MORRISON HERSHFIELD

Local Traffic Study Report
Southwestern Ontario Community Study

For Nuclear Waste Management Organization
NWMO P.O. No.: 2001020

MH Project No.: 2035249.00

July 13, 2022

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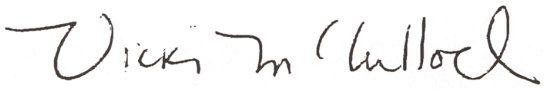

Vicki McCulloch
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Revision History

REV.	ISSUE DATE	DESCRIPTION	PREPARED BY	REVIEWED BY	APPROVED BY
0	April 8, 2022	Draft Local Traffic Study Report	Andres Baez, Morrison Hershfield	Stanley Li, Morrison Hershfield	Vicki McCulloch, DPRA
1	June 14, 2022	Revised Draft Local Traffic Study Report	Andres Baez, Morrison Hershfield	Stanley Li, Morrison Hershfield	Vicki McCulloch, DPRA
2	July 6, 2022	Final Local Traffic Study Report	Andres Baez, Morrison Hershfield	Stanley Li, Morrison Hershfield	Vicki McCulloch, DPRA
3	July 13, 2022	Revised Final Local Traffic Study Report	Andres Baez, Morrison Hershfield Deven Bhatla, Morrison Hershfield	Stanley Li, Morrison Hershfield	Vicki McCulloch, DPRA

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1 INTRODUCTION

1.1 Background and Context

Since 2012, the Municipality of South Bruce (MSB) has been involved in a process of learning about the Nuclear Waste Management Organization's (NWMO) Adaptive Phased Management Project ('the Project') for the long-term management of Canada's used nuclear fuel. The two remaining siting areas in the process are the South Bruce Area and the Ignace Area. The NWMO plans to complete all preliminary assessment work and to select one community/area to host the Project by 2023. Preliminary studies suggest that the Project can be implemented safely in the South Bruce Area for a repository that will contain, and isolate used nuclear fuel from people and the environment for the long timeframes required.

Further detailed studies are required to fully assess the potential impacts of the Project in the community and regionally. Building on previous work, engagement completed to-date, and the MSB's 36 Guiding Principles, the NWMO and the MSB are working together to prepare a suite of community studies which will be shared broadly with the community. The list of socio-economic community studies is included in **Appendix A**. These studies were undertaken by the NWMO or MSB, with some being joint efforts. The MSB has retained consultants (the GHD team) to develop a number of studies and to peer review others developed by the NWMO and their consultants (the DPRA Canada Inc. (DPRA) team). The information acquired through these studies is expected to help South Bruce leadership and residents make informed decisions about whether the Project is a good fit for their community, and if they are willing to consider hosting it and under what circumstances and terms.

This *Local Traffic Study* is one of the community studies being prepared. This study is organized as follows:

- Purpose and Scope (**Section 1.3**)
- Methodology (**Section 2**)
- Existing Conditions (**Section 3**)
- Relevant Adaptive Phased Management Project Characteristics (**Section o**)
- Preliminary Analysis/Effects Assessment (**Section 5**)
- Options Assessment (**Section 6**)
- Summary (**Section 7**)
- References (**Section 8**)

Note to Reader:

This and other community studies are preliminary and strategic in nature, all intended to identify possible consequences (e.g., to Local Traffic) in the South Bruce Area based on our current level of understanding of the Project. Using information known at this point in time, these community studies will describe a range of possible consequences that are the subject of specific and separate studies. For each possible consequence, potential options are offered to leverage opportunities and/or mitigate possible negative consequences/effects.

It is important to note that these community studies (developed collaboratively by the NWMO and the MSB) being investigated at this time are not the formal or final baseline or effects studies that will be part of the Impact Assessment (IA). Those studies will be completed at a later date if the Project is located in the area. However, these current studies will inform the effects studies that will be initiated at a later date.

These community studies are intended to support current dialogue between the MSB and the NWMO regarding a potential hosting agreement by:

Exploring in more detail the questions, aspirations and topics of interest expressed by the community through the Guiding Principles approved by the MSB following the project visioning process completed in the community;

a) Assisting the NWMO and the MSB in developing a deeper understanding of the community aspirations/values and to work with the MSB in identifying possible programs and commitments which ensure that the Project will be implemented in a manner that fosters the well-being of the community and area;

b) Advancing learning and understanding on topics of interest to the neighboring areas; and

c) Providing the community with information it has requested to help them make an informed decision in 2023.

The NWMO is committed to collaboratively working with the communities to ensure questions, concerns and aspirations are captured and addressed through continuous engagement and dialogue.

The NWMO will independently engage with the Saugeen Ojibway Nation to understand how they wish to evaluate the potential negative effects and benefits that the Project may bring to their communities.

1.2 Land Acknowledgement

It is acknowledged that the lands and communities discussed in this report are situated on the Traditional Territory of the Anishinabek Nation: The People of the Three Fires known as Ojibwe, Odawa and Pottawatomie Nations. The Chippewas of Saugeen and the Chippewas of Neyaashiinigmiing (Nawash), now known as the Saugeen Ojibway Nation, are the traditional keepers of this land and water. It is also recognized that the ancestors of the Historic Saugeen Métis and Georgian Bay Métis communities shared this land and these waters.

1.3 Purpose and Scope

Objectives for this study are described in the *Southwestern Ontario Local Traffic Study Work Plan* (DPRA, October 2021). The overall objective of the *Local Traffic Study* is to assess the local traffic effects associated with the Project in the MSB and neighboring communities and identify any potential changes required to the Municipal and County road network.

The specific objectives of the *Local Traffic Study* are to:

1. Describe the traffic load on the existing road system.
2. Describe the traffic effects associated with the Project.
3. Identify options for potential road improvements and other mitigation measures.
4. Identify options for a proposed monitoring program.

The *Local Traffic Study* is relevant to MSB Guiding Principles (2020) #2, #3, #7, #30, #31 and #36:

- #2: “The NWMO must demonstrate to the satisfaction of the Municipality that sufficient measures will be in place to ensure the natural environment will be protected, including the community’s precious waters, land and air, throughout the Project’s lifespan of construction, operation and into the distant future.”
- #3: “The NWMO must demonstrate to the satisfaction of the Municipality that used nuclear fuel can be safely and securely transported to the repository site.”
- #7: “The NWMO must commit to preparing construction management and operation plans that detail the measures the NWMO will implement to mitigate the impacts of construction and operation of the Project.”
- #30: “The NWMO will prepare a review of the existing and projected capacity of South Bruce’s road network and will commit to providing appropriate funding for any required upgrades to the road network.”
- #31: “The NWMO will enter into a road use agreement with the Municipality that identifies approved transportation routes during construction and operation of the Project and ensures proper funding for maintenance and repair of municipal roads and bridges used for the Project.”
- #36: “The NWMO must demonstrate to the satisfaction of the Municipality that the Project will benefit the broader region outside of the community of South Bruce, including local Indigenous communities.”

The *Local Traffic Study* provides information directly relevant to Principles #30 and #31 and contributes more generally to Principles #2, #3, #7 and #36.

The *Local Traffic Study* provides information that the NWMO and MSB can use to inform agreements and funding arrangements (as described by Principles #30 and #31) in the future as part of negotiations of a draft hosting agreement and/ or subsequent studies/ discussions if the South Bruce Area is ultimately selected as the Project location. For clarity, development of these types of agreements/arrangements is not part of the objectives / work plan for this study.

The NWMO is responsible for the completion of the *Local Traffic Study*. This study was undertaken as described in the work plan (DPRA, 2021) by Morrison Hershfield Limited, a sub-consultant to DPRA, the prime consultant to the NWMO.

1.3.1 Peer Review Approach

An earlier draft of the *Local Traffic Study Report* was reviewed by MSB consultants according to their Peer Review Protocol. The Peer Review Protocol provides for a collaborative approach to conducting the peer review, with peer review activity occurring throughout the execution of the study. The *Local Traffic Study* is an NWMO-led study, and the NWMO determined the spatial Study Area, the data and inputs used to establish baseline conditions, and the assessment of the forecasted effects resulting from the Project.

The peer review has been carried out on the scope and framing of the study, data inputs baseline conditions and the effects assessment. Options developed by the NWMO to address potential effects were presented to the NWMO and MSB in the draft study report.

This final *Local Traffic Study Report* reflects the comments provided by the MSB peer review consultants on the earlier draft report, and subsequent discussions.

For the *Local Traffic Study*, the peer review is led by RJ Burnside & Associates Ltd, as part of the GHD team.

1.3.2 Spatial Boundaries

The spatial boundary for the *Local Traffic Study* includes a review of roads between major population centres and the potential Project Site for worker access. The road network for review was established in consultation with NWMO and MSB peer reviewers according to their Peer Review Protocol.

Two areas have been used to frame this study:

a) Local Study Area
b) Core Study Area

The Local Study Area (see Figure 1, below) focusses on the municipalities surrounding South Bruce as well as South Bruce itself. The area has a wide variety of relationships grounded in social/cultural, economic and political relationships, both past and present. Persons residing in this area can easily commute to the potential Project Site on a daily basis.

The Core Study Area (see Figure 1, below) steps down from the Local Study Area and focuses on the municipalities of South Bruce, Huron-Kinloss, Brockton, Morris-Turnberry and North Huron. These five communities are again closely intertwined through social/cultural, economic and political relationships. All five communities have met and expressed an interest in working together to explore the Project and optimize its outcomes.

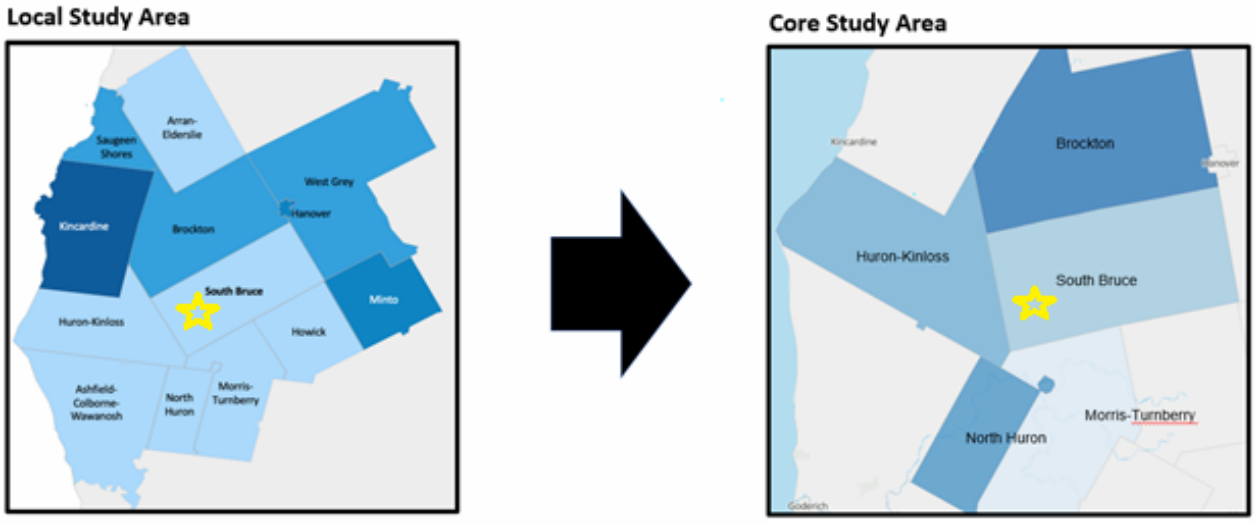


Figure 1. Traffic Study Spatial Boundaries (Local and Core Study Areas. Source: Keir, 2022a, c)

1.3.3 Temporal Boundaries

The temporal boundaries for the *Local Traffic Study* are as follows:

- Near-term (2023 to 2032) – Pre-Construction
  - Aligns with end of site preparation phase in 2023 and design and construction start 2033
- Mid-term (2033 to 2042) – Construction
  - Aligns with construction phase ending in 2042 and operations start 2043
- Long-term (2043 and beyond)
  - Aligns with operations phase (approximately 40 years; does not include monitoring and decommissioning)

1.3.4 Planning Assumptions – Workforce, Population, Housing and Employment

The community studies use the following planning assumptions for Project workforce by phase, and projections for population, housing and employment, for the five local municipalities:

- Municipality of South Bruce (including Teeswater, Mildmay and Formosa)
- Township of Huron-Kinloss (including Ripley and Lucknow)
- Municipality of Brockton (including Walkerton)
- Municipality of Morris-Turnberry
- Township of North Huron (including Wingham)

These five municipalities comprise the 'Core Study Area' used in the *Labour Baseline*, *Workforce Development*, *Housing Needs and Demand Analysis*, and *Regional Economic Development* studies.

As discussed further in **Section 4.2** of this report, traffic demand forecasting assumptions including definition of workforce categories (NWMO staff, surface and underground trades, construction labour, etc.) as well as Core versus Local Study area origin percentages for trip generation, distribution and assignment are in accordance with NWMO's (November 24, 2021), *Community Studies Planning Assumptions - South Bruce Traffic*' report.

2 Methodology

2.1 General Approach

The NWMO and the MSB drafted Statements of Work for each community study in response to the MSB's 36 Guiding Principles. As previously mentioned, the community studies are being undertaken by the NWMO or the MSB, with some being joint efforts.

The socio-economic community studies were categorized into three themes: Economics, Social Cultural, and Infrastructure and Aggregate. The list of socio-economic studies is provided in **Appendix A**.

The following methodology pertains to the 13 community studies solely or jointly led by the NWMO.

Based on the Statements of Work, work plans for each community study were developed. The work plans:

- Outlined the peer review approach with the MSB
- Identified linkages to other studies
- Identified the spatial and temporal boundaries
- Identified key assumptions that will dictate the completion of the study
- Described the tasks associated with the study and schedule for each task
- Identified key information sources and data collection methods

Draft work plans were reviewed by the MSB and its peer review team. Formal peer review team comments on the draft community study work plans were received in September 2021. The peer review of the draft *Local Traffic Study* work plan was undertaken by R.J. Burnside Associates Ltd. as part of the GHD team.

DPRA provided Comment Disposition Tables and revised work plans to respond to the peer review comments in October 2021. In a memo dated November 3, 2021, the GHD team provided acknowledgement of comments that were addressed in the revised community study work plans or flagged to be addressed in future work such as the community study reports.

Several consultant consortium meetings and "check-in" meetings with the MSB and its peer review team were held during the development of each study.

In addition, meetings with neighboring municipalities (i.e., the Township of Huron-Kinloss, Municipality of Brockton, Township of North Huron and Municipality of Morris-Turnberry[1]) were held to discuss the progress and scope of the community studies. Morrison Hershfield attended a meeting with the neighbouring municipalities on November 18, 2021 to provide an overview of the *Road Conditions* and *Local Traffic* studies, including field work, the preliminary road network and information sources.

Section 2.2.1 and **Appendix B** includes details of knowledge holder interviews / meetings that relate to the *Local Traffic Study*.

[1] Morris-Turnberry began attending these meetings in February 2022.

