0			0	0	0	0	0	0	0	
Reduced v/c Ratio	0.05	0.31			0.05	0.07	0.28	0.55	0.24	0.71	0.60	

Intersection Summary

Area Type: Other  
 Cycle Length: 121  
 Actuated Cycle Length: 89.2  
 Natural Cycle: 120  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.77  
 Intersection Signal Delay: 21.4  
 Intersection LOS: C  
 Intersection Capacity Utilization 68.2%  
 ICU Level of Service C  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 16: Highway 22 & South Access



Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate/James Walker Tr

2060 Horizon Displaced LT (Major) - AM Peak Hour

06/03/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖	↗↗	↘	↖↖	↗↗	↘		↖↖↖	↘		↗↗↗	↘
Traffic Volume (vph)	185	565	187	338	535	174	0	926	180	0	1221	102
Future Volume (vph)	185	565	187	338	535	174	0	926	180	0	1221	102
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	120.0		30.0	120.0		30.0	130.0		150.0	160.0		140.0
Storage Lanes	2		1	2		1	0		1	0		1
Taper Length (m)	60.0			50.0			100.0			100.0		
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	1.00	0.91	1.00	1.00	0.91	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950								
Satd. Flow (prot)	3247	3380	1512	3186	3380	1527	0	4209	1367	0	4509	1430
Flt Permitted	0.950			0.950								
Satd. Flow (perm)	3247	3380	1512	3186	3380	1527	0	4209	1367	0	4509	1430
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			133			181			196			119
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		229.7			296.3			254.3			318.2	
Travel Time (s)		16.5			21.3			11.4			14.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	5%	4%	4%	7%	4%	3%	13%	20%	15%	8%	12%	10%
Adj. Flow (vph)	201	614	203	367	582	189	0	1007	196	0	1327	111
Shared Lane Traffic (%)												
Lane Group Flow (vph)	201	614	203	367	582	189	0	1007	196	0	1327	111
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1		2	1		2	1
Detector Template	Left	Thru	Right	Left	Thru	Right		Thru	Right		Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0		10.0	2.0		10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0		0.6	2.0		0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	Perm	Prot	NA	Free		NA	Perm		NA	Perm
Protected Phases	3	8		7	4			2			6	



Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate/James Walker Tr

2060 Horizon Displaced LT (Major) - AM Peak Hour

06/03/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			8			Free			2			6
Detector Phase	3	8	8	7	4			2	2		6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0			20.0	20.0		20.0	20.0
Minimum Split (s)	10.5	15.5	15.5	10.5	48.5			47.0	47.0		58.0	58.0
Total Split (s)	15.0	39.3	39.3	26.0	50.3			58.0	58.0		58.0	58.0
Total Split (%)	12.2%	31.9%	31.9%	21.1%	40.8%			47.0%	47.0%		47.0%	47.0%
Maximum Green (s)	9.5	33.8	33.8	20.5	44.8			51.0	51.0		51.0	51.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5			5.0	5.0		5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0			2.0	2.0		2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0			0.0	0.0		0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5			7.0	7.0		7.0	7.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag							
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes							
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Recall Mode	None	Min	Min	None	Min			C-Max	C-Max		C-Max	C-Max
Walk Time (s)					7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)					36.0			33.0	33.0		33.0	33.0
Pedestrian Calls (#/hr)					0			0	0		0	0
Act Effct Green (s)	9.5	28.3	28.3	18.4	37.1	123.3		58.7	58.7		58.7	58.7
Actuated g/C Ratio	0.08	0.23	0.23	0.15	0.30	1.00		0.48	0.48		0.48	0.48
v/c Ratio	0.80	0.79	0.45	0.77	0.57	0.12		0.50	0.26		0.62	0.15
Control Delay	79.6	52.5	17.3	62.0	38.0	0.2		24.5	4.0		26.7	3.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Delay	79.6	52.5	17.3	62.0	38.0	0.2		24.5	4.0		26.7	3.8
LOS	E	D	B	E	D	A		C	A		C	A
Approach Delay		50.8			39.4			21.1			24.9	
Approach LOS		D			D			C			C	
Queue Length 50th (m)	26.4	78.0	14.5	46.5	65.1	0.0		64.3	0.0		91.3	0.0
Queue Length 95th (m)	#46.1	94.3	35.7	63.0	77.0	0.0		86.4	14.5		119.7	10.2
Internal Link Dist (m)		205.7			272.3			230.3			294.2	
Turn Bay Length (m)	120.0		30.0	120.0		30.0			150.0			140.0
Base Capacity (vph)	250	926	511	529	1228	1527		2002	753		2145	742
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	0.80	0.66	0.40	0.69	0.47	0.12		0.50	0.26		0.62	0.15

Intersection Summary

Area Type:	Other
Cycle Length:	123.3
Actuated Cycle Length:	123.3
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	120
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.80
Intersection Signal Delay:	32.9
Intersection LOS:	C
Intersection Capacity Utilization:	65.2%
ICU Level of Service:	C
Analysis Period (min):	15

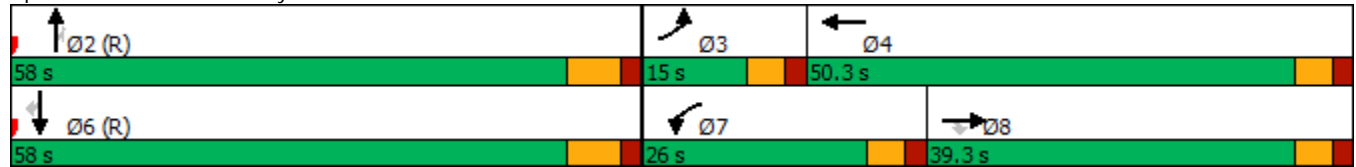
Lanes, Volumes, Timings  
 3: Hwy 22 & Fireside Gate/James Walker Tr

2060 Horizon Displaced LT (Major) - AM Peak Hour

06/03/2022

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































Splits and Phases: 3: Hwy 22 & Fireside Gate/James Walker Tr



Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Displaced LT (Major) - AM Peak Hour

06/03/2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 		 	 		 		  			  	 
Traffic Volume (vph)	440	20	196	26	35	120	0	1195	5	0	1608	465
Future Volume (vph)	440	20	196	26	35	120	0	1195	5	0	1608	465
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	125.0		50.0	30.0		30.0	50.0		30.0	45.0		50.0
Storage Lanes	2		1	1		1	0		0	0		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt			0.850			0.850		0.999				0.850
Flt Protected	0.950			0.950								
Satd. Flow (prot)	3044	1814	1258	1723	1814	1542	0	4547	0	0	4469	1542
Flt Permitted	0.950			0.743								
Satd. Flow (perm)	3044	1814	1258	1348	1814	1542	0	4547	0	0	4469	1542
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			206			123						177
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		225.2			254.5			172.2			208.4	
Travel Time (s)		16.2			18.3			7.7			9.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	12%	2%	25%	2%	2%	2%	2%	11%	2%	2%	13%	2%
Adj. Flow (vph)	478	22	213	28	38	130	0	1299	5	0	1748	505
Shared Lane Traffic (%)												
Lane Group Flow (vph)	478	22	213	28	38	130	0	1304	0	0	1748	505
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1		2			2	1
Detector Template	Left	Thru	Right	Left	Thru	Right		Thru			Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0		10.0			10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0		0.6			0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex			Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	Perm	pm+pt	NA	Perm		NA			NA	Free
Protected Phases	7	4		3	8			2			6	

Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Displaced LT (Major) - AM Peak Hour

06/03/2022



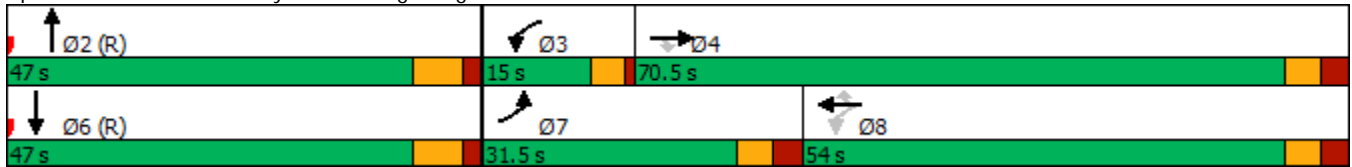
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4	8		8						Free
Detector Phase	7	4	4	3	8	8		2				6
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0		20.0				20.0
Minimum Split (s)	11.5	49.5	49.5	9.5	49.5	49.5		47.0				47.0
Total Split (s)	31.5	70.5	70.5	15.0	54.0	54.0		47.0				47.0
Total Split (%)	23.8%	53.2%	53.2%	11.3%	40.8%	40.8%		35.5%				35.5%
Maximum Green (s)	25.0	64.0	64.0	10.5	47.5	47.5		40.0				40.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5		5.0				5.0
All-Red Time (s)	3.0	3.0	3.0	1.0	3.0	3.0		2.0				2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0				0.0
Total Lost Time (s)	6.5	6.5	6.5	4.5	6.5	6.5		7.0				7.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0				3.0
Recall Mode	None	None	None	None	None	None		C-Max				C-Max
Walk Time (s)		7.0	7.0		7.0	7.0		7.0				7.0
Flash Dont Walk (s)		36.0	36.0		36.0	36.0		33.0				33.0
Pedestrian Calls (#/hr)		0	0		0	0		0				0
Act Effct Green (s)	23.8	33.6	33.6	19.7	10.6	10.6		78.1				78.1
Actuated g/C Ratio	0.18	0.25	0.25	0.15	0.08	0.08		0.59				0.59
v/c Ratio	0.88	0.05	0.45	0.13	0.26	0.55		0.49				0.66
Control Delay	70.4	39.8	9.4	33.2	61.6	20.2		16.7				20.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0				0.0
Total Delay	70.4	39.8	9.4	33.2	61.6	20.2		16.7				20.3
LOS	E	D	A	C	E	C		B				C
Approach Delay		51.3			30.1			16.7				15.9
Approach LOS		D			C			B				B
Queue Length 50th (m)	65.9	4.8	1.5	5.3	10.1	1.8		72.9				114.6
Queue Length 95th (m)	#91.8	12.2	23.7	12.2	21.6	22.0		90.7				139.8
Internal Link Dist (m)		201.2			230.5			148.2				184.4
Turn Bay Length (m)	125.0		50.0	30.0		30.0						50.0
Base Capacity (vph)	574	876	714	265	650	631		2678				2632
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	0.83	0.03	0.30	0.11	0.06	0.21		0.49				0.66

Intersection Summary

Area Type:	Other
Cycle Length:	132.5
Actuated Cycle Length:	132.5
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	140
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.88
Intersection Signal Delay:	22.4
Intersection LOS:	C
Intersection Capacity Utilization:	63.5%
ICU Level of Service:	B
Analysis Period (min):	15

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

Splits and Phases: 8: Hwy 22 & Rolling Range Drive



Lanes, Volumes, Timings  
16: Highway 22 & South Access

2060 Horizon Displaced LT (Major) - AM Peak Hour

06/03/2022

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	285	25	340	40	55	0	1121	175	0	1546	5
Future Volume (vph)	5	285	25	340	40	55	0	1121	175	0	1546	5
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	50.0		50.0	70.0		100.0	50.0		100.0	80.0		100.0
Storage Lanes	1		0	2		1	0		1	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	1.00	0.91	0.91
Frt		0.988				0.850			0.850			
Flt Protected	0.950			0.950								
Satd. Flow (prot)	1723	1792	0	3343	1814	1542	0	4951	1542	0	4951	0
Flt Permitted	0.950			0.950								
Satd. Flow (perm)	1723	1792	0	3343	1814	1542	0	4951	1542	0	4951	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3				90			190			
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		499.2			562.8			301.5			251.2	
Travel Time (s)		35.9			40.5			13.6			11.3	
Peak Hour Factor	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)	5	310	27	370	43	60	0	1218	190	0	1680	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	5	337	0	370	43	60	0	1218	190	0	1685	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2	1		2	1		2	
Detector Template	Left	Thru		Left	Thru	Right		Thru	Right		Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0	2.0		10.0	2.0		10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6	2.0		0.6	2.0		0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA		Prot	NA	Perm		NA	Perm		NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8			2			

Lanes, Volumes, Timings  
16: Highway 22 & South Access

2060 Horizon Displaced LT (Major) - AM Peak Hour

06/03/2022

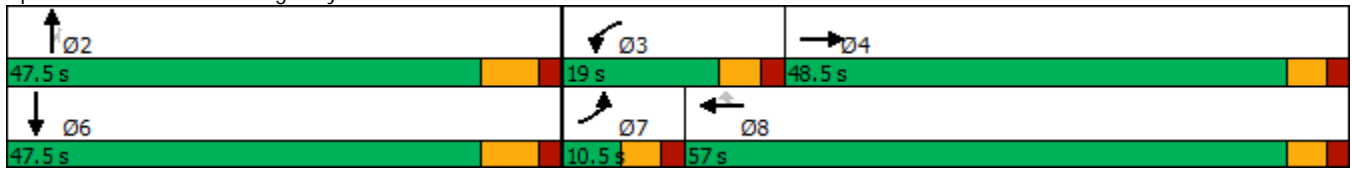


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4		3	8	8		2	2		6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0	10.0		20.0	20.0		20.0	
Minimum Split (s)	10.5	48.5		10.5	48.5	48.5		47.0	47.0		47.0	
Total Split (s)	10.5	48.5		19.0	57.0	57.0		47.5	47.5		47.5	
Total Split (%)	9.1%	42.2%		16.5%	49.6%	49.6%		41.3%	41.3%		41.3%	
Maximum Green (s)	5.0	43.0		13.5	51.5	51.5		40.5	40.5		40.5	
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5		5.0	5.0		5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	
Total Lost Time (s)	5.5	5.5		5.5	5.5	5.5		7.0	7.0		7.0	
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes						
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	
Recall Mode	None	None		None	None	None		Max	Max		Max	
Walk Time (s)		7.0			7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		36.0			36.0	36.0		33.0	33.0		33.0	
Pedestrian Calls (#/hr)		0			0	0		0	0		0	
Act Effect Green (s)	5.0	22.7		13.5	39.8	39.8		40.6	40.6		40.6	
Actuated g/C Ratio	0.05	0.24		0.14	0.42	0.42		0.43	0.43		0.43	
v/c Ratio	0.05	0.79		0.78	0.06	0.09		0.57	0.25		0.79	
Control Delay	47.2	46.8		52.6	17.5	2.2		22.7	3.9		27.9	
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	
Total Delay	47.2	46.8		52.6	17.5	2.2		22.7	3.9		27.9	
LOS	D	D		D	B	A		C	A		C	
Approach Delay		46.8			43.0			20.1			27.9	
Approach LOS		D			D			C			C	
Queue Length 50th (m)	1.0	60.3		35.7	4.6	0.0		63.2	0.0		100.0	
Queue Length 95th (m)	5.0	91.1		#64.5	13.0	4.2		90.9	13.9		140.6	
Internal Link Dist (m)		475.2			538.8			277.5			227.2	
Turn Bay Length (m)	50.0			70.0		100.0			100.0			
Base Capacity (vph)	91	816		477	987	880		2120	769		2120	
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	0.05	0.41		0.78	0.04	0.07		0.57	0.25		0.79	

Intersection Summary

Area Type: Other  
 Cycle Length: 115  
 Actuated Cycle Length: 94.9  
 Natural Cycle: 110  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.79  
 Intersection Signal Delay: 28.6  
 Intersection LOS: C  
 Intersection Capacity Utilization 72.7%  
 ICU Level of Service C  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 16: Highway 22 & South Access




























Lanes, Volumes, Timings  
16: Highway 22 & South Access

2060 Horizon Michigan LT (Minor) - AM Peak Hour

06/03/2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	285	365	0	380	55	25	1121	175	195	1546	5
Future Volume (vph)	5	285	365	0	380	55	25	1121	175	195	1546	5
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	50.0		50.0	70.0		100.0	50.0		100.0	80.0		100.0
Storage Lanes	1		1	0		1	1		1	2		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	0.91
Frt			0.850			0.850			0.850			
Flt Protected	0.950						0.950			0.950		
Satd. Flow (prot)	1723	1814	1542	0	1814	1542	1723	4951	1542	3343	4951	0
Flt Permitted	0.149						0.950			0.950		
Satd. Flow (perm)	270	1814	1542	0	1814	1542	1723	4951	1542	3343	4951	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			183			145			190			
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		144.9			562.8			266.6			207.0	
Travel Time (s)		10.4			40.5			12.0			9.3	
Peak Hour Factor	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)	5	310	397	0	413	60	27	1218	190	212	1680	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	5	310	397	0	413	60	27	1218	190	212	1685	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			7.2			7.2	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1		2	1	1	2	1	1	2	
Detector Template	Left	Thru	Right		Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0	2.0		10.0	2.0	2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6	2.0		0.6	2.0	2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	Perm		NA	Perm	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4		4			8			2			

Lanes, Volumes, Timings  
16: Highway 22 & South Access

2060 Horizon Michigan LT (Minor) - AM Peak Hour

06/03/2022



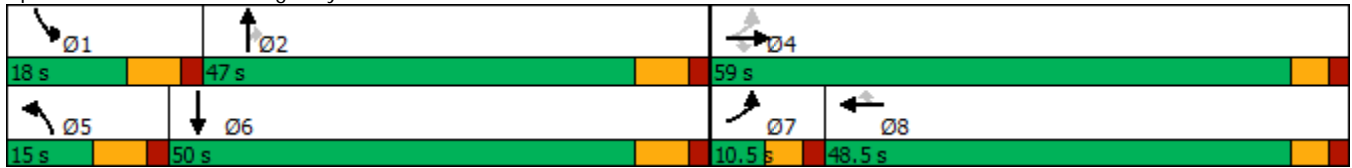
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	4		8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0		10.0	10.0	5.0	20.0	20.0	5.0	20.0	
Minimum Split (s)	10.5	48.5	48.5		48.5	48.5	12.0	47.0	47.0	12.0	47.0	
Total Split (s)	10.5	59.0	59.0		48.5	48.5	15.0	47.0	47.0	18.0	50.0	
Total Split (%)	8.5%	47.6%	47.6%		39.1%	39.1%	12.1%	37.9%	37.9%	14.5%	40.3%	
Maximum Green (s)	5.0	53.5	53.5		43.0	43.0	8.0	40.0	40.0	11.0	43.0	
Yellow Time (s)	3.5	3.5	3.5		3.5	3.5	5.0	5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.5	5.5	5.5		5.5	5.5	7.0	7.0	7.0	7.0	7.0	
Lead/Lag	Lead				Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes				Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None		None	None	None	Max	Max	None	Max	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		36.0	36.0		36.0	36.0		33.0	33.0		33.0	
Pedestrian Calls (#/hr)		0	0		0	0		0	0		0	
Act Effct Green (s)	29.5	29.5	29.5		27.8	27.8	6.9	40.6	40.6	10.4	49.8	
Actuated g/C Ratio	0.29	0.29	0.29		0.28	0.28	0.07	0.41	0.41	0.10	0.50	
v/c Ratio	0.03	0.58	0.68		0.82	0.11	0.23	0.61	0.26	0.61	0.68	
Control Delay	29.8	41.9	30.0		48.3	0.4	53.3	27.0	4.9	53.3	24.9	
Queue Delay	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	29.8	41.9	30.0		48.3	0.4	53.3	27.0	4.9	53.3	24.9	
LOS	C	D	C		D	A	D	C	A	D	C	
Approach Delay		35.2			42.2			24.6			28.0	
Approach LOS		D			D			C			C	
Queue Length 50th (m)	0.7	51.4	36.1		76.6	0.0	5.2	67.7	0.0	20.8	98.8	
Queue Length 95th (m)	m2.3	64.3	49.5		126.4	0.0	16.7	119.4	16.8	#43.2	#190.1	
Internal Link Dist (m)		120.9			538.8			242.6			183.0	
Turn Bay Length (m)	50.0		50.0			100.0	50.0		100.0	80.0		
Base Capacity (vph)	153	982	918		789	752	139	2004	737	372	2460	
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	0.03	0.32	0.43		0.52	0.08	0.19	0.61	0.26	0.57	0.68	

Intersection Summary

Area Type: Other  
 Cycle Length: 124  
 Actuated Cycle Length: 100.2  
 Natural Cycle: 120  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.82  
 Intersection Signal Delay: 29.5  
 Intersection LOS: C  
 Intersection Capacity Utilization 71.7%  
 ICU Level of Service C  
 Analysis Period (min) 15  
 # 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.

Splits and Phases: 16: Highway 22 & South Access


































Lanes, Volumes, Timings

2060 Horizon Michigan LT (Major) - AM Peak Hour

3: Hwy 22 & Fireside Gate/James Walker Tr

06/03/2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 	 			  			  	
Traffic Volume (vph)	185	565	187	338	535	174	75	926	687	0	1728	102
Future Volume (vph)	185	565	187	338	535	174	75	926	687	0	1728	102
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	120.0		30.0	120.0		30.0	130.0		150.0	160.0		140.0
Storage Lanes	2		1	2		1	1		1	0		1
Taper Length (m)	60.0			50.0			100.0			100.0		
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	1.00	0.91	1.00	1.00	0.91	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950					
Satd. Flow (prot)	3247	3380	1512	3186	3380	1527	1555	4209	1367	0	4509	1430
Flt Permitted	0.950			0.950			0.950					
Satd. Flow (perm)	3247	3380	1512	3186	3380	1527	1555	4209	1367	0	4509	1430
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			160			203			351			148
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		229.7			296.3			158.5			318.2	
Travel Time (s)		16.5			21.3			7.1			14.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	5%	4%	4%	7%	4%	3%	13%	20%	15%	8%	12%	10%
Adj. Flow (vph)	201	614	203	367	582	189	82	1007	747	0	1878	111
Shared Lane Traffic (%)												
Lane Group Flow (vph)	201	614	203	367	582	189	82	1007	747	0	1878	111
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2	1		2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0		10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0		0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA	Perm		NA	Perm
Protected Phases	3	8		7	4		5	2			6	

Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate/James Walker Tr

2060 Horizon Michigan LT (Major) - AM Peak Hour

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	8			Free			2			6		
Detector Phase	3	8	8	7	4	5			2	2	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	5.0			20.0	20.0	20.0	20.0
Minimum Split (s)	10.5	15.5	15.5	10.5	48.5	12.0			47.0	47.0	58.0	58.0
Total Split (s)	14.7	38.1	38.1	25.1	48.5	13.0			76.8	76.8	63.8	63.8
Total Split (%)	10.5%	27.2%	27.2%	17.9%	34.6%	9.3%			54.9%	54.9%	45.6%	45.6%
Maximum Green (s)	9.2	32.6	32.6	19.6	43.0	7.5			69.8	69.8	56.8	56.8
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5			5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0			2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5			7.0	7.0	7.0	7.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead			Lag			
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes			Yes			
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0			3.0	3.0	3.0	3.0
Recall Mode	None	Min	Min	None	Min	Max			C-Max	C-Max	C-Max	C-Max
Walk Time (s)					7.0				7.0	7.0	7.0	7.0
Flash Dont Walk (s)					36.0				33.0	33.0	33.0	33.0
Pedestrian Calls (#/hr)					0				0	0	0	0
Act Effct Green (s)	9.2	29.8	29.8	19.0	39.6	140.0	10.9	73.2	73.2	56.8	56.8	56.8
Actuated g/C Ratio	0.07	0.21	0.21	0.14	0.28	1.00	0.08	0.52	0.52	0.41	0.41	0.41
v/c Ratio	0.94	0.85	0.45	0.85	0.61	0.12	0.68	0.46	0.85	1.03	0.17	0.17
Control Delay	112.9	65.1	15.0	77.7	46.1	0.2	91.6	22.7	24.7	69.0	2.0	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	0.0
Total Delay	112.9	65.1	15.0	77.7	46.1	0.2	91.6	22.7	24.7	69.0	2.0	2.0
LOS	F	E	B	E	D	A	F	C	C	E	A	A
Approach Delay	64.6					48.6	26.6			65.2		
Approach LOS	E					D	C			E		
Queue Length 50th (m)	30.6	90.2	10.1	54.3	76.0	0.0	24.5	62.1	83.3	~213.3	0.0	0.0
Queue Length 95th (m)	#56.1	112.1	33.6	#78.2	94.7	0.0	m#51.5	m71.3	m123.6	#243.6	5.5	5.5
Internal Link Dist (m)	205.7					272.3	134.5			294.2		
Turn Bay Length (m)	120.0	30.0		120.0	30.0		130.0	150.0			140.0	
Base Capacity (vph)	213	787	474	446	1038	1527	121	2201	882	1829	668	668
Starvation Cap Reductn	0	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	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.94	0.78	0.43	0.82	0.56	0.12	0.68	0.46	0.85	1.03	0.17	0.17

Intersection Summary

Area Type:	Other
Cycle Length:	140
Actuated Cycle Length:	140
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	140
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	1.03
Intersection Signal Delay:	50.1
Intersection LOS:	D
Intersection Capacity Utilization:	84.1%
ICU Level of Service:	E
Analysis Period (min):	15

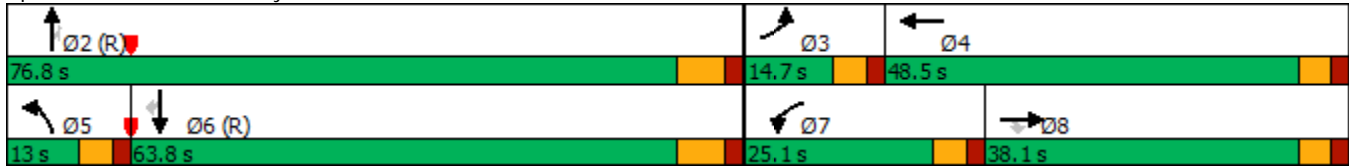
Lanes, Volumes, Timings  
 3: Hwy 22 & Fireside Gate/James Walker Tr

2060 Horizon Michigan LT (Major) - AM Peak Hour

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- ~ 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.


























Splits and Phases: 3: Hwy 22 & Fireside Gate/James Walker Tr



Lanes, Volumes, Timings  
16: Highway 22 & South Access

2060 Horizon Michigan LT (Major) - AM Peak Hour

06/03/2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				 				  			 	
Traffic Volume (vph)	5	285	25	340	40	55	25	1121	370	0	1741	5
Future Volume (vph)	5	285	25	340	40	55	25	1121	370	0	1741	5
Ideal Flow (vphp)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	50.0		50.0	70.0		100.0	50.0		100.0	80.0		100.0
Storage Lanes	1		0	2		1	1		1	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	1.00	0.91	0.91
Frt		0.988				0.850			0.850			
Flt Protected	0.950			0.950			0.950					
Satd. Flow (prot)	1723	1792	0	3343	1814	1542	1723	4951	1542	0	4951	0
Flt Permitted	0.950			0.950			0.950					
Satd. Flow (perm)	1723	1792	0	3343	1814	1542	1723	4951	1542	0	4951	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3				129			402			
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		499.2			562.8			189.2			160.1	
Travel Time (s)		35.9			40.5			8.5			7.2	
Peak Hour Factor	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)	5	310	27	370	43	60	27	1218	402	0	1892	5
Shared Lane Traffic (%)												
Lane Group Flow (vph)	5	337	0	370	43	60	27	1218	402	0	1897	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2	1	1	2	1		2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right		Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0		10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0		0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm		NA	
Protected Phases	7	4		3	8		5	2			6	
Permitted Phases						8			2			

Lanes, Volumes, Timings  
16: Highway 22 & South Access

2060 Horizon Michigan LT (Major) - AM Peak Hour

06/03/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4		3	8	8	5	2	2		6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0	10.0	5.0	20.0	20.0		20.0	
Minimum Split (s)	10.5	48.5		10.5	48.5	48.5	12.0	47.0	47.0		47.0	
Total Split (s)	10.5	48.5		21.2	59.2	59.2	12.0	70.3	70.3		58.3	
Total Split (%)	7.5%	34.6%		15.1%	42.3%	42.3%	8.6%	50.2%	50.2%		41.6%	
Maximum Green (s)	5.0	43.0		15.7	53.7	53.7	5.0	63.3	63.3		51.3	
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	5.0	5.0	5.0		5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0		2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	
Total Lost Time (s)	5.5	5.5		5.5	5.5	5.5	7.0	7.0	7.0		7.0	
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lead				Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes				Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0		3.0	
Recall Mode	None	None		None	None	None	None	Max	Max		Max	
Walk Time (s)		7.0			7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		36.0			36.0	36.0		33.0	33.0		33.0	
Pedestrian Calls (#/hr)		0			0	0		0	0		0	
Act Effect Green (s)	5.0	28.4		15.7	47.7	47.7	5.0	63.5	63.5		56.6	
Actuated g/C Ratio	0.04	0.23		0.12	0.38	0.38	0.04	0.51	0.51		0.45	
v/c Ratio	0.07	0.83		0.89	0.06	0.09	0.40	0.49	0.41		0.85	
Control Delay	64.0	63.1		77.8	25.6	0.3	79.8	22.2	3.9		37.3	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	
Total Delay	64.0	63.1		77.8	25.6	0.3	79.8	22.2	3.9		37.3	
LOS	E	E		E	C	A	E	C	A		D	
Approach Delay		63.2			63.2			18.7			37.3	
Approach LOS		E			E			B			D	
Queue Length 50th (m)	1.3	83.1		49.3	6.8	0.0	7.1	71.6	1.5		170.2	
Queue Length 95th (m)	6.2	118.1		#87.0	16.5	0.0	m17.3	98.4	m17.0		#238.2	
Internal Link Dist (m)		475.2			538.8			165.2			136.1	
Turn Bay Length (m)	50.0			70.0		100.0	50.0		100.0			
Base Capacity (vph)	68	616		418	777	734	68	2501	977		2227	
Starvation Cap Reductn	0	0		0	0	0	0	0	0		0	
Spillback Cap Reductn	0	0		0	0	0	0	0	0		0	
Storage Cap Reductn	0	0		0	0	0	0	0	0		0	
Reduced v/c Ratio	0.07	0.55		0.89	0.06	0.08	0.40	0.49	0.41		0.85	

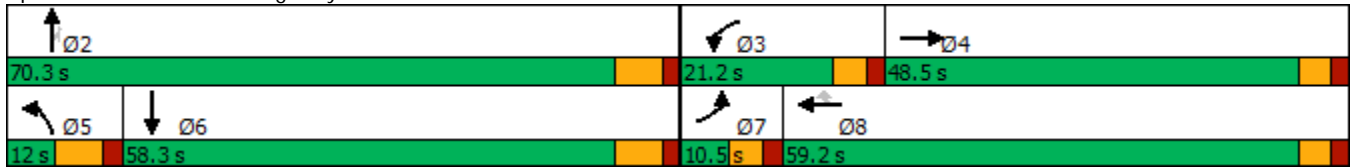
Intersection Summary

Area Type: Other  
 Cycle Length: 140  
 Actuated Cycle Length: 125.7  
 Natural Cycle: 140  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.89  
 Intersection Signal Delay: 35.1  
 Intersection LOS: D  
 Intersection Capacity Utilization 76.6%  
 ICU Level of Service D  
 Analysis Period (min) 15  
 # 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.