This report is intended to provide a high-level assessment of the traffic effects of the project on the municipal and County road network, establishing existing and projected baseline conditions, forecasting high-level anticipated traffic volumes and traffic composition, identifying potential impacts and screening capacity, operational and safety issues, as well as developing options for potential improvements and other mitigation measures while identifying future study needs. Refer to **Section 6** (Option Assessment).

2.2 Data Collection / Information Sources

Data and key information for this study was collected from primary sources such as knowledge holder interviews, modelling and field work, and secondary sources such as Project information from the NWMO and data/documents from local and regional organizations. The sections below describe how data and information was collected from these sources.

Key sources of information include available municipal and provincial traffic studies relevant to the area, publicly available traffic data from provincial and municipal online data repositories, as well as geographic information systems (GIS) databases publicly available from provincial and municipal sources.

In addition to data and information collected specifically for this study, some of the input was obtained from the results of the *Housing Needs & Demand Analysis Study Report* (Keir Corp., 2022a), *Aggregate Resources Study Report* (Keir Corp., 2022b), *Workforce Development Study Report* (Keir Corp., 2022c) and *Road Conditions Study Report* Morrison Hershfield (2022). Data and information were collected for these studies using the methodology described in those study reports.

As noted above in Section 2.1, Morrison Hershfield attended a meeting with the neighbouring municipalities on November 18, 2021 to provide an overview of the *Road Conditions* and *Local Traffic* studies, including field work, the preliminary road network and information sources.

Table 1: Data Collection Methods and Sources

DATA	COLLECTION METHODS	PRIMARY	SECONDARY
Existing Study Area Road Network	GIS Datasets Field Work Google Maps Google Street View	Field Work	Review of Ontario Ministry of the Environment, Conservation and Parks (MECP) Data NWMO Reports Knowledge holder interviews
Location of Pits and Quarries Ontario	GIS Datasets Google Maps Google Street View	n/a	Ontario Ministry of Natural Resources and Forestry (interactive pits and quarries map)
Location of Mennonite Communities and Schools	Knowledge Holder Interviews Municipal Mapping Data Google Street View Field Work (Nov 2021)	Huron-Kinloss Mennonite community interview Road safety field observations Traffic data collection of Mennonite vehicles	Municipal mapping data Google Street view Huron-Kinloss Mennonite community list of schools and churches Municipality of South Bruce map of Mennonite schools and churches in eastern Huron-Kinloss Municipality of South Bruce map of Mennonite schools and churches

DATA	COLLECTION METHODS	PRIMARY	SECONDARY
Traffic Data	GIS Datasets Field Work Google Maps Google Street View	Manual and automatic intersection turning movement counts (Nov 2021)	Ontario Ministry of Transportation (MTO) traffic volume data for various segments of the provincial highway network (https://www.library.mto.gov.on.ca/) MTO icorridor Transportation Data https://icorridor-mto-on-ca.hub.arcgis.com/ Brockton Road Counts 2020 Township of Huron-Kinloss 2021 Road Counts

Of note, no previous traffic count data was available from the MSB, other than segmented AADT data from the Bruce County Master Transportation Plan (MTP) report available online.

2.2.1 Knowledge Holder Interviews

Local knowledge and lived experience related to specific road network configuration and local travel patterns and vulnerable road users were central considerations to the *Local Traffic Study*. The selection of knowledge holders was undertaken through an iterative review process between the NWMO and the MSB and its peer review team. Interviews were scheduled by the NWMO and a representative from the NWMO, the NWMO's consultants and the MSB peer review team were present. The knowledge holders were provided with an Interview Guide prior to the interview to provide background information on the Project and a general framework for the interview. During the interview, the NWMO's consultants and MSB's peer review team also asked specific questions relevant to applicable community studies. The NWMO representative took notes during the interviews and distributed the notes and any documents received from the knowledge holder to the consultants/peer review team members. Information received from these interviews has been used in the development of the study report.

Knowledge holder interviews were undertaken with the following organizations:

- The Municipality of South Bruce
- The Township of Huron-Kinloss
- Bruce County
- Huron County
- Teeswater Concrete
- Bruce Power

The MTO and the Municipality of Brockton were also identified as knowledge holders but opted to participate in the interview process in written form.

The initial set of knowledge holders were identified by the NWMO and MSB. Additional knowledge holders were identified based on input from the NWMO's consultants, and the peer review team based on the jurisdiction of the roads subject to review as part of this study.

The following key items or themes regarding transportation were extracted from knowledge holder interview notes (it is noted that the following reflect the information provided by knowledge holders, and are not the views of the study authors, the NWMO or other parties):

- *Transportation of used nuclear fuel is heavily regulated by the Canadian Nuclear Safety Commission and Transport Canada[2]. Used fuel is currently transported in Canada and has a proven safe track record. Every transportation package is monitored and tracked for movement. The transportation packages for transporting used fuel in Canada are very robust and must pass stringent safety tests. The equipment is highly maintained, and the staff are professional drivers and well trained. This type of transportation may happen on local roads. The security perimeter for the project will not likely impact road travel.*

- *This Transportation Study will include regional areas like Huron-Kinloss. When the study is complete, it will be shared with all communities in the area. In relation to the studies, Huron Kinloss Mennonite Community needs to be included in the scope of work. NWMO is committed to working with the community in the study to gain feedback. Bruce County needs to consider the NWMO Project in the long term.*

- *Another concern is about how the workers will travel to the potential Project Site and what roads they will use. Workers could potentially come from a wide-ranging area, and need to better understand worker traffic and the potential travel patterns and areas of concern. NWMO can help with improving driver awareness and safety right now and in the future for driving in the community. Proposing strategies to deflect worker traffic from using Mennonite community roads should be considered.*

- *The MTO has an interest in understanding the nature of the traffic that will be generated by the Project (traffic volumes/movements, weight, etc.) and its potential impacts on the provincial highway infrastructure. Depending on the nature of traffic and the impacts generated by the Project, the MTO may have future concerns.*

- *If the Project is located in the South Bruce Area, Traffic Engineering at the MTO will be responsible for reviewing the Local Traffic Effects Study. The MTO may require a Traffic Impact Study (TIS) to assess the traffic impacts on the provincial highway network as well as current and future traffic needs identified as a result of the Project. Compliance with the pertinent MTO guidelines and discussions with appropriate Ministry staff in the preliminary stages of the development planning process will provide for a more consistent and efficient review process.*

- *If the Project is located in the South Bruce Area, potential traffic impacts on the highway network will be dependent on the scope and location of the Project. These impacts would be identified and analyzed by the proponent as part of the Local Traffic Effects Study and/or Traffic Impact Study and subsequently brought forward to the MTO for comment. Negative effects may include increased traffic loading (including oversized/heavy vehicles) on the existing highway network associated with the Project. This could accelerate the deterioration of pavement and impact the level of service for the travelling public. If future strengthening of the pavement structure is deemed necessary and/or additional road maintenance is required, it will generate additional costs for MTO.*

- *Negative effects can be mitigated by having a good understanding of the future increase in the traffic demand associated with the Project (i.e., the number of trips/loads, type/classification of the vehicles, traffic volumes, highway capacity, traffic delays, turning movements, etc.) and improving the highway network as required prior to Project*

[2] *During interviews, a knowledge holder suggested that the Ministry of Transportation may also have a role in the regulation of the transport of used nuclear fuel.*

construction and continuous monitoring of the network as noted in the Road Conditions Effects Study document.

- *For any proposed improvements to the provincial highway network, when feasible, consideration should be given to incorporating 'green' technologies that provide environmental benefits over traditional construction techniques. Pavement sustainability is MTO's mandate. Pavement design and rehabilitation strategies need to be evaluated with both the economic component (life cycle cost analysis) and the environmental component.*

- *There are several sections of the provincial highways that will be maintained and/or rehabilitated over the next few years. The future work may also include highway operational and safety improvements such as intersection improvements, lane/embankment widening, etc. To assist the Project with construction or maintenance forecasts, it is recommended that NWMO clearly identifies the limits of the Project impact on MTO's right-of-way. This will aid in optimizing the pavement design strategy for the impacted roads.*

- *MTO's Highway Corridor Management Office has a role in municipal planning. The MTO is a commenting agency for land use planning applications under the Planning Act, providing recommendations to the planning approval authority. Planning a construction project on or near a provincial highway may need a permit from the MTO.*

Further details on the knowledge holder interviews are provided in **Appendix B**.

2.2.2 Modelling

This study focuses on high- and medium-level applications of the Highway Capacity Manual (HCM) 2016 Major Update for planning and preliminary engineering for the assessment of regional areawide networks. Consequently, planning and preliminary engineering analyses apply included scenario planning, sketch planning, preliminary facility screening and system performance monitoring.

A combination of measured (field and available traffic data) and default inputs were applied for mid- or medium-level analysis for capacity screening issues at roadway facility, segment, and/or intersection level of detailed.

In addition, intersection capacity utilization (ICU) as per the HCM using Synchro modelling software was performed to evaluate macroscopic intersection capacity utilization level of service (ICU-LOS) at key intersections in the Study Area. On the other hand, the Level of Service (LOS) for roadways links is a qualitative measure used to relate the quality of motor vehicle traffic service on roadways. LOS for roadway links can be assessed using the parameters of traffic speed, flow rate and density.

Annual Average Daily Traffic (AADT) and Summer Average Daily Traffic (SADT) estimates are used throughout this document. AADT is the standard measurement for vehicle traffic load on a section of road and the basis for most decisions regarding transport planning or the environmental hazards of pollution related to road transport. AADT is a calculated daily estimation of the annual average number of vehicles passing a location or road segment. Similarly, Summer Average Daily Traffic (SADT) is typically estimated for the summer peak months, i.e., July and August. SADT tends to be higher than AADT.

Of note, the ICU method is a high-level review of potential congestion that uses a grading system, known as LOS, to rank the intersection by the amount of reserved capacity or capacity

deficit. The ICU LOS is not a predictor of intersection delays, but rather an indicator of how often an intersection may experience congestion.

2.2.3 Field Work

Supplementary field traffic data collection and road safety observations were also conducted in November 2021. A traffic data collection plan and road safety observation were established in consultation with NWMO and MSB peer reviewers according to their Peer Review Protocol.

The traffic data collection consisted of:

- Turning Movement & Classification Counts (TMC) at 8 locations previously identified and agreed upon with NWMO and peer reviewers (See **Appendix C** for map of locations)
- The data collected included:
    - Typical weekday during the 7:00-9:00 AM & 3:30-5:30 PM peak periods (2 hours each period).
    - 15-minute intervals and classified according to cars, trucks, buses, bicycles, pedestrians, and horse buggies.

Detailed discussion of observed traffic data trends and operation is included in **Section 3.2** below. **Appendix C** includes traffic data collection summary reports for each mode surveyed.

In addition, further discussion on Safety Field Observations is included in **Section 3.3** and **Appendix D**.

2.2.4 Other Key Information and Data Sources

Other key information and data sources for this study included:

- The NWMO's updated Project information:
    - *APM 2021 DGR Lifecycle Cost Estimate Update Cost Summary Report* (Heimlich, 2021)
    - *Community Studies Planning Assumptions – South Bruce Traffic* (Confidential) (November 2021).
    - *Community Studies Planning Assumptions* (Confidential) (NWMO, October 2021)
    - *Deep Geological Repository Conceptual Design Report Crystalline/Sedimentary Rock* (Naserifard et al., 2021)
    - *Deep Geological Repository Transportation System Conceptual Design Report Crystalline/Sedimentary Rock* (AECOM, 2021)
- Data/documents from organizations within the Local/Regional Study Areas (various levels of government, agencies, etc.)

2.3 Assessment

Considerations reflecting best practice in transportation planning in Canada and the US have been incorporated. As a general guideline for approach and methodology of this study, industry-recognized transportation planning guidelines in the preparation of similar studies have been adopted as set forth by the Canadian Institute of Transportation Engineers (CITE) and the Transportation Association of Canada (TAC).

In addition, methods from the HCM were used to evaluate the current and forecasted operations of roadway facilities. The National Cooperative Highway Research Program (NCHRP) *Report 825 Planning and Preliminary Engineering Applications Guide to the Highway Capacity Manual* was also used as a resource. The guide applies methodologies of the *Highway Capacity Manual (HCM) 2016 Major Update* to common planning and preliminary engineering analyses (including scenario planning and system performance monitoring).

2.4 Limitations

This study was undertaken in accordance with the work plan developed in October 2021 (DPRA, 2021). The contents of this report are based upon information and data obtained through the means and methods identified above. However, it is noted that not all relevant data and information contemplated in the work plan to be reviewed and considered as part of this study was available from knowledge holders and other sources. Below is a summary of some key information points that **could not be** obtained:

- Identification of specific haul routes and access routes (aggregates and/or used nuclear fuel (UNF) transporters) to be used to access the deep geological repository (DGR) / potential Project Site
- Proposed access points to the potential Project Site
- Historical Collision Data
- Drawings or data detailing existing pavement structures

Limitations noted above, especially those related to unspecified access points and hauling routes, will need to be revisited in future studies in order to confirm traffic distribution assumptions across the road network, especially among local municipal roads ('Last Mile') near the potential Project Site.

Other *Local Traffic Study* assumptions and limitations:

- This study is not intended to be a traffic impact study (TIS) for municipal development purposes.
- Transportation characteristics and conditions for UNF transport are considered outside the scope of this study. It is understood that other NWMO studies (AECOM, 2021) are specifically catered to this matter. Hence, linkage to the topic on this report is limited to **Section 4.2.2**, for estimated number of UNF Transport Vehicles as provided by the NWMO.

To the above, UNF transport considerations were summarized by NWMO and shared with the team for information purposes only (Personal Correspondence, Received from NWMO, September, 2021). The summary information included, among other topics, UNF shipment assumptions, UFTP transportation package summary characteristics, design vehicle typology and possible combinations.

The data gaps were mitigated by broadening the Study Area road network, conducting additional site observations and by relying on field reviews and other secondary data sources such as third-party relevant studies, Google Earth and publicly-available GIS online data repositories.

As noted in **Section 2.2.3**, field work completed in support of this study included supplementary field traffic data collection and road safety observations conducted in November 2021, as well as linkages to cursory visual observation of roadways characteristics conducted by Morrison Hershfield as part of the *Road Conditions Study* (2022).

3 Existing Conditions

3.1 Study Road Network

Figure 2 illustrates the base roadway network for the study in relation to the proposed general area of the potential Project Site in South Bruce. Potential commuter and material supply routes were identified in consultation with peer reviewers, knowledge-holders interviewed, and in consideration of the following:

- Road hierarchy and connectivity to and from national, provincial and county road networks
- Provincial and county road designated truck routes
- Existing roadways configuration and classification (i.e., freeways, highways, county and municipal roads)
- Current traffic volumes and traffic composition (i.e., passenger-car, trucks, buses, RVs)
- Geographical and socio-economic context (i.e., nearby housing, urbanized areas, commercial and institutional facilities and services)
- Current traffic trends/patterns of related facilities in the area such as the Bruce Nuclear Power Plant.

It is understood that although a final location for the Project has not yet been determined, the NWMO has secured land north of Teeswater through a combination of option and purchase arrangements that allow the NWMO to conduct studies while allowing landowners to continue using the land.

The Study Area can be considered a portion of the much larger Southwestern Ontario region. The Ontario Ministry of Transportation (MTO) has recently released a high-level plan entitled *Connecting the Southwest: A Draft Transportation Plan for Southwestern Ontario (January 2020)* which includes anticipated improvements and strategies across different modes of travel (i.e., public transit, rail, highways, airports) to improve the movement of people and goods across the region. Bruce County and Grey County are located at the northern tip of the Southwestern Ontario transportation region[3].

Most roads in the Study Area are generally consistent with a two-lane rural roadway facility as per TAC, HCM and MTO two-lane highway facility definition. Typical two-lane roadway facilities include one lane for the use of traffic in each direction plus a shoulder area (service area) that may or may not be paved. Generally, two-lane roadways have no access control or partial control of access.

[3] https://files.ontario.ca/connecting-the-southwest-english.pdf

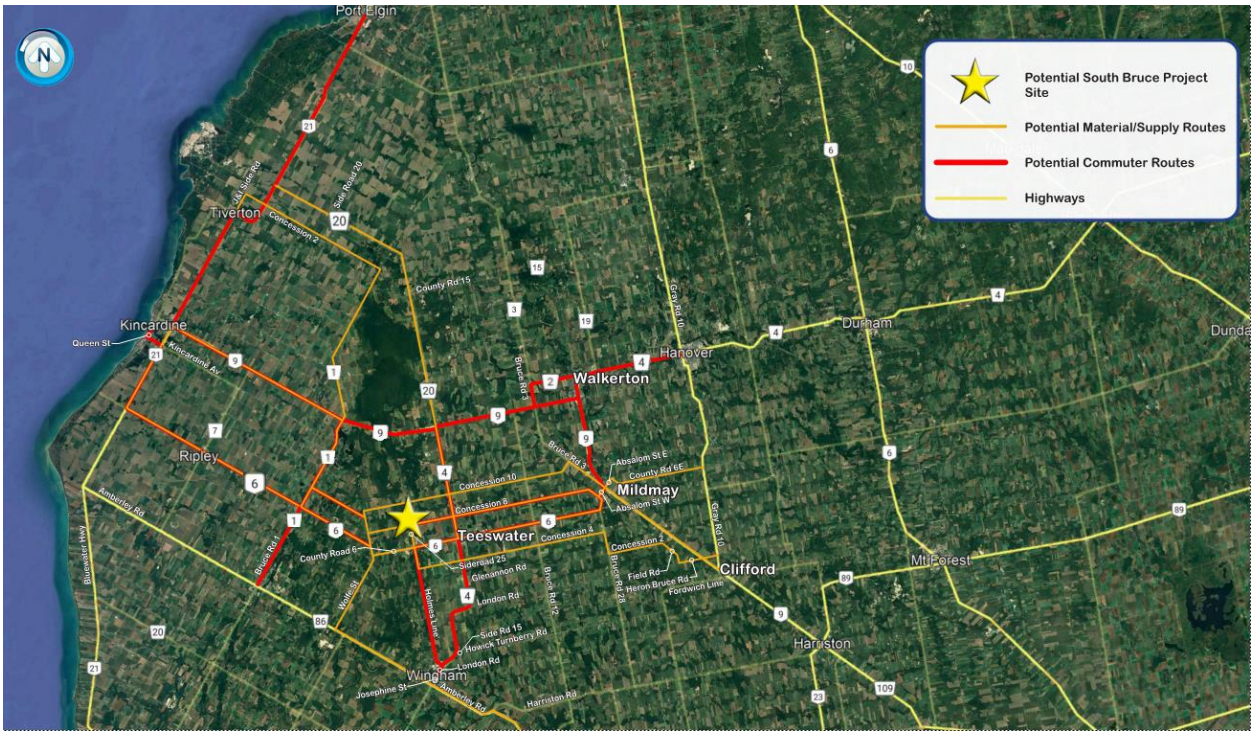


Figure 2. Base Road Network

In terms of functionality, the study base road network is comprised of Provincial Highways, County Roads (CRs) and municipal (local) roads. The connections from provincial highways to the potential Project site is termed the “last mile” route. The last mile in the South Bruce Area will typically be County and Municipal Roads of varying quality.

The primary function of Provincial Highways is to carry major traffic flows between regional urban centres and key regional attraction areas. Key Provincial Highways in the Study Area road network include Highway 9 and Highway 21; the latter is a higher quality road providing north-south connectivity to the broader study area and linking key regional communities such as Kincardine, Walkerton, Hanover, Tiverton and Port Elgin.

Provincial Highway 9 is identified as a higher quality, existing highway close to Teeswater and the potential repository area. It is a potential route from the Greater Toronto Area (GTA) (e.g., from Highway 89 and Highway. 400). It generally has wide paved lanes (~3 to 3.5 metres (m) width) and gravel shoulders (>1 m). The assumption is that for conventional traffic including site generated tractor-trailers (i.e., not oversized or overweight) these highways would require no upgrades (NWMO Community Studies Planning Assumptions – South Bruce Traffic, Nov 24, 2021).

CRs are mainly intended to connect area municipalities, providing efficient movement of goods and people and provide access to the Provincial Highway network. CRs in the area are typically narrower than provincial roads with centre lane markings (yellow line) and unmarked pavement side edges (no white lines). Examples of CRs in the area are CR-4 and CR-6. These roads generally have paved lanes and gravel shoulders; however, the quality in terms of width, markings, and inclusion of shoulders can vary by section.

Local Municipal (Concession) Roads are mainly intended to provide local property access and connectivity within local municipalities and to provide access to surrounding CR networks. Municipal Roads, such as Concession Road 8, are generally paved but narrow without shoulders. A summary of study road network links and basic characteristics are summarized in Table 2. Additional road condition information is available in the Road Conditions Study Report (Morrison Hershfield, 2022)

Table 2: Summary of Study Road Network Links and Characteristic

Study Road	From	To	Road Configuration	Road Surface	Posted Speed	Est. 2022 SADT* (vpd)	Est. Truck** %
Highway 9	Hwy 21 (Kincardine)	CR-1 (Kinloss)	Two-lane highway side ditches	Paved with gravel shoulders	80 kph	2,714	11%
Highway 9	CR-1 (Kinloss)	CR-4 / CR-20	Two-lane highway side ditches	Paved with gravel shoulders	80 kph	2,714	11%
Highway 9	CR-4 / CR-20	CR-12	Two-lane highway side ditches	Paved with gravel shoulders	80 kph	4,236	11%
Highway 9	CR-12	Young Street (Walkerton)	Two-lane highway side ditches	Paved with gravel shoulders	80 kph	6,420	10%
Highway 21	CR-6	Hwy 9 (Kincardine)	Two-lane highway side ditches	Paved with gravel shoulders	80 kph	5,824	8%
Highway 21	Hwy 9 (Kincardine)	CR-15 (Tiverton)	Two-lane highway side ditches	Paved with gravel shoulders	80 kph	6,949	9%
Highway 21	CR-15 (Tiverton)	CR-20	Two-lane highway side ditches	Paved with gravel shoulders	80 kph	8,670	8%
Highway 21	CR-20	CR-25 (Port Elgin)	Two-lane highway side ditches	Paved with gravel shoulders	80 kph	8,405	8%
CR-6	CR-4 (Teeswater)	Kinloss Culross	Two-lane roadway side ditches	Paved with gravel shoulders	80 kph	2,646	7.6%

Study Road	From	To	Road Configuration	Road Surface	Posted Speed	Est. 2022 SADT* (vpd)	Est. Truck** %
CR-6	Wolf St (South Bruce-Huron County Boundary)	CR-1 (Holyrood)	Two-lane roadway side ditches	Paved with gravel shoulders	80 kph	1,322	7.6%
CR-6	CR-1 (Holyrood)	CR-7 (Ripley)	Two-lane roadway side ditches	Paved with gravel shoulders	80 kph	1,322	7.6%
CR-6	CR-7 (Ripley)	Hwy 21	Two-lane roadway side ditches	Paved with gravel shoulders	80 kph	2,646	7.6%
CR-1	Lucknow	CR-6 (Holyrood)	Two-lane roadway side ditches	Paved with gravel shoulders	80 kph	5,293	8.9%
CR-1	CR-6 (Holyrood)	Hwy 9 (Kinloss)	Two-lane roadway side ditches	Paved with gravel shoulders	80 kph	3,969	9.5%
CR-4	Hanover	Walkerton	Two-lane roadway side ditches	Paved with gravel shoulders	80 kph	8,325	7.8%
CR-4	Hwy 9	CR-6 (Teeswater)	Two-lane roadway side ditches	Paved with gravel shoulders	80 kph	5,293	8.8%
CR-4	CR-6 (Teeswater)	Wingham	Two-lane roadway side ditches	Paved with gravel shoulders	80 kph	5,293	8.8%
CR-15	Hwy 21	CR-20	Two-lane roadway side ditches, unmarked pavement edges	Paved with gravel shoulders	80 kph	2,646	8%
CR-20	Hwy 21	Hwy 9	Two-lane roadway side ditches, unmarked pavement edges	Paved with gravel shoulders	80 kph	3,969	8%
Concession 10	Kinloss Culross	CR-4	Unmarked road	Chipseal without shoulders	Unposted	662	na

Study Road	From	To	Road Configuration	Road Surface	Posted Speed	Est. 2022 SADT* (vpd)	Est. Truck** %
Concession 10	CR-4	CR-12	Unmarked road	Chipseal without shoulders	Unposted	662	na
Concession 10	CR-12	CR-24	Unmarked road	Chipseal without shoulders	Unposted	662	na
Holmes Line / Sideroad 25 S	North Street W (Wingham)	Concession Rd. 4 / Sideroad 25 N	Unmarked road	Chipseal without shoulders	Unposted	662	0%
Sideroad 25 N	Concession Rd 4	CR-6	Unmarked road	Chipseal without shoulders	Unposted	662	0%
Concession 4	CR-28	25 Sideroad	Unmarked road	Paved without shoulders	Unposted	662	na
Concession 8	Kinloss Culross	CR-4	Unmarked road	Chipseal without shoulders	Unposted	662	18%
Concession 8	CR-4	CR-12	Unmarked road	Paved without shoulders	Unposted	662	10.8%
CR-24	CR-12	Absalom St. W (Mildmay)	Unmarked road	Chipseal without shoulders	Unposted	662	9.6%
Statters Lake Ave	CR-1	Kinloss Culross	Unmarked road	Paved without shoulders	Unposted	662	na

* Provincial highway based 2016 volumes obtained from Icorridor MTO website. CR and local road volumes from municipal traffic counts available (i.e., SADT ranges from Bruce County TMP, Spot Count Bruce County TMP, Brant County 2020 Traffic Road Maps for similar roads).
** Estimated truck percentages for Provincial Highways based on 2016 volumes at Icorridor MTO website. Truck percentages for CR and local roads estimated from Nov 2021 traffic survey conducted. NA (not available).
*** Estimated capacity utilization during summer based on SADTs and generalized daily service volumes for two-lane highway sections at LOS D as per HCM.

3.2 Existing Traffic Trends and Operation

As noted in **Section 2.2.3**, supplementary field traffic data collection and road safety observations were conducted in November 2021. Based on available and surveyed traffic data, current annual average daily traffic volumes (AADT) along the Study Area roads generally ranges as follows:

- Local municipal roads: Less than 1,000 vehicles per day (vpd)
- CRs: 1,000 to 5,000 vpd
- Provincial Highways: 2,000 – 7,000 vpd

AM and PM Peak hour traffic volume classifications across the Study Area network, was surveyed in November 2021 and are summarized in Figure 3 below. As shown, most of the traffic during both AM and PM Peak periods corresponds to private personal vehicles, followed by truck related traffic. The latter is significantly lower in the afternoon peak hour. Truck related traffic included slow-moving agricultural vehicles, the latter being presumably low in November at the time of the survey as it is understood to be the tail end of the harvesting calendar.

Concession Road 8 appears to have a significant proportion of larger vehicles, likely associated with agricultural activity and adjacent farmland along the corridor. The area is host to several different types of farms and production, including cattle and grain production. Prominent crop types include hay, winter wheat, soy, and corn. It is reported that both cattle farming and grain and oilseed production account for a significant share of the industry in the region.

Similar to agricultural vehicles, for which seasonality is expected, pedestrian and cyclist traffic volumes observed were fairly low also likely due to date of counts in November (off-season). Some uptake of activity during summer months should be expected, and if possible, should be confirm in later rounds of traffic data collection. Some cycling activity, particularly east-west, along CR-6, Concession Road 8 and Statters Lake Avenue in the proximity of the potential Project Site has been reported through third-party online data sources[4].

Of note, vehicle classification counts included differentiation of horse buggies as an indication of Mennonite-related travel activity in the Study Area. Roads mostly used currently by the Mennonite community include the following:

- County Road 1 (Bruce Road 1) between Lucknow and Kinloss
- County Road 6 between Ripley and Holyrood
- Huron-Kinloss Townline Road between Hwy 86 and Concession 12
- Langside St. between Hwy 86 and Kinloss Culross
- Statters Lake Ave between Huron-Kinloss Townline Road and Kinloss Culross
- Karishea Ave between Huron-Kinloss Townline Road and Langside St.
- Gray Ox Ave between Huron-Kinloss Townline Road and Langside St.
- South Kinloss Ave. between Huron-Kinloss Townline Road and Langside St.
- Hayes Ave. between Huron-Kinloss Townline Road and Walker Line.

[4] Strava Metro https://www.strava.com/heatmap#7.00/-123.08984/49.25155/hot/all

Although proportionally small, buggy traffic is concentrated geographically along CR-6 and CR-1 roads in the vicinity of the communities of Holyrood, Ripley and Kinloss. Such concentration of Mennonite-related traffic is consistent with a map clustering of schools and churches in the Township of Huron-Kinloss (Municipality of South Bruce, 2017) provided through the MSB (Knowledge Holder Interview, October 14, 2021 [post interview communication, October 29, 2021]).

No special design enhancements or accommodation treatments for horse and buggy traffic were observed along CR-1 or CR-6. Gravel shoulders were observed on both sides of CR-6 and CR-1; however, the existing gravel shoulders are discontinuous in some sections and notable when approaching the intersection of CR-6 and CR-1. According to guidelines from the Ohio Department of Transportation (ODOT, 2000), a 1.8 – 2.5 m wide bituminous surface treated, or paved shoulders is recommended to accommodate horse buggies (See **Section 6.3.2** for more details).