Splits and Phases: 16: Highway 22 & South Access



Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate/James Walker Tr

2060 Horizon Sensitivity Test - AM Peak Hour

06/03/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖	↗↗	↘	↖↖	↗↗	↘	↖	↗↗↗	↘	↖↖	↗↗↗	↘
Traffic Volume (vph)	139	565	187	253	535	174	75	926	180	380	1221	102
Future Volume (vph)	139	565	187	253	535	174	75	926	180	380	1221	102
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	120.0		30.0	120.0		30.0	130.0		150.0	160.0		140.0
Storage Lanes	2		1	2		1	1		1	2		1
Taper Length (m)	60.0			50.0			100.0			100.0		
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3247	3380	1512	3186	3380	1527	1555	4209	1367	3157	4509	1430
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3247	3380	1512	3186	3380	1527	1555	4209	1367	3157	4509	1430
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			167			212			196			111
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		229.7			296.3			254.3			318.2	
Travel Time (s)		16.5			21.3			11.4			14.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	5%	4%	4%	7%	4%	3%	13%	20%	15%	8%	12%	10%
Adj. Flow (vph)	151	614	203	275	582	189	82	1007	196	413	1327	111
Shared Lane Traffic (%)												
Lane Group Flow (vph)	151	614	203	275	582	189	82	1007	196	413	1327	111
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			7.2			7.2	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	8		7	4		5	2		1	6	

Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate/James Walker Tr

2060 Horizon Sensitivity Test - AM Peak Hour

06/03/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR		
Permitted Phases	8			Free			2			6				
Detector Phase	3	8	8	7	4		5	2	2	1	6	6		
Switch Phase														
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0		5.0	20.0	20.0	5.0	20.0	20.0		
Minimum Split (s)	10.5	15.5	15.5	10.5	48.5		12.0	47.0	47.0	12.0	58.0	58.0		
Total Split (s)	15.0	43.6	43.6	19.9	48.5		12.0	47.5	47.5	23.0	58.5	58.5		
Total Split (%)	11.2%	32.5%	32.5%	14.9%	36.2%		9.0%	35.4%	35.4%	17.2%	43.7%	43.7%		
Maximum Green (s)	9.5	38.1	38.1	14.4	43.0		6.5	40.5	40.5	17.5	51.5	51.5		
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	5.0	5.0	3.5	5.0	5.0		
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0		
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5		5.5	7.0	7.0	5.5	7.0	7.0		
Lead/Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0		
Recall Mode	None	Min	Min	None	Min		Max	C-Max	C-Max	Max	C-Max	C-Max		
Walk Time (s)					7.0				7.0	7.0			7.0	7.0
Flash Dont Walk (s)					36.0				33.0	33.0			33.0	33.0
Pedestrian Calls (#/hr)					0				0	0			0	0
Act Effct Green (s)	9.3	30.4	30.4	14.1	35.2	134.0	14.6	40.5	40.5	25.6	51.5	51.5		
Actuated g/C Ratio	0.07	0.23	0.23	0.11	0.26	1.00	0.11	0.30	0.30	0.19	0.38	0.38		
v/c Ratio	0.67	0.80	0.43	0.82	0.66	0.12	0.49	0.79	0.36	0.69	0.77	0.18		
Control Delay	76.1	57.1	12.3	78.9	47.3	0.2	68.1	48.3	6.5	58.0	39.6	5.4		
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Total Delay	76.1	57.1	12.3	78.9	47.3	0.2	68.1	48.3	6.5	58.0	39.6	5.4		
LOS	E	E	B	E	D	A	E	D	A	E	D	A		
Approach Delay	50.7					47.1				43.2	41.6			
Approach LOS	D					D				D	D			
Queue Length 50th (m)	21.4	85.5	8.0	39.1	76.2	0.0	21.9	94.3	0.0	55.9	117.1	0.0		
Queue Length 95th (m)	33.6	101.0	28.5	#60.4	90.0	0.0	#58.2	112.7	18.3	#92.7	136.3	12.5		
Internal Link Dist (m)	205.7					272.3				230.3	294.2			
Turn Bay Length (m)	120.0	30.0		120.0	30.0		130.0	150.0		160.0	140.0			
Base Capacity (vph)	230	961	549	342	1084	1527	168	1272	549	602	1732	617		
Starvation Cap Reductn	0	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	0		
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0		
Reduced v/c Ratio	0.66	0.64	0.37	0.80	0.54	0.12	0.49	0.79	0.36	0.69	0.77	0.18		

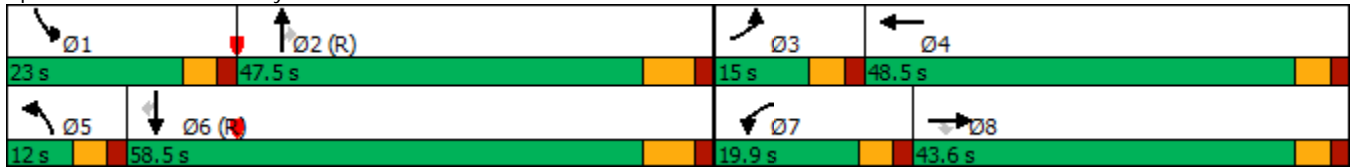
Intersection Summary

Area Type:	Other
Cycle Length:	134
Actuated Cycle Length:	134
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	130
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.82
Intersection Signal Delay:	44.8
Intersection LOS:	D
Intersection Capacity Utilization:	72.5%
ICU Level of Service:	C
Analysis Period (min):	15

Lanes, Volumes, Timings  
 3: Hwy 22 & Fireside Gate/James Walker Tr

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

Splits and Phases: 3: Hwy 22 & Fireside Gate/James Walker Tr



Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Sensitivity Test - AM Peak Hour

06/03/2022

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	486	20	196	111	35	120	85	1195	5	212	1608	465
Future Volume (vph)	486	20	196	111	35	120	85	1195	5	212	1608	465
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	125.0		50.0	30.0		30.0	50.0		30.0	45.0		50.0
Storage Lanes	2		1	1		1	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt			0.850			0.850		0.999				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3044	1814	1258	1723	1814	1542	1723	4547	0	1723	4469	1542
Flt Permitted	0.950			0.743			0.950			0.950		
Satd. Flow (perm)	3044	1814	1258	1348	1814	1542	1723	4547	0	1723	4469	1542
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			181			211						258
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		225.2			254.5			172.2			208.4	
Travel Time (s)		16.2			18.3			7.7			9.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	12%	2%	25%	2%	2%	2%	2%	11%	2%	2%	13%	2%
Adj. Flow (vph)	528	22	213	121	38	130	92	1299	5	230	1748	505
Shared Lane Traffic (%)												
Lane Group Flow (vph)	528	22	213	121	38	130	92	1304	0	230	1748	505
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2		1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	Perm	pm+pt	NA	Perm	Prot	NA		Prot	NA	Free
Protected Phases	7	4		3	8		5	2		1	6	

Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Sensitivity Test - AM Peak Hour

06/03/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4	8		8						Free
Detector Phase	7	4	4	3	8	8	5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	20.0		5.0	20.0	
Minimum Split (s)	11.5	49.5	49.5	9.5	49.5	49.5	12.0	47.0		12.0	47.0	
Total Split (s)	27.0	65.5	65.5	11.0	49.5	49.5	13.0	49.5		24.0	60.5	
Total Split (%)	18.0%	43.7%	43.7%	7.3%	33.0%	33.0%	8.7%	33.0%		16.0%	40.3%	
Maximum Green (s)	20.5	59.0	59.0	6.5	43.0	43.0	6.0	42.5		17.0	53.5	
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	5.0	5.0		5.0	5.0	
All-Red Time (s)	3.0	3.0	3.0	1.0	3.0	3.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.5	6.5	6.5	4.5	6.5	6.5	7.0	7.0		7.0	7.0	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	None	None	None	C-Max		None	C-Max	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	
Flash Dont Walk (s)		36.0	36.0		36.0	36.0		33.0			33.0	
Pedestrian Calls (#/hr)		0	0		0	0		0			0	
Act Effct Green (s)	20.5	26.4	26.4	18.9	10.4	10.4	18.5	59.6		32.6	73.7	150.0
Actuated g/C Ratio	0.14	0.18	0.18	0.13	0.07	0.07	0.12	0.40		0.22	0.49	1.00
v/c Ratio	1.27	0.07	0.58	0.65	0.31	0.43	0.43	0.72		0.61	0.80	0.33
Control Delay	189.0	52.0	18.1	67.7	72.9	4.4	68.5	40.9		61.6	35.3	0.6
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	189.0	52.0	18.1	67.7	72.9	4.4	68.5	40.9		61.6	35.3	0.6
LOS	F	D	B	E	E	A	E	D		E	D	A
Approach Delay		137.4			39.9			42.8			30.7	
Approach LOS		F			D			D			C	
Queue Length 50th (m)	~107.0	5.8	8.6	30.4	11.6	0.0	27.4	122.3		66.8	160.4	0.0
Queue Length 95th (m)	#145.2	14.4	36.5	48.7	24.3	0.0	46.6	146.3		96.5	188.6	0.0
Internal Link Dist (m)		201.2			230.5			148.2			184.4	
Turn Bay Length (m)	125.0		50.0	30.0		30.0	50.0			45.0		50.0
Base Capacity (vph)	416	713	604	185	520	592	212	1805		374	2194	1542
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	1.27	0.03	0.35	0.65	0.07	0.22	0.43	0.72		0.61	0.80	0.33

Intersection Summary

Area Type:	Other
Cycle Length:	150
Actuated Cycle Length:	150
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	150
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	1.27
Intersection Signal Delay:	51.1
Intersection LOS:	D
Intersection Capacity Utilization:	74.7%
ICU Level of Service:	D
Analysis Period (min):	15

Lanes, Volumes, Timings  
 8: Hwy 22 & Rolling Range Drive

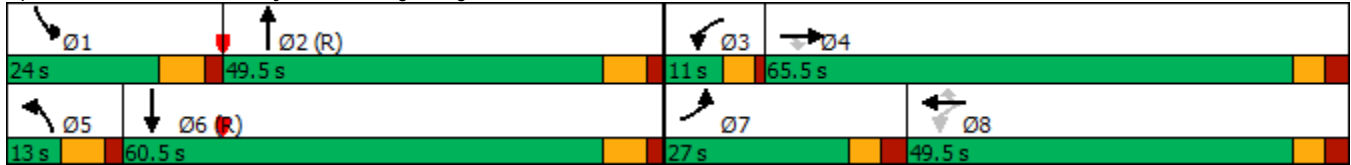
~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

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

Queue shown is maximum after two cycles.





























Splits and Phases: 8: Hwy 22 & Rolling Range Drive



Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Reassignment - AM Peak Hour

06/03/2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 							  			  	
Traffic Volume (vph)	240	220	196	26	35	120	85	1195	5	85	1608	465
Future Volume (vph)	240	220	196	26	35	120	85	1195	5	85	1608	465
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	125.0		50.0	30.0		30.0	50.0		30.0	45.0		50.0
Storage Lanes	2		1	1		1	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt			0.850			0.850		0.999				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3044	1814	1258	1723	1814	1542	1723	4547	0	1723	4469	1542
Flt Permitted	0.950			0.610			0.950			0.950		
Satd. Flow (perm)	3044	1814	1258	1106	1814	1542	1723	4547	0	1723	4469	1542
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			198			160						207
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		225.2			254.5			172.2			208.4	
Travel Time (s)		16.2			18.3			7.7			9.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	12%	2%	25%	2%	2%	2%	2%	11%	2%	2%	13%	2%
Adj. Flow (vph)	261	239	213	28	38	130	92	1299	5	92	1748	505
Shared Lane Traffic (%)												
Lane Group Flow (vph)	261	239	213	28	38	130	92	1304	0	92	1748	505
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2		1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	Perm	pm+pt	NA	Perm	Prot	NA		Prot	NA	Free
Protected Phases	7	4		3	8		5	2		1	6	



Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Reassignment - AM Peak Hour

06/03/2022



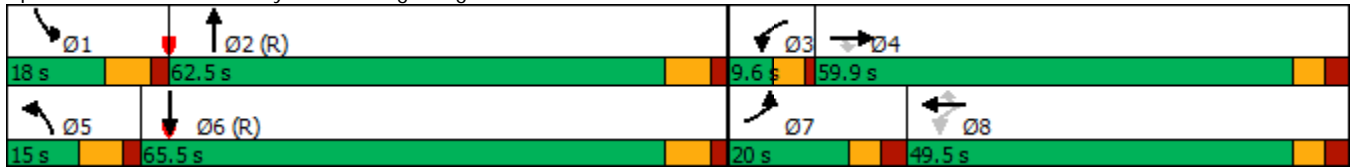
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4	8		8						Free
Detector Phase	7	4	4	3	8	8	5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	20.0		5.0	20.0	
Minimum Split (s)	11.5	49.5	49.5	9.5	49.5	49.5	12.0	47.0		12.0	47.0	
Total Split (s)	20.0	59.9	59.9	9.6	49.5	49.5	15.0	62.5		18.0	65.5	
Total Split (%)	13.3%	39.9%	39.9%	6.4%	33.0%	33.0%	10.0%	41.7%		12.0%	43.7%	
Maximum Green (s)	13.5	53.4	53.4	5.1	43.0	43.0	8.0	55.5		11.0	58.5	
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	5.0	5.0		5.0	5.0	
All-Red Time (s)	3.0	3.0	3.0	1.0	3.0	3.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.5	6.5	6.5	4.5	6.5	6.5	7.0	7.0		7.0	7.0	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	None	None	None	C-Max		None	C-Max	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	
Flash Dont Walk (s)		36.0	36.0		36.0	36.0		33.0			33.0	
Pedestrian Calls (#/hr)		0	0		0	0		0			0	
Act Effct Green (s)	13.5	29.6	29.6	22.5	15.4	15.4	15.9	80.4		13.7	78.2	150.0
Actuated g/C Ratio	0.09	0.20	0.20	0.15	0.10	0.10	0.11	0.54		0.09	0.52	1.00
v/c Ratio	0.96	0.67	0.52	0.15	0.21	0.43	0.51	0.54		0.59	0.75	0.33
Control Delay	111.1	65.6	13.1	43.1	61.7	8.0	73.0	24.9		79.6	31.9	0.6
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	111.1	65.6	13.1	43.1	61.7	8.0	73.0	24.9		79.6	31.9	0.6
LOS	F	E	B	D	E	A	E	C		E	C	A
Approach Delay		66.6			23.4			28.1			27.1	
Approach LOS		E			C			C			C	
Queue Length 50th (m)	42.6	72.5	4.0	6.8	11.1	0.0	27.7	94.5		28.1	152.8	0.0
Queue Length 95th (m)	#71.9	98.1	28.7	14.6	22.1	11.0	46.6	130.4		46.5	200.8	0.0
Internal Link Dist (m)		201.2			230.5			148.2			184.4	
Turn Bay Length (m)	125.0		50.0	30.0		30.0	50.0			45.0		50.0
Base Capacity (vph)	273	645	575	186	520	556	182	2436		163	2329	1542
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	0.96	0.37	0.37	0.15	0.07	0.23	0.51	0.54		0.56	0.75	0.33

Intersection Summary	
Area Type:	Other
Cycle Length:	150
Actuated Cycle Length:	150
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	150
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.96
Intersection Signal Delay:	33.3
Intersection LOS:	C
Intersection Capacity Utilization:	74.6%
ICU Level of Service:	D
Analysis Period (min):	15

Lanes, Volumes, Timings  
 8: Hwy 22 & Rolling Range Drive

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

Splits and Phases: 8: Hwy 22 & Rolling Range Drive



Lanes, Volumes, Timings

2060 Horizon Displaced LT Sensitivity - AM Peak Hour

3: Hwy 22 & Fireside Gate/James Walker Tr

06/03/2022

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	139	565	187	253	535	174	75	926	180	0	1221	102
Future Volume (vph)	139	565	187	253	535	174	75	926	180	0	1221	102
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	120.0		30.0	120.0		30.0	130.0		150.0	160.0		140.0
Storage Lanes	1		1	1		1	1		1	0		1
Taper Length (m)	60.0			50.0			100.0			100.0		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.91	1.00	1.00	0.91	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950					
Satd. Flow (prot)	1674	3380	1512	1643	3380	1527	1555	4209	1367	0	4509	1430
Flt Permitted	0.433			0.129			0.950					
Satd. Flow (perm)	763	3380	1512	223	3380	1527	1555	4209	1367	0	4509	1430
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			166			210			196			154
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		229.7			296.3			254.3			318.2	
Travel Time (s)		16.5			21.3			11.4			14.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	5%	4%	4%	7%	4%	3%	13%	20%	15%	8%	12%	10%
Adj. Flow (vph)	151	614	203	275	582	189	82	1007	196	0	1327	111
Shared Lane Traffic (%)												
Lane Group Flow (vph)	151	614	203	275	582	189	82	1007	196	0	1327	111
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2	1		2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0		10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0		0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Free	Prot	NA	Perm		NA	Perm
Protected Phases	3	8		7	4		5	2			6	

Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate/James Walker Tr

2060 Horizon Displaced LT Sensitivity - AM Peak Hour

06/03/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	8		8	4		Free			2			6
Detector Phase	3	8	8	7	4		5	2	2		6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0		5.0	20.0	20.0		20.0	20.0
Minimum Split (s)	10.5	15.5	15.5	10.5	48.5		12.0	47.0	47.0		58.0	58.0
Total Split (s)	11.0	35.4	35.4	25.0	49.4		16.0	74.5	74.5		58.5	58.5
Total Split (%)	8.2%	26.2%	26.2%	18.5%	36.6%		11.9%	55.2%	55.2%		43.4%	43.4%
Maximum Green (s)	5.5	29.9	29.9	19.5	43.9		10.5	67.5	67.5		51.5	51.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	5.0	5.0		5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5		5.5	7.0	7.0		7.0	7.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag		Lead				Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes				Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Recall Mode	None	Min	Min	None	Min		Max	C-Max	C-Max		C-Max	C-Max
Walk Time (s)					7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)					36.0			33.0	33.0		33.0	33.0
Pedestrian Calls (#/hr)					0			0	0		0	0
Act Effct Green (s)	33.7	28.2	28.2	53.2	42.2	134.9	12.2	69.2	69.2		51.5	51.5
Actuated g/C Ratio	0.25	0.21	0.21	0.39	0.31	1.00	0.09	0.51	0.51		0.38	0.38
v/c Ratio	0.66	0.87	0.45	0.94	0.55	0.12	0.59	0.47	0.25		0.77	0.17
Control Delay	49.8	65.1	13.9	75.1	40.5	0.2	77.2	22.2	3.1		40.3	1.9
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	49.8	65.1	13.9	75.1	40.5	0.2	77.2	22.2	3.1		40.3	1.9
LOS	D	E	B	E	D	A	E	C	A		D	A
Approach Delay		52.0			42.3			22.8			37.3	
Approach LOS		D			D			C			D	
Queue Length 50th (m)	27.3	86.9	8.4	59.3	69.9	0.0	22.8	66.1	0.0		118.4	0.0
Queue Length 95th (m)	43.9	110.2	31.7	#114.7	89.0	0.0	#48.0	79.0	12.9		137.8	4.7
Internal Link Dist (m)		205.7			272.3			230.3			294.2	
Turn Bay Length (m)	120.0		30.0	120.0		30.0	130.0		150.0			140.0
Base Capacity (vph)	228	749	464	293	1099	1527	140	2158	796		1721	641
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	0.66	0.82	0.44	0.94	0.53	0.12	0.59	0.47	0.25		0.77	0.17

Intersection Summary

Area Type:	Other
Cycle Length:	134.9
Actuated Cycle Length:	134.9
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	130
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.94
Intersection Signal Delay:	37.5
Intersection LOS:	D
Intersection Capacity Utilization:	78.5%
ICU Level of Service:	D
Analysis Period (min):	15

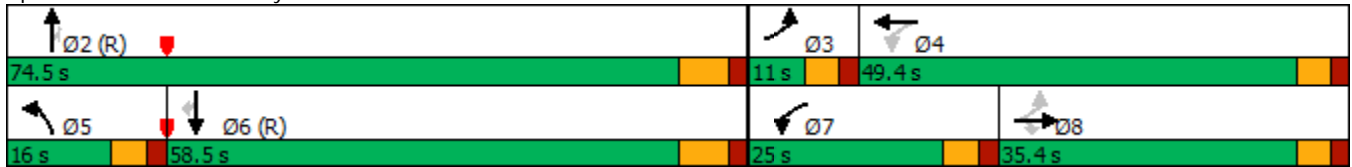
Lanes, Volumes, Timings  
 3: Hwy 22 & Fireside Gate/James Walker Tr

2060 Horizon Displaced LT Sensitivity - AM Peak Hour

06/03/2022

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























Splits and Phases: 3: Hwy 22 & Fireside Gate/James Walker Tr



Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Displaced LT Sensitivity - AM Peak Hour

06/03/2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	20	196	111	35	120	85	1195	5	212	1608	465
Future Volume (vph)	0	20	196	111	35	120	85	1195	5	212	1608	465
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	125.0		50.0	30.0		30.0	50.0		30.0	45.0		50.0
Storage Lanes	0		1	1		1	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt			0.850			0.850		0.999				0.850
Flt Protected				0.950			0.950			0.950		
Satd. Flow (prot)	0	1814	1258	1723	1814	1542	1723	4547	0	1723	4469	1542
Flt Permitted				0.550			0.950			0.950		
Satd. Flow (perm)	0	1814	1258	998	1814	1542	1723	4547	0	1723	4469	1542
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			173			126						203
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		225.2			254.5			172.2			208.4	
Travel Time (s)		16.2			18.3			7.7			9.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	12%	2%	25%	2%	2%	2%	2%	11%	2%	2%	13%	2%
Adj. Flow (vph)	0	22	213	121	38	130	92	1299	5	230	1748	505
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	22	213	121	38	130	92	1304	0	230	1748	505
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors		2	1	1	2	1	1	2		1	2	1
Detector Template		Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (m)		10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	2.0
Trailing Detector (m)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Position(m)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Size(m)		0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	2.0
Detector 1 Type		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type		NA	Perm	pm+pt	NA	Perm	Prot	NA		Prot	NA	Free
Protected Phases		4		3	8		5	2		1	6	

Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Displaced LT Sensitivity - AM Peak Hour

06/03/2022

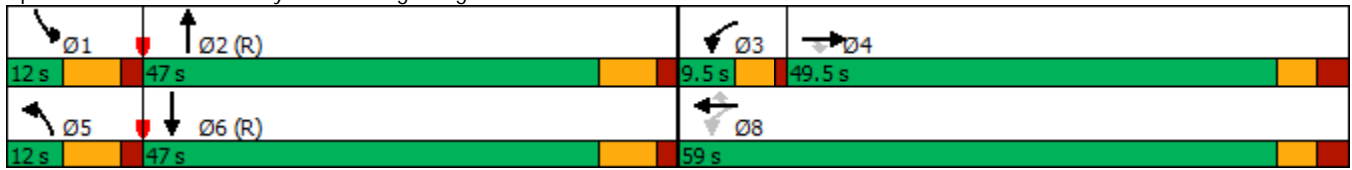


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4	8		8						Free
Detector Phase		4	4	3	8	8	5	2		1	6	
Switch Phase												
Minimum Initial (s)		10.0	10.0	5.0	10.0	10.0	5.0	20.0		5.0	20.0	
Minimum Split (s)		49.5	49.5	9.5	49.5	49.5	12.0	47.0		12.0	47.0	
Total Split (s)		49.5	49.5	9.5	59.0	59.0	12.0	47.0		12.0	47.0	
Total Split (%)		41.9%	41.9%	8.1%	50.0%	50.0%	10.2%	39.8%		10.2%	39.8%	
Maximum Green (s)		43.0	43.0	5.0	52.5	52.5	5.0	40.0		5.0	40.0	
Yellow Time (s)		3.5	3.5	3.5	3.5	3.5	5.0	5.0		5.0	5.0	
All-Red Time (s)		3.0	3.0	1.0	3.0	3.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.5	6.5	4.5	6.5	6.5	7.0	7.0		7.0	7.0	
Lead/Lag		Lag	Lag	Lead			Lead	Lag		Lead	Lag	
Lead-Lag Optimize?		Yes	Yes	Yes			Yes	Yes		Yes	Yes	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode		None	None	None	None	None	None	C-Max		None	C-Max	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	
Flash Dont Walk (s)		36.0	36.0		36.0	36.0		33.0			33.0	
Pedestrian Calls (#/hr)		0	0		0	0		0			0	
Act Effct Green (s)		12.8	12.8	24.3	22.3	22.3	15.5	42.9		32.3	59.7	118.0
Actuated g/C Ratio		0.11	0.11	0.21	0.19	0.19	0.13	0.36		0.27	0.51	1.00
v/c Ratio		0.11	0.73	0.51	0.11	0.33	0.41	0.79		0.49	0.77	0.33
Control Delay		46.4	27.2	47.6	38.6	9.3	53.3	37.7		41.7	27.3	0.6
Queue Delay		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay		46.4	27.2	47.6	38.6	9.3	53.3	37.7		41.7	27.3	0.6
LOS		D	C	D	D	A	D	D		D	C	A
Approach Delay		29.0			29.2			38.7			23.2	
Approach LOS		C			C			D			C	
Queue Length 50th (m)		5.1	9.4	26.2	8.0	0.8	21.1	96.4		47.9	113.6	0.0
Queue Length 95th (m)		12.4	34.3	40.0	16.3	16.4	37.9	126.4		77.3	165.0	0.0
Internal Link Dist (m)		201.2			230.5			148.2			184.4	
Turn Bay Length (m)			50.0	30.0		30.0	50.0			45.0		50.0
Base Capacity (vph)		661	568	236	807	756	225	1653		470	2261	1542
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		0.03	0.38	0.51	0.05	0.17	0.41	0.79		0.49	0.77	0.33

Intersection Summary

Area Type:	Other
Cycle Length:	118
Actuated Cycle Length:	118
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	130
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.79
Intersection Signal Delay:	28.8
Intersection LOS:	C
Intersection Capacity Utilization:	66.8%
ICU Level of Service:	C
Analysis Period (min):	15

Splits and Phases: 8: Hwy 22 & Rolling Range Drive





































Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate/James Walker Tr

2060 Horizon Improved - PM Peak Hour

05/31/2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 	 			  		 	  	
Traffic Volume (vph)	102	545	65	180	570	559	185	1341	321	206	867	185
Future Volume (vph)	102	545	65	180	570	559	185	1341	321	206	867	185
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	120.0		30.0	120.0		30.0	130.0		150.0	160.0		140.0
Storage Lanes	2		1	2		1	1		1	2		1
Taper Length (m)	60.0			50.0			100.0			100.0		
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3278	3446	1512	3247	3348	1527	1723	4676	1498	3310	4469	1542
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3278	3446	1512	3247	3348	1527	1723	4676	1498	3310	4469	1542
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			176			234			259			201
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		229.7			296.3			249.0			318.2	
Travel Time (s)		16.5			21.3			11.2			14.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	4%	2%	4%	5%	5%	3%	2%	8%	5%	3%	13%	2%
Adj. Flow (vph)	111	592	71	196	620	608	201	1458	349	224	942	201
Shared Lane Traffic (%)												
Lane Group Flow (vph)	111	592	71	196	620	608	201	1458	349	224	942	201
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			7.2			7.2	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	8		7	4		5	2		1	6	

Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate/James Walker Tr

2060 Horizon Improved - PM Peak Hour

05/31/2022

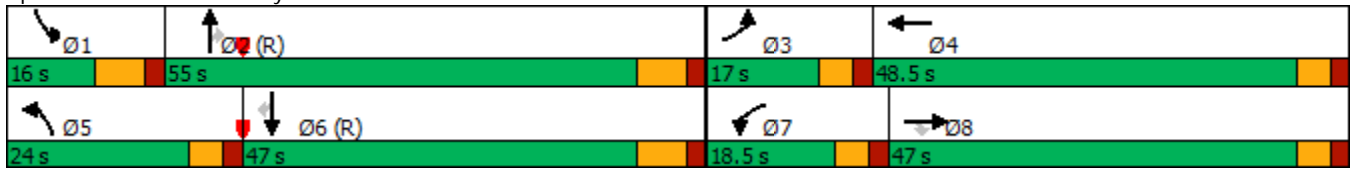


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	8			Free			2			6		
Detector Phase	3	8	8	7	4		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0		5.0	20.0	20.0	5.0	20.0	20.0
Minimum Split (s)	10.5	15.5	15.5	10.5	48.5		12.0	47.0	47.0	12.0	47.0	47.0
Total Split (s)	17.0	47.0	47.0	18.5	48.5		24.0	55.0	55.0	16.0	47.0	47.0
Total Split (%)	12.5%	34.4%	34.4%	13.6%	35.5%		17.6%	40.3%	40.3%	11.7%	34.4%	34.4%
Maximum Green (s)	11.5	41.5	41.5	13.0	43.0		18.5	48.0	48.0	9.0	40.0	40.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5		5.5	7.0	7.0	7.0	7.0	7.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	Min	Min	None	Min		Max	C-Max	C-Max	Max	C-Max	C-Max
Walk Time (s)					7.0				7.0	7.0		
Flash Dont Walk (s)					36.0				33.0	33.0		
Pedestrian Calls (#/hr)					0				0	0		
Act Effct Green (s)	9.7	29.3	29.3	12.1	31.8	136.5	31.5	48.0	48.0	22.0	40.0	40.0
Actuated g/C Ratio	0.07	0.21	0.21	0.09	0.23	1.00	0.23	0.35	0.35	0.16	0.29	0.29
v/c Ratio	0.48	0.80	0.15	0.68	0.80	0.40	0.51	0.89	0.50	0.42	0.72	0.34
Control Delay	67.5	59.1	0.7	72.5	57.2	0.8	52.9	49.4	11.7	56.1	47.0	6.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	67.5	59.1	0.7	72.5	57.2	0.8	52.9	49.4	11.7	56.1	47.0	6.3
LOS	E	E	A	E	E	A	D	D	B	E	D	A
Approach Delay	55.0					35.2	43.2			42.5		
Approach LOS	D					D	D			D		
Queue Length 50th (m)	15.8	84.8	0.0	28.0	87.7	0.0	50.3	142.2	17.6	30.0	87.9	0.0
Queue Length 95th (m)	25.9	99.7	0.0	41.7	104.0	0.0	82.6	163.8	47.0	46.4	105.0	18.8
Internal Link Dist (m)	205.7		272.3			225.0			294.2			
Turn Bay Length (m)	120.0	30.0		120.0	30.0		130.0	150.0		160.0	140.0	
Base Capacity (vph)	276	1047	582	309	1054	1527	397	1644	694	534	1309	593
Starvation Cap Reductn	0	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	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.40	0.57	0.12	0.63	0.59	0.40	0.51	0.89	0.50	0.42	0.72	0.34

Intersection Summary

Area Type: Other  
 Cycle Length: 136.5  
 Actuated Cycle Length: 136.5  
 Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green  
 Natural Cycle: 120  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.89  
 Intersection Signal Delay: 42.6  
 Intersection LOS: D  
 Intersection Capacity Utilization 74.2%  
 ICU Level of Service D  
 Analysis Period (min) 15

Splits and Phases: 3: Hwy 22 & Fireside Gate/James Walker Tr



Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Improved - PM Peak Hour

05/31/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	465	35	85	5	20	85	195	1782	25	120	1168	440
Future Volume (vph)	465	35	85	5	20	85	195	1782	25	120	1168	440
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	125.0		50.0	30.0		30.0	45.0		50.0	50.0		30.0
Storage Lanes	2		1	1		1	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt			0.850			0.850		0.998				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3343	1814	1542	1723	1814	1542	1674	4714	0	1723	4765	1542
Flt Permitted	0.950			0.732			0.950			0.950		
Satd. Flow (perm)	3343	1814	1542	1328	1814	1542	1674	4714	0	1723	4765	1542
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			142			182		1				222
Link Speed (k/h)		50			50			80				80
Link Distance (m)		197.4			152.4			175.4				208.4
Travel Time (s)		14.2			11.0			7.9				9.4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	5%	7%	2%	2%	6%	2%
Adj. Flow (vph)	505	38	92	5	22	92	212	1937	27	130	1270	478
Shared Lane Traffic (%)												
Lane Group Flow (vph)	505	38	92	5	22	92	212	1964	0	130	1270	478
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2		1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4				9.4
Detector 2 Size(m)		0.6			0.6			0.6				0.6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Prot	NA	Perm	pm+pt	NA	Perm	Prot	NA		Prot	NA	Free
Protected Phases	7	4		3	8		5	2		1		6

Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Improved - PM Peak Hour

05/31/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4	8		8						Free
Detector Phase	7	4	4	3	8	8	5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	20.0		5.0	20.0	
Minimum Split (s)	10.5	48.5	48.5	9.5	48.5	48.5	12.0	47.0		12.0	47.0	
Total Split (s)	32.5	63.0	63.0	18.0	48.5	48.5	22.0	53.0		16.0	47.0	
Total Split (%)	21.7%	42.0%	42.0%	12.0%	32.3%	32.3%	14.7%	35.3%		10.7%	31.3%	
Maximum Green (s)	27.0	57.5	57.5	13.5	43.0	43.0	16.5	46.0		10.5	40.0	
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	5.0		3.5	5.0	
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.5	5.5	5.5	4.5	5.5	5.5	5.5	7.0		5.5	7.0	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	None	None	None	C-Max		None	C-Max	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	
Flash Dont Walk (s)		36.0	36.0		36.0	36.0		33.0			33.0	
Pedestrian Calls (#/hr)		0	0		0	0		0			0	
Act Effct Green (s)	25.7	39.0	39.0	16.9	10.0	10.0	30.9	70.2		20.6	59.9	150.0
Actuated g/C Ratio	0.17	0.26	0.26	0.11	0.07	0.07	0.21	0.47		0.14	0.40	1.00
v/c Ratio	0.88	0.08	0.18	0.03	0.18	0.34	0.62	0.89		0.55	0.67	0.31
Control Delay	78.0	43.7	1.8	40.8	70.0	3.3	63.2	42.9		69.8	39.2	0.5
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	78.0	43.7	1.8	40.8	70.0	3.3	63.2	42.9		69.8	39.2	0.5
LOS	E	D	A	D	E	A	E	D		E	D	A
Approach Delay		64.9			17.2			44.9			31.4	
Approach LOS		E			B			D			C	
Queue Length 50th (m)	79.6	8.8	0.0	1.1	6.6	0.0	61.9	204.1		38.8	118.2	0.0
Queue Length 95th (m)	#105.7	20.7	2.5	4.8	16.6	0.0	90.0	235.0		61.1	138.6	0.0
Internal Link Dist (m)		173.4			128.4			151.4			184.4	
Turn Bay Length (m)	125.0		50.0	30.0		30.0	45.0			50.0		30.0
Base Capacity (vph)	601	695	678	252	520	571	344	2205		236	1901	1542
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	0.84	0.05	0.14	0.02	0.04	0.16	0.62	0.89		0.55	0.67	0.31

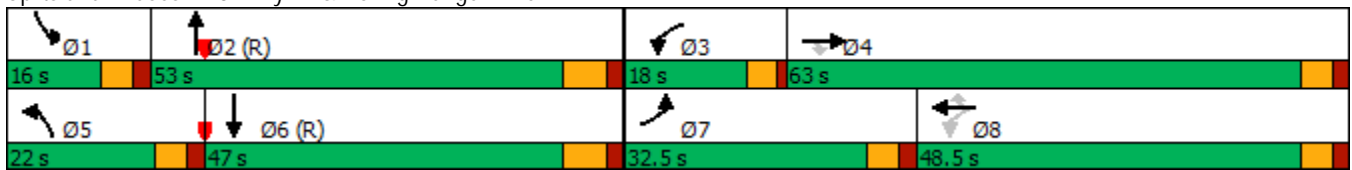
Intersection Summary

Area Type:	Other
Cycle Length:	150
Actuated Cycle Length:	150
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	150
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.89
Intersection Signal Delay:	41.6
Intersection LOS:	D
Intersection Capacity Utilization:	78.1%
ICU Level of Service:	D
Analysis Period (min):	15

Lanes, Volumes, Timings  
 8: Hwy 22 & Rolling Range Drive

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





























Splits and Phases: 8: Hwy 22 & Rolling Range Drive



Lanes, Volumes, Timings  
12: Highway 22 & South Access

2060 Horizon Improved - PM Peak Hour

05/31/2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				 				  		 	  	
Traffic Volume (vph)	5	40	25	175	285	195	25	1647	340	56	1050	6
Future Volume (vph)	5	40	25	175	285	195	25	1647	340	56	1050	6
Ideal Flow (vphp)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	50.0		50.0	70.0		100.0	50.0		100.0	80.0		100.0
Storage Lanes	1		0	2		1	1		1	2		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	0.97	0.91	0.91
Frt		0.942				0.850			0.850		0.999	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1723	1709	0	3343	1814	1542	1723	4951	1542	3343	4947	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1723	1709	0	3343	1814	1542	1723	4951	1542	3343	4947	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		24				192			321		1	
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		453.7			469.7			230.3			234.2	
Travel Time (s)		32.7			33.8			10.4			10.5	
Peak Hour Factor	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)	5	43	27	190	310	212	27	1790	370	61	1141	7
Shared Lane Traffic (%)												
Lane Group Flow (vph)	5	70	0	190	310	212	27	1790	370	61	1148	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			7.2			7.2	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2	1	1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			

Lanes, Volumes, Timings  
12: Highway 22 & South Access

2060 Horizon Improved - PM Peak Hour

05/31/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4		3	8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0	10.0	5.0	20.0	20.0	5.0	20.0	
Minimum Split (s)	10.5	48.5		15.0	48.5	48.5	12.0	47.0	47.0	12.0	47.0	
Total Split (s)	11.0	48.5		18.0	55.5	55.5	12.0	59.0	59.0	12.0	59.0	
Total Split (%)	8.0%	35.3%		13.1%	40.4%	40.4%	8.7%	42.9%	42.9%	8.7%	42.9%	
Maximum Green (s)	5.5	43.0		12.5	50.0	50.0	6.5	52.0	52.0	6.5	52.0	
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	5.0	5.0	3.5	5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	7.0	7.0	5.5	7.0	
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	Min		Max	Min	Min	Max	C-Max	C-Max	Max	C-Max	
Walk Time (s)		7.0			7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		36.0			36.0	36.0		33.0	33.0		33.0	
Pedestrian Calls (#/hr)		0			0	0		0	0		0	
Act Effct Green (s)	5.5	15.5		12.5	31.3	31.3	34.0	52.0	52.0	34.0	52.0	
Actuated g/C Ratio	0.04	0.11		0.09	0.23	0.23	0.25	0.38	0.38	0.25	0.38	
v/c Ratio	0.07	0.33		0.63	0.75	0.43	0.06	0.96	0.47	0.07	0.61	
Control Delay	66.0	39.6		70.1	61.3	10.0	45.0	54.5	7.3	43.6	36.3	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	66.0	39.6		70.1	61.3	10.0	45.0	54.5	7.3	43.6	36.3	
LOS	E	D		E	E	B	D	D	A	D	D	
Approach Delay		41.4			48.4			46.4			36.7	
Approach LOS		D			D			D			D	
Queue Length 50th (m)	1.4	12.7		27.4	85.6	4.6	5.6	181.4	9.0	6.5	96.7	
Queue Length 95th (m)	6.2	24.0		40.8	109.7	25.0	16.8	#216.3	34.3	15.4	112.8	
Internal Link Dist (m)		429.7			445.7			206.3			210.2	
Turn Bay Length (m)	50.0			70.0		100.0	50.0		100.0	80.0		
Base Capacity (vph)	68	550		303	659	682	426	1872	782	827	1871	
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	0.07	0.13		0.63	0.47	0.31	0.06	0.96	0.47	0.07	0.61	

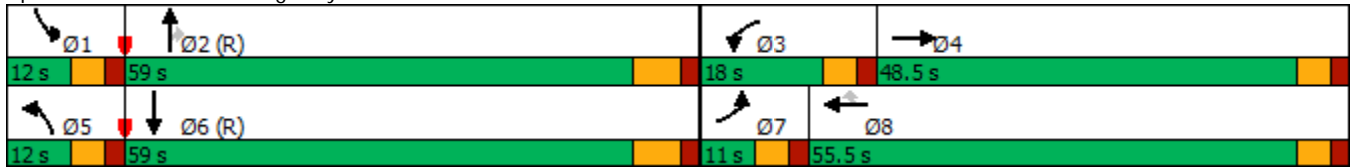
Intersection Summary

Area Type: Other  
 Cycle Length: 137.5  
 Actuated Cycle Length: 137.5  
 Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green  
 Natural Cycle: 125  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.96  
 Intersection Signal Delay: 43.8  
 Intersection LOS: D  
 Intersection Capacity Utilization 64.2%  
 ICU Level of Service C  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.