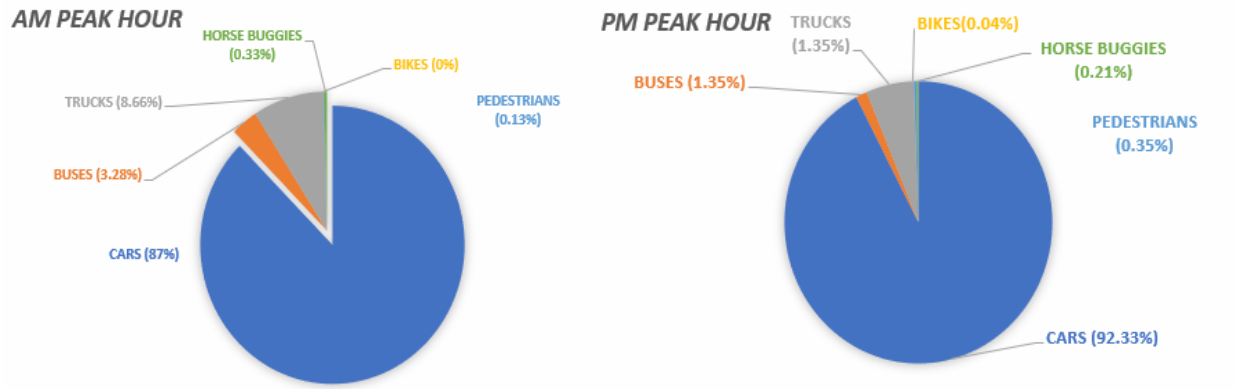


Figure 3 AM and PM Peak Hour Traffic Volume Classification

Although a municipal truck map route is unavailable, commercial trucks and agriculture-related vehicle traffic was observed on almost all roads in the area. Truck and agricultural related traffic percentages, as summarized in Table 2 above, range from 8% to 11% on Provincial Highways (as per available MTO data), 7% to 9% percent on CRs and some local municipal roads. Of note, significant truck traffic was observed on Concession 8 ranging from 10% to 18% of the total peak hour traffic.

Based on MTO traffic and Bruce County data available, seasonal uptake in traffic volumes between AADT and summer average daily traffic (SADT) is, on average, about 21% higher during summer months.

The regional traffic volume growth trend was estimated based on available historic traffic along Provincial Highways. No historic traffic data was available for County Roads. Figure 4 illustrates the general trend. On average, AADT volumes on Provincial Highways in the area have grown at about 1.6% annually. This 1.6% reflects a conservative scenario appropriate for a planning study of this nature.

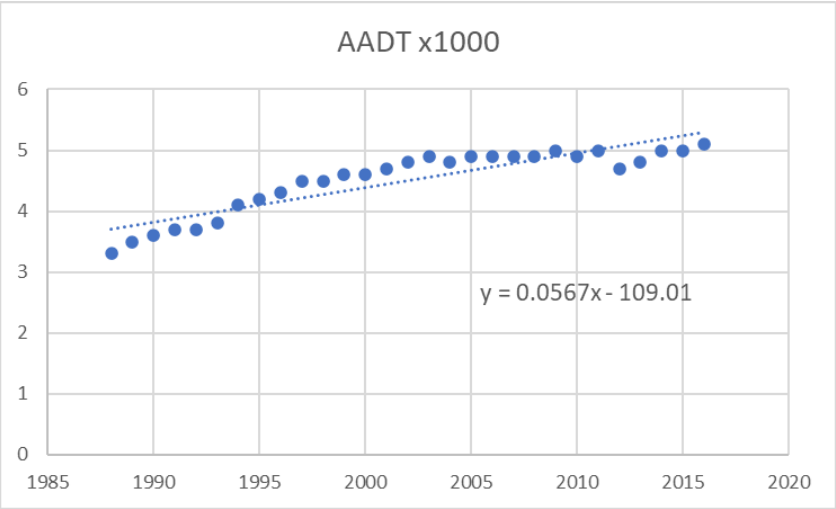


Figure 4. Historical AADT Volumes and General Trend

SADT volumes were used to estimate current capacity utilization ratios (percentage) for each road section in the Study Area. According to HCM, the default values used for service volume of a typical two-lane roadway facility operating at an acceptable LOS D is 12,500 and 11,500 vpd for Class I and Class II respectively. For study purposes, Class I were assumed to be comparable to Provincial Highways and CRs while Class II were assumed to be comparable with local municipal roads.

Traffic operation on two-lane rural highways is unique as no lane change is permitted and overtaking/passing is only possible in the opposing lane of oncoming traffic. This situation results in interaction and influence between the two traffic directions. Thus, passing maneuvers are limited by the availability of gaps in the opposing traffic stream as well as by the availability of sufficient sight distance for a driver to discern the approach of an opposing vehicle safely. This creates vehicle platoons within the traffic stream, with trailing vehicles subject to additional delay because of the inability to pass the lead vehicles.[5]

As demand flows and geometric restrictions increase, opportunities to pass decrease. Operating quality on two-lane roadways often decreases precipitously as demand flow increases, and operations can become “unacceptable” at relatively low volume-to-capacity ratios. Therefore, for most two-lane roadways, poor operating quality do generally lead to improvements long before capacity demand is reached. This is particularly important for the Municipal Road systems within the MSB which were likely not intended to operate anywhere near the technical capacity range 11,500-12,500 vpd suggested by HCM.

To the above, it is suggested that future studies, particularly for Municipal Roads within the MSB, consider analysis of beyond capacity-utilization ratios towards a more functional and contextual assessment of the network. The SADT analysis included in this report are intended as a screening tool only to identify segments of concern that require further investigation in the future. Additional criteria beyond the SADT capacity screening that could be supplemented in future studies include, but are not limited to, investigation of the proportion of existing SADT to proposed SADT, interaction with agricultural vehicles and slow- moving vehicles, passing

[5] Planning and Preliminary Engineering Applications Guide to the Highway Capacity Manual (National Academies of Sciences, Engineering, and Medicine, 2016)

opportunities, operational and safety considerations for vulnerable road users, etc. (Refer to **Section 6** for suggested future studies).

Current capacity-utilization ratios are shown in Table 3 below. Generally, road sections with capacity-utilization ratios that fall below 100%, should indicate that the facility is operating at and acceptable LOS D with no congestion spillover and virtually unlimited availability of gaps in the opposite traffic stream for passing maneuvers.

As shown, some sections of Highway 9 and Highway 21, as well as a section of CR-4 (between Hanover and Walkerton) are already nearing utilization levels ranging 60 to 69%. That said, most County and Local Roads are currently well below capacity utilization ratios.

Table 3: Current Capacity-Utilization Ratios

Study Road	From	to	Highway Type (HCM)	Service Volumes at LOS D	2022 SADT	Capacity-Utilization (2016-2022)
Highway 9	Hwy 21 (Kincardine)	CR-1 (Kinloss)	Class I	12,500	2,713	22%
Highway 9	CR-1 (Kinloss)	CR-4 / CR-20	Class I	12,500	2,713	22%
Highway 9	CR-4 / CR-20	CR-12	Class I	12,500	4,235	34%
Highway 9	CR-12	Young Street (Walkerton)	Class I	12,500	6,419	51%
Highway 21	CR-6	Hwy 9 (Kincardine)	Class I	12,500	5,824	47%
Highway 21	Hwy 9 (Kincardine)	CR-15 (Tiverton)	Class I	12,500	6,949	56%
Highway 21	CR-15 (Tiverton)	CR-20	Class I	12,500	8,669	69%
Highway 21	CR-20	CR-25 (Port Elgin)	Class I	12,500	8,404	67%
CR-6	CR-4 (Teeswater)	Kinloss Culross (South Bruce-Hur	Class I	12,500	2,646	21%
CR-6	Wolf St (South Bruce-Hu	CR-1 (Holyrood)	Class I	12,500	1,322	11%
CR-6	CR-1 (Holyrood)	CR-7 (Ripley)	Class I	12,500	1,322	11%
CR-6	CR-7 (Ripley)	Hwy 21	Class I	12,500	2,646	21%
CR-1	Lucknow	CR-6 (Holyrood)	Class I	12,500	5,293	42%
CR-1	CR-6 (Holyrood)	Hwy 9 (Kinloss)	Class I	12,500	3,969	32%
CR-4	Hannover	Walkerton	Class I	12,500	8,325	67%
CR-4	Hwy 9	CR-6 (Teeswater)	Class I	12,500	5,293	42%
CR-4	Cr-6 (Teeswater)	Wingham	Class I	12,500	5,293	42%
CR-15	Hwy 21	CR-20	Class I	12,500	2,646	21%
CR-20	Hwy 21	Hwy 9	Class I	12,500	3,969	32%
Concession 10	Kinloss Culross (South B	CR-4	Class II	11,500	662	6%
Concession 10	CR-4	CR-12	Class II	11,500	662	6%
Concession 10	CR-12	CR-24	Class II	11,500	662	6%
Holmes Line / Sideroad 25 S	North Street W (Wingha	Concession rd 4 / Sideroad 25 N	Class II	11,500	662	6%
Sideroad 25 N	Concession Rd 4	CR-6	Class II	11,500	662	6%
Concession 4	CR-28	25 Sideroad	Class II	11,500	662	6%
Concession 8	Kinloss Culross (South B	CR-4	Class II	11,500	662	6%
Concession 8	CR-4	CR-12	Class II	11,500	662	6%
CR-24	CR-12	Absalom St. W (Mildmay)	Class II	11,500	662	6%
Statters Lake Ave	CR-1	Kinloss Culross (South Bruce-Hur	Class II	11,500	662	6%

ICU analyses were also performed using Synchro V10 software in accordance with HCM methodologies. The ICU method uses a grading system, known as LOS, to rank the intersection by the amount of reserved capacity or capacity deficit. The ICU LOS is not a predictor of intersection delays, but rather an indicator of how often an intersection will experience congestion. ICU-LOS ranges from A to F where A is best (less than or equal to 55% utilization), D is generally acceptable for planning purposes (greater than 73% but less than 82%) and H is worst (greater than 109% utilization) capacity performance. Based on the traffic data collected on the field, current ICU LOS summary ranking of study intersections is shown in Figure 5**.**

Figure 5. Current 2022 ICU-LOS Summary of Study Intersections

As shown, most intersections of County Roads and Local Roads are currently operating at satisfactory capacity-utilization conditions, whereas the intersections of Highway 21 & CR-20 (Tiverton) and Highway 21 & Highway 9 (Kincardine) appear to be approaching near-capacity conditions. The latter is already signalized while the former is unsignalized and likely warranted for a traffic signal upgrade. Both intersections are suggested for additional confirmatory evaluation of operations and appropriateness of current intersection controls.

As noted earlier, future studies particularly for Municipal Roads (Last Mile) within the MSB, could consider criteria beyond capacity-utilization ratios and LOS analysis, including more functional and contextual assessment of the road network. (Refer to **Section 6** for suggested future studies).

3.3 Field Road Safety Observations

In addition to the field traffic data survey, field safety observations were conducted on November 10, 2021, including spot observations, photographic inventory of issues and drive-through video-monitoring of corridors. The site visit (corridor drive-thru) included the following time periods:

- Mid-day (1:00-2:00 PM) to observe off-peak traffic activity;
- Afternoon / PM peak period (5:00-6:00 PM) – to observe early evening commuter peak traffic;
- Evening (6:30 – 7:30 PM) – to observe roadway conditions during the darker (dusk) evening hours

The site visits also allowed the team to confirm roadway configuration and geometry, signing and pavement markings, access management, vulnerable road user facilities, lighting conditions, and observation of operational issues.

Moderate traffic volumes were observed during the drive and capacity constraints never seemed to be an issue. As a result, travel times were consistent with anticipated travel times form google directions. A variety of vehicle types were also observed including large commercial vehicles (i.e., trucks), school buses, horse-carriers, and horse buggies. **Appendix D** includes a summary memo of key observed safety issues and photographic records. A summary of key safety issues observed is included below:

- CR 4 (Hanover - Walkerton)
    - Poor Pavement Condition
    - Absence of Shoulders
    - Unmarked crosswalk and stop bars at the CR 4 / Victoria Street intersection.
- CR 4 (Jackson Street / Yonge Street)
    - Yonge Street South has an acute angle with Jackson Street. Thereby the southbound vehicles along Jackson Street are slowing down to make the right turn to Yonge Street. This creates conflicts with following vehicles and would cause rear end collisions.
    - The left turn arrow on the exclusive northbound left turn lane along Jackson Street is missing at the Yonge Street South intersection.
    - The stop bars at Elgin Street and Yonge Street South intersections are unmarked.
- Highway 9 (from CR 4 to CR 20)
    - The intersection of CR 4 / Highway 9 is a major junction in the road network, but no signs referring to the posted speed along Highway 9 are provided on the west leg along Highway 9. This lack of guidance and warning can confuse drivers. Speed signs close to intersections would encourage drivers to accelerate as merging from a county road to a highway.
- CR 20 (from Hwy 9 to Hwy 21)
    - Construction Sites Close to the Edge of the Road
    - Pedestrian Crossing
    - Gravel and Dirt on the Roadway
- Hwy 21 (from CR 20 to CR 15)
    - During the site visit, the traffic team visited the CR 20 at Highway 21 intersection and noted the opportunity to signalize this intersection
- CR 15 (between Hwy 21 and CR 1)
    - Large Commercial Vehicles, Horse-Carriers, and Horse Buggies on Shoulders
    - Wildlife Collisions

- CR 1/ CR 6 Intersection
    - Limited Visibility. A horse-carrier was observed crossing the intersection and turned left into a private driveway on the south leg. However, the driveway is located on a vertical curve and entering / exiting into this property is a difficult maneuver due to the limited sight lines. This can also result in northbound drivers being surprised and braking rapidly when horse-carriers enter / exit into / from the driveway.
- CR 1/ CR 86 Intersection
    - Vehicles were observed parking very close to the intersection. Parking on the south corner poses a particular concern because the view of southbound traffic is obscured for the drivers of vehicles stopped on the CR 1 (Stauffer Street) approach.
    - A building located on the northeast quadrant of the intersection (625 CR 86) blocks the sightline of southbound left tun traffic.
    - Pedestrian crosswalk is missing at this intersection
- CR 86 (between CR 1 and CR 4)
    - Large Commercial Vehicles on Shoulders
    - Lack of Safe Passing Opportunities
    - School Buses Stopping in the Travel Lane
- CR 4/ CR 6 Intersection
    - Pedestrian crosswalk is missing at this intersection
- CR 4 (between CR 86 and Hwy 9)
    - There is a hidden intersection (Clinton Street and Ann Street) on CR 4, north of the CR 4 / CR 6 intersection. The visibility of Ann Street for motorists approaching either direction on CR 4 is obstructed by a vertical curvature. The intersection does not have overhead lighting, further making it unnoticeable during the night. Lack of awareness of the intersection reduces the driver's perception time and the ability to stop or make evasive maneuvers if required. However, two warning signs are installed along CR 4 on both directions to warn motorist about this hidden intersection.
- Hwy 9 (between CR 4 and Hwy 21)
    - Vehicle parked on the Wrong Side of the Highway
- CR 6 (between Hwy 21 and Concession Rd 8)
    - Horse Buggies on Shoulders During the Nighttime. A horse buggy was observed on the shoulder of CR 6 during nighttime. The horse buggy was equipped with a flashing light. However, it was not as easily seen after dark as in the daylight. The horse buggies are in a dangerous position if a vehicle approaches from the front at the same time one is coming from the rear. Unless they have bright lights, they may not be seen as the lights of one vehicle may blind the driver of

the other vehicle. The horse buggies should watch the vehicle from the rear in their mirror and flash their lights to be better seen.

- Concession Road 8
    - Poor Night-Driving Conditions (i.e., poor/low lighting, reduced visibility, worn out demarcation)

- Miscellaneous
    - The regulatory posted speed limit is in the range of 50 to 80 km/hr.
    - Visibility is more of an issue during the nighttime hours, due to limited lighting along the corridor.
    - Most drivers along the corridor appear to comply with posted speed limits.
    - Safety field observations were relatively cursory. It is suggested that future studies be undertaken to establish collision rates and related causative factors for mitigation.

4 Relevant Adaptive Phased Management Project Characteristics

4.1 Summary of Key Finding/Results from Other Studies

A summary of key finding/results from other studies relevant to this specific *Local Traffic Study* are summarized in the Table 4 below. In combination, these studies have informed the analysis of anticipated project specific travel demand forecasting for both working force and construction materials traffic loads.

Table 4: Summary of Key Findings/Results From Other Studies

Relevant Study	Description	Linkage to Local Traffic Study
NWMO Community Studies Planning Assumptions – South Bruce Traffic (November 24, 2021)	Key assumptions to be used in the performance of the community studies of the potential social and economic changes that may arise in South Bruce and region from the NWMO Adaptive Phased Management Deep Geological Repository project (APM Project).	- Estimated traffic projections in South Bruce by commodity code for traffic study inputs - Anticipated vehicle type (design vehicles) and cargo capacities - Estimated traffic volume for: a) Movement of excavated rock material from underground operations to the excavated rock material area (ERMA) b) Movement of materials and supplies to the potential Project Site
NWMO Community Studies Planning Assumptions (October 18, 2021)	Key assumptions to be used in the performance of the community studies of the potential social and economic changes that may arise in South Bruce and region from the Project	- Conceptual labor workforce projected for the Project. - Workforce shift patterns for on-site labor - Spatial boundary assumptions for community studies (Macro Labour-Shed and Micro Labour-Shed) - Aggregate estimates - Emergency response site and transportation - Required road characteristics (typical cross-section) - Used fuel transportation system tractor-trailer configuration - Used fuel transportation system routing (simplified) - Suggested new road construction and last mile upgrades (typical cross-section)
metroeconomics (February 2022). South Bruce and Area Growth Expectations Memorandum.	South Bruce Area growth expectations developed by metroeconomics for the MSB.	MSB growth expectations for population and dwellings only. *Exhibit 3. The APM-DGR Site in South Bruce Population, Employment, Dwellings and GDP Impacts Core Area by Municipality 2021, 2031, 2041 and 2046 ('Impact Minus Base')*
Housing Needs & Demand Analysis	*Housing Needs and Demand Analysis Study* is one of several	- Identify housing that is available in proximity of the Project

Relevant Study	Description	Linkage to Local Traffic Study
Study Report - (Keir Corp., 2022a)	community studies. Its objective is to describe and characterize the local housing supply and market conditions	- Identify serviced and serviceable residential lands in proximity to the project. - Identify potential for expansion of serviced or serviceable lands to enable accommodation of the Project workforce within South Bruce - Identify strategies that could be implemented during the Project to - Influence worker choice to seek accommodation in South Bruce
Bruce County Transportation Master Plan (September 2021)	Master Transportation Plan Study which will analyze the status and future needs of the County's Land Transportation Systems (road network, public transit, specialized transit, taxi/ride share and active transportation)	- Baseline network assessment - Existing traffic volumes on County Road - Active transportation networks - Transit networks and services - Road/traffic safety issues and identification of collision-prone locations - Future planned network improvements
Aggregate Resources Study Report (Keir Corp., 2022b)	Baseline assessment of current and potential supply of aggregate in both Core and Local Study area. Establishment of baseline and incremental aggregate project demand overtime. Assessment of supply and demand imbalances.	- Potential future sources of aggregate. - Anticipated supply and demand of aggregates - Incremental aggregate demand from the Project aggregate - requirements set out by NWMO in their release of Project parameter/planning assumptions information (NWMO, October and November 2021)
Grey County Transportation Master Plan (September 2014)	The Transportation Master Plan (TMP) is a strategic plan that will direct policies and infrastructure initiatives for the County's transportation system over the next 25 years. The objectives of the study are to address short, medium, and long-term transportation needs of Grey County.	- Baseline network assessment - Existing traffic volumes on County Road - Active transportation networks - Transit networks and services - Road/traffic safety issues and identification of collision-prone locations - Future planned network improvements

Relevant Study	Description	Linkage to Local Traffic Study
Deep Geological Repository Transportation System Conceptual Design Report (AECOM, September 2021)	This report describes conceptual designs of the transportation system and considers transport of used fuel to a repository sited in either a crystalline or sedimentary rock geosphere.	Used fuel transport characteristics including: - Routing - Equipment - Logistics & operations - Security and communications - Emergency response
Other Traffic Impact Studies in the Area	- Bruce Power Traffic Study Update Part B, Jan 2019 - Bruce Power Major Component Replacement Traffic Impact Study Update, Jan 2017	- Background conditions - Baseline traffic volumes - Existing network assessment - Travel demand forecasting - Projected conditions
Ontario Road Safety Annual Reports (ORSAR)	The ORSAR provides road safety data and emerging trends including fatalities, injuries, collisions and more.	- Statistics on fatalities, injuries, and property damage collisions - Types of vehicles involved in collisions - Where collisions occurred - Conviction data
Brockton Roads Needs Study Map (September 2019)	Planned phased roadway upgrades (2020 – 2029)	- AADT volumes - Planned phased roadway upgrades

4.2 Travel Demand Forecasting

The estimated traffic demand forecasting modeling including trip generation, distribution and assignment is detailed in **Appendix E.** Essentially, traffic forecasting is comprised of two categories, in accordance with NWMO's (November 24, 2021) *Community Studies Planning Assumptions - South Bruce Traffic* report:

a) Movement of staff and trades to and from the potential Project Site,
b) Movement of excavated rock material (within 5 km), UFTPs, and materials and supplies.

4.2.1 Movement of Staff and Trades

Construction Labour (Surface and Underground Trades) – To be conservative, it is assumed that 80% of all construction labor would be sourced from the Local Study Area while the remaining 20% would be sourced from the Core Study Area. Refer to **Section 1.3.2** for spatial boundaries.

Direct Staff – To be conservative, it is assumed that most (80%) of direct labor resources, especially labor with the established capability to work within a nuclear facility, would commute to/from the potential Project site within the Core Study Area. Refer to **Section 1.3.2** for spatial boundaries.

The NWMO Community Studies Planning Assumptions Report (October 18, 2021) also indicated that with the current published timing of the completion of the Bruce Power Major Component Replacement (MCR) Project it is assumed that many (if not all) the resources with the necessary capability will be available within the Local and Core Study areas the at the point of commencement of construction (2033).

The conceptual labor workforce projected for the Project is presented in Table 5 below by Project phase. The workforce has been identified as being as either on-site (at the DGR) or off-site (at the Centre of Expertise (CoE)), and further sub-categorized as permanent NWMO staff, surface/trades labor, and labor associated with underground excavation activities.

Table 5: Labour FTE (Full Time Equivalent) Projections by Phase and Location (Source: NWMO October 18, 2021)

Location	Phase	NWMO Staff	Surface Trades	Underground Trades	Totals
On-Site	Pre-construction (2028)	20	-		20
	Construction (2033)	40	300	130	470
	Operations (2043)	510	10	60	580
Off-Site (CofE)	Pre-construction (2028)	180	-	-	180
	Construction (2033)	170	-	-	170
	Operations (2043)	120	-	-	120
Total	Pre-construction (2028)	200	-	-	200
	Construction (2033)	210	300	130	640
	Operations (2043)	630	10	60	700

Daily Vehicle Trip Generation estimates for the assumed workforce in Table 5, were obtained by applying the Institute of Transportation Engineers (ITE)[6] daily trip generation rate of 3.34 average daily trips per employee for Industrial Park (Code 130). This trip generation rate is a standard value determined based on the type of land use; it is not site- or Project-specific, and the actual rate may be lower. A site-specific multiplier may be determined at a later date.

Geographic distribution of trips across the region was based on a combination of assumptions largely derived from the *South Bruce and Area Growth Expectations Memorandum (metroeconomics, February 2022)*, and the *Housing Needs & Demand Analysis Study Report (Keir Corp., 2022a)*. A multi-criteria decision-making analysis tool for estimation of likely trip origins within both Core and Local Study Areas was developed based on the following criteria. Detailed calculations and assumptions are included in **Appendix E**.

- MSB and area population growth projections
- Future availability of housing
- Future employment opportunities, and
- Distance (travel times) to and from nearby municipalities

[6] ITE Trip Generation Rate Manual Version 9.0

The results of geographic distribution of daily trips by project phase and community of origin are summarized in Table 6 and color-coded highlighting low trip attraction in green, medium in yellow-orange and high trip attraction in red.

Table 6. Estimated Average Daily Trips (ADTs) for Projected Staff and Trades by Project Phase and by Community

Phase	Near-term Pre-construction (2023-2032)	Mid-term Construction (2033-2042)	Long-term Operations (2043-2083)	Sub-Total (vpd)
Teeswater	70	110	220	401
Formosa	30	47	90	167
Mildmay	67	107	214	387
Ripley	43	67	137	247
Lucknow	94	150	304	548
Shoreline	17	27	50	94
Walkerton	130	207	421	758
Wingham	100	157	321	578
Saugeen Shores	17	154	73	244
Kincardine	20	184	87	291
West Grey	13	110	53	177
Arran-Elderslie	7	67	33	107
Huron-Kinloss	13	117	57	187
Ashfield-Colborne-Wawanosh	7	63	30	100
South Bruce	13	110	53	177
Minto	13	100	50	164
Howick	3	37	20	60
Morris-Turnberry	7	57	30	94
Brockton	17	144	70	230
Hanover	13	110	53	177
North Huron	10	84	40	134
Sub-Total (vpd)	**705**	**2,208**	**2,408**	**5321**

Assignment of above trips to the network was based on shortest path routes between the potential Project site and the above noted communities. Of note, the long-term operation of the Project is expected to generate the greater amount of workforce daily commuting, closely followed by the mid-term construction period. Also of note, the communities of Walkerton, Wingham, Lucknow, and Teeswater are expected to generate (attract) nearly half of all anticipated daily trips.

Trip distribution and assignment should be reviewed and reassessed once additional details on the site access locations are identified.

4.2.2 Movement of Excavated Rock Material, UFTPs, Other Materials and Supplies

The NWMO provided an estimated number of round trips to and from the potential Project site for construction materials and excavated rock (NWMO, November 24, 2021). Trips were provided in the form of weekly number of round trips for each year over the 10-year anticipated construction period and for an average year for the Operations Period. For this study, trips provided were transformed to equivalent ADTs. Estimated passenger-car equivalent (PCE) for weekly and daily truck traffic volumes are summarized in Table 7. PCE estimates assumed a 1.5 conversion factor as per HCM[7].

Table 7: Estimated Weekly and Daily Passenger-Car Equivalent (PCE) for Truck Traffic Volumes (Round Trips)

Project Phase	Mid-term Construction (2033-2042)		Long-term Operations (2043-2083)	
Material	Avrg. PCE/Week	Avrg. PCE/Day$_{(g)}$	Avrg. PCE/Week	Avrg. PCE/Day$_{(g)}$
Excavated Rock (to/from ERMA) (f)	151	31	56	12
Site Development	71	15	0	0
Mining	6	2	2	1
Concrete (a)	169	34	5	1
Roadworks, Drainage & Paving	4	1	0	0
Earthwork	1	1	0	0
Architectural	8	2	0	0
Electric Equipment	1	1	0	0
Mechanical Equipment	2	1	18	4
Mobile Equipment	1	1	0	0
Pipework & Fittings	3	1	2	1
Structural Steel	2	1	3	1
Wire & Cable	2	1	2	1
Miscellaneous Supplies	1	1	27	6
Bentonite	0	0	41	9
Used Fuel Transportation Packages(b)	0	0	24	5
UFTP and BTP Escort Vehicles (c)	0	0	24	5
Fuel and Lubricants (d)	9	2	6	2
Waste and Recycling (e)	9	2	6	2
Sub-Total	**439**	**97**	**213**	**50**

[7] Highway Capacity Manual (HCM) 2002 Chapter 23- Basic Freeway segments Methodology, Page 23.-9 Exhibit 23-8 Passenger-Car Equivalents on extended Freeway segments for Level terrain Et (trucks and buses)

(a) The concrete batch plant gets constructed in Year 1. Thereafter assumes transport of aggregates to make concrete onsite.
(b) Based on 625 UFTPs/year over a 9-month period.
(c) This number will vary based on the shipment of UFTPs and load restrictions as per "Deep Geological Repository Transportation System Conceptual Design Report (APM-REP-00440-0209-R001 September 2021)"
(d) Assumed fuel and lubricants during construction period to be 1.5 times the operation period amounts.
(e) Assumed waste and recycling during construction period to be 1.5 times the operation period amounts.
(f) NWMO has confirmed that the ERMA will be located on NWMO optioned land. This could involve movement across public roads (e.g., Concession 8, Side Road 25 N).
(g) Daily trip estimates based on a 5-day work-week during construction, instead of 7-day work-week, to be conservative.

Of note, truck traffic above does not account for potential construction traffic associated with ancillary off-site infrastructure upgrades (i.e., roads/bridge rehabilitation, widening, resurface, etc.) that may be required to improve accessibility to the potential Project Site along nearby roads, especially along local MSB and 'Last Mile' roadways.

For planning purposes, truck daily traffic was averaged (Table 7) over the 10-year construction period, however it should be noted that the average of trucks per week would significantly increase during certain periods, most likely halfway into the construction period. NWMO indicated the estimated variation of commodity round trips overtime during the construction period, as shown in **Figure 6**.