Queue shown is maximum after two cycles.

Splits and Phases: 12: Highway 22 & South Access



Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Jughandle LT - PM Peak Hour

06- Hwy 22 FPS - Future 2060 Jughandle PM.syn

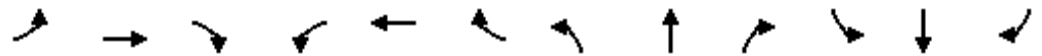


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↗	↘	↑	↗	↘	↑↑↑		↘	↑↑↑	↗
Traffic Volume (vph)	0	500	85	5	20	85	195	2247	25	120	1168	440
Future Volume (vph)	0	500	85	5	20	85	195	2247	25	120	1168	440
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	125.0		50.0	30.0		30.0	45.0		50.0	50.0		30.0
Storage Lanes	0		1	1		1	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt			0.850			0.850		0.998				0.850
Flt Protected				0.950			0.950			0.950		
Satd. Flow (prot)	0	1814	1542	1723	1814	1542	1674	4713	0	1723	4765	1542
Flt Permitted				0.110			0.950			0.950		
Satd. Flow (perm)	0	1814	1542	200	1814	1542	1674	4713	0	1723	4765	1542
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			142			109		1				182
Link Speed (k/h)		50			50			80				80
Link Distance (m)		197.4			152.4			175.4				208.4
Travel Time (s)		14.2			11.0			7.9				9.4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	5%	7%	2%	2%	6%	2%
Adj. Flow (vph)	0	543	92	5	22	92	212	2442	27	130	1270	478
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	543	92	5	22	92	212	2469	0	130	1270	478
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors		2	1	1	2	1	1	2		1	2	1
Detector Template		Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (m)		10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	2.0
Trailing Detector (m)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Position(m)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Size(m)		0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	2.0
Detector 1 Type		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4				9.4
Detector 2 Size(m)		0.6			0.6			0.6				0.6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type		NA	Perm	pm+pt	NA	Perm	Prot	NA		Prot	NA	Free
Protected Phases		4		3	8		5	2		1		6

Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Jughandle LT - PM Peak Hour

06- Hwy 22 FPS - Future 2060 Jughandle PM.syn



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4	8		8						Free
Detector Phase		4	4	3	8	8	5	2		1	6	
Switch Phase												
Minimum Initial (s)		10.0	10.0	5.0	10.0	10.0	5.0	20.0		5.0	20.0	
Minimum Split (s)		48.5	48.5	9.5	48.5	48.5	12.0	47.0		12.0	47.0	
Total Split (s)		48.5	48.5	9.5	58.0	58.0	29.0	78.0		14.0	63.0	
Total Split (%)		32.3%	32.3%	6.3%	38.7%	38.7%	19.3%	52.0%		9.3%	42.0%	
Maximum Green (s)		43.0	43.0	5.0	52.5	52.5	23.5	71.0		8.5	56.0	
Yellow Time (s)		3.5	3.5	3.5	3.5	3.5	3.5	5.0		3.5	5.0	
All-Red Time (s)		2.0	2.0	1.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		5.5	5.5	4.5	5.5	5.5	5.5	7.0		5.5	7.0	
Lead/Lag		Lag	Lag	Lead			Lead	Lag		Lead	Lag	
Lead-Lag Optimize?		Yes	Yes	Yes			Yes	Yes		Yes	Yes	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode		None	None	None	None	None	None	C-Max		None	C-Max	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	
Flash Dont Walk (s)		36.0	36.0		36.0	36.0		33.0			33.0	
Pedestrian Calls (#/hr)		0	0		0	0		0			0	
Act Effct Green (s)		50.6	50.6	53.5	52.5	52.5	21.9	71.0		8.5	57.6	150.0
Actuated g/C Ratio		0.34	0.34	0.36	0.35	0.35	0.15	0.47		0.06	0.38	1.00
v/c Ratio		0.89	0.15	0.04	0.03	0.15	0.87	1.11		1.34	0.69	0.31
Control Delay		64.6	1.4	32.0	32.5	4.1	94.2	92.6		257.3	41.5	0.5
Queue Delay		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay		64.6	1.4	32.0	32.5	4.1	94.2	92.6		257.3	41.5	0.5
LOS		E	A	C	C	A	F	F		F	D	A
Approach Delay		55.4			10.5			92.8			46.0	
Approach LOS		E			B			F			D	
Queue Length 50th (m)		157.7	0.0	1.0	4.5	0.0	65.0	~322.4		~52.7	124.1	0.0
Queue Length 95th (m)		#258.4	2.3	4.3	11.3	9.0	#107.0	#349.7		#98.1	142.1	0.0
Internal Link Dist (m)		173.4			128.4			151.4			184.4	
Turn Bay Length (m)			50.0	30.0		30.0	45.0			50.0		30.0
Base Capacity (vph)		611	614	122	634	610	262	2231		97	1830	1542
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		0.89	0.15	0.04	0.03	0.15	0.81	1.11		1.34	0.69	0.31

Intersection Summary

Area Type:	Other
Cycle Length:	150
Actuated Cycle Length:	150
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	150
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	1.34
Intersection Signal Delay:	69.9
Intersection LOS:	E
Intersection Capacity Utilization:	94.0%
ICU Level of Service:	F
Analysis Period (min):	15

Lanes, Volumes, Timings  
 8: Hwy 22 & Rolling Range Drive

2060 Horizon Jughandle LT - PM Peak Hour  
 06- Hwy 22 FPS - Future 2060 Jughandle PM.syn

- ~ 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.























Splits and Phases: 8: Hwy 22 & Rolling Range Drive



Lanes, Volumes, Timings  
12: Highway 22 & South Access

2060 Horizon Jughandle LT - PM Peak Hour

06- Hwy 22 FPS - Future 2060 Jughandle PM.syn

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	40	25	0	460	195	25	1647	340	56	1225	6
Future Volume (vph)	5	40	25	0	460	195	25	1647	340	56	1225	6
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	50.0		50.0	70.0		100.0	50.0		100.0	80.0		100.0
Storage Lanes	1		0	0		1	1		1	2		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	0.91
Frt		0.942				0.850			0.850		0.999	
Flt Protected	0.950						0.950			0.950		
Satd. Flow (prot)	1723	1709	0	0	1814	1542	1723	4951	1542	3343	4947	0
Flt Permitted	0.160						0.950			0.950		
Satd. Flow (perm)	290	1709	0	0	1814	1542	1723	4951	1542	3343	4947	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		27				147			370		1	
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		453.7			469.7			230.3			234.2	
Travel Time (s)		32.7			33.8			10.4			10.5	
Peak Hour Factor	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)	5	43	27	0	500	212	27	1790	370	61	1332	7
Shared Lane Traffic (%)												
Lane Group Flow (vph)	5	70	0	0	500	212	27	1790	370	61	1339	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			7.2			7.2	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2			2	1	1	2	1	1	2	
Detector Template	Left	Thru			Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0			10.0	2.0	2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6			0.6	2.0	2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA			NA	Perm	Prot	NA	Perm	Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4					8			2			

Lanes, Volumes, Timings  
12: Highway 22 & South Access

2060 Horizon Jughandle LT - PM Peak Hour

06- Hwy 22 FPS - Future 2060 Jughandle PM.syn



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	4	4			8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0			10.0	10.0	5.0	20.0	20.0	5.0	20.0	
Minimum Split (s)	48.5	48.5			48.5	48.5	12.0	47.0	47.0	12.0	47.0	
Total Split (s)	48.5	48.5			48.5	48.5	15.5	53.0	53.0	12.0	49.5	
Total Split (%)	42.7%	42.7%			42.7%	42.7%	13.7%	46.7%	46.7%	10.6%	43.6%	
Maximum Green (s)	43.0	43.0			43.0	43.0	10.0	46.0	46.0	6.5	42.5	
Yellow Time (s)	3.5	3.5			3.5	3.5	3.5	5.0	5.0	3.5	5.0	
All-Red Time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.5	5.5			5.5	5.5	5.5	7.0	7.0	5.5	7.0	
Lead/Lag							Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	Min	Min			Min	Min	Max	C-Max	C-Max	Max	C-Max	
Walk Time (s)	7.0	7.0			7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)	36.0	36.0			36.0	36.0		33.0	33.0		33.0	
Pedestrian Calls (#/hr)	0	0			0	0		0	0		0	
Act Effct Green (s)	36.3	36.3			36.3	36.3	16.7	46.0	46.0	13.2	42.5	
Actuated g/C Ratio	0.32	0.32			0.32	0.32	0.15	0.41	0.41	0.12	0.37	
v/c Ratio	0.05	0.12			0.86	0.36	0.11	0.89	0.44	0.16	0.72	
Control Delay	25.2	16.7			51.2	10.5	47.2	38.4	4.0	49.7	33.2	
Queue Delay	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	25.2	16.7			51.2	10.5	47.2	38.4	4.0	49.7	33.2	
LOS	C	B			D	B	D	D	A	D	C	
Approach Delay		17.2			39.1			32.7			33.9	
Approach LOS		B			D			C			C	
Queue Length 50th (m)	0.8	6.9			107.2	10.6	5.6	140.4	0.0	6.8	97.1	
Queue Length 95th (m)	3.6	16.2			140.4	27.2	15.4	163.0	18.3	14.4	114.9	
Internal Link Dist (m)		429.7			445.7			206.3			210.2	
Turn Bay Length (m)	50.0					100.0	50.0		100.0	80.0		
Base Capacity (vph)	109	664			687	675	252	2006	844	387	1853	
Starvation Cap Reductn	0	0			0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0			0	0	0	0	0	0	0	
Storage Cap Reductn	0	0			0	0	0	0	0	0	0	
Reduced v/c Ratio	0.05	0.11			0.73	0.31	0.11	0.89	0.44	0.16	0.72	

Intersection Summary

Area Type:	Other
Cycle Length:	113.5
Actuated Cycle Length:	113.5
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	110
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.89
Intersection Signal Delay:	33.8
Intersection LOS:	C
Intersection Capacity Utilization:	68.4%
ICU Level of Service:	C
Analysis Period (min):	15

Lanes, Volumes, Timings  
 12: Highway 22 & South Access

2060 Horizon Jughandle LT - PM Peak Hour  
 06- Hwy 22 FPS - Future 2060 Jughandle PM.syn

Splits and Phases: 12: Highway 22 & South Access



Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Displaced LT (Minor) - PM Peak Hour

06/03/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↗	↖	↑	↗	↖	↑↑↑		↖	↑↑↑	↗
Traffic Volume (vph)	0	35	85	5	20	85	195	1782	25	120	1168	440
Future Volume (vph)	0	35	85	5	20	85	195	1782	25	120	1168	440
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	125.0		50.0	30.0		30.0	45.0		50.0	50.0		30.0
Storage Lanes	0		1	1		1	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt			0.850			0.850		0.998				0.850
Flt Protected				0.950			0.950			0.950		
Satd. Flow (prot)	0	1814	1542	1723	1814	1542	1674	4714	0	1723	4765	1542
Flt Permitted				0.507			0.950			0.950		
Satd. Flow (perm)	0	1814	1542	920	1814	1542	1674	4714	0	1723	4765	1542
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			131			92		2				182
Link Speed (k/h)		50			50			80				80
Link Distance (m)		197.4			152.4			175.4				208.4
Travel Time (s)		14.2			11.0			7.9				9.4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	5%	7%	2%	2%	6%	2%
Adj. Flow (vph)	0	38	92	5	22	92	212	1937	27	130	1270	478
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	38	92	5	22	92	212	1964	0	130	1270	478
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors		2	1	1	2	1	1	2		1	2	1
Detector Template		Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (m)		10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	2.0
Trailing Detector (m)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Position(m)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Size(m)		0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	2.0
Detector 1 Type		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4				9.4
Detector 2 Size(m)		0.6			0.6			0.6				0.6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type		NA	Perm	pm+pt	NA	Perm	Prot	NA		Prot	NA	Free
Protected Phases		4		3	8		5	2		1		6



Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Displaced LT (Minor) - PM Peak Hour

06/03/2022

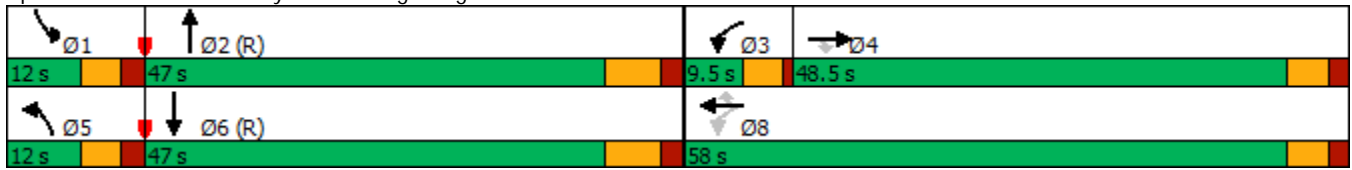


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4	8		8						Free
Detector Phase		4	4	3	8	8	5	2		1	6	
Switch Phase												
Minimum Initial (s)		10.0	10.0	5.0	10.0	10.0	5.0	20.0		5.0	20.0	
Minimum Split (s)		48.5	48.5	9.5	48.5	48.5	12.0	47.0		12.0	47.0	
Total Split (s)		48.5	48.5	9.5	58.0	58.0	12.0	47.0		12.0	47.0	
Total Split (%)		41.5%	41.5%	8.1%	49.6%	49.6%	10.3%	40.2%		10.3%	40.2%	
Maximum Green (s)		43.0	43.0	5.0	52.5	52.5	6.5	40.0		6.5	40.0	
Yellow Time (s)		3.5	3.5	3.5	3.5	3.5	3.5	5.0		3.5	5.0	
All-Red Time (s)		2.0	2.0	1.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		5.5	5.5	4.5	5.5	5.5	5.5	7.0		5.5	7.0	
Lead/Lag		Lag	Lag	Lead			Lead	Lag		Lead	Lag	
Lead-Lag Optimize?		Yes	Yes	Yes			Yes	Yes		Yes	Yes	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode		None	None	None	None	None	None	C-Max		None	C-Max	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	
Flash Dont Walk (s)		36.0	36.0		36.0	36.0		33.0			33.0	
Pedestrian Calls (#/hr)		0	0		0	0		0			0	
Act Effct Green (s)		10.1	10.1	13.0	12.0	12.0	32.7	67.3		19.7	54.3	117.0
Actuated g/C Ratio		0.09	0.09	0.11	0.10	0.10	0.28	0.58		0.17	0.46	1.00
v/c Ratio		0.24	0.37	0.04	0.12	0.38	0.45	0.72		0.45	0.57	0.31
Control Delay		54.0	7.1	44.0	47.2	13.8	41.2	20.5		50.0	23.9	0.5
Queue Delay		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay		54.0	7.1	44.0	47.2	13.8	41.2	20.5		50.0	23.9	0.5
LOS		D	A	D	D	B	D	C		D	C	A
Approach Delay		20.8			21.3			22.5			19.8	
Approach LOS		C			C			C			B	
Queue Length 50th (m)		8.7	0.0	1.1	5.0	0.0	44.5	109.8		29.0	71.0	0.0
Queue Length 95th (m)		19.9	7.1	4.7	12.3	14.8	72.3	162.3		49.1	97.0	0.0
Internal Link Dist (m)		173.4			128.4			151.4			184.4	
Turn Bay Length (m)			50.0	30.0		30.0	45.0			50.0		30.0
Base Capacity (vph)		666	649	136	813	742	468	2712		289	2210	1542
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		0.06	0.14	0.04	0.03	0.12	0.45	0.72		0.45	0.57	0.31

Intersection Summary

Area Type:	Other
Cycle Length:	117
Actuated Cycle Length:	117
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	130
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.72
Intersection Signal Delay:	21.2
Intersection LOS:	C
Intersection Capacity Utilization:	66.1%
ICU Level of Service:	C
Analysis Period (min):	15























Splits and Phases: 8: Hwy 22 & Rolling Range Drive



Lanes, Volumes, Timings  
12: Highway 22 & South Access

2060 Horizon Displaced LT (Minor) - PM Peak Hour

06/03/2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	40	25	0	285	195	25	1647	340	56	1050	6
Future Volume (vph)	5	40	25	0	285	195	25	1647	340	56	1050	6
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	50.0		50.0	70.0		100.0	50.0		100.0	80.0		100.0
Storage Lanes	1		0	0		1	1		1	2		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	0.91
Frt		0.942				0.850			0.850		0.999	
Flt Protected	0.950						0.950			0.950		
Satd. Flow (prot)	1723	1709	0	0	1814	1542	1723	4951	1542	3343	4947	0
Flt Permitted	0.950						0.950			0.950		
Satd. Flow (perm)	1723	1709	0	0	1814	1542	1723	4951	1542	3343	4947	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		27				212			301		1	
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		453.7			469.7			230.3			234.2	
Travel Time (s)		32.7			33.8			10.4			10.5	
Peak Hour Factor	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)	5	43	27	0	310	212	27	1790	370	61	1141	7
Shared Lane Traffic (%)												
Lane Group Flow (vph)	5	70	0	0	310	212	27	1790	370	61	1148	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			7.2			7.2	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2			2	1	1	2	1	1	2	
Detector Template	Left	Thru			Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0			10.0	2.0	2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6			0.6	2.0	2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA			NA	Perm	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases						8			2			

Lanes, Volumes, Timings  
12: Highway 22 & South Access

2060 Horizon Displaced LT (Minor) - PM Peak Hour

06/03/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4			8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0			10.0	10.0	5.0	20.0	20.0	5.0	20.0	
Minimum Split (s)	10.5	48.5			48.5	48.5	12.0	47.0	47.0	12.0	47.0	
Total Split (s)	15.0	72.0			57.0	57.0	12.0	66.0	66.0	12.0	66.0	
Total Split (%)	10.0%	48.0%			38.0%	38.0%	8.0%	44.0%	44.0%	8.0%	44.0%	
Maximum Green (s)	9.5	66.5			51.5	51.5	6.5	59.0	59.0	6.5	59.0	
Yellow Time (s)	3.5	3.5			3.5	3.5	3.5	5.0	5.0	3.5	5.0	
All-Red Time (s)	2.0	2.0			2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.5	5.5			5.5	5.5	5.5	7.0	7.0	5.5	7.0	
Lead/Lag	Lead				Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes				Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	Min			Min	Min	Max	C-Max	C-Max	Max	C-Max	
Walk Time (s)		7.0			7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		36.0			36.0	36.0		33.0	33.0		33.0	
Pedestrian Calls (#/hr)		0			0	0		0	0		0	
Act Effct Green (s)	6.1	34.1			31.6	31.6	38.9	59.0	59.0	38.9	59.0	
Actuated g/C Ratio	0.04	0.23			0.21	0.21	0.26	0.39	0.39	0.26	0.39	
v/c Ratio	0.07	0.17			0.81	0.43	0.06	0.92	0.47	0.07	0.59	
Control Delay	71.0	27.2			72.6	7.9	49.0	51.9	8.7	47.2	37.4	
Queue Delay	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	71.0	27.2			72.6	7.9	49.0	51.9	8.7	47.2	37.4	
LOS	E	C			E	A	D	D	A	D	D	
Approach Delay		30.2			46.4			44.6			37.9	
Approach LOS		C			D			D			D	
Queue Length 50th (m)	1.6	11.0			93.5	0.0	6.3	194.0	13.6	7.3	103.3	
Queue Length 95th (m)	6.5	20.4			119.7	20.3	17.9	216.6	41.1	16.5	119.3	
Internal Link Dist (m)		429.7			445.7			206.3			210.2	
Turn Bay Length (m)	50.0					100.0	50.0		100.0	80.0		
Base Capacity (vph)	109	772			622	668	446	1947	789	866	1946	
Starvation Cap Reductn	0	0			0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0			0	0	0	0	0	0	0	
Storage Cap Reductn	0	0			0	0	0	0	0	0	0	
Reduced v/c Ratio	0.05	0.09			0.50	0.32	0.06	0.92	0.47	0.07	0.59	

Intersection Summary

Area Type:	Other
Cycle Length:	150
Actuated Cycle Length:	150
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	120
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.92
Intersection Signal Delay:	42.5
Intersection LOS:	D
Intersection Capacity Utilization	64.2%
ICU Level of Service	C
Analysis Period (min)	15

Splits and Phases: 12: Highway 22 & South Access



Lanes, Volumes, Timings

2060 Horizon Displaced LT (Major) - PM Peak Hour

3: Hwy 22 & Fireside Gate/James Walker Tr

06/03/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖	↗↗	↘	↖↖	↗↗	↘		↗↗↗	↘		↗↗↗	↘
Traffic Volume (vph)	102	545	65	180	570	559	0	1341	321	0	867	185
Future Volume (vph)	102	545	65	180	570	559	0	1341	321	0	867	185
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	120.0		30.0	120.0		30.0	130.0		150.0	160.0		140.0
Storage Lanes	2		1	2		1	0		1	0		1
Taper Length (m)	60.0			50.0			100.0			100.0		
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	1.00	0.91	1.00	1.00	0.91	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950								
Satd. Flow (prot)	3278	3446	1512	3247	3348	1527	0	4676	1498	0	4469	1542
Flt Permitted	0.950			0.950								
Satd. Flow (perm)	3278	3446	1512	3247	3348	1527	0	4676	1498	0	4469	1542
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			94			290			300			201
Link Speed (k/h)		50			50			80				80
Link Distance (m)		229.7			296.3			249.0				318.2
Travel Time (s)		16.5			21.3			11.2				14.3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	4%	2%	4%	5%	5%	3%	2%	8%	5%	3%	13%	2%
Adj. Flow (vph)	111	592	71	196	620	608	0	1458	349	0	942	201
Shared Lane Traffic (%)												
Lane Group Flow (vph)	111	592	71	196	620	608	0	1458	349	0	942	201
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			0.0				0.0
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1		2	1		2	1
Detector Template	Left	Thru	Right	Left	Thru	Right		Thru	Right		Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0		10.0	2.0		10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0		0.6	2.0		0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	Perm	Prot	NA	Free		NA	Perm		NA	Perm
Protected Phases	3	8		7	4			2			6	

Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate/James Walker Tr

2060 Horizon Displaced LT (Major) - PM Peak Hour

06/03/2022

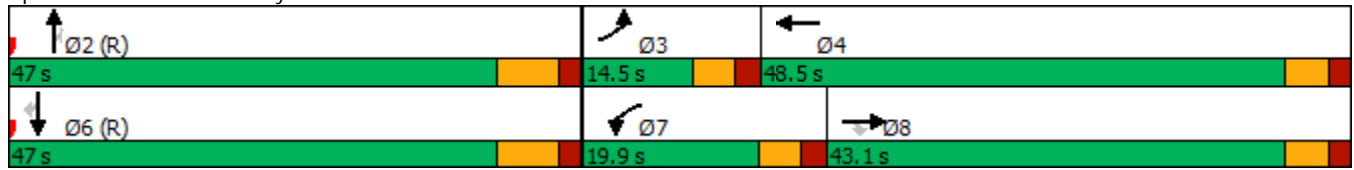


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			8			Free			2			6
Detector Phase	3	8	8	7	4			2	2		6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0			20.0	20.0		20.0	20.0
Minimum Split (s)	10.5	15.5	15.5	10.5	48.5			47.0	47.0		47.0	47.0
Total Split (s)	14.5	43.1	43.1	19.9	48.5			47.0	47.0		47.0	47.0
Total Split (%)	13.2%	39.2%	39.2%	18.1%	44.1%			42.7%	42.7%		42.7%	42.7%
Maximum Green (s)	9.0	37.6	37.6	14.4	43.0			40.0	40.0		40.0	40.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5			5.0	5.0		5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0			2.0	2.0		2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0			0.0	0.0		0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5			7.0	7.0		7.0	7.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag							
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes							
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Recall Mode	None	Min	Min	None	Min			C-Max	C-Max		C-Max	C-Max
Walk Time (s)					7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)					36.0			33.0	33.0		33.0	33.0
Pedestrian Calls (#/hr)					0			0	0		0	0
Act Effct Green (s)	8.3	24.7	24.7	11.7	28.1	110.0		55.6	55.6		55.6	55.6
Actuated g/C Ratio	0.08	0.22	0.22	0.11	0.26	1.00		0.51	0.51		0.51	0.51
v/c Ratio	0.45	0.77	0.17	0.57	0.73	0.40		0.62	0.39		0.42	0.23
Control Delay	54.4	46.6	4.3	53.0	42.1	0.8		22.1	5.0		18.8	3.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Delay	54.4	46.6	4.3	53.0	42.1	0.8		22.1	5.0		18.8	3.3
LOS	D	D	A	D	D	A		C	A		B	A
Approach Delay		43.8			26.0			18.8			16.1	
Approach LOS		D			C			B			B	
Queue Length 50th (m)	12.5	66.5	0.0	22.0	68.2	0.0		83.3	5.4		46.9	0.0
Queue Length 95th (m)	21.8	80.6	6.9	33.2	79.2	0.0		117.0	26.3		68.6	13.6
Internal Link Dist (m)		205.7			272.3			225.0			294.2	
Turn Bay Length (m)	120.0		30.0	120.0		30.0			150.0			140.0
Base Capacity (vph)	268	1177	578	425	1308	1527		2362	905		2258	878
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	0.41	0.50	0.12	0.46	0.47	0.40		0.62	0.39		0.42	0.23

Intersection Summary

Area Type:	Other
Cycle Length:	110
Actuated Cycle Length:	110
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	110
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.77
Intersection Signal Delay:	23.9
Intersection LOS:	C
Intersection Capacity Utilization:	62.4%
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 3: Hwy 22 & Fireside Gate/James Walker Tr





Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Displaced LT (Major) - PM Peak Hour

06/03/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	465	35	85	5	20	85	0	1782	25	0	1168	440
Future Volume (vph)	465	35	85	5	20	85	0	1782	25	0	1168	440
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	125.0		50.0	30.0		30.0	45.0		50.0	50.0		30.0
Storage Lanes	2		1	1		1	0		0	0		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt			0.850			0.850		0.998				0.850
Flt Protected	0.950			0.950								
Satd. Flow (prot)	3343	1814	1542	1723	1814	1542	0	4714	0	0	4765	1542
Flt Permitted	0.950			0.732								
Satd. Flow (perm)	3343	1814	1542	1328	1814	1542	0	4714	0	0	4765	1542
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			92			106		2				148
Link Speed (k/h)		50			50			80				80
Link Distance (m)		272.6			152.4			175.4				208.4
Travel Time (s)		19.6			11.0			7.9				9.4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	5%	7%	2%	2%	6%	2%
Adj. Flow (vph)	505	38	92	5	22	92	0	1937	27	0	1270	478
Shared Lane Traffic (%)												
Lane Group Flow (vph)	505	38	92	5	22	92	0	1964	0	0	1270	478
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			0.0				0.0
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1		2			2	1
Detector Template	Left	Thru	Right	Left	Thru	Right		Thru			Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0		10.0			10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0		0.6			0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex			Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	Perm	pm+pt	NA	Perm		NA			NA	Free
Protected Phases	7	4		3	8			2			6	

Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Displaced LT (Major) - PM Peak Hour

06/03/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4	8		8						Free
Detector Phase	7	4	4	3	8	8		2			6	
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0		20.0			20.0	
Minimum Split (s)	10.5	48.5	48.5	9.5	48.5	48.5		47.0			47.0	
Total Split (s)	31.0	70.0	70.0	9.5	48.5	48.5		64.2			64.2	
Total Split (%)	21.6%	48.7%	48.7%	6.6%	33.8%	33.8%		44.7%			44.7%	
Maximum Green (s)	25.5	64.5	64.5	5.0	43.0	43.0		57.2			57.2	
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5		5.0			5.0	
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0	2.0		2.0			2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Total Lost Time (s)	5.5	5.5	5.5	4.5	5.5	5.5		7.0			7.0	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0			3.0	
Recall Mode	None	None	None	None	None	None		C-Max			C-Max	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	
Flash Dont Walk (s)		36.0	36.0		36.0	36.0		33.0			33.0	
Pedestrian Calls (#/hr)		0	0		0	0		0			0	
Act Effct Green (s)	24.5	38.2	38.2	16.0	10.0	10.0		91.1			91.1	143.7
Actuated g/C Ratio	0.17	0.27	0.27	0.11	0.07	0.07		0.63			0.63	1.00
v/c Ratio	0.89	0.08	0.19	0.03	0.17	0.45		0.66			0.42	0.31
Control Delay	76.2	41.2	9.1	39.0	66.4	15.1		17.9			13.8	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	0.0
Total Delay	76.2	41.2	9.1	39.0	66.4	15.1		17.9			13.8	0.5
LOS	E	D	A	D	E	B		B			B	A
Approach Delay		64.4			25.6			17.9			10.1	
Approach LOS		E			C			B			B	
Queue Length 50th (m)	76.4	8.4	0.0	1.1	6.3	0.0		130.1			67.0	0.0
Queue Length 95th (m)	#103.8	19.7	15.2	4.5	16.1	14.1		146.5			77.5	0.0
Internal Link Dist (m)		248.6			128.4			151.4			184.4	
Turn Bay Length (m)	125.0		50.0	30.0		30.0						30.0
Base Capacity (vph)	593	814	742	161	542	535		2990			3022	1542
Starvation Cap Reductn	0	0	0	0	0	0		0			0	0
Spillback Cap Reductn	0	0	0	0	0	0		0			0	0
Storage Cap Reductn	0	0	0	0	0	0		0			0	0
Reduced v/c Ratio	0.85	0.05	0.12	0.03	0.04	0.17		0.66			0.42	0.31

Intersection Summary

Area Type:	Other
Cycle Length:	143.7
Actuated Cycle Length:	143.7
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	140
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.89
Intersection Signal Delay:	21.7
Intersection LOS:	C
Intersection Capacity Utilization:	72.9%
ICU Level of Service:	C
Analysis Period (min):	15

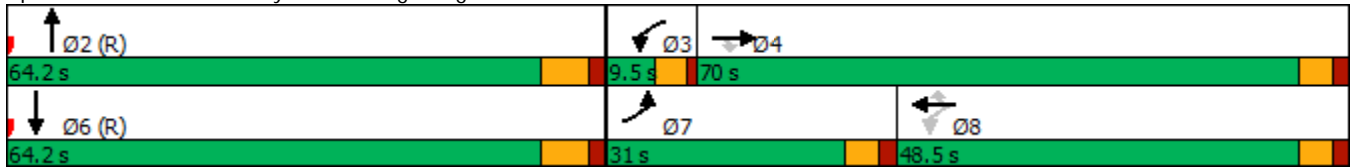
Lanes, Volumes, Timings  
 8: Hwy 22 & Rolling Range Drive

2060 Horizon Displaced LT (Major) - PM Peak Hour

06/03/2022

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

Splits and Phases: 8: Hwy 22 & Rolling Range Drive



Lanes, Volumes, Timings  
12: Highway 22 & South Access

2060 Horizon Displaced LT (Major) - PM Peak Hour

06/03/2022

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	40	25	175	285	195	0	1647	340	0	1050	6
Future Volume (vph)	5	40	25	175	285	195	0	1647	340	0	1050	6
Ideal Flow (vphp)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	50.0		50.0	70.0		100.0	50.0		100.0	80.0		100.0
Storage Lanes	1		0	2		1	0		1	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	1.00	0.91	0.91
Frt		0.942				0.850			0.850		0.999	
Flt Protected	0.950			0.950								
Satd. Flow (prot)	1723	1709	0	3343	1814	1542	0	4951	1542	0	4947	0
Flt Permitted	0.950			0.950								
Satd. Flow (perm)	1723	1709	0	3343	1814	1542	0	4951	1542	0	4947	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		27				170			368			1
Link Speed (k/h)		50			50			80				80
Link Distance (m)		453.7			469.7			230.3				234.2
Travel Time (s)		32.7			33.8			10.4				10.5
Peak Hour Factor	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)	5	43	27	190	310	212	0	1790	370	0	1141	7
Shared Lane Traffic (%)												
Lane Group Flow (vph)	5	70	0	190	310	212	0	1790	370	0	1148	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			0.0				0.0
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2	1		2	1		2	
Detector Template	Left	Thru		Left	Thru	Right		Thru	Right		Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0	2.0		10.0	2.0		10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6	2.0		0.6	2.0		0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA		Prot	NA	Perm		NA	Perm		NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8			2			

Lanes, Volumes, Timings  
12: Highway 22 & South Access

2060 Horizon Displaced LT (Major) - PM Peak Hour

06/03/2022

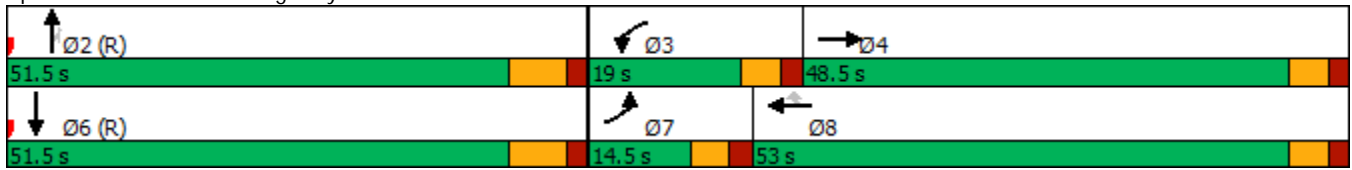


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4		3	8	8		2	2		6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0	10.0		20.0	20.0		20.0	
Minimum Split (s)	10.5	48.5		15.0	48.5	48.5		47.0	47.0		47.0	
Total Split (s)	14.5	48.5		19.0	53.0	53.0		51.5	51.5		51.5	
Total Split (%)	12.2%	40.8%		16.0%	44.5%	44.5%		43.3%	43.3%		43.3%	
Maximum Green (s)	9.0	43.0		13.5	47.5	47.5		44.5	44.5		44.5	
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5		5.0	5.0		5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	
Total Lost Time (s)	5.5	5.5		5.5	5.5	5.5		7.0	7.0		7.0	
Lead/Lag	Lead	Lag		Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes						
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	
Recall Mode	None	Min		Max	Min	Min		C-Max	C-Max		C-Max	
Walk Time (s)		7.0			7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		36.0			36.0	36.0		33.0	33.0		33.0	
Pedestrian Calls (#/hr)		0			0	0		0	0		0	
Act Effect Green (s)	6.0	13.8		13.5	30.3	30.3		73.7	73.7		73.7	
Actuated g/C Ratio	0.05	0.12		0.11	0.25	0.25		0.62	0.62		0.62	
v/c Ratio	0.06	0.32		0.50	0.67	0.41		0.58	0.34		0.37	
Control Delay	55.0	33.3		54.6	47.7	11.1		15.5	2.4		12.5	
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0	
Total Delay	55.0	33.3		54.6	47.7	11.1		15.5	2.4		12.5	
LOS	D	C		D	D	B		B	A		B	
Approach Delay		34.8			38.7			13.3			12.5	
Approach LOS		C			D			B			B	
Queue Length 50th (m)	1.2	10.1		22.9	69.8	8.1		81.0	0.2		43.1	
Queue Length 95th (m)	5.5	20.8		35.3	94.9	27.5		142.7	16.0		78.6	
Internal Link Dist (m)		429.7			445.7			206.3			210.2	
Turn Bay Length (m)	50.0			70.0		100.0			100.0			
Base Capacity (vph)	130	634		379	724	717		3068	1095		3065	
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	0.04	0.11		0.50	0.43	0.30		0.58	0.34		0.37	

Intersection Summary

Area Type:	Other
Cycle Length:	119
Actuated Cycle Length:	119
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	115
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.67
Intersection Signal Delay:	17.9
Intersection LOS:	B
Intersection Capacity Utilization:	64.2%
ICU Level of Service:	C
Analysis Period (min):	15

Splits and Phases: 12: Highway 22 & South Access



Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Michigan LT (Minor) - PM Peak Hour