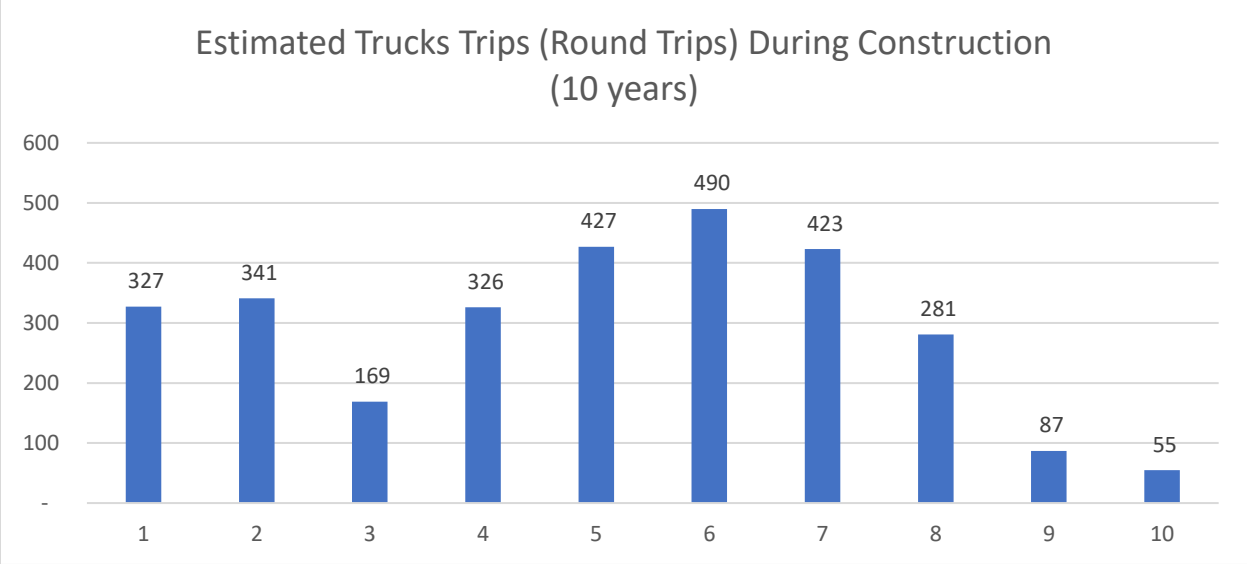


Figure 6: Estimated Variation of Commodity Trips (round trips) During Construction.

For planning purposes, assignment of truck traffic volumes across the study road network has been conducted following first principles, availability of road connection and geographic distribution of aggregate sites in accordance with the *Aggregate Resources Study Report* (Keir Corp., 2022b). Table 8 shows the assumed geographic distribution of truck trips by phase.

Table 8: Assumed Geographic Distribution of Passenger-Car Equivalent for Truck Trips (round trips) by Phase

To/From	Routing	Split	Construction (vpd)	Operation (vpd)
North-East 1	from Hwy 9 and CR-4 and Concession 10	20%	20	10
North 2	From Hwy 21, CR 20, and Concession 10	20%	20	10
South 1	From CR 86, Wolf St and CR 6	15%	15	8
South 2	From Hwy 9 , Concession 4, Sideroad 25 N	25%	25	13
South 3	CR-1 (from Mines near Lucknow), CR-6	10%	10	5
East	East of Teeswater (CR-6 and Sideroad 25 S)	5%	5	3
West	Hwy 21 (south), CR-6	5%	5	3
		100%	100	52

As noted above, resulted pre and -post development trip distribution across the Study Area is included in **Appendix E**. Trip distribution and assignment should be reviewed and reassessed once additional details on the site access locations are identified.

5 Preliminary Analysis/Effects Assessment

5.1 Preliminary Roadway Capacity Screening Assessment

Base Case ('without the Project') and Impact Case ('with the Project') roadways capacity scenarios are summarized in **Table 9** below. The Base Case scenario refers to network vehicular capacity utilization due to anticipated background traffic growth unrelated to the Project (status-quo). The Impact Case scenario refers to network capacity utilization assuming the Project is implemented, that is, assuming both background traffic and site development traffic are superimposed across the road network. The Impact-Minus-Base analysis indicates the net capacity effect of Project-generated traffic across Study Area road sections.

- By and large, no substantial net difference in capacity utilization of existing and future roadways is expected as a result of the Project, over and above what normally would have been expected due to anticipated background traffic growth in the area.
- Current and near-term capacity-utilization conditions (Without the Project) on a number of sections of Provincial Highways and County Roads are near or over 50% capacity. As noted earlier, two-lane highway operating quality often decreases precipitously as demand flow increases, and operations can become "unacceptable" at relatively low volume-to-capacity ratios.
- Further to the above, it is expected that by the time the construction phase starts (approximately 2033), a number of Provincial Highway and County Road sections could be approaching near-to-capacity conditions thereby operational quality could rapidly decline.
- As noted earlier, future studies particularly for Municipal Roads (Last Mile) within the MSB, should consider criteria beyond capacity-utilization ratios and LOS analysis including more functional and contextual assessment of the road network. (Refer to **Section 6** for suggested future studies).
- Future review of functional road considerations is suggested, particularly for the Last Mile roads in the core area, particularly on roads that have other users (e.g., horse and buggy, cyclists) and where passing lanes and shoulders are a concern.
- Specific road sections that require further monitoring and investigation (more in-depth two-lane highway analysis as per HCM) in the short-term (2-5 years) include:
    - Hwy 9 between CR-12 and Yonge Street South in Walkerton
    - Hwy 21 between Hwy 9 (Kincardine) and CR-15 (Tiverton)
    - Hwy 21 between CR-15 (Tiverton) and CR-20
    - Hwy 21 between CR-20 and CR-25 (Port Elgin)
    - CR-1 between Lucknow and CR-6 (Holyrood)
    - CR-4 between Hanover and Walkerton
    - CR-4 between Hwy 9 and CR-6 (Teeswater)
    - CR-4 between CR-6 (Teeswater) and Howick Turnberry Rd (Wingham)
- Most local municipal two-lane roadways (Municipal Roads) are expected to remain well below sustainable capacity conditions under all study horizons.

- Depending on where the site access(s) points are located, a noticeable impact on capacity utilization may be expected on some local and CRs due to the subject Project on road sections around the potential site. These impacts could result due to the concentration and overlap of last-mile trips (both staff and trucks) in and out of the facility on adjacent local roads, namely Concession Road 8, Concession Road 10, Sideroad 25, CR-6, CR-4 and Kinloss Culross Road. In addition, the presence of trucks may further reduce roadway capacity on nearby roadways as evidenced by the use of passenger car equivalents.

- A decline in operating quality on two-lane roads may lead to unsafe passing maneuvers as demand flows and geometric restrictions increase (i.e., lack of passing lanes, lack of turning/storage lanes at key intersections, substandard or non-existing shoulders, etc.). These safety concerns are particularly important on road sections that are also shared with vulnerable road users (i.e., pedestrian, cyclists, and horse-powered buggies) and slow-moving agricultural vehicles. As noted earlier, County Rd 6 (CR-6) and County Road 1 (CR-1) were observed to be important routes for Mennonite slow-moving buggies as several schools and churches appear to be concentrated in and around the communities of Kinloss, Ripley, and Holyrood. Some US reports indicate that in some communities, school-age children begin driving horse-buggies roadways as early as 12 years old and often take other children to school in the same buggy[8].Also, slow-moving farming related vehicles were observed and are expected increase during the summer months.

- Further to the above, CR-6 around Ripley and Holyrood, as well as CR-1 between CR-86 (Lucknow) and Highway 9 (Kinloss) were identified as historically collision-prone locations in the latest Bruce County TMP (2021). The latter also identifies CR-6 west of Ripley as a future cyclist touring route. The Bruce County TMP also identifies sections of CR-1 north of Hwy 9 from Concession 6 to CR-20 and beyond as part of a future cycling tour route recommended for upgrade on-shoulder paved cycling accommodation.

[8] Improving Safety for Slow Moving Vehicles on Iowa's High-Speed Rural Roadways, CTRE 2009.

Table 9: Roadway (SADT) Capacity-Utilization Summary Base Case, Impact Case, Net Impact Case

			SADT CAPACITY (%)									
			Base Case (Background Traffic Without Project)				*Impact Case (Post-Development Traffic With Project)*			*Impact Minus Base (Percentage Impact)*		
Study Road	**From**	**to**	Current Capacity-Utilization (2016-2022)	Near-Term / Preconstruction (2023-2032)	Mid-term / Construction (2033 - 2042)	Long-term / Operation (2043-2083)	Near-Term / Preconstruction (2023-2032)	Mid-term / Construction (2033 - 2042)	Long-term / Operation (2043-2083)	Near-Term / Preconstruction (2023-2032)	Mid-term / Construction (2033 - 2042)	Long-term / Operation (2043-2083)
Highway 9	Hwy 21 (Kincardine)	CR-1 (Kinloss)	22%	25%	28%	41%	25%	28%	41%	0%	0%	0%
Highway 9	CR-1 (Kinloss)	CR-4 / CR-20	22%	25%	28%	41%	25%	28%	41%	0%	0%	0%
Highway 9	CR-4 / CR-20	CR-12	34%	39%	44%	64%	40%	48%	68%	1%	4%	4%
Highway 9	CR-12	Young Street (Walkerton)	51%	59%	66%	96%	60%	69%	100%	1%	3%	4%
Highway 21	CR-6	Hwy 9 (Kincardine)	47%	53%	60%	87%	54%	62%	88%	0%	1%	1%
Highway 21	Hwy 9 (Kincardine)	CR-15 (Tiverton)	56%	64%	72%	104%	64%	72%	104%	0%	0%	0%
Highway 21	CR-15 (Tiverton)	CR-20	69%	79%	90%	130%	79%	90%	130%	0%	0%	0%
Highway 21	CR-20	CR-25 (Port Elgin)	67%	77%	87%	126%	77%	88%	127%	0%	1%	1%
CR-6	CR-4 (Teeswater)	Kinloss Culross (South Bruce-	21%	24%	27%	40%	24%	27%	40%	0%	0%	0%
CR-6	Wolf St (South Bruce-Huron	CR-1 (Holyrood)	11%	12%	14%	20%	14%	17%	25%	1%	3%	5%
CR-6	CR-1 (Holyrood)	CR-7 (Ripley)	11%	12%	14%	20%	13%	15%	22%	1%	2%	2%
CR-6	CR-7 (Ripley)	Hwy 21	21%	24%	27%	40%	24%	28%	40%	0%	0%	0%
CR-1	Lucknow	CR-6 (Holyrood)	42%	49%	55%	79%	49%	56%	82%	1%	2%	3%
CR-1	CR-6 (Holyrood)	Hwy 9 (Kinloss)	32%	36%	41%	60%	36%	41%	60%	0%	0%	0%
CR-4	Hannover	Walkerton	67%	76%	86%	125%	76%	86%	125%	0%	0%	0%
CR-4	Hwy 9	CR-6 (Teeswater)	42%	49%	55%	79%	50%	60%	85%	1%	5%	5%
CR-4	Cr-6 (Teeswater)	Wingham	42%	49%	55%	79%	49%	55%	80%	0%	0%	0%
CR-15	Hwy 21	CR-20	21%	24%	27%	40%	24%	27%	40%	0%	0%	0%
CR-20	Hwy 21	Hwy 9	32%	36%	41%	60%	37%	43%	60%	0%	2%	1%
Concession 10	Kinloss Culross (South Bruc	CR-4	6%	7%	7%	11%	7%	8%	11%	0%	0%	0%
Concession 10	CR-4	CR-12	6%	7%	7%	11%	7%	7%	11%	0%	0%	0%
Concession 10	CR-12	CR-24	6%	7%	7%	11%	7%	7%	11%	0%	0%	0%
Holmes Line / Sideroad 25	North Street W (Wingham)	Concession rd 4 / Sideroad 25	6%	7%	7%	11%	7%	9%	12%	1%	1%	1%
Sideroad 25 N	Concession Rd 4	CR-6	6%	7%	7%	11%	7%	9%	14%	1%	2%	3%
Concession 4	CR-28	25 Sideroad	6%	7%	7%	11%	7%	8%	11%	0%	0%	0%
Concession 8	Kinloss Culross (South Bruc	CR-4	6%	7%	7%	11%	12%	25%	29%	5%	18%	18%
Concession 8	CR-4	CR-12	6%	7%	7%	11%	8%	12%	15%	1%	4%	5%
CR-24	CR-12	Absalom St. W (Mildmay)	6%	7%	7%	11%	7%	10%	14%	1%	3%	3%
Statters Lake Ave	CR-1	Kinloss Culross (South Bruce-	6%	7%	7%	11%	7%	9%	12%	0%	2%	1%

5.2 Intersection Capacity Level of Service Screening Assessment

Intersection capacity utilization ICU-LOS assessment was conducted in Synchro software for future projected study horizons **(Table 10).** As noted earlier, ICU-LOS is not intended for traffic operations or signal timing design, rather it indicates how much reserve capacity would be available or how much the intersection would be overcapacity. **Appendix F** include details about Synchro inputs and outputs.

Table 10: AM and PM Peak ICU-LOS Capacity Screening for Study Intersections All Horizons

Intersection	ICU-Level of Service AM (PM)		
	Near-term / Preconstruction (2023-2032)	*Mid-term / Construction (2033-2042)*	*Long-term / Operation (2043-2083)*
#901: Hwy 9 & Bruce Rd 1	A (A)	A (A)	A (A)
#902: Hwy 4 & Concession Rd 8	A (A)	A (A)	A (A)
#903: Hwy 1 & Hwy 6	A (A)	A (A)	A (A)
#904: Hwy 4 & Hillcrest St	A (D)	A (D)	B (C)
#905: Sideroad 25 N & Hwy 6	A (A)	A (A)	A (A)
#906: Wolfe St & Hwy 6	A (A)	A (A)	A (A)
#907: Bismark St N & Absalom St W	A (A)	A (A)	A (A)
#908: Yonge St (Hwy 9) & Kincardine Hwy (Hwy 9)	B (B)	B (B)	A (B)
#909: Hwy 21 & Broadway St (Hwy 9)	B (B)	D (H)	F (H)
#910: Hwy 21 & CR-20	A (F)	B (E)	F (H)

- As noted earlier, the ICU method uses a grading system, known as LOS, to rank the intersection by the amount of reserved capacity or capacity deficit. ICU-LOS ranges from A to H where A is best (less than or equal to 55% utilization), D is generally acceptable for planning purposes (greater than 73% but less than 82%) and H is worst (greater than 109% utilization) capacity performance.

- As shown in Table 10 above, the signalized intersections of Highway 21 and Highway 9 (Broadway St.) in Kincardine, and the unsignalized intersection of Highway 20 and CR-20 near Tiverton are expected to require capacity and operational upgrades starting in near and mid-term respectevely.

- Intersections capacity issues are clearly more prevalent in the proximity to urban boundaries (transition zones) as rural two-lane roadways transition to more urbanized roadway environments were higher levels of traffic control and signalization are required especially during morning and afternoon peak commuting hours.

- Road environment transitioning from rural to urban areas, e.g., CR-6 eastbound through the community of Teeswater, should be considered carefully. Rural roads in the proximity to urban communities typically interface with sudden higher volumes of vulnerable road users and local motor vehicles. Rural road traffic in the interface typically bring higher speed, volume and heavy vehicle percentage that could adversely impact the transportation environment and safety of crossing small urban area. A transition zone could be set to help alleviate the negative impacts and collision risk brought by the rural traffic into the urban area. A transition zone can be established in the intreface between rural/urban road sections so that can be planned and desiged to helps slowing down traffic and minimize or mitigate increased level of conflicts. A series of speed calming measures can be implemented before and/or within the urban-rural road transition zone based on an appropriate design integrating sufficient engineering experience and practices, expert judgements, as well as opinions of the neighbourhoods.