06/03/2022

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	125.0		50.0	30.0		30.0	50.0		30.0	45.0		50.0
Storage Lanes	2		1	1		1	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt												
Flt Protected												
Satd. Flow (prot)	3204	1814	1480	1814	1814	1814	1814	4550	0	1814	4469	1814
Flt Permitted												
Satd. Flow (perm)	3204	1814	1480	1814	1814	1814	1814	4550	0	1814	4469	1814
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		225.2			254.5			172.2			208.4	
Travel Time (s)		16.2			18.3			7.7			9.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	12%	2%	25%	2%	2%	2%	2%	11%	2%	2%	13%	2%
Adj. Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2		1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot		Perm	pm+pt		Perm	Prot			Prot		Free
Protected Phases	7	4		3	8		5	2		1	6	

Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Michigan LT (Minor) - PM Peak Hour

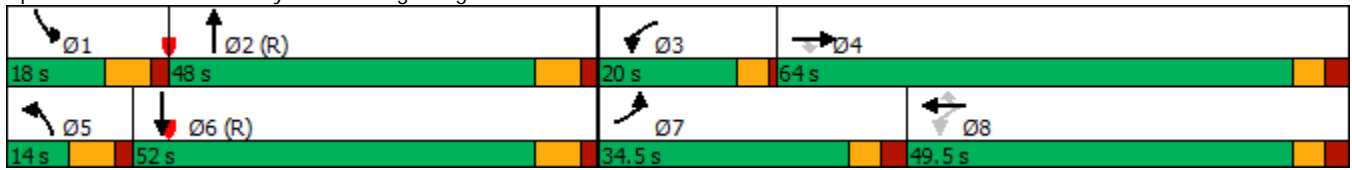
06/03/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4	8		8						Free
Detector Phase	7	4	4	3	8	8	5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	20.0		5.0	20.0	
Minimum Split (s)	11.5	49.5	49.5	9.5	49.5	49.5	12.0	47.0		12.0	47.0	
Total Split (s)	34.5	64.0	64.0	20.0	49.5	49.5	14.0	48.0		18.0	52.0	
Total Split (%)	23.0%	42.7%	42.7%	13.3%	33.0%	33.0%	9.3%	32.0%		12.0%	34.7%	
Maximum Green (s)	28.0	57.5	57.5	15.5	43.0	43.0	7.0	41.0		11.0	45.0	
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	5.0	5.0		5.0	5.0	
All-Red Time (s)	3.0	3.0	3.0	1.0	3.0	3.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.5	6.5	6.5	4.5	6.5	6.5	7.0	7.0		7.0	7.0	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	None	None	None	C-Max		None	C-Max	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	
Flash Dont Walk (s)		36.0	36.0		36.0	36.0		33.0			33.0	
Pedestrian Calls (#/hr)		0	0		0	0		0			0	
Act Effct Green (s)												
Actuated g/C Ratio												
v/c Ratio												
Control Delay												
Queue Delay												
Total Delay												
LOS												
Approach Delay												
Approach LOS												
Queue Length 50th (m)												
Queue Length 95th (m)												
Internal Link Dist (m)		201.2			230.5			148.2			184.4	
Turn Bay Length (m)												
Base Capacity (vph)												
Starvation Cap Reductn												
Spillback Cap Reductn												
Storage Cap Reductn												
Reduced v/c Ratio												
<b>Intersection Summary</b>												
Area Type:	Other											
Cycle Length:	150											
Actuated Cycle Length:	150											
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green											
Natural Cycle:	120											
Control Type:	Actuated-Coordinated											
Maximum v/c Ratio:	0.00											
Intersection Signal Delay:	0.0						Intersection LOS: A					
Intersection Capacity Utilization:	0.0%						ICU Level of Service A					
Analysis Period (min)	15											


























Splits and Phases: 8: Hwy 22 & Rolling Range Drive



Lanes, Volumes, Timings  
16: Highway 22 & South Access

2060 Horizon Michigan LT (Minor) - PM Peak Hour

06/03/2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	40	200	0	460	195	25	1647	340	56	1050	6
Future Volume (vph)	5	40	200	0	460	195	25	1647	340	56	1050	6
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	50.0		50.0	70.0		100.0	50.0		100.0	80.0		100.0
Storage Lanes	1		1	0		1	1		1	2		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	1.00	0.97	0.91	0.91
Frt			0.850			0.850			0.850		0.999	
Flt Protected	0.950						0.950			0.950		
Satd. Flow (prot)	1723	1814	1542	0	1814	1542	1723	4951	1542	3343	4947	0
Flt Permitted	0.109						0.950			0.950		
Satd. Flow (perm)	198	1814	1542	0	1814	1542	1723	4951	1542	3343	4947	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			149			212			347			1
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		181.9			562.8			301.5			216.5	
Travel Time (s)		13.1			40.5			13.6			9.7	
Peak Hour Factor	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)	5	43	217	0	500	212	27	1790	370	61	1141	7
Shared Lane Traffic (%)												
Lane Group Flow (vph)	5	43	217	0	500	212	27	1790	370	61	1148	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			7.2			7.2	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1		2	1	1	2	1	1	2	
Detector Template	Left	Thru	Right		Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0	2.0		10.0	2.0	2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	2.0	0.6	2.0		0.6	2.0	2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	Perm		NA	Perm	Prot	NA	Perm	Prot	NA	
Protected Phases	7	4			8		5	2		1	6	
Permitted Phases	4		4			8			2			

Lanes, Volumes, Timings  
16: Highway 22 & South Access

2060 Horizon Michigan LT (Minor) - PM Peak Hour

06/03/2022



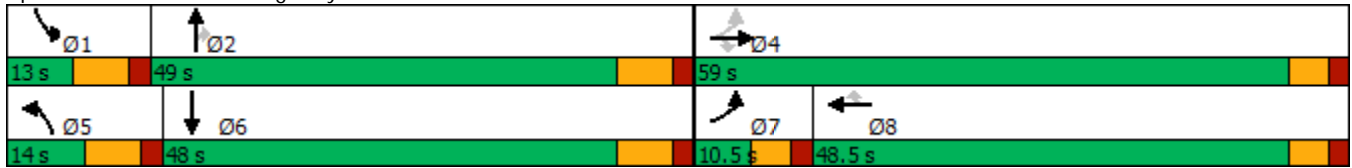
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	4		8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0		10.0	10.0	5.0	20.0	20.0	5.0	20.0	
Minimum Split (s)	10.5	48.5	48.5		48.5	48.5	12.0	47.0	47.0	12.0	47.0	
Total Split (s)	10.5	59.0	59.0		48.5	48.5	14.0	49.0	49.0	13.0	48.0	
Total Split (%)	8.7%	48.8%	48.8%		40.1%	40.1%	11.6%	40.5%	40.5%	10.7%	39.7%	
Maximum Green (s)	5.0	53.5	53.5		43.0	43.0	7.0	42.0	42.0	6.0	41.0	
Yellow Time (s)	3.5	3.5	3.5		3.5	3.5	5.0	5.0	5.0	5.0	5.0	
All-Red Time (s)	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.5	5.5	5.5		5.5	5.5	7.0	7.0	7.0	7.0	7.0	
Lead/Lag	Lead				Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes				Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None		None	None	None	Max	Max	None	Max	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0	7.0		7.0	
Flash Dont Walk (s)		36.0	36.0		36.0	36.0		33.0	33.0		33.0	
Pedestrian Calls (#/hr)		0	0		0	0		0	0		0	
Act Effct Green (s)	33.5	33.5	33.5		31.8	31.8	6.6	43.1	43.1	6.1	45.3	
Actuated g/C Ratio	0.34	0.34	0.34		0.32	0.32	0.07	0.43	0.43	0.06	0.46	
v/c Ratio	0.03	0.07	0.35		0.86	0.33	0.24	0.83	0.43	0.30	0.51	
Control Delay	33.2	34.1	21.8		48.1	5.1	54.9	32.0	5.3	54.0	23.5	
Queue Delay	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	33.2	34.1	21.8		48.1	5.1	54.9	32.0	5.3	54.0	23.5	
LOS	C	C	C		D	A	D	C	A	D	C	
Approach Delay		24.0			35.3			27.8			25.0	
Approach LOS		C			D			C			C	
Queue Length 50th (m)	0.7	7.0	19.2		94.3	0.0	5.4	120.8	2.8	6.3	65.4	
Queue Length 95th (m)	m2.1	m12.1	31.9		154.9	16.6	16.7	#208.4	27.1	15.3	107.0	
Internal Link Dist (m)		157.9			538.8			277.5			192.5	
Turn Bay Length (m)	50.0		50.0			100.0	50.0		100.0	80.0		
Base Capacity (vph)	145	1003	919		806	803	124	2150	866	207	2256	
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	0.03	0.04	0.24		0.62	0.26	0.22	0.83	0.43	0.29	0.51	

Intersection Summary

Area Type: Other  
 Cycle Length: 121  
 Actuated Cycle Length: 99.3  
 Natural Cycle: 120  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.86  
 Intersection Signal Delay: 28.0  
 Intersection LOS: C  
 Intersection Capacity Utilization 68.0%  
 ICU Level of Service C  
 Analysis Period (min) 15  
 # 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.
































Splits and Phases: 16: Highway 22 & South Access



Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate/James Walker Tr

2060 Horizon Michigan LT (Major) - PM Peak Hour

06/03/2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 	 			  			  	
Traffic Volume (vph)	102	545	65	180	570	559	185	1341	527	0	1073	185
Future Volume (vph)	102	545	65	180	570	559	185	1341	527	0	1073	185
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	120.0		30.0	120.0		30.0	130.0		150.0	160.0		140.0
Storage Lanes	2		1	2		1	1		1	0		1
Taper Length (m)	60.0			50.0			100.0			100.0		
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	1.00	0.91	1.00	1.00	0.91	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950					
Satd. Flow (prot)	3247	3380	1512	3186	3380	1527	1555	4209	1367	0	4509	1430
Flt Permitted	0.950			0.950			0.950					
Satd. Flow (perm)	3247	3380	1512	3186	3380	1527	1555	4209	1367	0	4509	1430
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			111			215			258			201
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		229.7			296.3			158.5			318.2	
Travel Time (s)		16.5			21.3			7.1			14.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	5%	4%	4%	7%	4%	3%	13%	20%	15%	8%	12%	10%
Adj. Flow (vph)	111	592	71	196	620	608	201	1458	573	0	1166	201
Shared Lane Traffic (%)												
Lane Group Flow (vph)	111	592	71	196	620	608	201	1458	573	0	1166	201
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2	1		2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0		10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0		0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA	Perm		NA	Perm
Protected Phases	3	8		7	4		5	2			6	

Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate/James Walker Tr

2060 Horizon Michigan LT (Major) - PM Peak Hour

06/03/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			8			Free			2			6
Detector Phase	3	8	8	7	4		5	2	2		6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0		5.0	20.0	20.0		20.0	20.0
Minimum Split (s)	10.5	15.5	15.5	10.5	48.5		12.0	47.0	47.0		58.0	58.0
Total Split (s)	15.0	43.5	43.5	20.0	48.5		26.0	84.5	84.5		58.5	58.5
Total Split (%)	10.1%	29.4%	29.4%	13.5%	32.8%		17.6%	57.1%	57.1%		39.5%	39.5%
Maximum Green (s)	9.5	38.0	38.0	14.5	43.0		20.5	77.5	77.5		51.5	51.5
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	5.0	5.0		5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5		5.5	7.0	7.0		7.0	7.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag		Lead				Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes				Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Recall Mode	None	Min	Min	None	Min		Max	C-Max	C-Max		C-Max	C-Max
Walk Time (s)					7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)					36.0			33.0	33.0		33.0	33.0
Pedestrian Calls (#/hr)					0			0	0		0	0
Act Effct Green (s)	9.0	31.4	31.4	13.3	35.6	148.0	28.3	85.3	85.3		51.5	51.5
Actuated g/C Ratio	0.06	0.21	0.21	0.09	0.24	1.00	0.19	0.58	0.58		0.35	0.35
v/c Ratio	0.56	0.83	0.17	0.69	0.76	0.40	0.68	0.60	0.64		0.74	0.32
Control Delay	78.8	65.8	2.4	78.0	58.4	0.8	71.0	21.7	14.6		46.0	5.6
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	78.8	65.8	2.4	78.0	58.4	0.8	71.0	21.7	14.6		46.0	5.6
LOS	E	E	A	E	E	A	E	C	B		D	A
Approach Delay		61.9			36.5			24.3			40.0	
Approach LOS		E			D			C			D	
Queue Length 50th (m)	17.4	93.0	0.0	30.5	94.1	0.0	59.7	96.4	55.7		115.8	0.0
Queue Length 95th (m)	28.2	109.3	3.3	44.6	109.6	0.0	m#113.1	125.2	104.9		134.4	17.7
Internal Link Dist (m)		205.7			272.3			134.5			294.2	
Turn Bay Length (m)	120.0		30.0	120.0		30.0	130.0		150.0			140.0
Base Capacity (vph)	208	867	470	312	982	1527	297	2427	897		1569	628
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	0.53	0.68	0.15	0.63	0.63	0.40	0.68	0.60	0.64		0.74	0.32

Intersection Summary

Area Type:	Other
Cycle Length:	148
Actuated Cycle Length:	148
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	140
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.83
Intersection Signal Delay:	36.0
Intersection LOS:	D
Intersection Capacity Utilization:	72.1%
ICU Level of Service:	C
Analysis Period (min):	15

Lanes, Volumes, Timings  
 3: Hwy 22 & Fireside Gate/James Walker Tr

2060 Horizon Michigan LT (Major) - PM Peak Hour

06/03/2022

# 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.

Splits and Phases: 3: Hwy 22 & Fireside Gate/James Walker Tr



Lanes, Volumes, Timings  
12: Highway 22 & South Access

2060 Horizon Michigan LT (Major) - PM Peak Hour

06/03/2022

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	40	25	175	285	195	25	1647	396	0	1106	6
Future Volume (vph)	5	40	25	175	285	195	25	1647	396	0	1106	6
Ideal Flow (vphp)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	50.0		50.0	70.0		100.0	50.0		100.0	80.0		100.0
Storage Lanes	1		0	2		1	1		1	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.91	1.00	1.00	0.91	0.91
Frt		0.942				0.850			0.850		0.999	
Flt Protected	0.950			0.950			0.950					
Satd. Flow (prot)	1723	1709	0	3343	1814	1542	1723	4951	1542	0	4947	0
Flt Permitted	0.950			0.950			0.950					
Satd. Flow (perm)	1723	1709	0	3343	1814	1542	1723	4951	1542	0	4947	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		25				212			393		1	
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		453.7			469.7			164.8			234.2	
Travel Time (s)		32.7			33.8			7.4			10.5	
Peak Hour Factor	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)	5	43	27	190	310	212	27	1790	430	0	1202	7
Shared Lane Traffic (%)												
Lane Group Flow (vph)	5	70	0	190	310	212	27	1790	430	0	1209	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2	1	1	2	1		2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right		Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0	2.0	2.0	10.0	2.0		10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	
Detector 1 Size(m)	2.0	0.6		2.0	0.6	2.0	2.0	0.6	2.0		0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA		Prot	NA	Perm	Prot	NA	Perm		NA	
Protected Phases	7	4		3	8		5	2			6	
Permitted Phases						8			2			



Lanes, Volumes, Timings  
12: Highway 22 & South Access

2060 Horizon Michigan LT (Major) - PM Peak Hour

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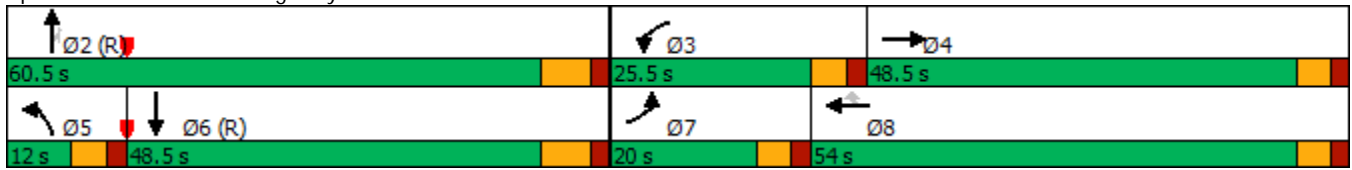


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4		3	8	8	5	2	2		6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0	10.0	5.0	20.0	20.0		20.0	
Minimum Split (s)	10.5	48.5		15.0	48.5	48.5	12.0	47.0	47.0		47.0	
Total Split (s)	20.0	48.5		25.5	54.0	54.0	12.0	60.5	60.5		48.5	
Total Split (%)	14.9%	36.1%		19.0%	40.1%	40.1%	8.9%	45.0%	45.0%		36.1%	
Maximum Green (s)	14.5	43.0		20.0	48.5	48.5	6.5	53.5	53.5		41.5	
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	5.0	5.0		5.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0		2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	
Total Lost Time (s)	5.5	5.5		5.5	5.5	5.5	5.5	7.0	7.0		7.0	
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lead					Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes					Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0		3.0	
Recall Mode	None	Min		Max	Min	Min	Max	C-Max	C-Max			C-Max
Walk Time (s)		7.0			7.0	7.0		7.0	7.0			7.0
Flash Dont Walk (s)		36.0			36.0	36.0		33.0	33.0			33.0
Pedestrian Calls (#/hr)		0			0	0		0	0			0
Act Effct Green (s)	6.0	13.2		20.0	36.2	36.2	36.3	83.3	83.3			41.5
Actuated g/C Ratio	0.04	0.10		0.15	0.27	0.27	0.27	0.62	0.62			0.31
v/c Ratio	0.06	0.37		0.38	0.64	0.37	0.06	0.58	0.39			0.79
Control Delay	63.0	41.7		54.2	50.0	6.6	41.0	17.0	3.1			47.1
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0			0.0
Total Delay	63.0	41.7		54.2	50.0	6.6	41.0	17.0	3.1			47.1
LOS	E	D		D	D	A	D	B	A			D
Approach Delay		43.1			38.2			14.6				47.1
Approach LOS		D			D			B				D
Queue Length 50th (m)	1.4	12.2		25.0	77.3	0.0	5.5	94.7	3.6			113.2
Queue Length 95th (m)	6.0	24.9		37.4	107.5	19.2	m15.6	146.0	m21.3			132.1
Internal Link Dist (m)		429.7			445.7			140.8				210.2
Turn Bay Length (m)	50.0			70.0		100.0	50.0		100.0			
Base Capacity (vph)	185	563		497	654	691	465	3065	1104			1527
Starvation Cap Reductn	0	0		0	0	0	0	0	0			0
Spillback Cap Reductn	0	0		0	0	0	0	0	0			0
Storage Cap Reductn	0	0		0	0	0	0	0	0			0
Reduced v/c Ratio	0.03	0.12		0.38	0.47	0.31	0.06	0.58	0.39			0.79

Intersection Summary

Area Type: Other  
 Cycle Length: 134.5  
 Actuated Cycle Length: 134.5  
 Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green  
 Natural Cycle: 125  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.79  
 Intersection Signal Delay: 28.3      Intersection LOS: C  
 Intersection Capacity Utilization 64.2%      ICU Level of Service C  
 Analysis Period (min) 15  
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 12: Highway 22 & South Access



Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate/James Walker Tr

2060 Horizon Sensitivity Test - PM Peak Hour

06/03/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↖	↗↗	↖	↖↖	↗↗	↖	↖	↗↗↗	↖	↖↖	↗↗↗	↖
Traffic Volume (vph)	77	545	65	135	570	559	185	1341	321	155	867	185
Future Volume (vph)	77	545	65	135	570	559	185	1341	321	155	867	185
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	120.0		30.0	120.0		30.0	130.0		150.0	160.0		140.0
Storage Lanes	2		1	2		1	1		1	2		1
Taper Length (m)	60.0			50.0			100.0			100.0		
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	1.00	0.91	1.00	0.97	0.91	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3278	3446	1512	3247	3348	1527	1723	4676	1498	3310	4469	1542
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3278	3446	1512	3247	3348	1527	1723	4676	1498	3310	4469	1542
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			150			266			180			197
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		229.7			296.3			249.0			318.2	
Travel Time (s)		16.5			21.3			11.2			14.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	4%	2%	4%	5%	5%	3%	2%	8%	5%	3%	13%	2%
Adj. Flow (vph)	84	592	71	147	620	608	201	1458	349	168	942	201
Shared Lane Traffic (%)												
Lane Group Flow (vph)	84	592	71	147	620	608	201	1458	349	168	942	201
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			7.2			7.2	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	Perm	Prot	NA	Free	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	8		7	4		5	2		1	6	

Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate/James Walker Tr

2060 Horizon Sensitivity Test - PM Peak Hour

06/03/2022



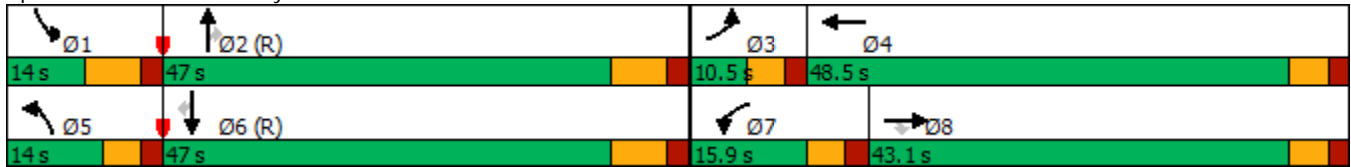
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR		
Permitted Phases	8			Free			2			6				
Detector Phase	3	8	8	7	4		5	2	2	1	6	6		
Switch Phase														
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0		5.0	20.0	20.0	5.0	20.0	20.0		
Minimum Split (s)	10.5	15.5	15.5	10.5	48.5		12.0	47.0	47.0	12.0	47.0	47.0		
Total Split (s)	10.5	43.1	43.1	15.9	48.5		14.0	47.0	47.0	14.0	47.0	47.0		
Total Split (%)	8.8%	35.9%	35.9%	13.3%	40.4%		11.7%	39.2%	39.2%	11.7%	39.2%	39.2%		
Maximum Green (s)	5.0	37.6	37.6	10.4	43.0		8.5	40.0	40.0	7.0	40.0	40.0		
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	5.0	5.0	5.0	5.0	5.0		
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0		
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5		5.5	7.0	7.0	7.0	7.0	7.0		
Lead/Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0		
Recall Mode	None	Min	Min	None	Min		Max	C-Max	C-Max	Max	C-Max	C-Max		
Walk Time (s)					7.0				7.0	7.0			7.0	7.0
Flash Dont Walk (s)					36.0				33.0	33.0			33.0	33.0
Pedestrian Calls (#/hr)					0				0	0			0	0
Act Effct Green (s)	5.0	26.3	26.3	9.7	31.0	120.0	20.5	40.0	40.0	19.0	40.0	40.0		
Actuated g/C Ratio	0.04	0.22	0.22	0.08	0.26	1.00	0.17	0.33	0.33	0.16	0.33	0.33		
v/c Ratio	0.62	0.78	0.16	0.56	0.72	0.40	0.68	0.94	0.56	0.32	0.63	0.31		
Control Delay	76.2	51.6	0.8	61.6	45.0	0.8	61.3	51.0	19.2	48.7	36.1	5.6		
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Total Delay	76.2	51.6	0.8	61.6	45.0	0.8	61.3	51.0	19.2	48.7	36.1	5.6		
LOS	E	D	A	E	D	A	E	D	B	D	D	A		
Approach Delay	49.5					27.2	46.5			33.0				
Approach LOS	D					C	D			C				
Queue Length 50th (m)	10.7	73.4	0.0	18.2	73.4	0.0	47.6	127.6	33.1	19.3	71.9	0.7		
Queue Length 95th (m)	#21.7	88.1	0.0	29.3	87.4	0.0	#102.7	#159.1	64.5	32.5	87.6	17.4		
Internal Link Dist (m)	205.7					272.3	225.0			294.2				
Turn Bay Length (m)	120.0	30.0		120.0	30.0		130.0	150.0		160.0	140.0			
Base Capacity (vph)	136	1079	576	281	1199	1527	294	1558	619	523	1489	645		
Starvation Cap Reductn	0	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	0		
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0		
Reduced v/c Ratio	0.62	0.55	0.12	0.52	0.52	0.40	0.68	0.94	0.56	0.32	0.63	0.31		

Intersection Summary

Area Type:	Other
Cycle Length:	120
Actuated Cycle Length:	120
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	120
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.94
Intersection Signal Delay:	38.8
Intersection LOS:	D
Intersection Capacity Utilization:	72.3%
ICU Level of Service:	C
Analysis Period (min):	15

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

Splits and Phases: 3: Hwy 22 & Fireside Gate/James Walker Tr



Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Sensitivity Test - PM Peak Hour

06/03/2022

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	490	35	85	50	20	85	195	1782	25	171	1168	440
Future Volume (vph)	490	35	85	50	20	85	195	1782	25	171	1168	440
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	125.0		50.0	30.0		30.0	45.0		50.0	50.0		30.0
Storage Lanes	2		1	1		1	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt			0.850			0.850		0.998				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3343	1814	1542	1723	1814	1542	1674	4714	0	1723	4765	1542
Flt Permitted	0.950			0.732			0.950			0.950		
Satd. Flow (perm)	3343	1814	1542	1328	1814	1542	1674	4714	0	1723	4765	1542
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			142			182		1				222
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		197.4			152.4			175.4			208.4	
Travel Time (s)		14.2			11.0			7.9			9.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	5%	7%	2%	2%	6%	2%
Adj. Flow (vph)	533	38	92	54	22	92	212	1937	27	186	1270	478
Shared Lane Traffic (%)												
Lane Group Flow (vph)	533	38	92	54	22	92	212	1964	0	186	1270	478
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2		1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	Perm	pm+pt	NA	Perm	Prot	NA		Prot	NA	Free
Protected Phases	7	4		3	8		5	2		1	6	

Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Sensitivity Test - PM Peak Hour

06/03/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4	8		8						Free
Detector Phase	7	4	4	3	8	8	5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	20.0		5.0	20.0	
Minimum Split (s)	10.5	48.5	48.5	9.5	48.5	48.5	12.0	47.0		12.0	47.0	
Total Split (s)	24.0	62.9	62.9	9.6	48.5	48.5	24.0	59.5		18.0	53.5	
Total Split (%)	16.0%	41.9%	41.9%	6.4%	32.3%	32.3%	16.0%	39.7%		12.0%	35.7%	
Maximum Green (s)	18.5	57.4	57.4	5.1	43.0	43.0	18.5	52.5		12.5	46.5	
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	5.0		3.5	5.0	
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.5	5.5	5.5	4.5	5.5	5.5	5.5	7.0		5.5	7.0	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	None	None	None	C-Max		None	C-Max	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	
Flash Dont Walk (s)		36.0	36.0		36.0	36.0		33.0			33.0	
Pedestrian Calls (#/hr)		0	0		0	0		0			0	
Act Effct Green (s)	18.5	26.3	26.3	16.1	10.0	10.0	28.4	68.5		29.5	69.6	150.0
Actuated g/C Ratio	0.12	0.18	0.18	0.11	0.07	0.07	0.19	0.46		0.20	0.46	1.00
v/c Ratio	1.29	0.12	0.24	0.35	0.18	0.34	0.67	0.91		0.55	0.57	0.31
Control Delay	198.9	55.0	2.6	55.0	70.0	3.3	67.4	45.3		62.1	30.9	0.5
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	198.9	55.0	2.6	55.0	70.0	3.3	67.4	45.3		62.1	30.9	0.5
LOS	F	E	A	D	E	A	E	D		E	C	A
Approach Delay		163.4			28.7			47.4			26.4	
Approach LOS		F			C			D			C	
Queue Length 50th (m)	~109.3	10.3	0.0	13.5	6.6	0.0	62.5	200.3		54.2	104.3	0.0
Queue Length 95th (m)	#147.5	22.0	2.7	26.3	16.6	0.0	90.0	226.1		81.0	125.0	0.0
Internal Link Dist (m)		173.4			128.4			151.4			184.4	
Turn Bay Length (m)	125.0		50.0	30.0		30.0	45.0			50.0		30.0
Base Capacity (vph)	412	694	677	155	520	571	317	2153		338	2210	1542
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	1.29	0.05	0.14	0.35	0.04	0.16	0.67	0.91		0.55	0.57	0.31

Intersection Summary

Area Type:	Other
Cycle Length:	150
Actuated Cycle Length:	150
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	150
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	1.29
Intersection Signal Delay:	54.1
Intersection LOS:	D
Intersection Capacity Utilization:	81.7%
ICU Level of Service:	D
Analysis Period (min):	15

Lanes, Volumes, Timings  
 8: Hwy 22 & Rolling Range Drive

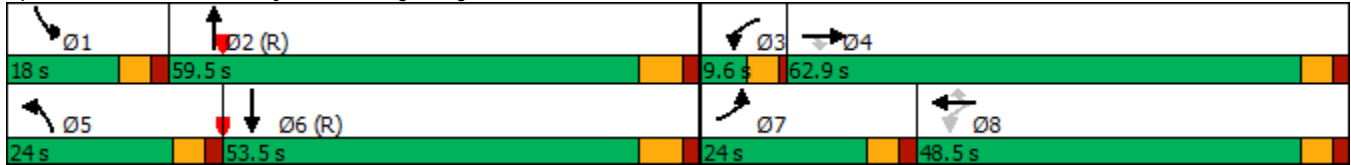
~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

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

Queue shown is maximum after two cycles.

Splits and Phases: 8: Hwy 22 & Rolling Range Drive





Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Reassignment - PM Peak Hour

06/03/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	265	235	85	5	20	85	195	1782	25	120	1168	440
Future Volume (vph)	265	235	85	5	20	85	195	1782	25	120	1168	440
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	125.0		50.0	30.0		30.0	45.0		50.0	50.0		30.0
Storage Lanes	2		1	1		1	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt			0.850			0.850		0.998				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3343	1814	1542	1723	1814	1542	1674	4714	0	1723	4765	1542
Flt Permitted	0.950			0.559			0.950			0.950		
Satd. Flow (perm)	3343	1814	1542	1014	1814	1542	1674	4714	0	1723	4765	1542
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			142			182		2				222
Link Speed (k/h)		50			50			80				80
Link Distance (m)		297.4			152.4			175.4				208.4
Travel Time (s)		21.4			11.0			7.9				9.4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	5%	7%	2%	2%	6%	2%
Adj. Flow (vph)	288	255	92	5	22	92	212	1937	27	130	1270	478
Shared Lane Traffic (%)												
Lane Group Flow (vph)	288	255	92	5	22	92	212	1964	0	130	1270	478
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2		1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4				9.4
Detector 2 Size(m)		0.6			0.6			0.6				0.6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Prot	NA	Perm	pm+pt	NA	Perm	Prot	NA		Prot	NA	Free
Protected Phases	7	4		3	8		5	2		1	6	

Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Reassignment - PM Peak Hour

06/03/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4	8		8						Free
Detector Phase	7	4	4	3	8	8	5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	20.0		5.0	20.0	
Minimum Split (s)	10.5	48.5	48.5	9.5	48.5	48.5	12.0	47.0		12.0	47.0	
Total Split (s)	18.6	57.6	57.6	9.5	48.5	48.5	28.0	66.9		16.0	54.9	
Total Split (%)	12.4%	38.4%	38.4%	6.3%	32.3%	32.3%	18.7%	44.6%		10.7%	36.6%	
Maximum Green (s)	13.1	52.1	52.1	5.0	43.0	43.0	22.5	59.9		10.5	47.9	
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	5.0		3.5	5.0	
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.5	5.5	5.5	4.5	5.5	5.5	5.5	7.0		5.5	7.0	
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	None	None	None	C-Max		None	C-Max	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	
Flash Dont Walk (s)		36.0	36.0		36.0	36.0		33.0			33.0	
Pedestrian Calls (#/hr)		0	0		0	0		0			0	
Act Effct Green (s)	13.1	30.1	30.1	19.4	13.4	13.4	25.1	79.4		20.6	74.9	150.0
Actuated g/C Ratio	0.09	0.20	0.20	0.13	0.09	0.09	0.17	0.53		0.14	0.50	1.00
v/c Ratio	0.99	0.70	0.22	0.03	0.14	0.30	0.76	0.79		0.55	0.53	0.31
Control Delay	117.3	66.6	2.1	42.8	61.8	2.6	76.5	32.1		69.8	28.3	0.5
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	117.3	66.6	2.1	42.8	61.8	2.6	76.5	32.1		69.8	28.3	0.5
LOS	F	E	A	D	E	A	E	C		E	C	A
Approach Delay		80.3			15.2			36.4			24.1	
Approach LOS		F			B			D			C	
Queue Length 50th (m)	47.2	76.1	0.0	1.3	6.6	0.0	63.9	166.0		38.8	93.1	0.0
Queue Length 95th (m)	#79.3	103.3	2.4	4.7	14.6	0.0	89.8	#254.8		61.1	142.8	0.0
Internal Link Dist (m)		273.4			128.4			151.4			184.4	
Turn Bay Length (m)	125.0		50.0	30.0		30.0	45.0			50.0		30.0
Base Capacity (vph)	291	630	628	154	520	571	291	2494		236	2379	1542
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	0.99	0.40	0.15	0.03	0.04	0.16	0.73	0.79		0.55	0.53	0.31

Intersection Summary

Area Type:	Other
Cycle Length:	150
Actuated Cycle Length:	150
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	150
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.99
Intersection Signal Delay:	36.9
Intersection LOS:	D
Intersection Capacity Utilization:	72.2%
ICU Level of Service:	C
Analysis Period (min):	15

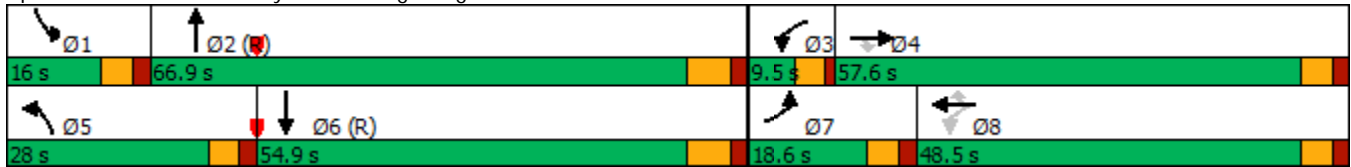
Lanes, Volumes, Timings  
 8: Hwy 22 & Rolling Range Drive

2060 Horizon Reassignment - PM Peak Hour

06/03/2022

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






























Splits and Phases: 8: Hwy 22 & Rolling Range Drive



Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate/James Walker Tr

2060 Horizon Displaced LT Sensitivity - PM Peak Hour

06/03/2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			  			  	
Traffic Volume (vph)	77	545	65	135	570	559	185	1341	321	0	867	185
Future Volume (vph)	77	545	65	135	570	559	185	1341	321	0	867	185
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	120.0		30.0	120.0		30.0	130.0		150.0	160.0		140.0
Storage Lanes	1		1	1		1	1		1	0		1
Taper Length (m)	60.0			50.0			100.0			100.0		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.91	1.00	1.00	0.91	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950					
Satd. Flow (prot)	1690	3446	1512	1674	3348	1527	1723	4676	1498	0	4469	1542
Flt Permitted	0.269			0.156			0.950					
Satd. Flow (perm)	479	3446	1512	275	3348	1527	1723	4676	1498	0	4469	1542
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			175			249			203			191
Link Speed (k/h)		50			50			80			80	
Link Distance (m)		229.7			296.3			249.0			318.2	
Travel Time (s)		16.5			21.3			11.2			14.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	4%	2%	4%	5%	5%	3%	2%	8%	5%	3%	13%	2%
Adj. Flow (vph)	84	592	71	147	620	608	201	1458	349	0	942	201
Shared Lane Traffic (%)												
Lane Group Flow (vph)	84	592	71	147	620	608	201	1458	349	0	942	201
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2	1		2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0		10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0		0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Free	Prot	NA	Perm		NA	Perm
Protected Phases	3	8		7	4		5	2			6	