6 Options Assessment

Note to Reader

This section provides an overview of possible options to mitigate negative consequences or to enhance positive outcomes. They are presented by the authors to foster discussion only. They do not represent commitments or actions for the NWMO, the Municipality of South Bruce, or other parties. The final decisions on actions and commitments will be made at a future date.

Options discussed below are intended to emphasize areas suggested for further evaluation based on the information, analysis and knowledge gathered at the current stage of the Project. Furthermore, options are not intended to be narrowly focused, nor mutually exclusive or even to preclude any other alternative options that could be deemed appropriate in subsequent studies.

In general, the options describe below address issues that stand out in our evaluation as relatively more important to prioritize than others, for example closer investigation and monitoring of operation quality of certain road sections (and intersections) that may be prone to rapid operational decline due to current and near-term traffic loads unrelated to the project.

Also important to consider in the next stages of the Project, is to explicitly incorporate design options to safely accommodate and integrate vulnerable road users (i.e., pedestrian, cyclists, and horse-buggies) as well as slow-moving agricultural vehicles particularly on Municipal 'Last Mile' roads in the proximity of the potential Project Site. This study has evidenced geographic areas of focus where these types of traffic are expected and therefore roadway design options are to be included.

Other options discussed below include additional road safety features and roadway design considerations for accommodation of large commercial vehicles, especially on last-mile road sections that would also need to integrate and interact with local traffic and vulnerable road users.

Of note, options discussed below are focused on addressing operational issues rather than purely physical infrastructure characteristics of study area roadways which is the focus of the *Road Conditions Study Report (Morrison Hershfield, 2022)* developed in tandem with this study.

The *Local Traffic Study* provides information that the NWMO and MSB can use to inform agreements and funding arrangements (as described by Principles #30 and #31) in the future as part of negotiations of a draft hosting agreement and/ or subsequent studies/ discussions if the South Bruce Area is ultimately selected as the Project location. For clarity, development of these types of agreements/arrangements is not part of the objectives / work plan for this study.

6.1 Further Investigation of Anticipated Near-to-Capacity Two-Lane Roadway Sections

Detailed two-lane facility capacity analysis is suggested for near-to-capacity road sections identified in this study for potential capacity and operational improvements in accordance with

HCM methodologies. The detailed analysis should focus on near-to-capacity road sections to confirm the extent of potential operational and safety impacts and to determine the influence of traffic volume, geometrics, and treatment length on the operational effectiveness of the treatments. Possible treatments may include passing lanes, short four-lane sections, '2+1 lanes' zones or any other capacity alternative to increase passing opportunities. Candidate road sections identified for further investigation include:

- Hwy 9 between CR-12 and Yonge Street South in Walkerton;
- Hwy 21 between Hwy 9 (Kincardine) and CR-15 (Tiverton);
- Hwy 21 between CR-15 (Tiverton) and CR-20;
- Hwy 21 between CR-20 and CR-25 (Port Elgin)
- CR-1 between Lucknow and CR-6 (Holyrood)
- CR-4 between Hanover and Walkerton
- CR-4 between Hwy 9 and CR-6 (Teeswater)
- CR-4 between CR-6 (Teeswater) and Howick Turnberry Rd (Wingham)

For clarity, the above road sections for further evaluation are not included due to concerns related to the Project, but rather almost exclusively related to effects of background traffic growth in the study area. Further HCM detailed analysis for the above road sections should include detailed performance evaluation of two-lane highway sections (with measured field data), and evaluation of passing zones/lanes (including alternatives for passing lane configuration) as applicable.

6.2 Future Studies for Municipal 'Last Mile' Roads

In addition to the above, 'Last Mile' Municipal Roads to be considered for future functional studies, in consideration of cumulative impacts due to the proximity to the Project, anticipated background traffic growth, and interaction with vulnerable road users (ie. Mennonite horse-buggies, school-related transportation, and agricultural vehicles) include:

- CR-4 between Hanover and Walkerton
- CR-4 between Hwy 9 and CR-6 (Teeswater)
- CR-4 between CR-6 (Teeswater) and Howick Turnberry Rd (Wingham)
- CR-1 (Bruce Road 1) between Lucknow and Kinloss
- CR-6 between Ripley and Holyrood
- Huron-Kinloss Townline Road between Hwy 86 and Concession 12
- Langside St. between Hwy 86 and Kinloss Culross
- Statters Lake Ave between Huron-Kinloss Townline Road and Kinloss Culross
- Karishea Ave between Huron-Kinloss Townline Road and Langside St.
- Gray Ox Ave between Huron-Kinloss Townline Road and Langside St.
- South Kinloss Ave. between Huron-Kinloss Townline Road and Langside St.
- Hayes Ave. between Huron-Kinloss Townline Road and Walker Line.

Suggested future further analysis of MSB roads includes additional in-depth two-lane roadway analysis as per HCM (i.e. passing lanes, LOS), systemic safety reviews and in-service safety reviews (ISSR), and context-sensitive functional operational review for local roadways (i.e. land uses, access/driveway management, operational, agricultural vehicles, % increase of truck traffic that will interrelate with AT, design improvements, demarcations and signs).

6.3 Intersection Capacity and Operational Improvements

Potential intersection capacity and operational improvements are suggested at the signalized intersections of Highway 21 and Highway 9 (Broadway St.) in Kincardine, and the unsignalized intersection of Highway 20 and CR-20 near Tiverton. Based on preliminary Synchro capacity analysis, the following upgrades (Table 11) are suggested subject to confirmatory analysis at later stages of the siting process:

Table 11: Suggested Intersection Upgrades and Timilines

Intersection	Potential Improvement	Timeframe
Hwy 21 & CR-20	Traffic signal implementation	Near-term Preconstruction (2023-2032)
Hwy 21 & Broadway St (Hwy 9)	- Signal timing plan optimization - Potential additional turning lanes (TBD)	Mid-term / Construction (2033-2042)
CR-4 & CR-6 (Hillcrest St-Teeswater)	Traffic signal implementation	Long-term / Operation (2043-2083)
Hwy 21 & Broadway St (Hwy 9)	- Signal timing plan optimization - Potential additional turning lanes (TBD)	Long-term / Operation (2043-2083)
Hwy 21 & CR-20	- Signal timing plan optimization - Potential additional turning lanes (TBD)	Long-term / Operation (2043-2083)

For clarity, the above suggested intersection improvements are unrelated to the Project and are almost exclusively associated with effects related to background traffic growth in the study area. Suggested improvement involving Highway 9 and Highway 21 are assumed to be the responsibility of MTO under their jurisdiction, or to be implemented in coordination with the respective municiaplities under jurisdiction.

Confirmatory detailed Synchro analysis of intersection operations is recommended at later stages in the project once travel demand forecasting (4-step) distribution and asignment assumptions are further refined. Intersection capacity analysis for the various movements at the above intersection will be undertaken as part of future study to confirm intersection improvements, signalization/optimization of timingn plans and/or safety-related improvements.

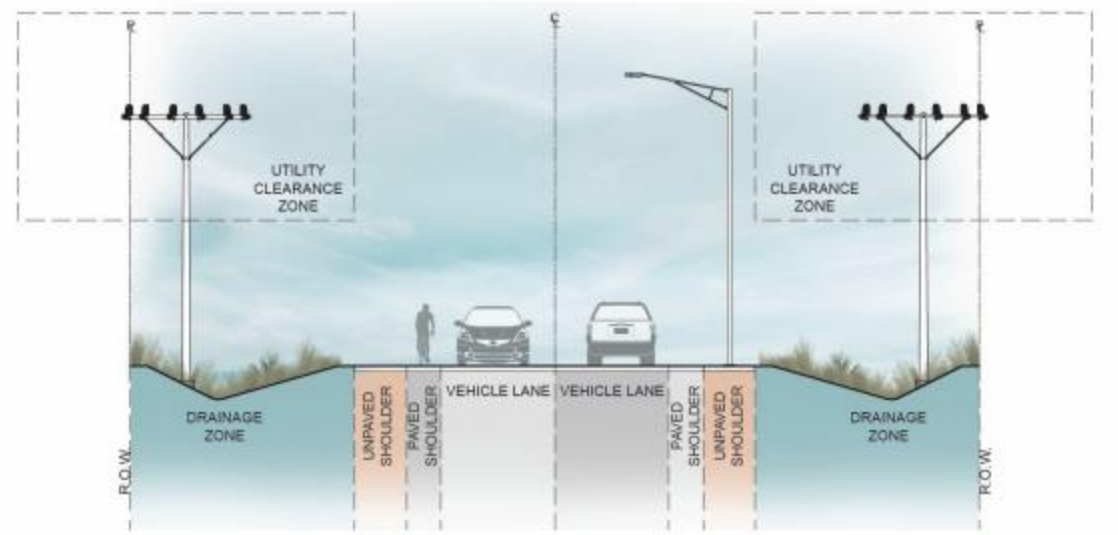
6.4 Alternative Capacity and Geometric Roadway Improvements for Vulnerable Road Users

Various roadway sections under investigation were found to be subjected to a combination of potential capacity and operational issues that may compound to unsafe operational conditions, especially along important routes for vulnerable road users (VRUs) and slow-moving vehicles such as Mennonite horse-powered buggies and agricultural machinery. County Rd 6 (CR-6) and CR-1 were observed to be important routes for Mennonite horse-powered buggies and agricultural vehicles (i.e. tractors) as several schools and churches appear to be concentrated in

and around the communities of Kinloss, Ripley, and Holyrood. In addition, these roadways sections were also identified in previous studies as historically prone-collision locations, and in some cases, as part of existing and future cycling networks.

6.4.1 Recommended Configuration for Rural Cycling Corridors

- ***The Bruce County TMP (2021)*** recommends the following configuration for designated cycling corridors (**Figure 7)** within agricultural and natural areas. These are intended to



link relatively close spaced communities and destinations. They are corridors that have been designated by the County as cycling routes. Their function includes accommodating cyclists, typically with shoulder bike-lanes or multi-use paths, in addition to moving private and goods movement vehicles.

Figure 7: Recommended Rural Cycling Corridors (Source: Bruce County TMP, 2021)

- ***The OTM Book 18*** was reviewed to confirm recommended requirements for cyclist accommodation along rural highways. Paved shoulders on rural roads may be used for cycling when sufficient operating space and pavement marking a separation from motor vehicle traffic is provided, and the shoulder surface is smooth and clear without obstacles. The recommended paved shoulder width depends on the speed and volume of the roadway. The desired widths and suggested minimum widths of paved shoulders in a rural setting are summarized in **Table 12**.

Table 12: Desired and Suggested Minimum Widths for Pave Shoulders in Rural Setting (Excerpted from OTM Book 18)

Facility	Desired Width	Suggested Minimum Width
Rural Paved Shoulder	1.5 - 2.0 m	1.2 m
Rural Paved Shoulder with Marked Buffer	1.5 – 2.0 m operating space + 0.5 – 1.0 m buffer	1.5 m operating space + 0.5 m buffer

Note: 1. On rural roads with higher-speed or higher-volume traffic, a paved shoulder buffer is recommended; 2. Paved shoulders of 2.0 m or more should be marked with a buffer.

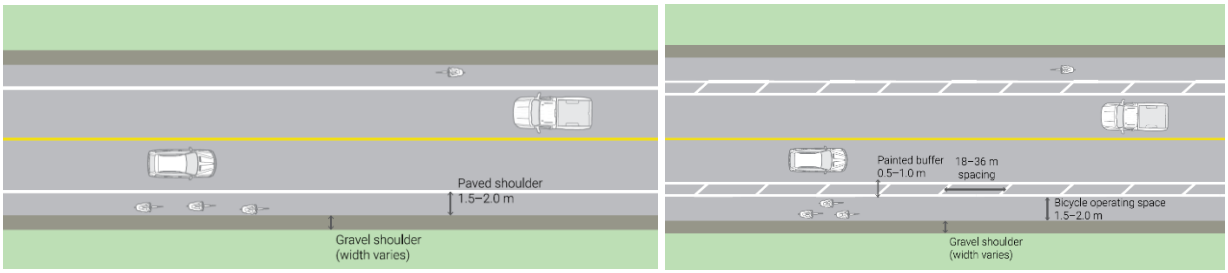


Figure 8: Typical Layout of Roadway with Paved Shoulders (Left) and Buffered Paved Shoulders (Right) (Excerpted from OTM Book 18)

Meanwhile, for rural roads with operating speeds of 70 kph or more and heavier motor vehicle volume, shoulder and buffer width should be further increased to provide greater separation to protect cyclists, as shown in **Figure 9**.

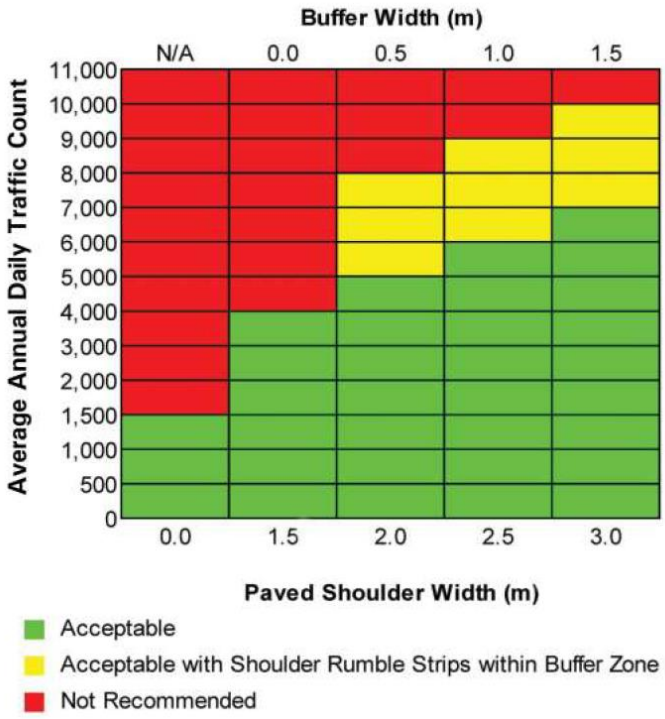


Figure 9: Paved Shoulder and Buffer Widths on Rural Roads with Operating Speeds of 70 kph or more (Excerpted from OTM Book 18)

In addition, greater lateral separation between cyclists and motor vehicles is desirable when the speed and/or volume of heavy trucks are high to reduce the aerodynamic interaction on cyclists caused by passing heavy trucks, exclusive of crosswinds.

6.4.2 Alternative Considerations for Slow-Moving Vehicles (Horse/Buggies) Routes

As noted in **Section 3.2**, CR-6 and CR-1 and nearby local roads in the vicinity of the communities of Holyrood, Ripley and Kinloss appear to concentre a significant volume of Mennonite slow-moving vehicles (horse/buggies). Strategies to deflect worker traffic from using Mennonite community roads should be considered in future studies.