Lanes, Volumes, Timings  
3: Hwy 22 & Fireside Gate/James Walker Tr

2060 Horizon Displaced LT Sensitivity - PM Peak Hour

06/03/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	8		8	4		Free			2			6
Detector Phase	3	8	8	7	4		5	2	2		6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0		5.0	20.0	20.0		20.0	20.0
Minimum Split (s)	10.5	15.5	15.5	10.5	48.5		12.0	47.0	47.0		47.0	47.0
Total Split (s)	10.5	42.5	42.5	16.5	48.5		22.0	69.0	69.0		47.0	47.0
Total Split (%)	8.2%	33.2%	33.2%	12.9%	37.9%		17.2%	53.9%	53.9%		36.7%	36.7%
Maximum Green (s)	5.0	37.0	37.0	11.0	43.0		16.5	62.0	62.0		40.0	40.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5		3.5	5.0	5.0		5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0	2.0		2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5		5.5	7.0	7.0		7.0	7.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag		Lead				Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes				Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0		3.0	3.0
Recall Mode	None	Min	Min	None	Min		Max	C-Max	C-Max		C-Max	C-Max
Walk Time (s)					7.0			7.0	7.0		7.0	7.0
Flash Dont Walk (s)					36.0			33.0	33.0		33.0	33.0
Pedestrian Calls (#/hr)					0			0	0		0	0
Act Effct Green (s)	32.6	27.6	27.6	43.6	33.3	128.0	26.2	71.7	71.7		40.0	40.0
Actuated g/C Ratio	0.25	0.22	0.22	0.34	0.26	1.00	0.20	0.56	0.56		0.31	0.31
v/c Ratio	0.50	0.80	0.15	0.70	0.71	0.40	0.57	0.56	0.38		0.67	0.33
Control Delay	40.3	55.7	0.7	47.6	47.4	0.8	54.7	19.7	8.0		41.2	6.7
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	40.3	55.7	0.7	47.6	47.4	0.8	54.7	19.7	8.0		41.2	6.7
LOS	D	E	A	D	D	A	D	B	A		D	A
Approach Delay		48.7			26.8			21.2			35.2	
Approach LOS		D			C			C			D	
Queue Length 50th (m)	15.3	79.1	0.0	28.0	78.9	0.0	48.5	86.9	18.1		79.7	1.8
Queue Length 95th (m)	25.8	94.3	0.0	42.0	93.2	0.0	#89.2	114.2	43.3		96.1	19.9
Internal Link Dist (m)		205.7			272.3			225.0			294.2	
Turn Bay Length (m)	120.0		30.0	120.0		30.0	130.0		150.0			140.0
Base Capacity (vph)	169	996	561	214	1124	1527	352	2619	928		1396	613
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	0.59	0.13	0.69	0.55	0.40	0.57	0.56	0.38		0.67	0.33

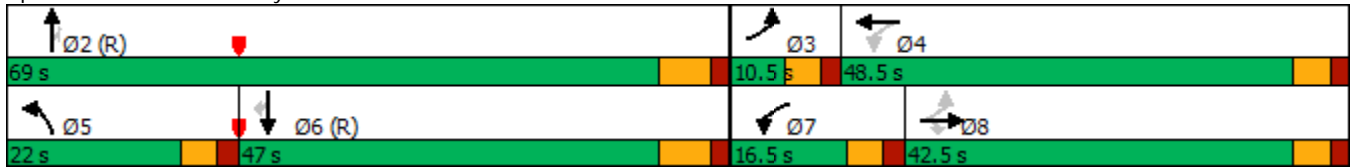
Intersection Summary

Area Type:	Other
Cycle Length:	128
Actuated Cycle Length:	128
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	120
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.80
Intersection Signal Delay:	29.6
Intersection LOS:	C
Intersection Capacity Utilization:	70.5%
ICU Level of Service:	C
Analysis Period (min):	15

Lanes, Volumes, Timings  
 3: Hwy 22 & Fireside Gate/James Walker Tr

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

Splits and Phases: 3: Hwy 22 & Fireside Gate/James Walker Tr



Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Displaced LT Sensitivity - PM Peak Hour

06/03/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↗	↘	↑	↗	↘	↑↑↑		↘	↑↑↑	↗
Traffic Volume (vph)	0	35	85	50	20	85	195	1782	25	171	1168	440
Future Volume (vph)	0	35	85	50	20	85	195	1782	25	171	1168	440
Ideal Flow (vphpl)	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850	1850
Storage Length (m)	125.0		50.0	30.0		30.0	45.0		50.0	50.0		30.0
Storage Lanes	0		1	1		1	1		0	1		1
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	1.00	0.91	1.00
Frt			0.850			0.850		0.998				0.850
Flt Protected				0.950			0.950			0.950		
Satd. Flow (prot)	0	1814	1542	1723	1814	1542	1674	4714	0	1723	4765	1542
Flt Permitted				0.507			0.950			0.950		
Satd. Flow (perm)	0	1814	1542	920	1814	1542	1674	4714	0	1723	4765	1542
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			131			92		2				182
Link Speed (k/h)		50			50			80				80
Link Distance (m)		197.4			152.4			175.4				208.4
Travel Time (s)		14.2			11.0			7.9				9.4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	5%	7%	2%	2%	6%	2%
Adj. Flow (vph)	0	38	92	54	22	92	212	1937	27	186	1270	478
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	38	92	54	22	92	212	1964	0	186	1270	478
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.6			3.6			3.6				3.6
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors		2	1	1	2	1	1	2		1	2	1
Detector Template		Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (m)		10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	2.0
Trailing Detector (m)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Position(m)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Size(m)		0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	2.0
Detector 1 Type		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4				9.4
Detector 2 Size(m)		0.6			0.6			0.6				0.6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type		NA	Perm	pm+pt	NA	Perm	Prot	NA		Prot	NA	Free
Protected Phases		4		3	8		5	2		1		6

Lanes, Volumes, Timings  
8: Hwy 22 & Rolling Range Drive

2060 Horizon Displaced LT Sensitivity - PM Peak Hour

06/03/2022



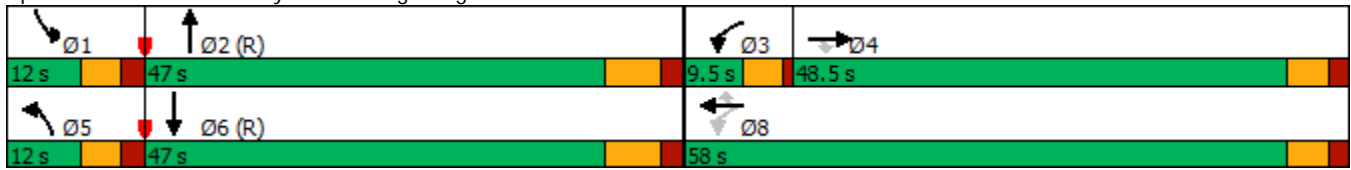
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4	8		8						Free
Detector Phase		4	4	3	8	8	5	2		1	6	
Switch Phase												
Minimum Initial (s)		10.0	10.0	5.0	10.0	10.0	5.0	20.0		5.0	20.0	
Minimum Split (s)		48.5	48.5	9.5	48.5	48.5	12.0	47.0		12.0	47.0	
Total Split (s)		48.5	48.5	9.5	58.0	58.0	12.0	47.0		12.0	47.0	
Total Split (%)		41.5%	41.5%	8.1%	49.6%	49.6%	10.3%	40.2%		10.3%	40.2%	
Maximum Green (s)		43.0	43.0	5.0	52.5	52.5	6.5	40.0		6.5	40.0	
Yellow Time (s)		3.5	3.5	3.5	3.5	3.5	3.5	5.0		3.5	5.0	
All-Red Time (s)		2.0	2.0	1.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		5.5	5.5	4.5	5.5	5.5	5.5	7.0		5.5	7.0	
Lead/Lag		Lag	Lag	Lead			Lead	Lag		Lead	Lag	
Lead-Lag Optimize?		Yes	Yes	Yes			Yes	Yes		Yes	Yes	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode		None	None	None	None	None	None	C-Max		None	C-Max	
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	
Flash Dont Walk (s)		36.0	36.0		36.0	36.0		33.0			33.0	
Pedestrian Calls (#/hr)		0	0		0	0		0			0	
Act Effct Green (s)		10.1	10.1	18.7	17.7	17.7	32.7	52.7		28.5	48.6	117.0
Actuated g/C Ratio		0.09	0.09	0.16	0.15	0.15	0.28	0.45		0.24	0.42	1.00
v/c Ratio		0.24	0.37	0.30	0.08	0.30	0.45	0.92		0.44	0.64	0.31
Control Delay		54.0	7.1	45.7	41.9	11.2	41.2	38.5		43.7	28.6	0.5
Queue Delay		0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay		54.0	7.1	45.7	41.9	11.2	41.2	38.5		43.7	28.6	0.5
LOS		D	A	D	D	B	D	D		D	C	A
Approach Delay		20.8			26.3			38.7			23.1	
Approach LOS		C			C			D			C	
Queue Length 50th (m)		8.7	0.0	11.2	4.5	0.0	44.5	153.9		40.0	84.5	0.0
Queue Length 95th (m)		19.9	7.1	23.2	12.3	14.8	72.3	175.8		64.8	97.0	0.0
Internal Link Dist (m)		173.4			128.4			151.4			184.4	
Turn Bay Length (m)			50.0	30.0		30.0	45.0			50.0		30.0
Base Capacity (vph)		666	649	181	813	742	468	2125		420	1978	1542
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		0.06	0.14	0.30	0.03	0.12	0.45	0.92		0.44	0.64	0.31

Intersection Summary

Area Type:	Other
Cycle Length:	117
Actuated Cycle Length:	117
Offset:	0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	140
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.92
Intersection Signal Delay:	30.9
Intersection LOS:	C
Intersection Capacity Utilization:	70.2%
ICU Level of Service:	C
Analysis Period (min):	15



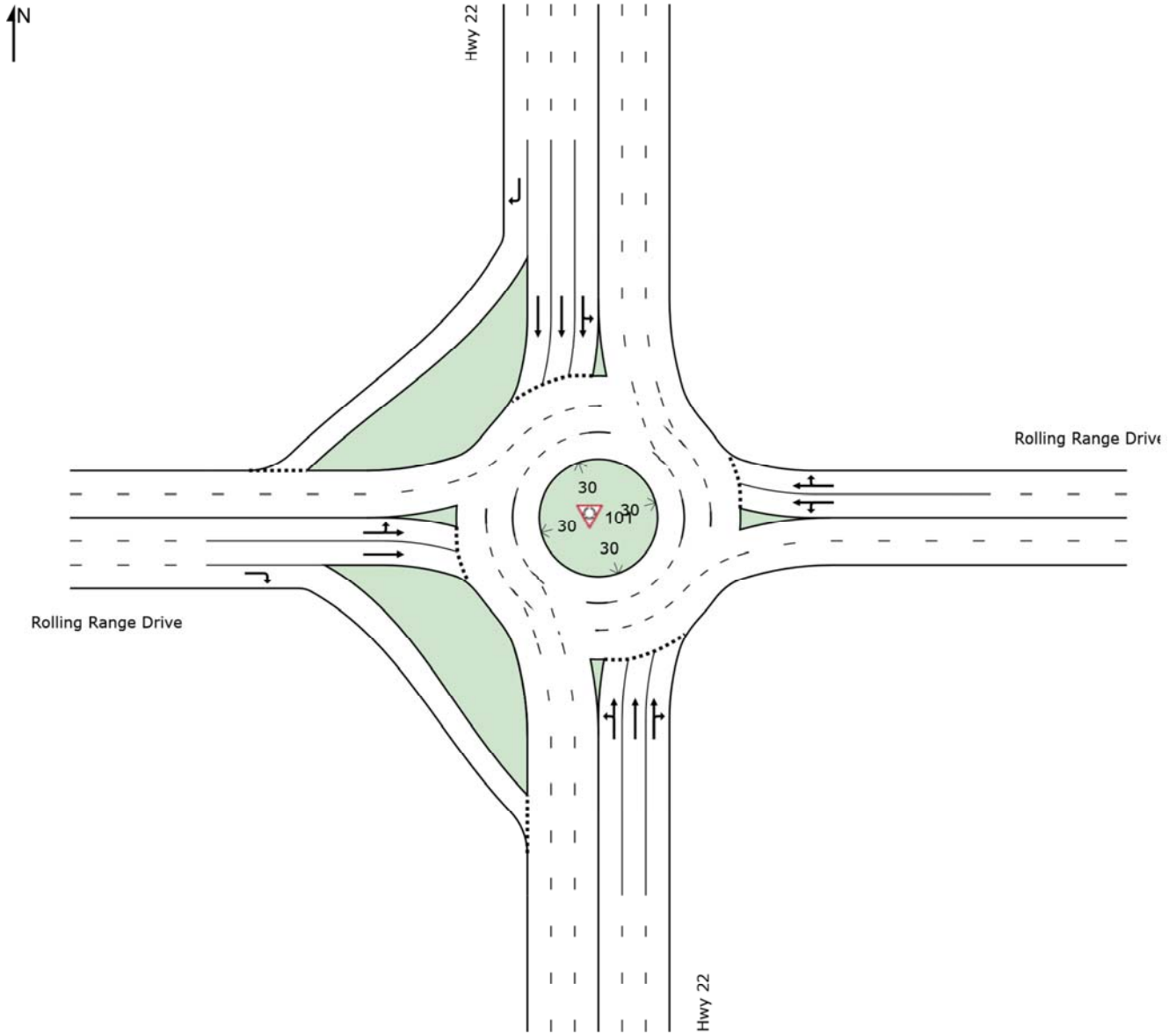
Splits and Phases: 8: Hwy 22 & Rolling Range Drive



# SITE LAYOUT

 Site: 101 [Rolling Range Drive - AM]

New Site  
Site Category: (None)  
Roundabout



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# MOVEMENT SUMMARY

 Site: 101 [Rolling Range Drive - AM]

New Site  
Site Category: (None)  
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Hwy 22												
3	L2	92	3.0	0.500	10.3	LOS B	3.4	26.3	0.62	0.65	0.80	52.3
8	T1	1299	3.0	0.500	10.1	LOS B	3.4	26.3	0.61	0.63	0.78	52.9
18	R2	5	3.0	0.500	9.8	LOS A	3.3	25.8	0.60	0.61	0.76	51.7
Approach		1397	3.0	0.500	10.1	LOS B	3.4	26.3	0.61	0.63	0.79	52.9
East: Rolling Range Drive												
1	L2	28	3.0	0.245	18.7	LOS C	0.8	6.1	0.83	0.85	0.92	46.2
6	T1	38	3.0	0.245	18.7	LOS C	0.8	6.1	0.83	0.85	0.92	46.1
16	R2	130	3.0	0.407	20.7	LOS C	1.5	11.7	0.84	0.93	1.19	44.7
Approach		197	3.0	0.407	20.0	LOS C	1.5	11.7	0.84	0.90	1.09	45.2
North: Hwy 22												
7	L2	92	3.0	0.533	9.4	LOS A	3.4	26.5	0.47	0.32	0.47	53.2
4	T1	1748	3.0	0.533	9.3	LOS A	3.4	26.5	0.46	0.31	0.46	53.6
14	R2	505	3.0	0.411	7.0	LOS A	2.2	17.2	0.34	0.21	0.34	53.4
Approach		2346	3.0	0.533	8.8	LOS A	3.4	26.5	0.43	0.29	0.43	53.5
West: Rolling Range Drive												
5	L2	478	3.0	1.781	398.1	LOS F	73.2	570.7	1.00	4.12	13.71	8.3
2	T1	22	3.0	0.097	18.4	LOS C	0.3	2.2	0.84	0.84	0.84	47.6
12	R2	213	3.0	0.732	43.5	LOS E	3.7	29.0	0.93	1.19	1.97	35.0
Approach		713	3.0	1.781	280.6	LOS F	73.2	570.7	0.97	3.14	9.81	11.0
All Vehicles		4652	3.0	1.781	51.3	LOS F	73.2	570.7	0.59	0.86	2.00	33.2

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 6.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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# MOVEMENT SUMMARY

 Site: 101 [Rolling Range Drive - PM]

New Site  
Site Category: (None)  
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Hwy 22												
3	L2	212	3.0	0.927	40.3	LOS E	20.7	161.5	1.00	1.80	3.30	36.8
8	T1	1937	3.0	0.927	39.4	LOS E	22.0	171.1	1.00	1.81	3.31	37.5
18	R2	27	3.0	0.927	38.0	LOS E	22.0	171.1	1.00	1.82	3.32	37.3
Approach		2176	3.0	0.927	39.5	LOS E	22.0	171.1	1.00	1.81	3.31	37.4
East: Rolling Range Drive												
1	L2	5	3.0	0.234	41.2	LOS E	0.6	5.1	0.93	0.96	1.05	36.7
6	T1	22	3.0	0.234	41.2	LOS E	0.6	5.1	0.93	0.96	1.05	36.6
16	R2	92	3.0	0.628	61.8	LOS F	2.2	17.2	0.96	1.12	1.69	29.8
Approach		120	3.0	0.628	57.1	LOS F	2.2	17.2	0.95	1.08	1.55	31.1
North: Hwy 22												
7	L2	130	3.0	0.436	8.3	LOS A	2.3	18.0	0.49	0.38	0.49	53.5
4	T1	1270	3.0	0.436	8.1	LOS A	2.3	18.0	0.48	0.37	0.48	54.4
14	R2	478	3.0	0.426	7.7	LOS A	2.2	17.1	0.46	0.34	0.46	52.9
Approach		1878	3.0	0.436	8.0	LOS A	2.3	18.0	0.48	0.36	0.48	53.9
West: Rolling Range Drive												
5	L2	505	3.0	1.255	162.6	LOS F	41.3	322.2	1.00	3.21	9.31	16.8
2	T1	38	3.0	0.110	12.2	LOS B	0.3	2.7	0.76	0.76	0.76	51.6
12	R2	92	3.0	0.205	11.0	LOS B	0.7	5.3	0.72	0.72	0.72	50.7
Approach		636	3.0	1.255	131.6	LOS F	41.3	322.2	0.94	2.70	7.55	19.4
All Vehicles		4810	3.0	1.255	39.8	LOS E	41.3	322.2	0.79	1.34	2.72	37.0

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 6.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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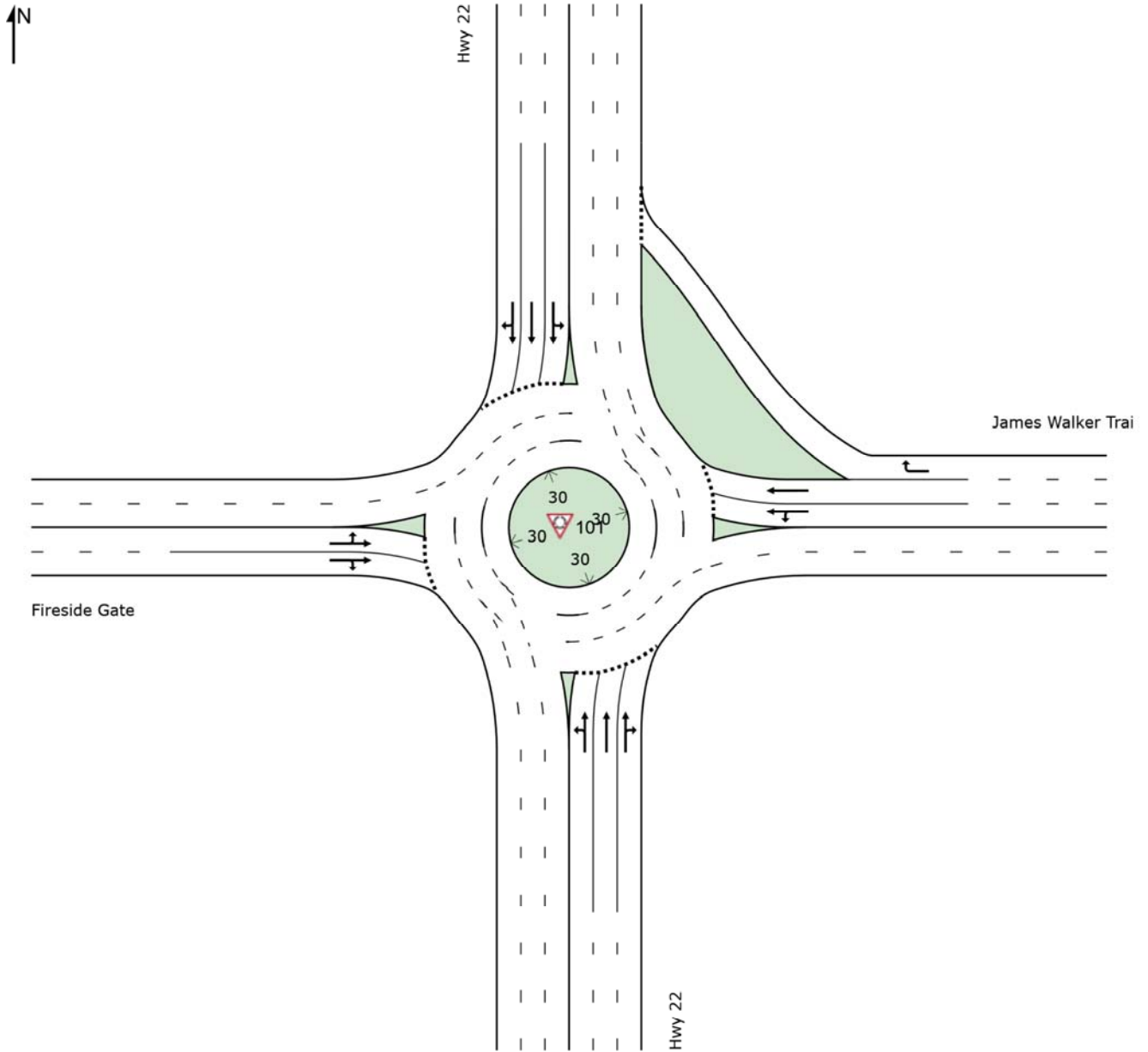
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# SITE LAYOUT

 Site: 101 [Fireside Gate - AM]

New Site  
Site Category: (None)  
Roundabout



# MOVEMENT SUMMARY

 Site: 101 [Fireside Gate - AM]

New Site  
Site Category: (None)  
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Hwy 22												
3	L2	82	3.0	0.691	21.9	LOS C	5.5	42.5	0.82	1.08	1.66	45.1
8	T1	1007	3.0	0.691	21.4	LOS C	5.6	44.0	0.82	1.08	1.66	45.6
18	R2	196	3.0	0.691	20.0	LOS C	5.6	44.0	0.81	1.07	1.65	45.1
Approach		1284	3.0	0.691	21.2	LOS C	5.6	44.0	0.82	1.08	1.65	45.5
East: James Walker Trail												
1	L2	367	3.0	1.035	84.4	LOS F	18.8	146.5	1.00	2.09	4.98	25.5
6	T1	582	3.0	1.035	79.9	LOS F	20.6	160.8	1.00	2.17	5.19	26.7
16	R2	189	3.0	0.360	12.5	LOS B	1.5	11.4	0.71	0.77	0.92	49.8
Approach		1138	3.0	1.035	70.2	LOS F	20.6	160.8	0.95	1.91	4.41	28.4
North: Hwy 22												
7	L2	551	3.0	1.254	154.5	LOS F	52.3	407.6	1.00	3.47	9.53	17.4
4	T1	1327	3.0	1.254	152.8	LOS F	58.3	454.0	1.00	3.58	9.83	17.6
14	R2	111	3.0	1.254	150.9	LOS F	58.3	454.0	1.00	3.70	10.19	17.6
Approach		1989	3.0	1.254	153.2	LOS F	58.3	454.0	1.00	3.55	9.77	17.6
West: Fireside Gate												
5	L2	201	3.0	2.053	524.0	LOS F	82.2	640.9	1.00	4.10	13.75	6.5
2	T1	614	3.0	2.053	519.7	LOS F	97.5	760.0	1.00	4.41	14.94	6.5
12	R2	203	3.0	2.053	516.6	LOS F	97.5	760.0	1.00	4.65	15.82	6.4
Approach		1018	3.0	2.053	520.0	LOS F	97.5	760.0	1.00	4.40	14.88	6.5
All Vehicles		5429	3.0	2.053	173.4	LOS F	97.5	760.0	0.95	2.78	7.69	16.0

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 6.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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# MOVEMENT SUMMARY

 Site: 101 [Fireside Gate - PM]

New Site  
Site Category: (None)  
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Hwy 22												
3	L2	201	3.0	1.180	124.0	LOS F	44.5	346.7	1.00	3.11	8.13	20.3
8	T1	1458	3.0	1.180	123.1	LOS F	49.2	383.0	1.00	3.16	8.25	20.4
18	R2	349	3.0	1.180	120.5	LOS F	49.2	383.0	1.00	3.29	8.61	20.3
Approach		2008	3.0	1.180	122.7	LOS F	49.2	383.0	1.00	3.18	8.30	20.4
East: James Walker Trail												
1	L2	196	3.0	1.212	157.1	LOS F	28.8	224.1	1.00	2.66	7.47	17.3
6	T1	620	3.0	1.212	152.1	LOS F	32.8	255.8	1.00	2.81	7.99	17.7
16	R2	608	3.0	1.440	236.3	LOS F	67.3	524.3	1.00	4.15	12.73	12.3
Approach		1423	3.0	1.440	188.7	LOS F	67.3	524.3	1.00	3.36	9.94	14.9
North: Hwy 22												
7	L2	224	3.0	0.735	24.6	LOS C	6.4	50.2	0.85	1.15	1.84	42.9
4	T1	942	3.0	0.735	24.0	LOS C	6.7	52.2	0.84	1.15	1.84	44.1
14	R2	201	3.0	0.735	22.5	LOS C	6.7	52.2	0.84	1.15	1.83	43.8
Approach		1367	3.0	0.735	23.9	LOS C	6.7	52.2	0.84	1.15	1.84	43.9
West: Fireside Gate												
5	L2	111	3.0	0.960	70.7	LOS F	11.3	88.3	0.97	1.70	3.72	28.5
2	T1	592	3.0	0.960	67.3	LOS F	12.3	95.5	0.97	1.73	3.79	29.3
12	R2	71	3.0	0.960	64.8	LOS F	12.3	95.5	0.97	1.74	3.84	29.4
Approach		774	3.0	0.960	67.5	LOS F	12.3	95.5	0.97	1.73	3.78	29.2
All Vehicles		5572	3.0	1.440	107.6	LOS F	67.3	524.3	0.96	2.53	6.51	22.2

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 6.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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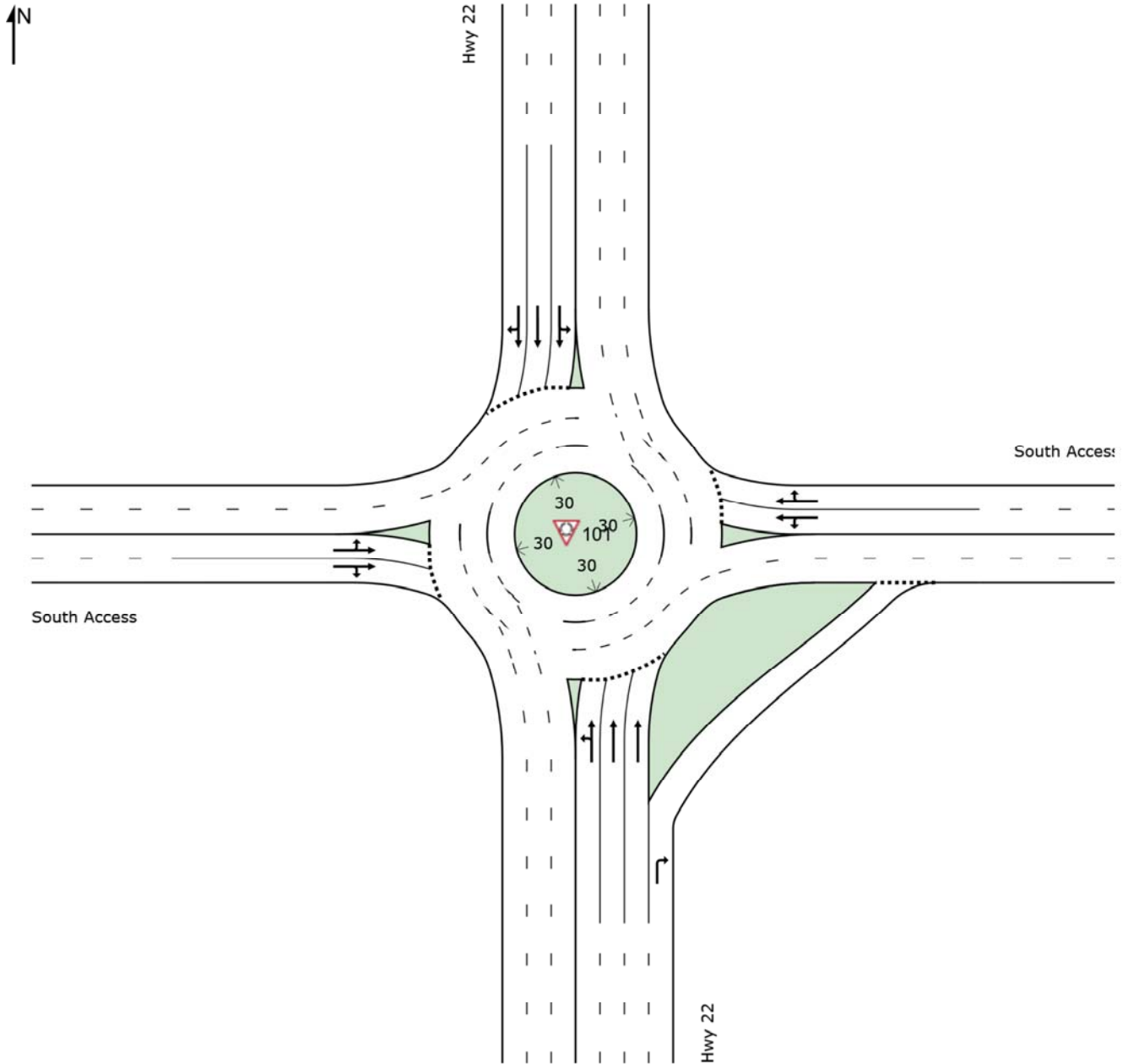
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# SITE LAYOUT

 **Site: 101 [South Access - AM]**

New Site  
Site Category: (None)  
Roundabout





# MOVEMENT SUMMARY

 Site: 101 [South Access - AM]

New Site  
Site Category: (None)  
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Hwy 22												
3	L2	27	3.0	0.506	11.6	LOS B	3.4	26.2	0.68	0.79	0.98	51.9
8	T1	1218	3.0	0.506	11.3	LOS B	3.4	26.3	0.67	0.78	0.97	52.2
18	R2	190	3.0	0.218	6.4	LOS A	0.8	6.5	0.52	0.49	0.52	53.9
Approach		1436	3.0	0.506	10.7	LOS B	3.4	26.3	0.65	0.74	0.91	52.4
East: South Access												
1	L2	370	3.0	0.802	36.5	LOS E	6.2	48.6	0.90	1.27	2.26	37.0
6	T1	43	3.0	0.258	13.4	LOS B	0.9	6.9	0.75	0.77	0.81	50.7
16	R2	60	3.0	0.258	13.4	LOS B	0.9	6.9	0.75	0.77	0.81	49.2
Approach		473	3.0	0.802	31.5	LOS D	6.2	48.6	0.87	1.16	1.94	39.2
North: Hwy 22												
7	L2	212	3.0	0.712	17.3	LOS C	9.0	70.3	0.80	1.10	1.56	47.3
4	T1	1680	3.0	0.712	16.9	LOS C	9.3	72.1	0.80	1.09	1.55	48.2
14	R2	5	3.0	0.712	16.3	LOS C	9.3	72.1	0.79	1.07	1.53	47.5
Approach		1898	3.0	0.712	17.0	LOS C	9.3	72.1	0.80	1.09	1.55	48.1
West: South Access												
5	L2	5	3.0	0.995	129.8	LOS F	7.2	56.2	1.00	1.56	3.45	19.8
2	T1	310	3.0	0.995	122.0	LOS F	8.0	62.2	1.00	1.59	3.57	20.6
12	R2	27	3.0	0.995	114.9	LOS F	8.0	62.2	0.99	1.62	3.68	21.1
Approach		342	3.0	0.995	121.6	LOS F	8.0	62.2	1.00	1.60	3.58	20.6
All Vehicles		4149	3.0	0.995	25.1	LOS D	9.3	72.1	0.77	1.02	1.54	43.4

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 6.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Organisation: WATT CONSULTING GROUP LTD | Processed: Tuesday, April 5, 2022 4:34:43 PM

Project: T:\Projects\Open\3470.T03 - Hwy 22 Functional Study\4 - Analysis\01 - Modelling\SIDRA\Roundabout Option for All Three Intersections - AM and PM Peak Hours - 2060.sip8

# MOVEMENT SUMMARY

 Site: 101 [South Access - PM]

New Site  
Site Category: (None)  
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Hwy 22												
3	L2	27	3.0	0.503	8.6	LOS A	3.2	24.9	0.38	0.22	0.38	54.2
8	T1	1790	3.0	0.503	8.5	LOS A	3.2	24.9	0.37	0.22	0.37	54.3
18	R2	370	3.0	0.294	5.5	LOS A	1.4	10.7	0.26	0.14	0.26	54.6
Approach		2187	3.0	0.503	8.0	LOS A	3.2	24.9	0.35	0.20	0.35	54.4
East: South Access												
1	L2	190	3.0	1.389	239.7	LOS F	35.2	274.1	1.00	2.88	8.73	12.6
6	T1	310	3.0	1.389	234.6	LOS F	41.2	320.8	1.00	3.06	9.38	12.7
16	R2	212	3.0	1.389	230.8	LOS F	41.2	320.8	1.00	3.19	9.87	12.7
Approach		712	3.0	1.389	234.9	LOS F	41.2	320.8	1.00	3.05	9.35	12.6
North: Hwy 22												
7	L2	61	3.0	0.435	9.2	LOS A	2.3	18.0	0.58	0.56	0.64	53.3
4	T1	1141	3.0	0.435	9.0	LOS A	2.3	18.0	0.57	0.54	0.62	53.8
14	R2	7	3.0	0.435	8.7	LOS A	2.2	17.3	0.56	0.52	0.60	52.5
Approach		1209	3.0	0.435	9.0	LOS A	2.3	18.0	0.57	0.54	0.62	53.8
West: South Access												
5	L2	5	3.0	0.096	11.3	LOS B	0.3	2.4	0.74	0.74	0.74	51.8
2	T1	43	3.0	0.096	10.8	LOS B	0.3	2.4	0.73	0.73	0.73	52.2
12	R2	27	3.0	0.096	9.8	LOS A	0.3	2.3	0.71	0.71	0.71	51.6
Approach		76	3.0	0.096	10.5	LOS B	0.3	2.4	0.72	0.72	0.72	51.9
All Vehicles		4184	3.0	1.389	46.9	LOS E	41.2	320.8	0.53	0.80	1.97	34.7

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).

Roundabout Capacity Model: US HCM 6.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Organisation: WATT CONSULTING GROUP LTD | Processed: Tuesday, April 5, 2022 4:34:43 PM

Project: T:\Projects\Open\3470.T03 - Hwy 22 Functional Study\4 - Analysis\01 - Modelling\SIDRA\Roundabout Option for All Three Intersections - AM and PM Peak Hours - 2060.sip8



## APPENDIX C: SIGNAL WARRNATS



## Alberta Transportation - Traffic Signal Warrant Analysis

Main Street (name)	Highway 22	Direction (EW or NS)	NS
Side Street (name)	Rolling Range Drive	Direction (EW or NS)	EW
Quadrant / Int #		Comments	2060 Horizon
CHECK SHEET			

Road Authority:	Alberta Transportation
City:	City of Cochrane
Analysis Date:	2022 January
Count Date:	N/A
Date Entry Format:	(yyyy-mm-dd)

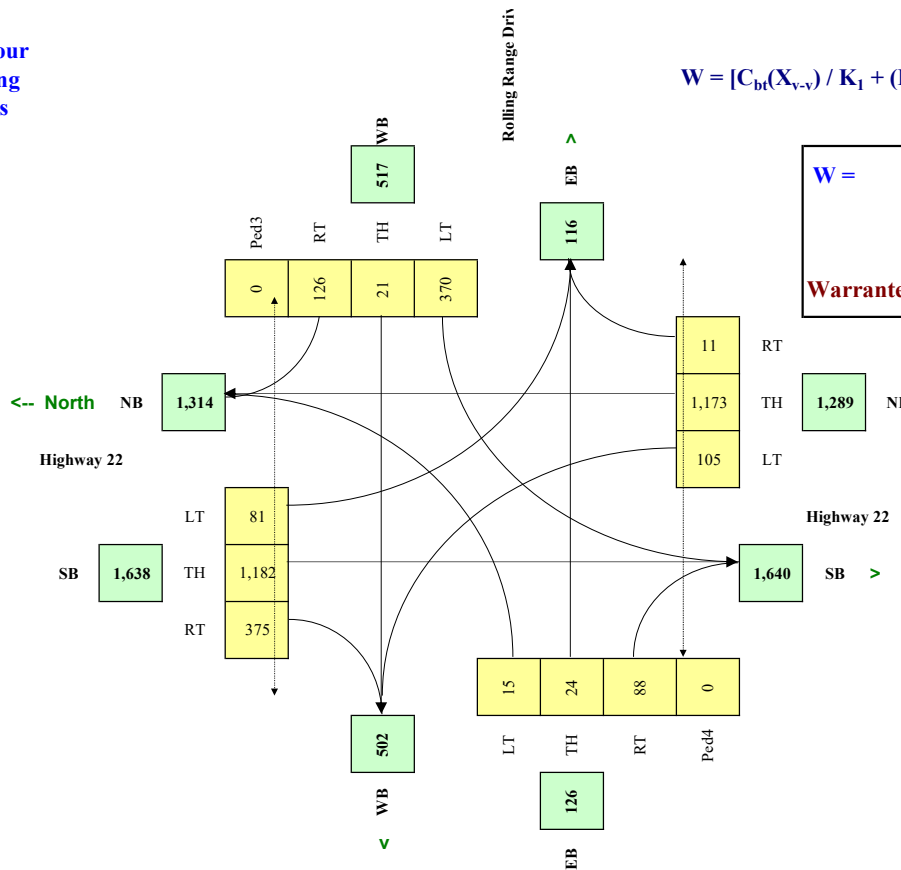
Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	Upstream Signal (m)	# of Thru Lanes
Highway 22	NB	1		3			1	1,200	3
Highway 22	SB	1		3			1	800	3
Rolling Range Drive	WB	1		1			1		
Rolling Range Drive	EB	2		1			1		

Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	80,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Highway 22	NS	80	7.2%	n	
Rolling Range Drive	EW			n	

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
	7:00 - 8:00	69	968	4	69	1302	377	356	16	159	21	28	97			
8:00 - 9:00	85	1195	5	85	1608	465	440	20	196	26	35	120				
11:00 - 12:00	51	717	3	51	965	279	264	12	118	16	21	72				
12:00 - 13:00	51	717	3	51	965	279	264	12	118	16	21	72				
16:00 - 17:00	189	1729	24	116	1133	427	451	34	82	5	19	82				
17:00 - 18:00	187	1711	24	115	1121	422	446	34	82	5	19	82				
<b>Total (6-hour peak)</b>	<b>632</b>	<b>7,037</b>	<b>63</b>	<b>487</b>	<b>7,094</b>	<b>2,249</b>	<b>2,221</b>	<b>128</b>	<b>755</b>	<b>89</b>	<b>143</b>	<b>525</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Average (6-hour peak)</b>	<b>105</b>	<b>1,173</b>	<b>11</b>	<b>81</b>	<b>1,182</b>	<b>375</b>	<b>370</b>	<b>21</b>	<b>126</b>	<b>15</b>	<b>24</b>	<b>88</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

### Average 6-hour Peak Turning Movements



$$W = [C_{bt}(X_{v-v}) / K_1 + (F(X_{v-p})L) / K_2] \times C_i$$

W =	838	838	0
		Veh	Ped

Warranted

RESET SHEET



## Alberta Transportation - Traffic Signal Warrant Analysis

Main Street (name)	Highway 22	Direction (EW or NS)	NS
Side Street (name)	South Access	Direction (EW or NS)	EW
Quadrant / Int #		Comments	2060 Horizon
CHECK SHEET			

Road Authority:	Alberta Transportation
City:	City of Cochrane
Analysis Date:	2022 January
Count Date:	N/A
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	Upstream Signal (m)	# of Thru Lanes
Highway 22	NB	1		3			1	1,200	3
Highway 22	SB	1		3			1	800	3
South Access	WB	1		1			1		
South Access	EB	2		1			1		

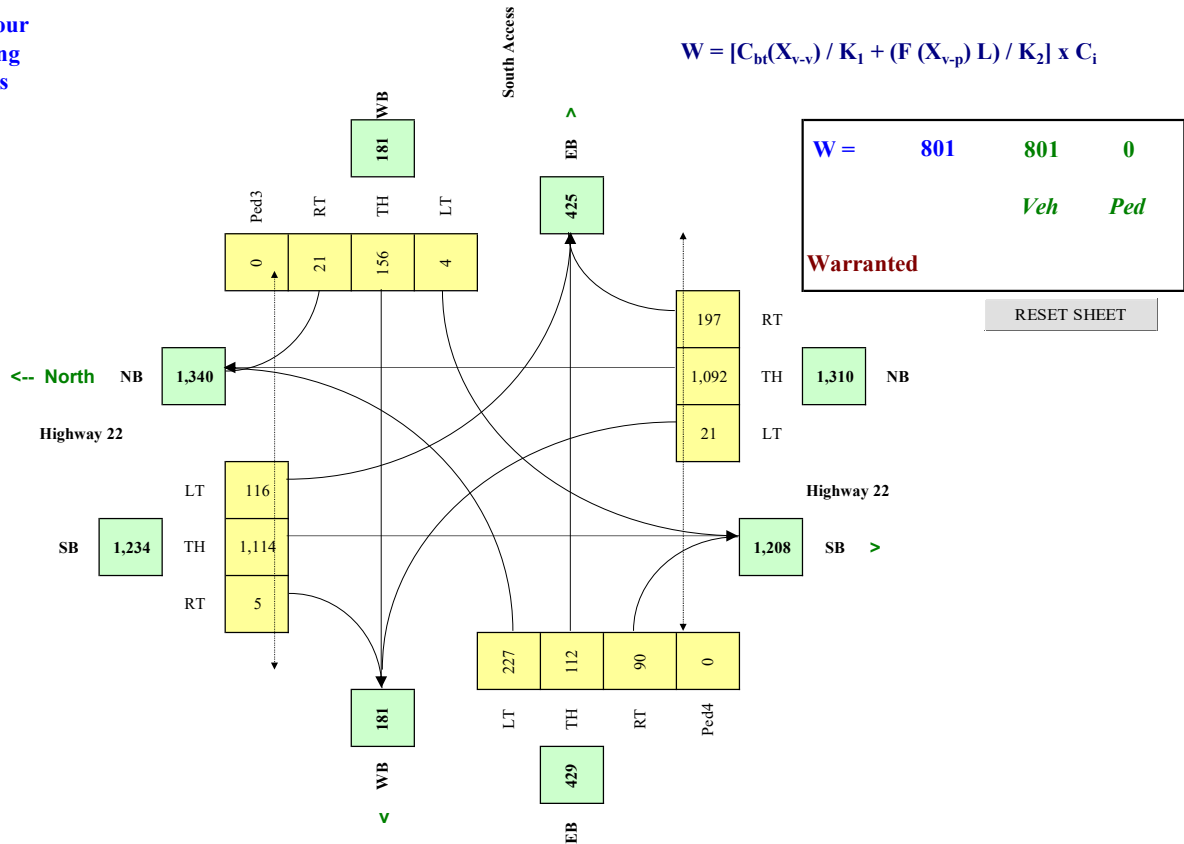
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	80,000
Central Business District	(y/n)	n

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Highway 22	NS	80	7.2%	n	
South Access	EW			n	

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
	7:00 - 8:00	20	908	142	158	1252	4	4	231	20	275	32	45			
8:00 - 9:00	25	1121	175	195	1546	5	5	285	25	340	40	55				
11:00 - 12:00	15	673	105	117	928	3	3	171	15	204	24	33				
12:00 - 13:00	15	673	105	117	928	3	3	171	15	204	24	33				
16:00 - 17:00	24	1598	330	54	1019	6	5	39	24	170	276	189				
17:00 - 18:00	24	1581	326	54	1008	6	5	38	24	168	274	187				
<b>Total (6-hour peak)</b>	<b>123</b>	<b>6,554</b>	<b>1,183</b>	<b>695</b>	<b>6,681</b>	<b>27</b>	<b>25</b>	<b>935</b>	<b>123</b>	<b>1,361</b>	<b>670</b>	<b>542</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Average (6-hour peak)</b>	<b>21</b>	<b>1,092</b>	<b>197</b>	<b>116</b>	<b>1,114</b>	<b>5</b>	<b>4</b>	<b>156</b>	<b>21</b>	<b>227</b>	<b>112</b>	<b>90</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

### Average 6-hour Peak Turning Movements

$$W = [C_{bt}(X_{v-v}) / K_1 + (F(X_{v-p})L) / K_2] \times C_i$$





## APPENDIX D: ROLLING TRAILS DEVELOPMENT MEMORANDUM



WATT CALGARY  
#310, 3016 – 5th Avenue N.E.,  
Calgary, AB T2A 6K4  
(403) 273-9001

Town of Cochrane  
101 Ranchehouse Rd.,  
Cochrane, AB T4C 2K8

2020-01-10  
Our File No: 3470.T02

**Attention: Ryan Stewart, Manager, Civil Land Development**

To: Ryan Stewart, Manager, Civil Land Development  
**Re: Rolling Trails Development – Hwy 22 Grades/Site Distance**

Further to our recent meetings and your email to Mr. Asad Niazi on January 7, the purpose of this email is to provide some technical information related to the traffic analysis conducted for the proposed new signalized intersection of Rolling Range Drive and Highway 22. More specifically, this letter addresses your question of how we evaluated the sight lines, grades and geometry of the intersection as part of our analysis.

## SIGHT LINES

The sight lines at the proposed intersection were evaluated as part of previous analysis that WATT did on behalf of Canopy Lands in 2017 to establish whether an at-grade intersection was feasible at this location. The relevant paragraph from the October 2017 Letter is provided below:

WATT staff confirmed in the field the available Intersection Sight Distances (ISD) from the existing Rolling Range Drive approach looking to the north and the south along Highway 22. The available ISD from Rolling Range Drive looking to the south is 290 m for a Passenger (P) design vehicle, and 325 m for a Single Unit (SU) design vehicle. For a design speed of 90 km/h, the required minimum ISD are 174 m and 268 m, respectively. The available sight distance looking to the north are in excess of 500 m for both the Passenger and Single Unit design vehicles. Therefore, the field measurements confirmed that **the existing sight distances from Rolling Range Drive looking to the north and south are sufficient for an urban intersection.**

The analysis above assumes that the grades along Highway 22 will not change significantly with the introduction of a signalized intersection.

## GRADES

The grades along Highway 22 near the intersection of Rolling Range Drive were estimated based on elevations and distances provided in Google Earth. Based on this review the grade of Highway 22 is approximately +4 percent in the southbound direction and -3 percent in the northbound direction. These grades in conjunction with the percentage of trucks within the traffic

stream impact the capacity of an approach to a signalized intersection. The higher the grade and the higher the percentage of trucks, the less capacity. Both the grade and truck percentage are inputs to the capacity analysis that was conducted for the intersection. Operationally, heavy trucks starting from a stop position on a steep grade take longer to get up to normal operating speeds. These operational characteristics of trucks are considered in the traffic capacity analysis and the results reflect these conditions. In summary, the grades along Highway 22 were considered in the traffic analysis that has been included in the most recent TIA.

### INTERSECTION GEOMETRY

The detailed geometry of the intersection of Rolling Range Drive and Highway 22 has not been designed yet. This will be prepared at the appropriate time within the development approval process. For the purposes of our TIA, assumptions were made regarding the number and width of through lanes and turn lanes on each approach to the intersection. These assumptions are summarized in the capacity analysis output included in the Appendices of the TIA.

A cursory review of the right-of-way available along Highway 22 indicated that there is enough space to provide the necessary number of lanes in the northbound and southbound direction. The right-of-way on the eastbound and westbound approaches will need to be established through the subdivision process.

I trust this letter address the questions you had regarding the site lines, grades and geometry of the intersection of Rolling Range Drive and Highway 22. If you have any questions or need further information, please do not hesitate to contact me directly at either of the numbers provided below.

Sincerely,

**WATT Consulting Group**



**Bruce Nelligan**, M.Eng., P.Eng., PTOE  
President & CEO

**D** 403-569-8703 **C** 403-473-2685

**E** bnelligan@wattconsultinggroup.com

**#WEAREWATT**

cc: Drew Hyndman, Candace Banack - Town of Cochrane  
Trevor Richelhof – Alberta Transportation  
Asad Niazi, Graham Green - Canopy Lands





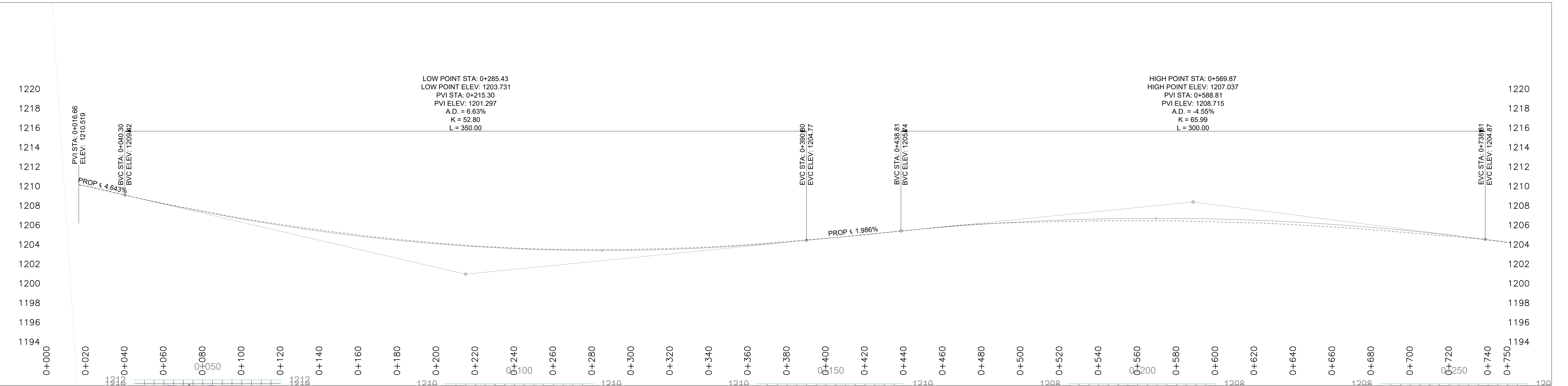
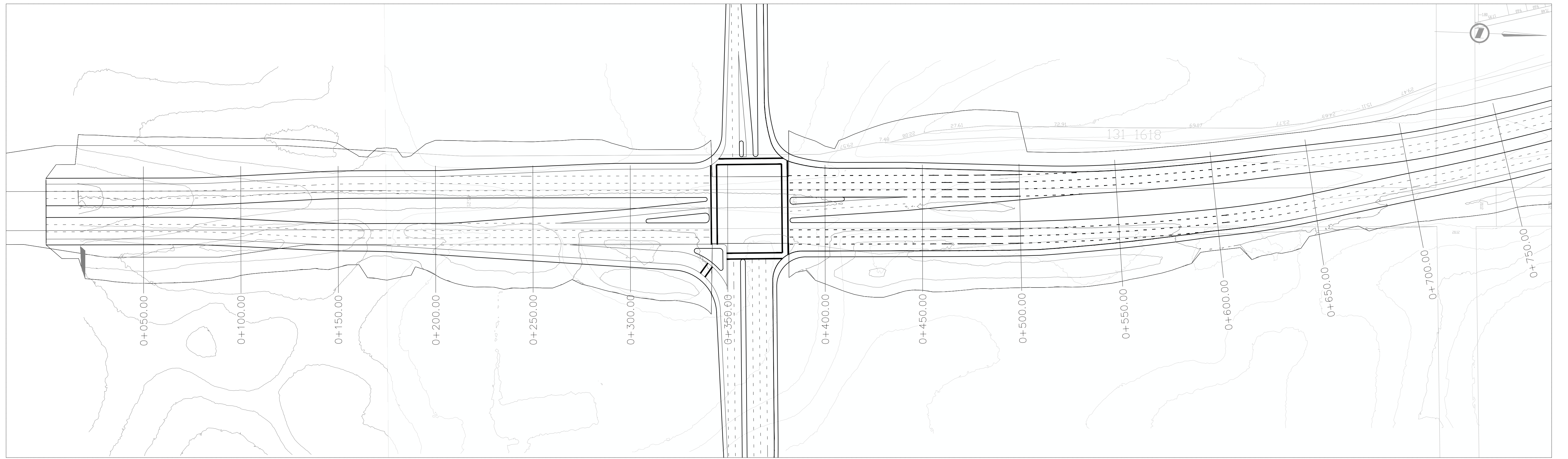
## APPENDIX E: DESIGN DRAWINGS







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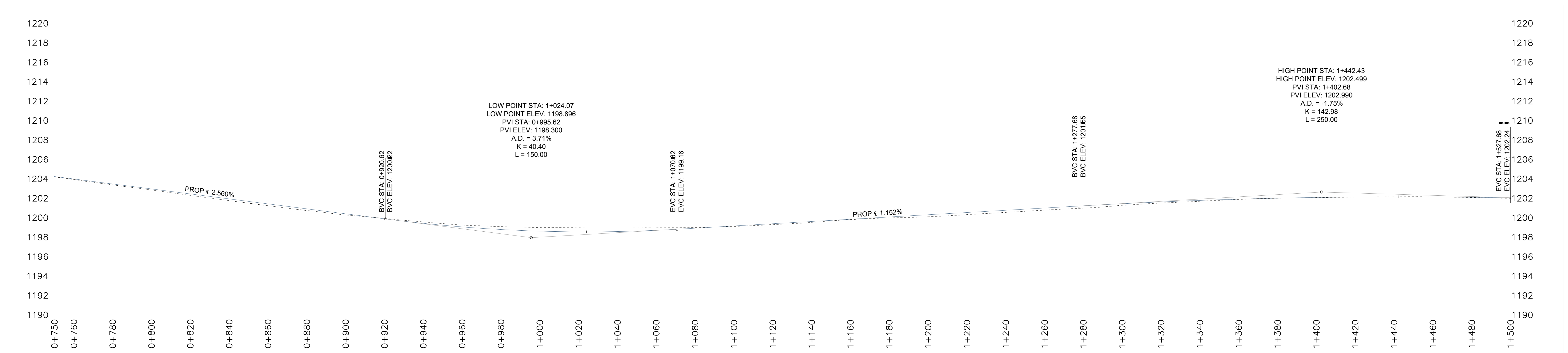
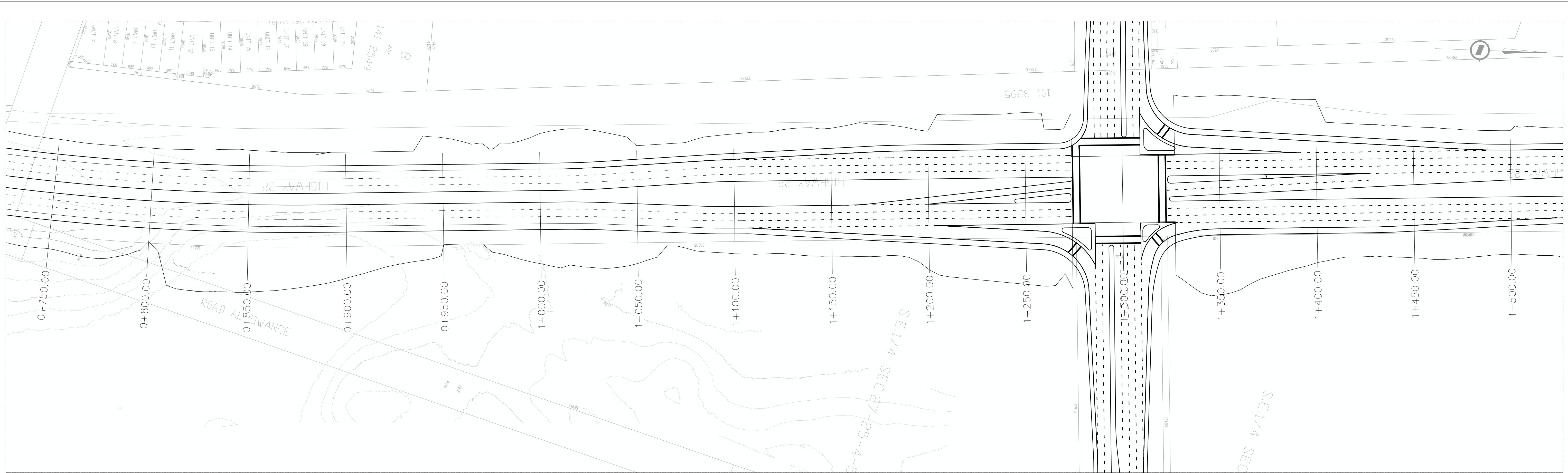


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		LOCATION	SITE

<b>Transportation</b>			
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		LOCATION	SITE

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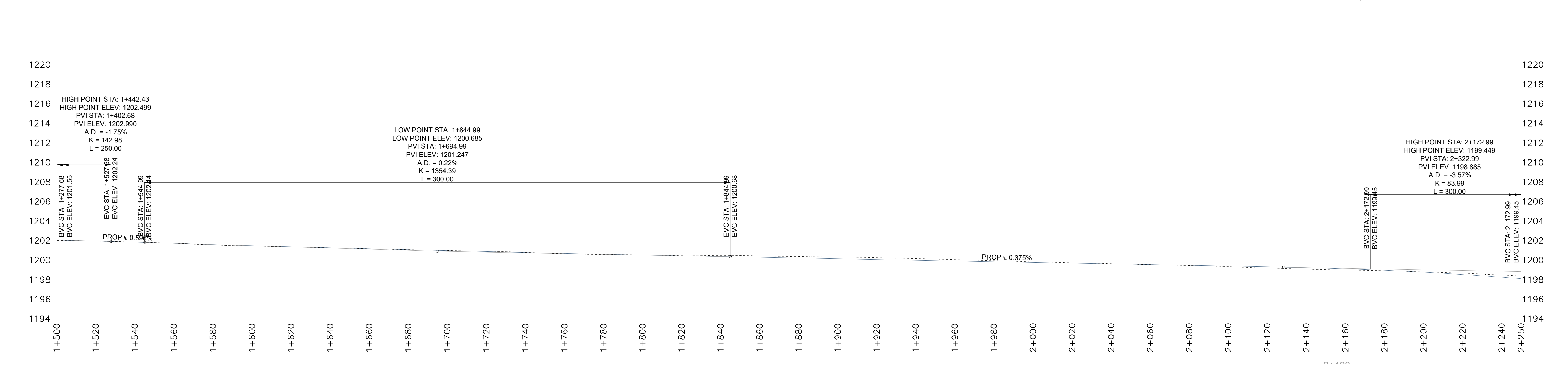
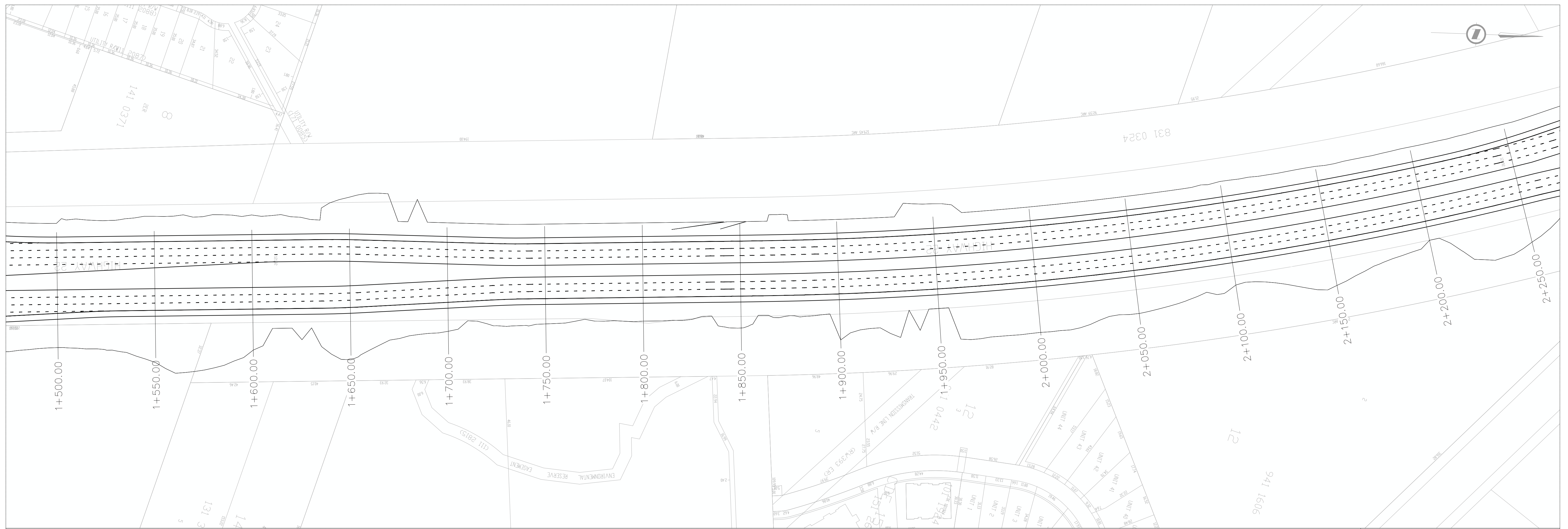
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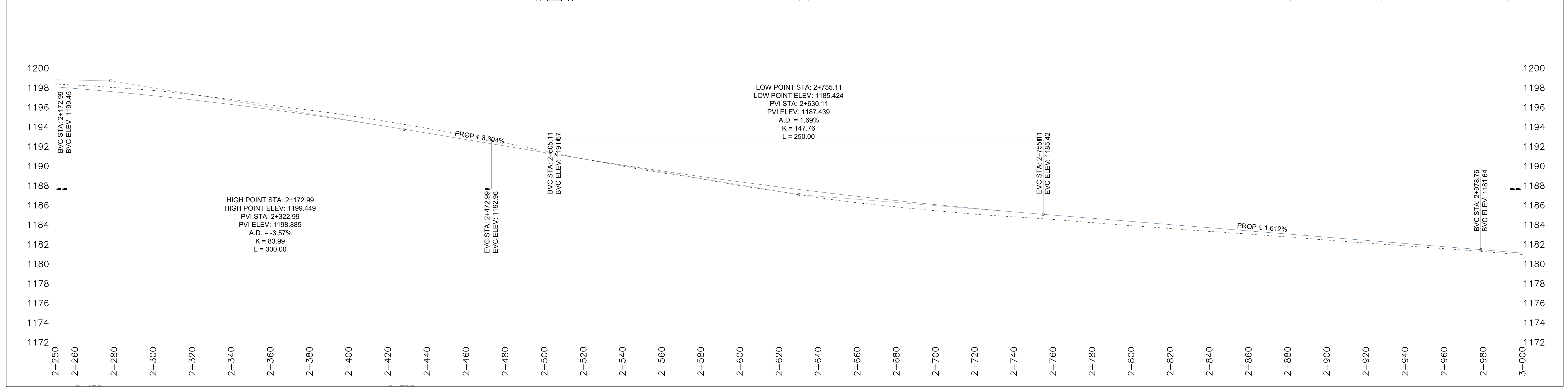
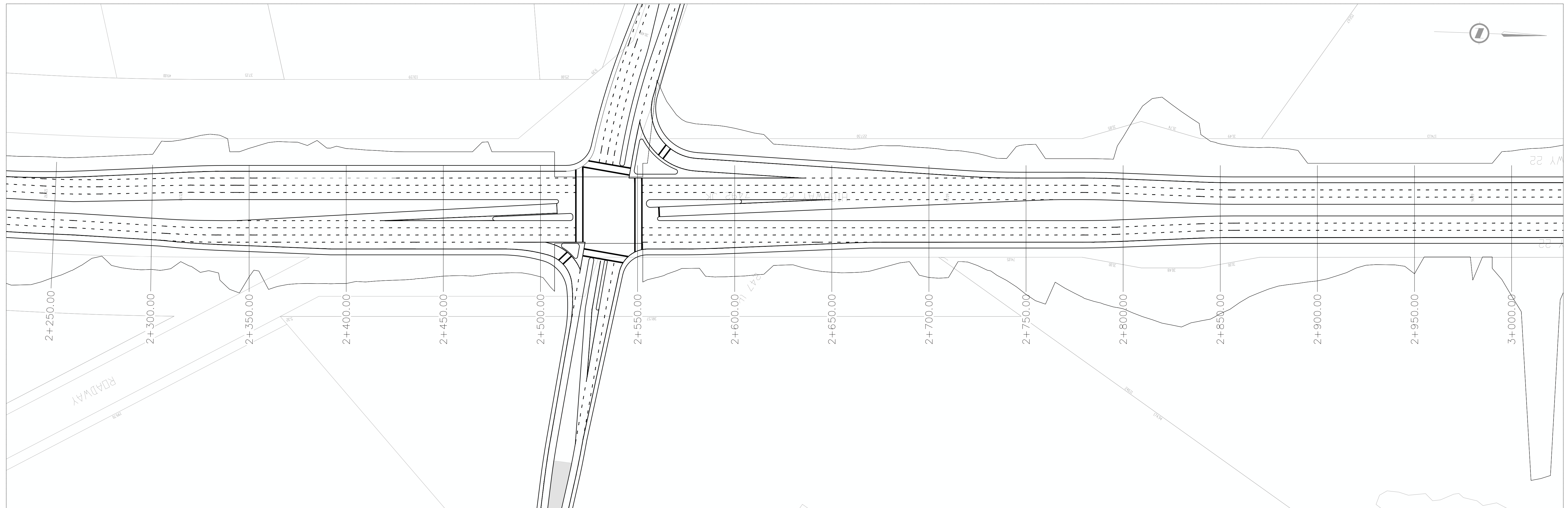
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**AT** Transportation

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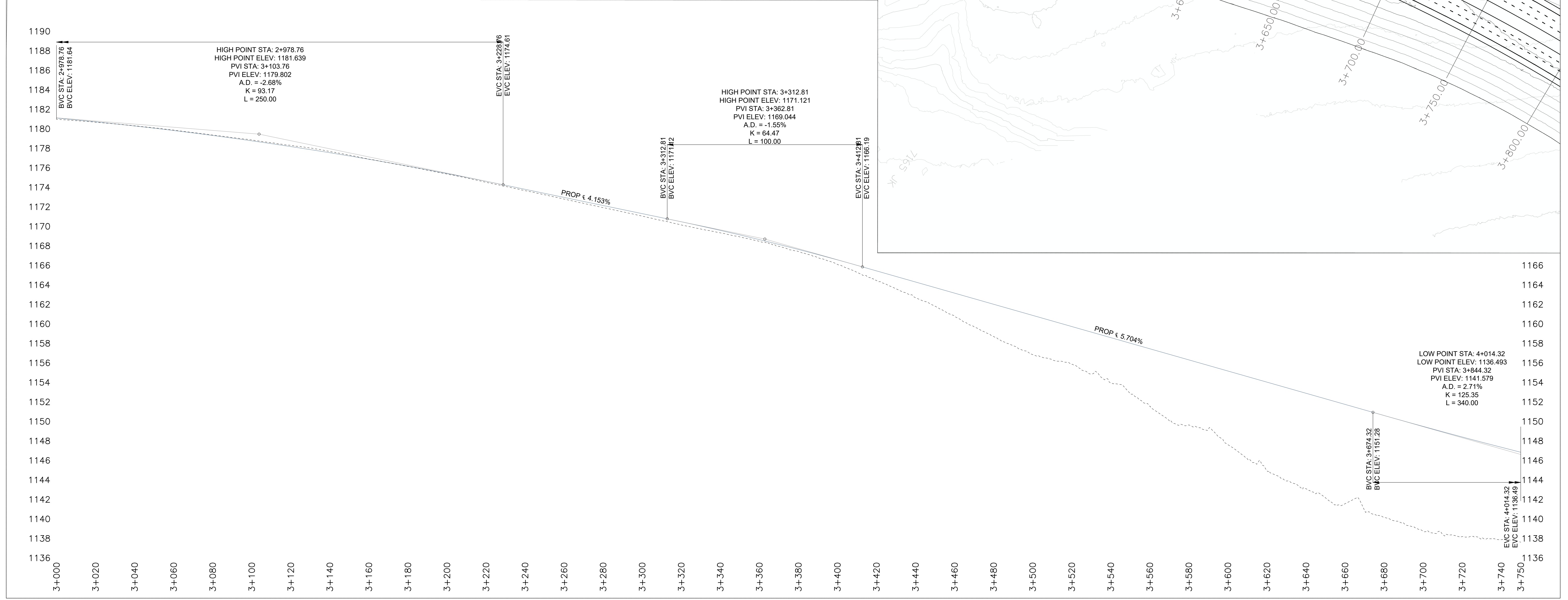
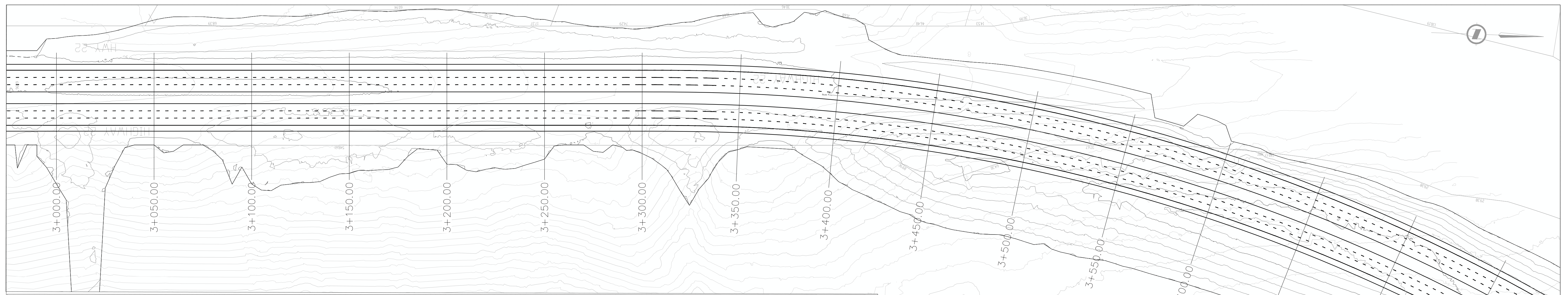
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Transportation

### HIGHWAY 22 PROFILE

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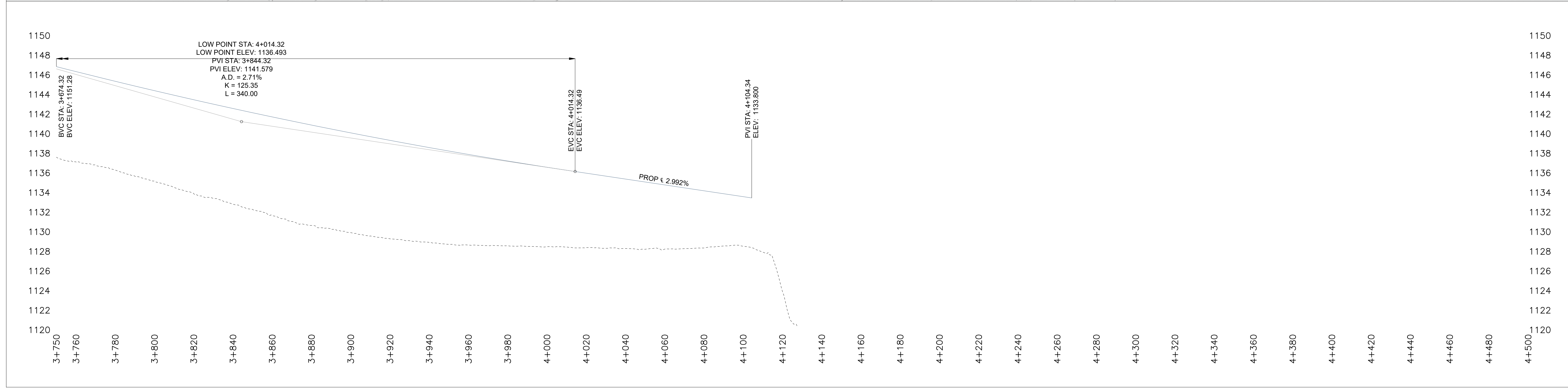
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**Transportation**

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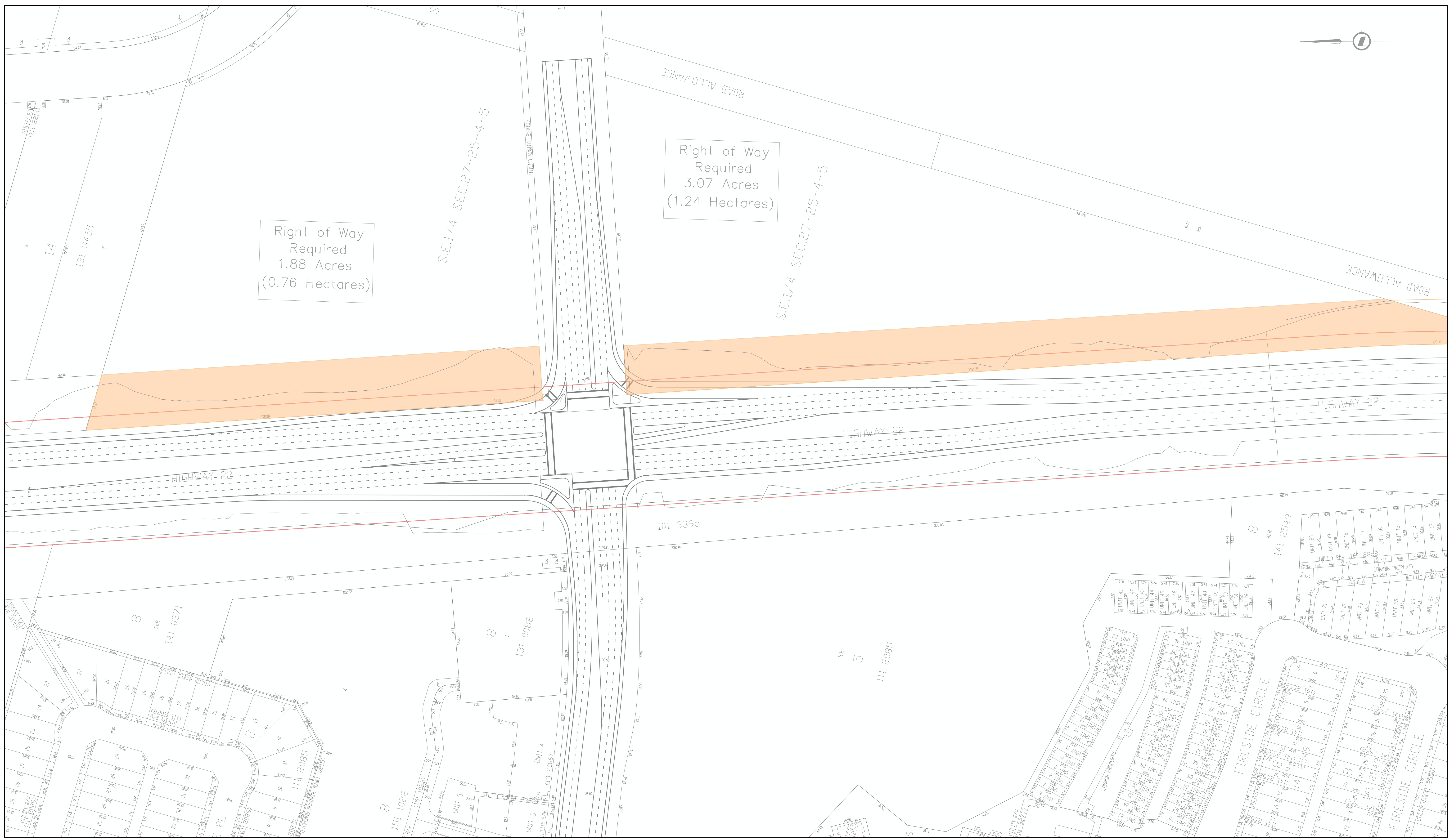
  
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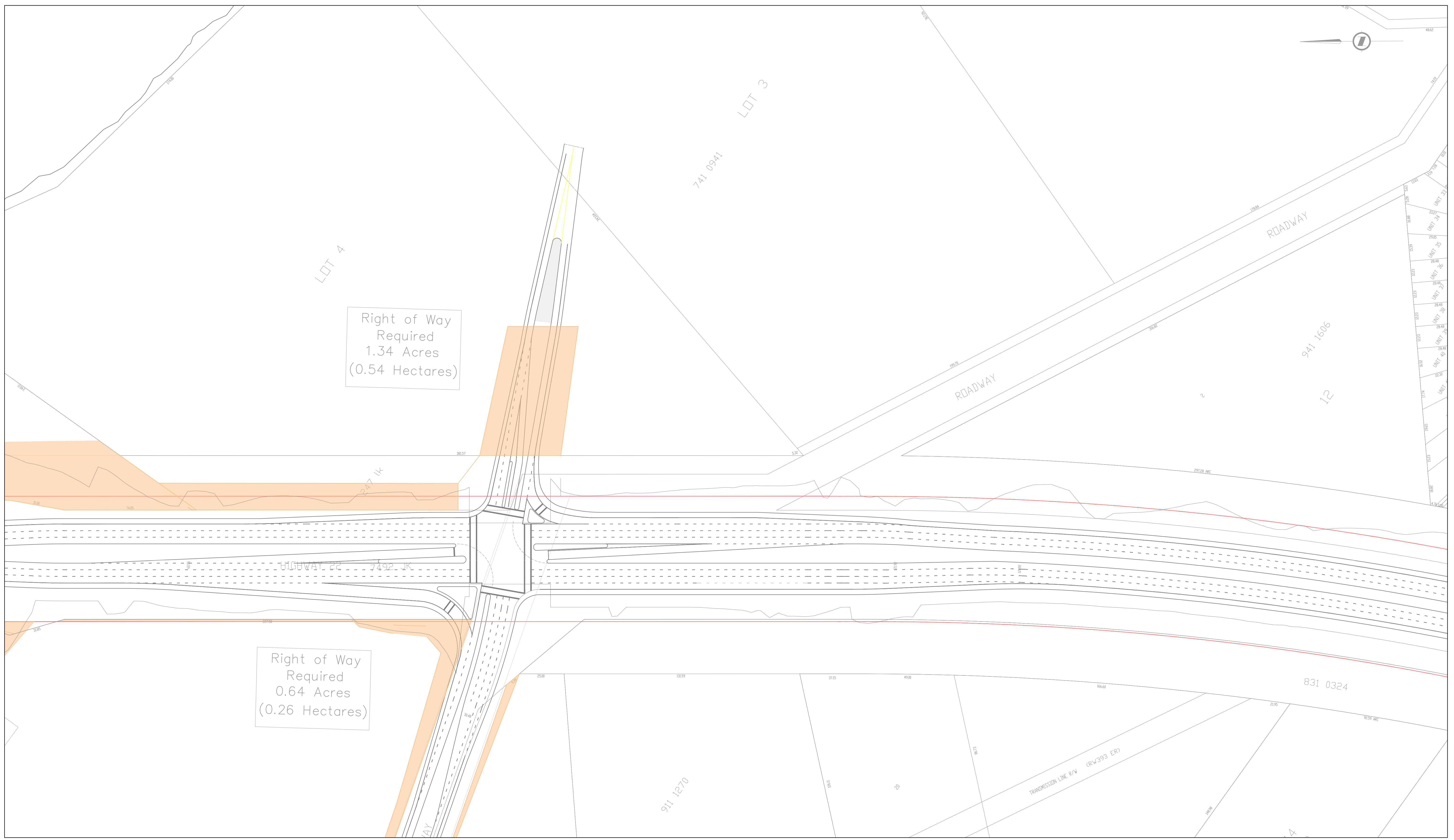
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**AT** Transportation

HIGHWAY 22  
ROW

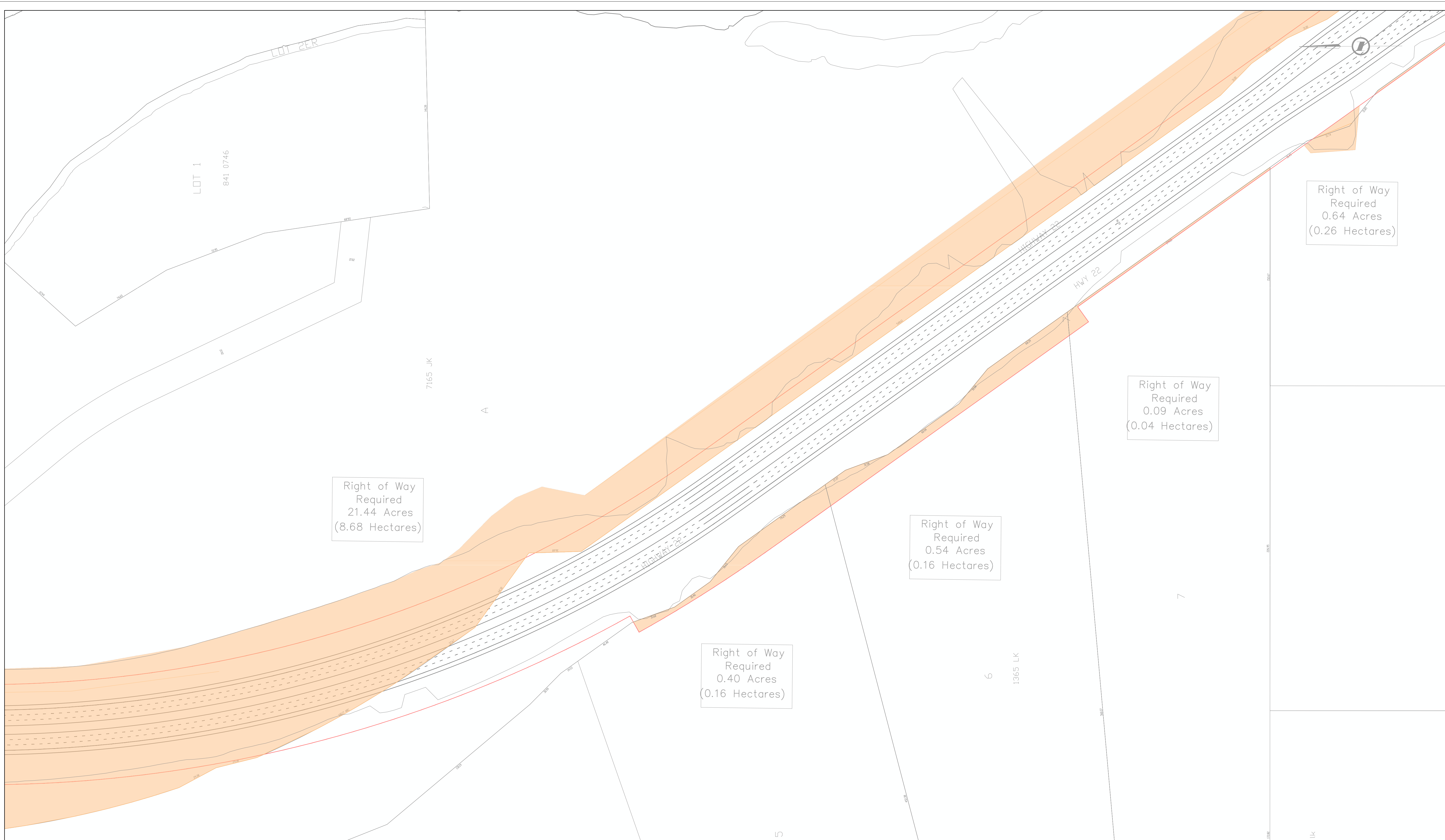
CONTRACT	HIGHWAY	SHEET	DRAWING
	22	3 OF 5	x

DATE: June 03, 2022

LOCATION: \_\_\_\_\_

SITE: \_\_\_\_\_

DEPARTMENT BAR CODE  
 SURVEYED  
 BY  
 DATE  
 PHOTO  
 DESCRIPTION  
 Functional Study  
 CONTRACT  
 HIGHWAY  
 22  
 DRAWING



DESIGNER  
 DATE \_\_\_\_\_

CHECKER  
 DATE \_\_\_\_\_

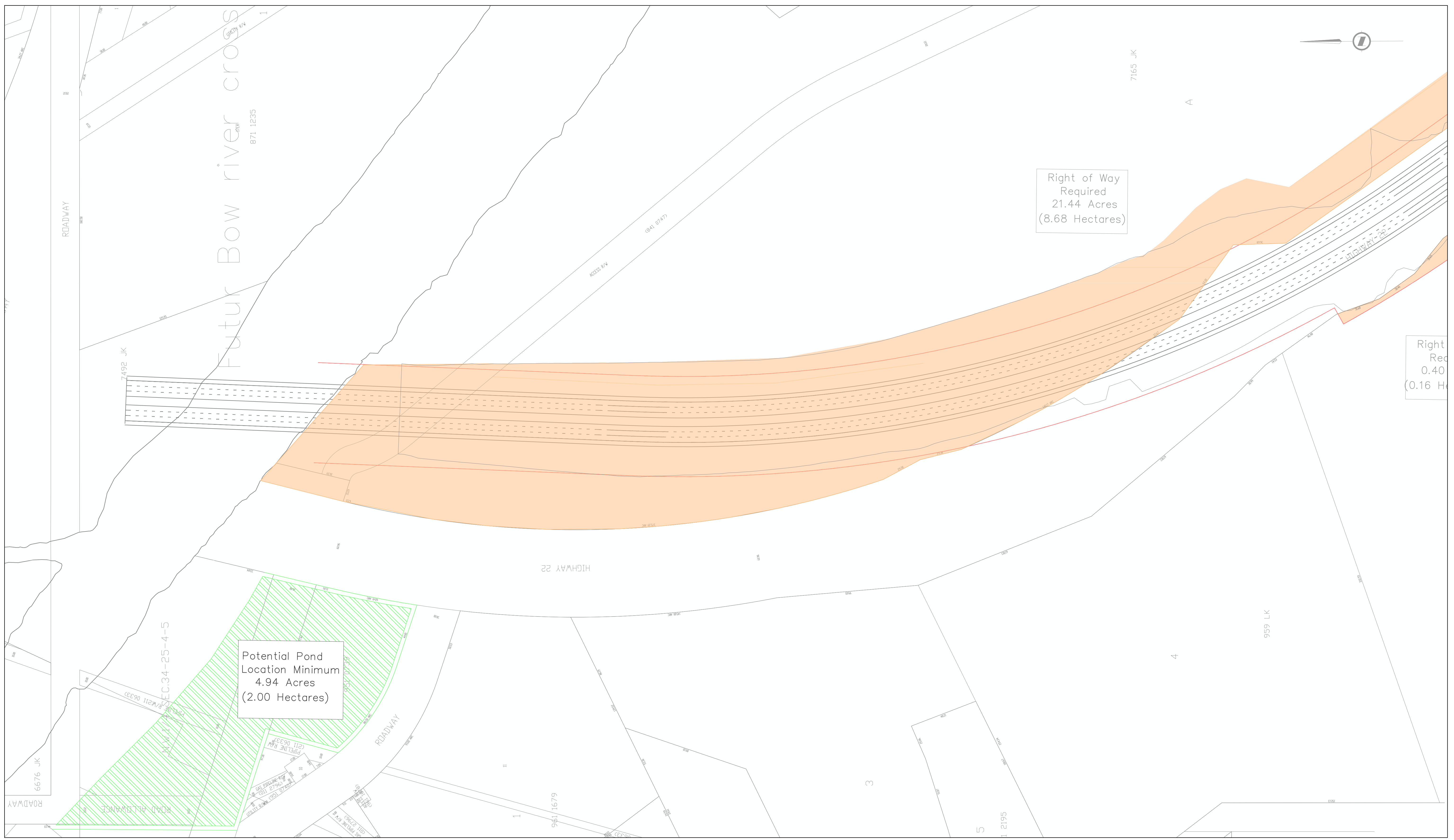
REV	DATE	REVISION	BY

**AT** Transportation

HIGHWAY 22  
 ROW

CONTRACT	HIGHWAY	SHEET	DRAWING
	22	4 OF 5	x

DEPARTMENT BAR CODE SURVEYED BY DATE PHOTO DESCRIPTION Functional Study CONTRACT HIGHWAY 22 DRAWING



Right of Way Required  
21.44 Acres  
(8.68 Hectares)

Potential Pond Location Minimum  
4.94 Acres  
(2.00 Hectares)

Right of Way Required  
0.40 Acres  
(0.16 Hectares)



DESIGNER \_\_\_\_\_ DATE \_\_\_\_\_  
CHECKER \_\_\_\_\_ DATE \_\_\_\_\_

REV	DATE	REVISION	SITE	BY

**AT** Transportation

HIGHWAY 22 ROW

CONTRACT	HIGHWAY	SHEET	DRAWING
	22	5 OF 5	x

DATE June 03, 2022

LOCATION

SITE

CONTRACT

HIGHWAY 22

SHEET 5 OF 5

DRAWING x





## APPENDIX F: WHAT WE HEARD REPORT



[WWW.HWY22UPDATE.COM](http://WWW.HWY22UPDATE.COM)



# **HIGHWAY 22** **FUNCTIONAL STUDY** **UPDATE**

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## **WHAT WE HEARD** **REPORT**

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PREPARED BY  
ON BEHALF OF

**B&A PLANNING GROUP**  
**CANOPY LANDS & WATT CONSULTING GROUP**

**JANUARY 2022**



# ABOUT

This What We Heard Report provides an overview of the Highway 22 Functional Study Update project, the communications and engagement strategy, a summary of key feedback themes and the project team’s response to questions received.

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# 1.0 INTRODUCTION

## 1.1 BACKGROUND

In 2003, the Highway 22 and Highway 1A Access Management & Functional Planning Study was approved by Alberta Transportation, setting a 20-year horizon for the future of the two primary highways.

The Study confirmed the long-range function, classification and design standards for both highways and determined future configurations, Right-of-Way (ROW) requirements, and an Access Management Strategy for the corridors.

## 1.2 CURRENT SITUATION

At the request of Alberta Transportation, Watt Consulting Group is leading an update to the Study for a portion of Highway 22; from south of the Bow River to the future Township Road 254, just south of the Town of Cochrane limits.

The Study update will align with the direction set out in Connecting Cochrane, the Town of Cochrane's Transportation Master Plan and will help guide future decisions on development, road network planning and highway improvements along this segment of Highway 22, with a primary focus on highway access and intersection improvements.

## 1.3 PROJECT TIMELINE





## 1.4 STUDY AREA



# 2.0 ENGAGEMENT

Stakeholder and public engagement is an important component of the Highway 22 Functional Study Update. The project team is committed to sharing information, answering questions and collecting feedback to strengthen project decisions.

Through both in-person and online engagement tactics, the project team shared information with, and collected input from key stakeholders, adjacent landowners and the public at large.

## 2.1 OUTREACH ACTIVITIES

The following outreach methods were utilized to raise awareness and drive participation in the engagement process leading up to the public open house. The promotions invited stakeholders and the public to visit the project website and get involved by attending the public open house, completing the online survey or getting in touch with the project team.



**Project Website**  
**([www.Hwy22Update.com](http://www.Hwy22Update.com))**  
334 visitors as of January 4, 2022\*.



**Print Advertisements**  
Advertisements in the Cochrane Eagle and Cochrane Times.



**Mailers**  
450 letters delivered to adjacent landowners and businesses.



**Road Signage**  
One northbound and one southbound road sign along Highway 22 within the Study Update limits.



**Email Invitations to Stakeholders**  
15 emails to stakeholder and community groups, introducing the project and inviting them to participate.

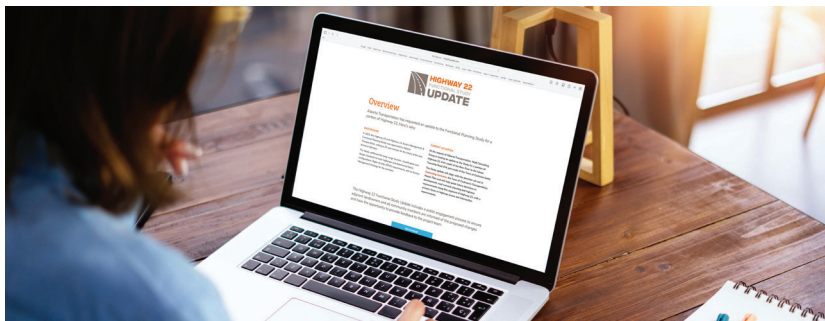


**Geotargeted Facebook Advertisements**  
10,728 impressions.



**News Article on CochraneNow.com**  
Published on December 8.

\*Impressions are the total number of displayed advertisements





## 2.2 ENGAGEMENT ACTIVITIES

The following engagement methods were used to share information, facilitate conversations, answer questions and collect input.



### Project Email Address

8 emails received and responded to.



### Public Open House

**December 7, 2021 5:30-7:30 p.m.**  
45 attendees and 7 feedback forms collected.



### Online Survey

6 online surveys completed.



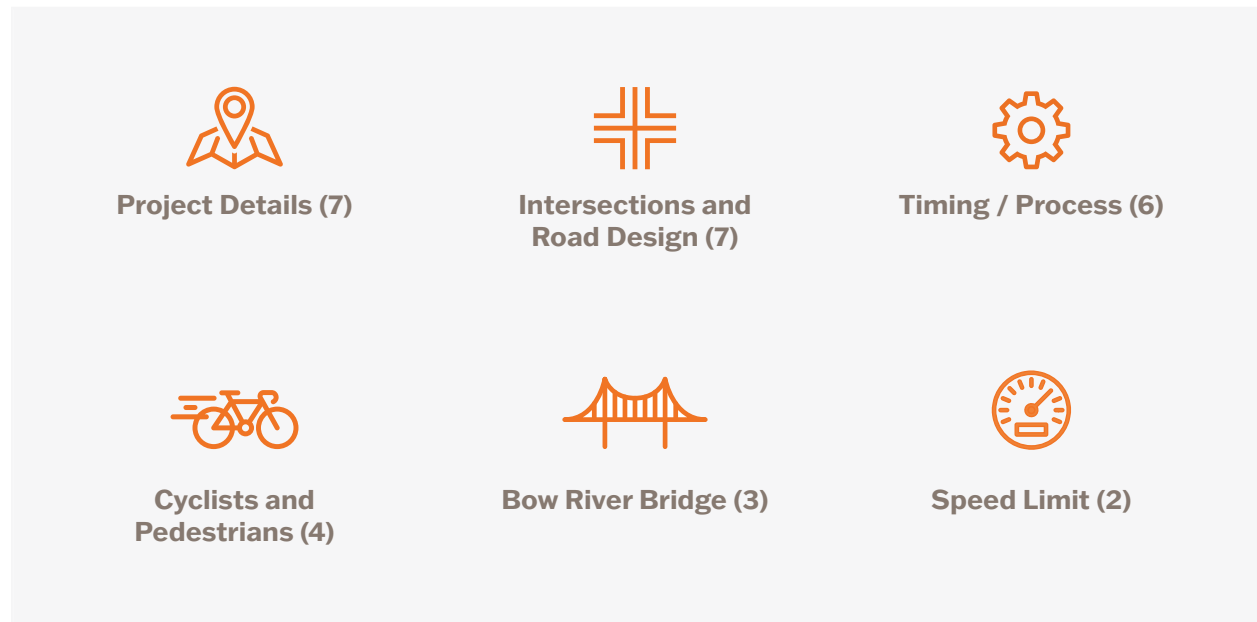


# 3.0 WHAT WE HEARD

Feedback and questions received across all engagement methods have been consolidated and categorized into a number of themes. This section provides a list of the identified themes, as well as an overview of specific questions and comments received, with the responses provided by the project team.

## 3.1 FEEDBACK THEMES

The following outreach methods were utilized to raise awareness and drive participation in the engagement process leading up to the public open house. The promotions invited stakeholders and the public to visit the project website and get involved by attending the public open house, completing the online survey or getting in touch with the project team.



Please see a summary of all comments, questions and responses prepared by the project team in **section 3.2**.

## 3.2 FEEDBACK & RESPONSES

To ensure transparency and open communication, the project team has responded to every question and comment received throughout the public engagement program. This section includes all questions and comments received throughout engagement, categorized into themes, along with responses prepared by the Project Team.



### 3.3.1 PROJECT DETAILS (7 COMMENTS/QUESTIONS)



Questions/Comments	Response
The information provided is general. Would like to see data, analysis and more specific timeline information. Would like to see the summary report. (2)	Once the summary report is completed by Watt, the project team would be happy to share it with those who have expressed interest.
The “current situation” should include that this section of Highway 22 is over capacity and experiences heavy rush hour traffic.	We are currently conducting detailed traffic and safety analysis, which will speak to existing traffic volumes within this stretch of Highway 22. The final report will include a section on current operations and indicate where congestion is occurring.
The current update is restricted to one intersection, hence it is not an update for the entire segment in Cochrane south of the Bow River.	This is incorrect. Alberta Transportation requested an update to the Study for the portion of Highway 22; from south of the Bow River to the future Township Road 254, just south of the Town of Cochrane limits. The request from Alberta Transportation was to look at road network planning and highway improvements along this entire segment of Highway 22, with a key focus on access and intersection improvements, not isolated to any one intersection. The traffic analysis for the future 2060 horizon focused on three intersections including Rolling Range Dr., Fireside Dr. and the new intersection in Rocky View that will service the Southbow development. The George Fox intersection is planned to shift north of the Bow River by 2060 and was therefore excluded from the future traffic analysis.

Questions/Comments	Response
This update should not stand on its own. It should include the rest of Highway 22 as well, specifically from Highway 1A through to Highway 1 (Trans Canada Highway).	Alberta Transportation recently completed a functional study for the portions of Highway 22 between the Bow River and Highway 1A, as well as from the Town of Cochrane to Highway 1. These three studies cover the entire length of Highway 22 between Highway 1A and Highway 1.
Would like to see the County and the Town work together on this study.	Both the Town and Rocky View County are key stakeholders in this project and will be reviewing and commenting on the Study Update Report.



### 3.3.2 INTERSECTIONS AND ROAD DESIGN (7 COMMENTS/QUESTIONS)



Questions/Comments	Response
Too many light controlled intersections along Highway 22 will result in slow commute times. Consider overpasses (or other intersection designs such as a roundabout / overpass / underpass to avoid additional traffic lights) to allow for free flowing traffic. (3)	The signalized intersections are the preferred traffic control for the three study intersections along the corridor. Roundabouts were looked at, but were excluded from further analysis since the corridor is being planned as a six-lane highway. Overpasses are not required based on the future traffic analysis.
Would like to see separate turning lane into Rolling Range Estates from both directions. Have noticed more people using this turn since Fireside has access to this road. Safety concern with turning on and off the highway here.	The proposed long term concept for Rolling Range Drive and Highway 22 includes separate turning lanes at Rolling Range Drive in all directions to improve traffic flow and safety. As development proceeds within the Rolling Range area, interim upgrades to the intersection of Highway 22 and Rolling Range Drive may be required.

<p>Are the three lanes continuing through town, or will a bottleneck be created at the bridge?</p>	<p>The interim design includes three southbound lanes and two northbound lanes. The additional southbound lane would mostly act as a climbing lane for heavy trucks and would only be required on the upgrade portion of the highway. The plan to expand the bridge over the Bow River only contemplates two lanes in each direction. Based on the analysis conducted as part of this study, no bottlenecks are forecasted at the bridge.</p>
<p>Concerns with Rolling Range Drive intersection on a hill, which can impact traffic with a slow start especially in the winter.</p>	<p>When this intersection is upgraded, the grades would be reviewed and refined based on Alberta Transportation design guidelines. Typically, the approaches to signalized intersections are kept at two percent or less to reduce the impacts on traffic operations. The grades adjacent to Rolling Range Drive have been reviewed and it is feasible to keep these grades at two percent or less.</p>
<p>What is the plan for Towers Trail?</p>	<p>Tower Trail will remain as an access road for some of the acreages in Rocky View and will also serve as an alternate route for future development traffic in the area. Alberta Transportation has requested that Tower Trail connect to the new intersection that will service the Southbow Development. The timing and construction of this connection is underdetermined at this time. More work is required to define the alignment of this potential connection.</p>



### 3.3.3 TIMING / PROCESS (6 COMMENTS)



Questions/Comments	Response
<p>The bridge over the Bow must be replaced and Highway 22/1A intersection needs to be improved prior to widening this stretch of highway to avoid additional bottlenecks. Government officials must be made aware of this.</p>	<p>We agree that the bridge over the Bow River should be upgraded either before or at the same time as this section of Highway 22 is upgraded. Funding for the bridge improvements has not been approved at this time.</p> <p>The Highway 22/1A intersection will be complete prior to the widening within this study area.</p> <p>This report as well as the Study Update report will be shared with government officials with Alberta Transportation, the Town of Cochrane and Rocky View County.</p>
<p>No intersection should be added to Highway 22 until the Highway is at least twinned.</p>	<p>The only new at-grade intersection being planned in the area is the one in Rocky View County that will service the proposed Southbow development. When this development application comes forward, the Town of Cochrane, Rocky View County and Alberta Transportation will determine what improvements are required to Highway 22 before building a new at-grade intersection.</p>
<p>Recommend adding an additional lane northbound before any expansion takes place.</p>	<p>The interim design includes three southbound lanes and two northbound lanes. The timing of these upgrades will be determined through the development process and will also be based on the availability of funding.</p>
<p>The opportunity to develop should be contingent on the completion of these improvements so current traffic levels are not increased and safety is not jeopardized.</p>	<p>Intersection upgrades along the corridor will be tied to specific development phases and will be required as a condition of approval.</p>

Given the uncertainty of provincial funding and rapid growth, the report needs to reach decision-makers ASAP.	We anticipate the report being complete in February 2022, at which time it will be shared with Alberta Transportation, the Town of Cochrane and Rocky View County.
Would like to see these improvements made as soon as possible.	We anticipate the report being complete in February 2022, however the timing of improvements are subject to provincial funding. The province's next capital plan will be released next spring, at which time we will have a better idea of when improvements are expected.



### 3.3.4 CYCLISTS AND PEDESTRIANS (4 COMMENTS/QUESTIONS)



Questions/Comments	Response
All intersections should accommodate road cyclist safety. Roads should include minimum 1.5 m wide shoulders. Should also include rumble strips to warn drivers crossing onto the shoulder.	The plans include 2.0m shoulders which could accommodate cyclists. Discussions regarding a potential pathway on the west side of the Highway (outside of the ROW) are ongoing between the Town and Rocky View.
Recommend seasonal signage in the area to notify drivers to watch for cyclists.	Thank you for this comment. This comment will be included in the final report for consideration by Alberta Transportation.
Does this study include looking at a multi-use pathway along the highway?	Yes, this was considered and Alberta Transportation, the Town and Rocky View County are looking at this opportunity.
A pedestrian bridge over Highway 22 should be considered somewhere along this study area.	Thank you for this feedback. This comment will be included in the final report for consideration by the Town.



### 3.3.5 BOW RIVER BRIDGE (3 COMMENTS/QUESTIONS)



Questions/Comments	Response
Will there be a better bridge over the Bow River?	The Study limits end before the Bow River bridge, however we are aware that there is a functional plan in the works to expand and improve the bridge, as per the Town's Transportation Master Plan. Funding for the bridge improvements has not been approved at this time.
Bridge is dangerous and undesirable for cyclists and pedestrians.	
Pathway under the bridge is dangerous in winter due to icy conditions.	



### 3.3.6 SPEED LIMIT (2 COMMENTS)



Questions/Comments	Response
Would like to see the speed limit approaching Fireside Gate dropped to 60 km/h due to safety concerns (currently is 80 km/h). (2)	While speed limits along the corridor are out of scope for the Study Update, we will pass this feedback along to Alberta Transportation who is responsible for setting and adjusting speed limits.

## 4.0 NEXT STEPS

This What We Heard Report will be shared with those who participated in the engagement program, posted on [www.Hwy22Update.com](http://www.Hwy22Update.com) and provided to Alberta Transportation, the Town of Cochrane and Rocky View County. The project team will review the input received and alongside additional technical planning, analysis and assessment, will prepare the Highway 22 Functional Study Update report.







**HIGHWAY 22**  
FUNCTIONAL STUDY  
**UPDATE**

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WHAT WE HEARD  
REPORT

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## APPENDIX G: PRELIMINARY COST ESTIMATE

**SCHEDULE OF QUANTITIES AND UNIT PRICES**

**Surface Improvements  
Hwy 22 Functional Study**

2-Jun-21

**Summary**

Schedule 9.0: Earthworks	<u>\$ 11,830,000.00</u>
Schedule 10.0: Surface Improvements - Concrete	<u>\$ 6,630,000.00</u>
Schedule 11.0: Surface Improvements - Asphalt	<u>\$ 6,280,000.00</u>
Schedule 12.0: Surface Improvements - Asphalt Miscellaneous Items	<u>\$ 810,000.00</u>
<b>SUBTOTAL - SURFACE IMPROVEMENTS</b>	<u><b>\$ 25,550,000.00</b></u>
<b>CONTINGENCY ALLOWANCE (30%)</b>	<u><b>\$ 7,670,000.00</b></u>
<b>TOTAL:</b>	<b>\$ 33,220,000.00</b>

(Corporate name )

PER

PER

(Corporate Seal is to be affixed if the contractor is a corporation; if the contractor is not a corporation, personal wafer seals are to be added after signatures and each contractor's name typed below signature).

**SCHEDULE OF QUANTITIES AND UNIT PRICES**

**Surface Improvements - Concrete**

**Hwy 22 Functional Study**

Item	Description	Tender Quantity	Unit	Unit Price	Total Amount
Concrete unit rates include all excavation or fill and compaction required within 200mm of the finished grade elevation. All compaction will be completed to 98% Standard Proctor Density. No additional payment will be made for moisture conditioning. Monowalk and curb and gutter unit rates to include berm construction using native material.					

2-Jun-21

**Schedule 9.0: Earthworks**

<b>9.1</b>	<b>Subgrade excavation from cut to fill c/w compaction</b>	78,300.0	cm	\$ 17.00	\$ 1,330,000.00
<b>9.2</b>	<b>Haul &amp; Place Additional Import Fill</b>				
9.2.1	Haul, Place and Compact Additional Import Fill	500,000.0	cm	\$ 21.00	\$ 10,500,000.00
<b>Subtotal: Earthworks</b>					<b>\$ 11,830,000.00</b>

**SCHEDULE OF QUANTITIES AND UNIT PRICES**

**Surface Improvements - Concrete**

**Hwy 22 Functional Study**

<b>Item</b>	<b>Description</b>	<b>Tender Quantity</b>	<b>Unit</b>	<b>Unit Price</b>	<b>Total Amount</b>
Concrete unit rates include all excavation or fill and compaction required within 200mm of the finished grade elevation. All compaction will be completed to 98% Standard Proctor Density. No additional payment will be made for moisture conditioning. Monowalk and curb and gutter unit rates to include berm construction using native material.					

**Schedule 10.0: Surface Improvements - Concrete**

<b>10.1</b>	<b>Low Profile Curb and Gutter</b>				
10.1.1	0.5m Low Profile Curb & Gutter - 32MPa	7,800.0	m	\$ 112.00	\$ 870,000.00
<b>10.2</b>	<b>Concrete Median Fill</b>				
		36,200.0	sm	\$ 90.00	\$ 3,260,000.00
<b>10.3</b>	<b>TL4 Jersey Barrier Extrusion</b>				
		7,800.0	m	\$ 320.00	\$ 2,500,000.00
<b>Subtotal: Surface Improvements - Concrete</b>					<b>\$ 6,630,000.00</b>

**SCHEDULE OF QUANTITIES AND UNIT PRICES**  
**Surface Improvements - Asphalt**  
**Hwy 22 Functional Study**

Item	Description	Tender Quantity	Unit	Unit Price	Total Amount
------	-------------	-----------------	------	------------	--------------

All compaction will be completed to 98% Standard Proctor Density. No additional payment will be made for moisture conditioning.

2-Jun-21

**Schedule 11.0: Surface Improvements - Asphalt**

11.1	<b>Saw Cut Existing Asphalt (Provisional)</b>	100	m	\$ 12.00	\$ -
11.2	<b>Breakout and Removal of Existing Asphalt (Provisional)</b>	500	sm	\$ 75.00	\$ 40,000.00
11.3	<b>Subgrade Preparation</b>	90,825	sm	\$ 1.70	\$ 150,000.00
11.4	<b>Granular Material</b>				
11.4.1	250mm of 25mm Crushed Base Gravel (Major Two Way)	90,825	sm	\$ 13.00	\$ 1,180,000.00
11.4.2	325mm of 80mm Sub Base Gravel (Major Two Way)	90,825	sm	\$ 25.00	\$ 2,270,000.00
11.5	<b>Prime &amp; Tack Coat</b>				
11.5.1	Prime Coat	90,825	sm	\$ 1.00	\$ 90,000.00
11.5.2	Tack Coat (FAC)	90,825	sm	\$ 1.00	\$ 90,000.00
11.6	<b>Asphalt</b>				
11.6.1	Mix 'A' - 110mm Thick	90,825	sm	\$ 20.00	\$ 1,820,000.00
11.6.2	Mix 'B' - 40mm Thick PG 58-31	90,825	sm	\$ 7.00	\$ 640,000.00

**Subtotal - Surface Improvements - Asphalt**

**\$ 6,280,000.00**

**SCHEDULE OF QUANTITIES AND UNIT PRICES**  
**Surface Improvements - Asphalt**  
**Hwy 22 Functional Study**

Item	Description	Tender Quantity	Unit	Unit Price	Total Amount
------	-------------	--------------------	------	------------	--------------

All compaction will be completed to 98% Standard Proctor Density. No additional payment will be made for moisture conditioning.

**Schedule 12.0: Surface Improvements - Asphalt Miscellaneous Items**

<b>12.1</b>	<b>Line Painting</b>				
12.1.1	Supply and place asphalt paint	27	km	\$ 255.00	\$ 10,000.00
<b>12.2</b>	<b>Construct Singalized Intersection</b>	2	ea	\$ 400,000.00	\$ 800,000.00
	<i>Includes installation of signal lights and traffic cabinets. Concrete islands and bases are included in the concrete section.</i>				
<b>Subtotal: Surface Improvements - Asphalt Miscellaneous Items</b>					<b>\$ 810,000.00</b>

**Assumptions and Notes**

- 1) Prices taken from AT&U 2022 Unit Price Summary.
- 2) Assuming no geotextile preparation for subgrade.
- 3) Highway closures or land acquisition costs were not considered as part of this estimate.
- 4) TL4 Jersey Barrier assumed along the entirety of HWY 22.
- 5) Concrete median fill assumed only (no landscaping).
- 6) Assumed no hydroseed or side ditch seeding.



## APPENDIX H: SAFETY AUDIT



# Watt Consulting Group

On behalf of Canopy Lands and Alberta Transportation

## Road Safety Audit – Planning Stage

Highway 22 Functional Planning Study within the Town of Cochrane



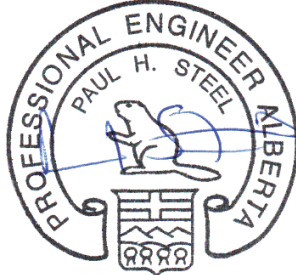
CIMA+ file number: CA000814  
August 9, 2022 – Final Report

# Watt Consulting Group

On behalf of Canopy Lands and Alberta Transportation

## Road Safety Audit – Planning Stage

Highway 22 Functional Planning Study within the Town of Cochrane



August 9 2022  
ID 81229

Prepared by:

Paul H.A. Steel, M.Eng., P.Eng., RSP<sub>1</sub>

A handwritten signature in black ink that reads "Jeff Suggett".

Jeffrey Suggett, M.Sc.

Verified by:

Ali Hadayeghi, P.Eng., Ph.D.

<b>PERMIT TO PRACTICE CIMA CANADA INC.</b>	
RM SIGNATURE:	<u>MARK KOEHL</u>
RM APEGA ID#:	<u>78252</u>
DATE:	<u>2022 Aug 10</u>
<b>PERMIT NUMBER: P 8204</b> The Association of Professional Engineers and Geoscientists of Alberta (APEGA)	



300, 6815 – 8 Street NE, Calgary, Alberta  
Canada T2E 7H7

CIMA+ file number: CA000814  
August 9, 2022 – Final Report

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# 1. Introduction

CIMA Canada Inc. (CIMA+) has completed a planning stage road safety audit (RSA) for the proposed upgrades to Highway 22 within the Town of Cochrane between the south corporate limit and the Bow River. This report documents the findings of this audit and any suggested improvements associated with these findings.

## 1.1 Project Background

Watt Consulting Group (Watt) was retained by Canopy Lands to assist with the development of lands on either side of Highway 22, to the south of the Bow River, within the town's municipal limits. As part of the proposed infrastructure required to manage land development associated with continued neighbourhood and community growth, specifically the Towers Trail, Rolling Range Estates, Fireside, and River Heights developments, improvements to Highway 22 have been identified. These improvements necessitated Alberta Transportation to request that Watt update the previously completed functional plans established by the province in 2004 and incorporate the proposed infrastructure improvements required to support the current community development plans.

The subject section of Highway 22 lies between the south municipal boundary of the Town of Cochrane and the Bow River crossing, approximately 3.4 km in length. The 2004 study identified the future requirements for twinning (four-lane cross-section) including establishing a new river crossing to the east of the existing Bow River Bridge and a partial realignment of Highway 22 on the south side approach to the river. The existing bridge would remain in operation to serve local community access needs, specifically maintaining desirable access into the Bow Meadows neighbourhood and adjacent areas via George Fox Trail. As such, the focus of this RSA is on the proposed realignment of Highway 22, its associated geometry and the community access needs to the south of the Bow River, and does not include a detailed review of the George Fox Trail intersection or bridge crossings defined in the 2004 study.

## 1.2 Road Safety Audit Objectives

The objectives set forward by Alberta Transportation specific to this project have been defined as follows:

'Undertake a Planning Stage Road Safety Audit for the project that addresses the interim and final stage plans. This task shall include a safety evaluation of the basic design elements such as alignment, number of lanes, facility classification, access management, project limits, design speed, posted speed and other design criteria. Some of the modifications that may be suggested can include a different alignment, a roundabout or an interchange, or an additional pedestrian/bicycle facility etc. the safety audit shall be conducted following Alberta Transportation Road Safety Audit Guidelines and Transportation Association of Canada (TAC) publication, "Canadian Road Safety Audit Guide" and must be conducted by qualified and independent road safety auditors.'

## 2. The Road Safety Audit Process

This RSA was undertaken in accordance with Alberta Transportation's *Road Safety Audit Guidelines* (March 2004) and the TAC *Canadian Road Safety Audit Guide* (December 2001). The steps to the RSA process were as follows:

- + Step 1 – Audit start-up meeting with the design team to exchange project information, (i.e., functional plans, supporting reports, project constraints and other data).
- + Step 2 – Site visit by the Lead Auditor was completed on January 11, 2022 with observations presented to other members of the RSA team during Step 3.
- + Step 3 – Audit analysis by the RSA team in a workshop setting. There are no members of the design team present during this analysis to ensure the required independence of the RSA team and process.
- + Step 4 – Preparation of the audit report to highlight the safety issues and provide suggestions. This audit report becomes part of the project documentation.
- + Step 5 – Presentation of findings at a meeting with the design team (may also include the owner).
- + Step 6 – Preparation of a response report by the design team and owner outlining actions or justification for not implementing suggestions.

At the time of preparing this report, which represents the completion of Step 4, Steps 5 and 6 are yet to occur in the RSA process but will be subsequently coordinated.

Ultimately, the functional design and its implementation are the responsibility of the design team and the facility owner. It is important that the design team and the owner prepare a response report within the context of the overall project constraints (budget, land availability, risk management, etc.) outlining what action will be taken to address each of the audit findings. This response report becomes part of the project documentation. The presentation of the audit findings in this report allows for Step 6 to be incorporated as part of this report documentation for a single point of source.

### 2.1 Road Safety Audit Team

The RSA team was made up of qualified individuals who have experience in roadway design, traffic engineering, safety audits/assessments, and active transportation requirements. The individual team members are:

- + Ali Hadayeghi, P.Eng., Ph.D., Vice President – Transportation, CIMA+
- + Paul Steel, M.Eng, P.Eng, RSP1, Senior Project Manager and Lead Auditor, CIMA+
- + Jeffrey Suggett, M.Sc., Senior Project Manager, CIMA+

Team members employed by CIMA+ are transportation specialists who have not been involved in the work completed by Watt or the province previously within the Highway 22 study area, but have completed RSA training courses of two days or longer, and have greater than 10 years of experience in their relevant transportation fields.

## 2.2 Available Documents

Several planning level documents were provided to CIMA+ for review and consideration as part of this audit. These documents include the following:

- + Draft functional plans labelled 'HWY 22 / South Access, Full Buildout' (5 sheets) showing:
  - Horizontal plan view of Highway 22 and proposed intersections but with no horizontal attribute data or design dimensions
  - Design vertical profile for Highway 22
  - Intersection and corridor lanes and corresponding pavement markings
- + Draft functional plan labelled 'Profile, Full Buildout' (1 sheet)
- + Highway 22 Functional Study, Existing and Proposed Right-of-Way Plan (1 sheet)
- + Stage 1 Cross-Section (1 sheet)
- + Ultimate Cross-Section (1 sheet)
- + Reference to the Recommended Walking Network and Recommended Cycling Network from the town's Connecting Cochrane (overarching Transportation Master Plan)
- + Highway 22 collision statistics visuals
- + Highway 22 Functional Study – Technical Memo #2: Options Development (Draft), dated January 11, 2022

## 2.3 Step 1 – Start-Up Meeting Notes

The project start-up meeting was held between the RSA team lead and Watt for the purpose of orienting the team to the project requirements, and to confirm the study limits, project scope, audit documents, constraints, and other pertinent project information. This meeting was held on December 20, 2021, via a virtual meeting platform. The following information was presented during this start up meeting:

- + The previous functional planning study completed in 2004 identified the requirements for the future twinning of Highway 22, including the closure of River Heights Drive and Rolling Range Road as part of establishing a 120 km/h (design speed) four-lane cross-section with an additional southbound climbing lane.
- + This update to the previous functional plans will determine whether additional accesses could be introduced and/or current accesses remain to support land development demands, since the original plans called for a reduction in the number of accesses.
- + The proposed access management required to support community plans includes retaining the access at Rolling Range Drive with a new approach from the east, retention of the all-movements intersection at James Walker Trail, and a new all-movements intersection south of the current Fireside development.
- + The design speed being proposed by Watt Consulting is 80 km/h with a posted speed of 70 km/h.
- + Alberta Transportation is concerned regarding the proposed grades along Highway 22. The current design includes vertical grades as steep as 8%. This is specifically on the immediate approach to the Bow River bridge that may be associated with the future elevation of the bridge and tying the road grade to meet design requirements.

- + The possibility of an interchange at Fireside Gate/James Walker Trail is not the subject of this planning study update.
- + The functional plans consider a future horizon year of 2060.
- + The ultimate stage has considered a six-lane cross-section with three northbound and three southbound lanes within the study limits. Initial considerations for an interim stage plan suggested a five-lane cross-section due to the need to retain the southbound climbing lane. Given the similarities between an interim stage five-lane cross-section and an ultimate stage six-lane cross-section, it was determined by Watt to define only the ultimate stage requirements. The exception being the development of the interim stage cross-section.
- + Drainage requirements have not been defined at this time specific to the functional plans and so it is anticipated that the audit will not focus on drainage requirements in any detail.

### 3. Findings and Suggested Improvements

The findings of this audit have been provided in tabular format to aid in the organization of comments and facilitation of discussion. There are seven columns that document the audit findings and associated design team responses:

- + **Column 1:** ID – identifies the issue number.
- + **Column 2:** Reference – identifies the source to which the safety issue and associated actions correspond to within the information package provided by Watt.
- + **Column 3:** Safety Issue – states the audit findings in terms of perceived safety issues or concerns related to the current functional design that could be improved upon beyond baseline conditions.
- + **Column 4:** Photo – provides a screenshot or photo to illustrate the identified safety issue or design concern (where applicable).
- + **Column 5:** Suggested Action – indicates a suggested improvement measure that the design team should consider to address the perceived safety issue.
- + **Column 6:** Design Team Response (to be completed by the Design Team and/or Owner) – captures comments that justify the current design choice or need to consider a modification to the design based on the audit findings and/or project constraints.
- + **Column 7:** Resolution (to be completed by the Design Team and/or Owner) – provides space for the design team to indicate the desired course of action to resolve the safety issue and suggested action. This might include full acceptance, partial acceptance, or rejection of the audit's suggested action.

A copy of the design team responses shall be provided to CIMA once each suggestion is addressed in writing. It is only when this written response is received that this report becomes official.

The audit findings are contained in the table format included as pages 6 to 11 of this report.

#### 3.1 Additional Considerations

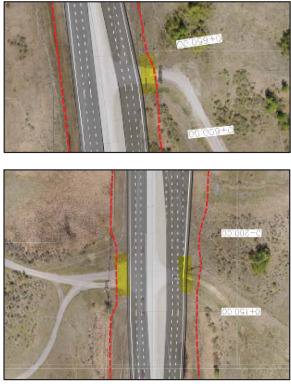
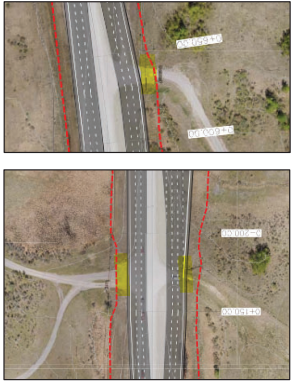
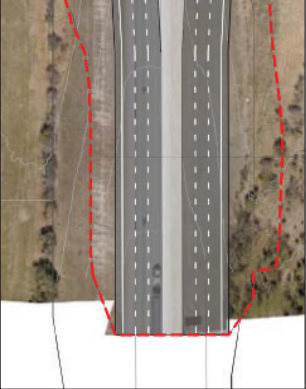
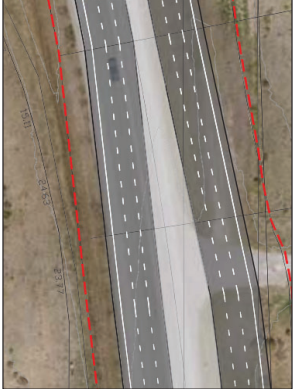
With respect to the audit objectives provided by Alberta Transportation, the audit team provides the following commentary based on the completion of Steps 1 to 4 in the audit process:



- + The design criteria used to develop the draft functional plans seems to match the correct function for Highway 22 as per Alberta Transportation's current Roadside Management Classification.
- + The proposed design speed of 80 km/h aligns with the requirements for a future Urban Expressway Divided designation.
- + Some of the suggested actions identified by the RSA team indicate that developing a staged plan would be beneficial to guide some of the decisions related to implementing the proposed improvements. The need to develop plans to guide the interim stage should be given additional consideration, particularly since the ultimate improvements have been analyzed for a 40-year design horizon. The actual timing of the proposed improvements will inform Alberta Transportation and others with respect to the timing of constructing new accesses, the appropriate traffic control prior to the onset of signals (or other ultimate control requirements), and other considerations such as budgeting and programming.
- + Technical Memo #2 (Watt, 2022) indicates rationale for analyzing signals instead of a roundabout. Issues specific to each of the three study intersections suggest the possible 'over-building' of the approach/departure legs. Consideration of a roundabout should be pursued further, particularly if roundabouts could delay the need for a six-lane cross-section and maintain the 2004 study's four-lane cross-section within the Town of Cochrane and to the south. Roundabouts can also assist with the transition from a rural to an urban environment and could be safer than the proposed signals.

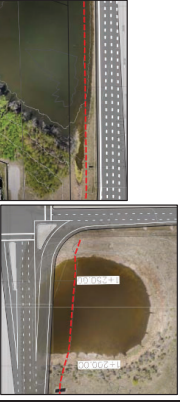


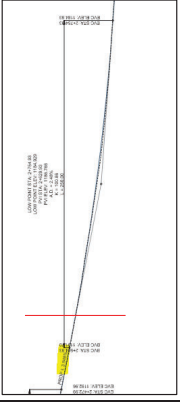
## 4. Concluding Statement

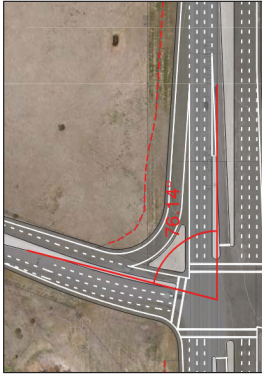
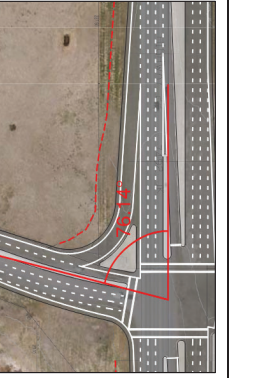
An RSA of the draft planning stage drawings and design considerations has been completed. The auditors have identified potential safety issues related to road user expectations and workload, clarifications with respect to various aspects of the functional design, and design elements that could contribute to collisions when implemented. The auditors have provided suggestions to correct noted issues; however, it is at the discretion of the design team to determine the appropriate mitigation measures and corrective actions based on tangible and intangible project constraints.

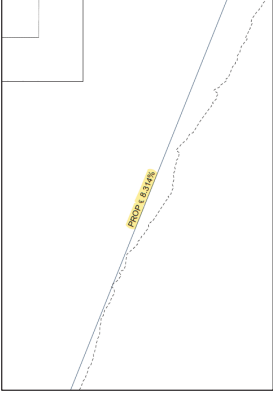
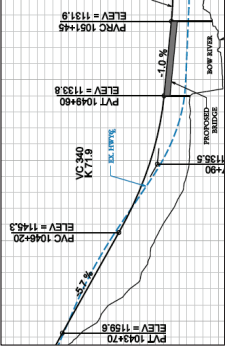

Issue #	Reference	Safety Issue	Photo	Suggested Action	Design Team Response	Resolution
1	All segments	Expressways are considered to be an interim stage prior to full freeway development and as such, follow similar access spacing requirements. The current locations of the South Access (Southbow), James Walker Trail/Fireside Gate and Rolling Range Drive are spaced approx. 940 m and 1.23 km respectively. TAC guidelines suggest a minimum 800 m spacing for right-in/right-out accesses, with other accesses generally at public road allowances (every 1.6 km). The previous functional plans (2004) considered a Multi-Lane designation that required numerous access closures; however, stricter access control is required for an expressway to achieve desirable safety and operational conditions between and at all accesses.		Consult with Alberta Transportation regarding the desired spacing allowable between the proposed intersections at South Access (Southbow) and Rolling Range Drive from James Walker Trail/Fireside Gate (assuming James Walker Trail/Fireside Gate remains at its current location).	With the intention of maintaining an urban environment, interchanges are not anticipated along this corridor. We have consulted with A.T. are comfortable with the proposed intersection spacing.	Resolved to the satisfaction of all parties.
2	Sheet 1 of 5	Farm accesses noted near Station 0+160.00 (both sides) and Station 0+650.00. Will these accesses continue to be permitted in the context of their likely use by slow moving farm vehicles and higher traffic volumes on Highway 22 in the future, or are these proposed to be closed, as per the 2004 study? Expressways require strict access control to maintain the intended safety and operational integrity.		Confirm that accesses are to be closed. Investigate opportunities to provide an alternative access via the local road network. If these are to remain on a temporary basis as part of the twinning, consider providing advance warning to drivers on Highway 22.	All existing minor road accesses will be closed, and traffic is recommended to be diverted to secondary roads.	Resolved to the satisfaction of all parties.
3	Sheet 1 of 5	There is no information provided relating to the transition from the six-lane cross-section (south end) to an assumed two-lane cross-section further to the south. Likewise, there is no information on the transition from an urban cross-section to a rural cross-section. These transition areas are a critical component to ensuring a safe road environment in gateways between rural and urban areas.		Provide details on the transition from the six-lane urban cross-section to the two-lane rural cross-section further to the south. Similar details should also be provided for the north transition between the proposed cross-section and the existing or approved functional plans (from 2004), which do not utilize the same cross-section.	In 2014 ISL completed a functional study that proposed a 6 lane cross-section that will connect to WATT's proposed design at the southern Cochrane border. Since the timing of construction is unknown and the transition may not be required, we have not included the details of this transition at the south end of the corridor. This can be reviewed/designed at the next stage of the design process.	Addressing this detail as part of the next stage is acceptable.
4	Sheet 1 of 5	The horizontal plan view of Highway 22 shows abrupt changes (kinks) in the alignment at a number of locations (pictured here and elsewhere). No information regarding the curve radius or other curve attributes is indicated anywhere within the entire drawing package. Provision of horizontal curve features will confirm whether the design requirements have been achieved to the satisfaction of the road authority and others.		Provide horizontal alignment information (i.e. horizontal curve radius) for all curves to ensure proper geometric design requirements are adopted.	Noted - horizontal alignment and curve radius have been included in the revised report.	Resolved to the satisfaction of all parties.

Issue #	Reference	Safety Issue	Photo	Suggested Action	Design Team Response	Resolution
5	Sheet 1 of 5	Turn lane arrows are not indicated on the functional plans for the South Access intersection depicting individual and/or shared lane movements. According to the Highway 22 Functional Study Technical Memo #2: Options Development (Figure 2), traffic volumes in 2060 are projected to be roughly 500 - 700 in the PM peak hour along the South Access, for which a two-lane cross-section would be fully adequate (with turn lanes). In addition, dual southbound left turn lanes are indicated despite modest traffic volumes. Over building the intersection will encourage excessive speeds and result in an unfriendly pedestrian/cyclist environment.	<p>South Access</p> <p>PER HOUR VEHICLE TURNING MOVEMENTS</p>	Confirm lane configuration on each approach within the drawing package. Revisit the need for a dual southbound left and multiple lanes on the South Access approaches to intersection (Synchro analysis).	Although the southbound left turn volume at the South Access is not high (<200 vph) and does not typically warrant a dual left turn lane; three lanes are anticipated for the northbound through traffic. The resulting protected EB and WB left turn must be protected, and adding a dual left turn lane at this location improves overall intersection performance.	Response noted.
6	Sheet 1 of 5	The staging of the intersection improvements has not been specified. It is assumed that a staged approach to improvement implementation would be likely, given an almost 40 year project horizon. Will the South Access intersection initially be a Stop controlled intersection? If so, adequate intersection sight distance for a vehicle turning from the east and west accesses onto Highway 22 should be confirmed due to the combination of vertical and horizontal curves to the north.		Confirm staging of intersection. If it is to be stop controlled initially, confirm the adequacy of intersection sight distance for a vehicle turning from the east and west accesses onto Highway 22.	The South Access is not anticipated to be a stop controlled intersection due to decreased LOS in the interim 2040 horizon, but is anticipated to be constructed as a signalized intersection following the geometry in Figure 22 in the report.	Response noted.
7	Sheet 1 of 5	No pedestrian facilities are shown on the east and west approaches to the South Access intersection and no crosswalks are shown at the intersection itself. Confirm the intention to eventually provide pedestrian/ cyclist facilities on the east and west approaches to and at the intersection itself, that would establish a consistent approach with the facilities provided at the other study intersections.		Confirm need for pedestrian facilities at this intersection.	All designs have been revised to include pedestrian facilities.	Resolved to the satisfaction of all parties.
8	Sheet 1 of 5	The South Access intersection has left turn channelization on the north, west and south approaches, with a dual left turn lane on the north and (presumably) east approaches. Unfamiliar drivers may find this confusing when making a left turn and may inadvertently drive on the wrong side of the median. Refer to previous comments regarding lane configuration on the South Access approaches.		Skip lines should be provided to give additional guidance to left turning motorists.	Noted - these have been included in the updated report.	Resolved to the satisfaction of all parties.
9	Sheet 1 of 5	There is no indication relating to the measures that will be taken to safely transition motorists from the 100 km/h speed zone to 70 km/h speed zone prior to arriving at the South Access intersection.		Provide details on the speed transition (100 km/h to 70 km/h speed).	A detailed signage plan is considered outside of the scope for this functional study. This can be completed as part of the next stage of the design process (detailed design).	Addressing this detail as part of the next stage is acceptable.
10	Sheet 1 of 5	Based on the proposed plans, the South Access intersection will have the first traffic signal entering the Town of Cochrane from the south. Presently, advanced warning flashers are provided at the James Walker Trail/Fireside Gate intersection (the first set of signals currently). The need to provide advanced warning flashers at the South Access should be considered as part of signalization. The effectiveness of this control measure should be considered in relation to the intersection constraints.		Investigate the need for advance warning flashers approaching South Access intersection.	Section 5.5 of the report talks about Advanced Warning Flashers (AWF) for the south access. Again, this is something that can be investigated in more depth at the detailed design stage.	Addressing this detail as part of the next stage is acceptable.

Issue #	Reference	Safety Issue	Photo	Suggested Action	Design Team Response	Resolution
11	Sheet 2 of 5	<p>Turn lane arrows are not indicated on the functional plans for the James Walker Trail/Fireside Gate intersection depicting individual and/or shared lane movements. With reference to the reconfigured intersection according to the Highway 22 Functional Study Technical Memo #2: Options Development (Figure 2), traffic volumes in 2060 are projected to be roughly 700 in the PM peak hour on the west leg and roughly 1300 on the east leg, indicating the need for a four-lane cross-section on the east leg but on the west leg a two-lane cross-section (with turn lanes) would be fully adequate. 'Over building' the east leg and the west leg (to a six-lane cross-section) will encourage excessive speeds and result in an unfriendly pedestrian/cyclist environment. The latest collision data available for this intersection indicates there may be safety performance issues that exist today, which could be exacerbated by increasing the cross-section width on each approach.</p>		<p>Confirm the lane configuration on each approach. Revisit the need for numerous lanes on the approaches to the intersection based on Synchro analysis and a review of available collision data, in an attempt to make this more user friendly/inviting for active mode use while seeking to improve the current safety performance.</p>	<p>Analysis and proposed geometry follows the current intersection buildout, which is not expected to be reduced in future horizons. Dual left turn lanes have been protected for in the current design for eastbound traffic. The diagram for James Walker Tr / Hwy 22 is only for illustrating traffic volumes movements. The proposed intersection geometry has been shown in Figure 24.</p>	<p>Response noted.</p>
12	Sheet 2 of 5	<p>The reconfigured intersection (Fireside Gate/James Walker Trail) has left turn channelization on the north and south approaches, with dual left turn lanes on the north, east and west approach (presumably). Unfamiliar (eastbound/westbound) drivers may find this confusing when making a left turn and may inadvertently drive on the wrong side of the median. This is similar to the concerns raised for the South Access intersection (refer to comments regarding lane configuration on the east/west approaches).</p>		<p>Skip lines should be provided to give additional guidance to left turning motorists.</p>	<p>Noted - these have been included in the updated report.</p>	<p>Resolved to the satisfaction of all parties.</p>
13	Sheet 2 of 5	<p>Pedestrian facilities are provided on the west approach (Fireside Gate) on both sides and the east approach (James Walker Trail) on the north side only. The introduction of the right turn channel on the north approach will likely increase speeds for vehicles while making right turns and increase the severity of any pedestrian-vehicle collision. No crosswalk is indicated between the northwest corner and southbound right turn channel. In addition, if pedestrian facilities are introduced in the future on the south side of James Walker Trail, the same issue will occur with the right turn channel on the south approach.</p>		<p>Investigate the need for right turn channels in context of 2060 traffic volumes (see earlier comment regarding traffic projections). If right turn channelization is required, consider smart right turn channels that would reduce turning speeds along with a desire to encourage yielding to pedestrians and other road users.</p>	<p>The channelized right-turn lanes are recommended from a traffic operational perspective at this intersection. We agree that smart right-turns should be investigated at the next stage of the design process. There is enough ROW to allow for smart right-turns on all corners of the intersection.</p>	<p>Addressing this detail as part of the next stage is acceptable.</p>

Issue #	Reference	Safety Issue	Photo	Suggested Action	Design Team Response	Resolution
14	Sheet 2/3 of 5	The proposed design shows impacts to existing ponds that may need to be relocated outside the clear zone and highway right-of-way. Refer also to ponds at Station 1+750 and 1+900.		Relocate ponds or provide an appropriate barrier system to protect traffic from submergence hazards based on the ability to relocate within or outside the highway right-of-way.	Noted - any barrier protection from stormwater ponds can be reviewed as part of the next phase of the design process (detailed design).	Addressing this detail as part of the next stage is acceptable.
15	Sheet 3 of 5	It is unclear from the drawings if access at Station 1+850 will remain closed. Confirm the intent to retain this access for emergency vehicles only. Consider whether a break in the median is required to allow southbound emergency vehicle access or whether some other access provision is required. Access for southbound emergency vehicles must consider the potential for illegal U-turns and other misuse of the median.		Confirm closure of access at Station 1+850 to vehicles. Investigate the need for a break in the median to provide access for emergency vehicles.	This access will be closed permanently, with access and emergency egress provided via the intersection at Rolling Range Drive.	Resolved to the satisfaction of all parties.
16	Sheet 4 of 5	With the widening of Highway 22, the River Heights Lane cul-de-sac terminates directly adjacent to Highway 22 (within the right shoulder). Concrete barricades have been placed to discourage access onto Highway 22. Consideration needs to be given to address the proximity of the cul-de-sac and avoid illegal access through the ditch.		Relocate the cul-de-sac outside the future Highway 22 right-of-way.	This cul-de-sac will be removed / relocated as part of the intersection design with Rolling Range Drive.	Resolved to the satisfaction of all parties.
17	Sheet 4 of 5	The location of the Rolling Range Drive intersection is on a proposed 4% grade, which may create operational issues for heavy vehicles during inclement weather (approx. location indicated on the proposed profile for Highway 22). The current collision data indicates some historical crashes have occurred; however, traffic volumes are very low on Rolling Range Drive (relatively speaking). Increased turning movements may result in an increase in crashes due to the vertical profile and presence of a crest curve to the south. The staging of traffic control (i.e. maintaining stop control) for many years into the future prior to signalization may result in vehicles using alternative access options due to concerns finding an acceptable gap in the Highway 22 traffic flow.		Should there be a possibility to consider relocating the intersection to meet expressway access spacing, the vertical grade to the north is flatter and may be a more appropriate location to manage vehicle operations and address geometric design issues.	The grade was changed to 3.3% from the original 4% slope. The grade at the curve was also reduced to 1.69%. Updated design drawings are included in the revised report.	Resolved to the satisfaction of all parties.

Issue #	Reference	Safety Issue	Photo	Suggested Action	Design Team Response	Resolution
18	Sheet 4 of 5	The east and west legs (Rolling Range Drive) are skewed in relationship to Highway 22 legs (approx. 14 degrees from perpendicular). While this is within AT and TAC guidelines, skewed intersections tend to have higher crash frequencies, and result in greater swept paths for commercial vehicles, and longer crossing distances for pedestrians.		Investigate feasibility of adjusting alignment of east and west legs to 90 degrees.	Noted - The east leg of this intersection has been included assuming a future connection to the existing development. As development progresses in future horizons, the alignment of this leg may be reviewed to align with the greater transportation network.	Addressing this detail as part of the next stage is acceptable.
19	Sheet 4 of 5	Turn lane arrows are not indicated on the functional plans for the Rolling Range Drive intersection depicting individual and/or shared lane movements. According to the Highway 22 Functional Study Technical Memo #2: Options Development (Figure 2), traffic volumes in 2060 are projected to be roughly 600 in the PM peak hour on the west leg and roughly 200 on the east leg, indicating that both approaches would only require a two-lane cross-section with turn lanes. As noted elsewhere, 'Over building' the east leg and the west leg will encourage excessive speeds. The introduction of the right turn channel on the north and south approach will increase vehicle speeds while making right turns and will increase the severity of any pedestrian-vehicle collision. There are negligible northbound right turn movements that would suggest channelization is likely not required.		Confirm the appropriate lane configuration. Provide justification for multiple lanes indicated on the approaches, whether pedestrian facilities are planned on the east and west legs, and if so, whether the right turn channel islands are required (particularly for the northbound approach).	Noted - due to the high north / south through volumes along Hwy 22, dual left turn lanes were provided for eastbound left turning traffic at the intersection of Rolling Range Drive to improve the overall LOS for the minor road movements. Analysis indicates that several movements will still operate at a LOS E during the AM and PM peak hours as a standard intersection design, with details of alternative left turn configurations provided in the updated report.  Channelized right turns were included to align with standards from Alberta Transportation.	Response noted.
20	Sheet 4 of 5	No pedestrian facilities are shown on the east and west approaches to the intersection. No crosswalks are shown between the southeast corner and right turn channel island on the south approach, and between the northwest corner and right turn channel island on the north approach.		If right turn channel islands are justified based on Synchro analysis/swept path analysis, provide crosswalks in right turn channel islands along with Yield to Pedestrian signs. Also consider smart right turn channels that would reduce turning speeds.	Noted - crosswalks on the right-turn channelized lanes have been included in the updated report.	Resolved to the satisfaction of all parties.

Issue #	Reference	Safety Issue	Photo	Suggested Action	Design Team Response	Resolution
21	Sheet 5 of 5	<p>A downhill grade of 8.3% is indicated between Station 3+380 and Station 3+740 before beginning to level off. Guidelines in the AT and TAC <i>geometric design guides</i> indicate a maximum gradient of 6.0% is appropriate. This is also the maximum grade shown in the <i>Highway 22 Functional Study - Technical Memo #2: Options Development in Table 5</i>. The length of grade increases downhill speeds and the risk of loss of control collisions (particularly in slippery conditions). The collision data for segments on either side of Rolling Range Drive suggest there may be safety performance issues associated with the steeper grades for the Bow River Valley.</p>		<p>Investigate alignment options that would reduce the downhill grade as per the 2004 <i>Functional Plan Study (5.7% downhill grade indicated)</i> to within appropriate standards.</p> 	<p>Noted - the profile of the roadway has been adjusted to match the previous study at 5.7%.</p>	<p>Resolved to the satisfaction of all parties.</p>
22	Sheet 5 of 5	<p>The intersection of George Fox Trail/Camp Jubilee access/highway 22 is currently located at the base of the downhill grade (just off the edge of Sheet 5). With the alignment of Highway 22 being shifted to the east, as per the 2004 study plan and proposed functional upgrades, access to George Fox Trail will be as per the 2004 study; however, the Camp Jubilee access design needs to be confirmed. Provisions to ensure motorists anticipate this intersection (advance warning) should be indicated or alternative access options reviewed to preserve expressway requirements.</p>		<p>Provide clarification regarding how the proposed design addresses access to the Camp Jubilee development (at grade or grade separated via the Bow River Bridge crossing).</p>	<p>The closure of this roadway and the associated access plan to the various impacted parcels has been addressed as part of the previous functional study. No changes to this plan are proposed as part of this study.</p>	<p>Response noted.</p>