Also, Concession Road 8 in the vecinity of the potential Project Site appears to have a significant proportion of larger vehicles, likely associated with agricultural activity and adjacent farmland along the corridor. Such a combination of slow-moving vehicles and large truck traffic could result in greater safety risk and exposure of vulnerable road users.

From site observations, as reported in **Section 3.3**., CR-6 and CR-1 roads, as well as most local roads in the vicinity of these communities mentioned above, lack addequate shoulder widths and surfaces to properly accommodate horse and buggy traffic currently, let alone anticipated increased traffic and trucks that are forecasted on the road network.

The following alternative considerations were developed by the Ohio Department of Transportation (ODOT, 2000) upon extensive consultation with Amish communities in the area. Excerpts from a frequently cited US report on the subject matter (Improving Safety for Slow

Moving Vehicles on Iowa's High-Speed Rural Roadways, CTRE 2009) have been consulted and adapted to this study as applicable:

- **1.8 – 2.5 m wide bituminous surface treated or paved shoulders**. Buggies will be off of the road in their own ”buggy lane”. If possible, preference is for fully paved shoulder to further separate horses from large trucks since the transition from paved lane to gravel shoulder often has a “drop off” that can cause problems for both horse and buggy. Construction costs could be high if the right-of-way must be purchased regarding the improvements needed in areas with no shoulder or steep grades. Another disadvantage is that bridges and culverts need to be widened so buggies do not need to merge in and out of traffic.

- **Separate Trail (off-carriageway), possible buggy/bike trail.** Potential benefits include separation of buggies and bicycles away from stronger and faster moving vehicles. Buggies to bicycle conflicts are less of a concern due to comparable scale, size, speed and manouverability. Potential disadvantages include cost and maintenance responsibility.

- **Buggy pull-off or hill climbing/downhill lanes for buggies.** Shoulder lanes before cresting a hill allow slow-moving buggies to pull off away from faster moving vehicles. They are also useful and safer for buggies to pull off right after a crest as a car traveling over the crest at faster speed can rapidly come upon a buggy (on the travel lane) just out of sight over the hill, leading to a collision.

- **Rumble strips are a problem for horses and buggies**. The Ohio study documented reported issues and concerns raised by the Amish community with road edge rumble strips intended by design to be a road safety enhacement. Reported concerns from the Amish community revolved around horses not wanting to go across them as they could easily turn a hoof. Also, these rumbles were reported to be hard on the buggy chassis. Some noted that the buggies could fishtail when crossing the rumble strips.

6.4.3 Other Safety Countermeasures

- **Advanced Warning Signage. Figure 10** below shows the most recent Manual of Uniform Traffic Control Devices (MUTCD) slow movement vehicle advanced warning signage (i.e., the W11-5, W11-5a and W11-14). The W11-5 is shown as a diamond-shaped sign with a symbol of a left-facing tractor and driver. The W11-5a is shown as a diamond-shaped sign with an oblique symbol of a tractor. The W11-14 is shown as a diamond-shaped sign with a symbol of a left-facing horse and closed buggy. Candidate roads for enhanced slow-moving vehicle signage were noted in **Section 3.2.**

Figure 10: Current MUCD Advanced Warning Signs for SMV

- **Other non-design related possible strategies**. Alternative non-design related strategies aimed to improve SMV safety that have been recommended in other jurisdictions in North America and Europe include education campaigns, marketing and branding, permitting and enforcing. The following strategies are suggested for potential further consideration:

    - Learner's Permit for operating farming vehicles on public roadways (North Carolina, US)
    - Safety Sticker/Safety Brochure (NFU Scotland)
    - Safety Information Campaign (print, radio, and other media) designed to address safety issues related to SMVs. These media deal with such issues as proper use of the SMV sign, tips for farmers on driving, tips for motor vehicle drivers, etc. Examples include Pensilvania Farm Bureau, OH, Farm Safety 4 Just Kids, ND, Cornell Agricultural and Health Safety Program.

6.4.4 Roadway Design Considerations for Truck Movements and Other Large Vehicles for Future Rehabilitation Roadway Projects

Geometric design and operational considerations for trucks should be considered for planned (committed) County and Local Road rehabiliation projects, specifically for roads expected to carry excavation and aggregate material identified in this report. Truck swept-path widths, acceleration and deceleration characteristics, curb-return radii at intersections, lane width, and horizontal curve widening on horizontal curves are all impacted by the physical dimensions and operating characteristics of trucks. In addition, stopping sight distance, intersection sight distance, and passing sight distance are all impacted by the presence of heavy vehicles in the traffic stream. As discussed, roadways expected to carry truck loads in the vicinity of the potential Project Site include:

- County Road 4 (CR-4)
- Concession Road 8
- Concession Road 10
- County Road 20 (CR-20)
- County Road 6 (CR-6)

- Wolf Street
- Concession 4
- Sideroad 25
- County Road 1 (CR-1)

Recommended New Road Construction and Last Mile Upgrades. Previous studies (NWMO, October 2021) have recommended the following configuration (Figure 12**Error! Reference source not found.Error! Reference source not found.Error! Reference source not found.Error! Reference source not found.**Error! Reference source not found.) for new road construction and reconstruction:

- *"The recommended right-of-way / corridor width will vary from no less than 18.3 m (60') with a preferred common width of 30.5 m (100'), increasing to accommodate cuts, fills, ditches, and any special access points (e.g., access to turnouts). This width is sufficient to accommodate the proposed roadbed with open ditches on each side. These clearances are appropriate for operations, maintenance, and response to routine incidents within the corridor."*

- *"The proposed typical cross section for new road sections of the last mile includes a 13 m wide paved road surface to accommodate two 4 m wide lanes and 2.5 m paved shoulders", as shown in* **Figure *12*** *below. Given the duration of the Project, wider lanes (i.e., 13 m) are proposed to facilitate any future maintenance and rehabilitation needs".*

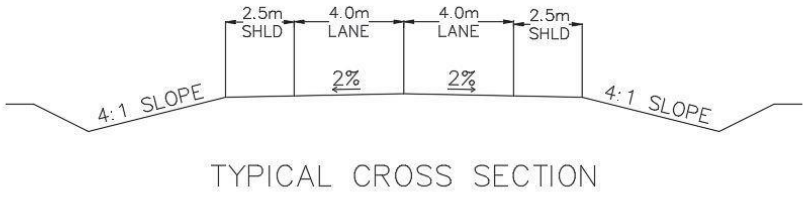


Figure 11 Recommended Typical Cross-section for New Road Construction / Reconstruction (Source: NWMO Community Studies Planning Assumptions – South Bruce Traffic (NWMO, October 18, 2021)

- *"Any proposed road works are guided by and must adhere to:*

  - *TAC Geometric Design Guide for Canadian Roads, June 2017;*
  - *Applicable structural, illumination, and road safety guidelines and / or warrants to ensure an appropriate road corridor will be available between the facility and the Primary Route Segment;*
  - *Applicable provincial and industry requirements; and,*
  - *Canadian Highway Bridge Design Code (CHBDC) (for structural works)."*

Due to potential road widenings using the new cross-section, it should be noted that the right-of-way for the roadways will need to be widened to accommodate this new cross-section and property acquisition may be required.

6.5 Traffic Monitoring

If the Project comes to the South Bruce Area, in order to understand potential and realized Project-related traffic effects, traffic monitoring will be needed. It is assumed that coordination between the NWMO, MSB and neighbouring municipalities in the Core Study Area will be required to build upon existing traffic monitoring programs (i.e., Huron-Kinloss, Brockton, Morris-Turnberry and North Huron) and to further enhance traffic monitoring for mutual benefit among other muncipalities in the Study Area.

Actual implementation will vary from municipality to municipality, as each local municipality has its own traffic counting needs, priorities, budgets, and geographic and organizational constraints. These differences will influence the selection of different equipment for data collection, plans for obtaining traffic data, and different data reporting outputs. However, all municipalities will gravitate for the collection of the same basic types of data, and each can benefit from using a similar basic data collection framework.

A basic program structure for traffic monitoring is suggested. The basic data collection framework suggested consists of portable equipment (i.e., mechanic pneumatic traffic counters or video-based monitoring) for short-term duration counts as well as special-needs counts on an as-needed basis.

No continuous traffic monitoring is suggested as these are assumed to be currently in place along Provincial Highways under the jurisdiction of the MTO. The continuous provincial count program should provide users with better understanding of vehicle classification, time-of-day, day-of-week, and seasonal variation of volumes.

- Portable Short-Term Counts: Short-term count programs are designed to provide roadway segment-specific traffic count information on a cyclical basis. Recommended short count data collection programs consist of 48-hour periods with counters that record hourly data, ideally on periodic comprehensive coverage over the subject network on a annual basis. Recommended data type to be collected include:
    - Section directional counts over a 48-hour period, recorded hourly on 15-min intervals
    - Vehicle classification by number of axles
    - Speed profiles data
- Special Needs Count Program: The coverage program may be augmented with a “special needs” element where additional counts are performed as needed to meet other more specific data needs (i.e., pavement design counts for maintenance, rehabiliation and reconstruction, traffic operation for new signal timing plans, other special purpose studies).

  Manual or video-based special needs counts for intersection turning movement data may be on a “as needed” basis, or one every three years for particualr intersections of interest.

6.6 Travel Demand Management (TDM) Programs

The NWMO indicated that although the option of shuttle buses for staff and labour to and from the potential Project Site has been considered as a possible TDM strategy, a conservative assumption at this point is to assume that most staff and labour will be using their personal vehicles for daily commuting needs. Thus traffic analysis in this study reflect highly conservative travel demand for personal automobile as the main transportation mode. Hence, no additional TDM measures beyond the suggested potential shuttle bus program for staff and labour during construction and operation phases are discussed at this time.

7 Summary

7.1 Key Findings

The following are the key findings and conclusions of this *Local Traffic Study*:

1) This report is intended to provide a high-level assessment of the potential traffic effects of the Project on the municipal and County road network, establishing existing and projected baseline conditions, forecasting future traffic levels, pre-screening potential capacity, operational and safety issues as well as exploring potential options for mitigation/improvements. However, it is recognized that additional information and investigation will be required in the future to better understand and assess the potential effects on local and regional traffic patterns beyond capacity-utilization analysis that was the focus of this study.

2) Additional suggested analyses for future studies are twofold:

    - First, those recommended for in-depth two-lane analysis as per HCM for road sections pre-screened due to capacity constraints; and

    - Secondly, those recommended for Municipal 'Last Mile' Roads which encompass a more holistic, functional and context-sensitive investigation which includes confirmatory data collection, operational assessment, functional design review to accommodate all road users, as well as safety parameters for those roads prone to conflicts between slow-moving vehicles, vulnerable road users, agricultural vehicles and anticipated truck/construction traffic due to the Project. Future safety analysis should be undertaken to establish collision rates and related causative factors for mitigation.

3) Current capacity-utilization ratios across the study road network are generally below 60% utilization ratios. That indicates that most roadway facilities are currently operating at acceptable LOS D with no congestion spillover and virtually unlimited availability of gaps in the opposite traffic stream for passing maneuvers.

4) Preliminary capacity screening analysis indicates some potential road sections with capacity constraints as a result of expected growth of background traffic (unrelated to the Project), largely associated with future growth of communities and area attractions. As noted above, in-depth two-lane analysis as per HCM for road sections is suggested for future studies.

5) It is suggested that future detailed study be undertaken for all roads that are used for access or goods supply for the Project, between the Provincial Highways and the potential Project Site. Of note, the most significant impact in terms of capacity-utilization directly related to the Project is expected on Concession 8 near the potential Project Site (Kinloss Culross Road to CR-4) where an estimated net increase of 18% capacity utilization is expected due to the Project. Other minor impacts on roadway capacity were summarized in **Section 5.1, Table 9**.

6) Despite the above, some sections of Highway 9 and Highway 21, as well as a section of CR-4 (between Hanover and Walkerton) are starting to exhibit utilization levels nearing the 60 to 70% utilization ratios. As discussed, two-lane roadways are unique in the sense that

operation quality often decreases precipitously as demand flow increases; therefore, operations can become “unacceptable” at relatively low volume-to-capacity ratios.

7) Screened road sections in this study for potential capacity and operational improvements are recommended for detailed facility analysis in accordance with HCM methodologies. This detailed analysis should focus on near-to-capacity road sections identified in this report so to confirm the extent of potential operational and safety impacts and to determine the influence of traffic volume, geometrics, and treatment length and the operational effectiveness of the treatments. Possible treatments may include passing lanes, short four-lane sections, ‘2+1 lanes’ zones or any other capacity alternative to increase passing opportunities. See **Section 6.1** for specific road sections.

8) Specific intersections including the signalized intersection of Highway 21 and Highway 9 (Broadway St.) in Kincardine, and the unsignalized intersection of Highway 20 and CR-20 near Tiverton are currently experiencing capacity and operational issues which will require upgrades in the near-term. Intersection capacity constraints are more prevalent in the proximity to urban boundaries (transition zones) as rural two-lane roadways transition to more urbanized roadway environments were higher levels of traffic control and signalization are required especially during morning and afternoon peak commuting hours. **Sections 3.2** and **5.2** discuss current and future operational issues, as well as potential mitigation options, at these two particular intersections.

9) Since two-lane operation quality decreases as a result of demand flow increases and because of capacity restrictions due to insufficient passing opportunities, driving behavior is susceptible to riskier maneuvering and overall impact to road safety. This is particularly important to evaluate and mitigate on road sections that overlap capacity-utilization issues, collision-prone historic locations, as well as the presence of vulnerable road users. **Sections 3.2** and **5.1** of this report identify these road sections.

10) Road sections of particular interest for vulnerable road users (i.e., horse-buggies, cyclists and pedestrians) and slow-moving vehicles (e.g., agricultural machinery) have been identified and alternative safety consideration recommended for potential implementation. Refer to **Section 6** above.

11) Commercial trucks and agriculture-related vehicle traffic were observed on almost every road in the Study Area. Truck traffic ranges from 8% to 11% on Provincial Highways, and 7% to 9% percent on ‘last-mile’ County and local municipal roads. Of note, significant truck traffic was observed on Concession Road 8 ranging from 10 to 18% of the total peak hour traffic. Future studies regarding truck traffic increases and variability should be considered on a daily and seasonal basis and during periods of increased construction activities on the potential Project Site.

12) Although near-to-zero pedestrian and cycling activity was observed during field data collection, some increase in activity during summer months should be expected, and if possible, should be confirmed in future studies related to traffic data collection over the summer months. Some cycling activity, particularly east-west, along CR-6, Concession Road 8 and Statters Lake Avenue in the proximity of the potential Project Site has been recorded through third-party online data sources.

13) According to the *Road Conditions Study Report* (Morrison Hershfield, 2022), all roads within the Study Area are expected to require rehabilitation(s) and or reconstruction during the lifespan of the Project given its long duration. **Section 6.4.4** of this *Local Traffic Study* report discusses design considerations for truck movements and other large vehicle accommodation that should be considered in future roadway rehabilitation projects.

14) The *Local Traffic Study Report* provides information that the NWMO and MSB can use to inform agreements and funding arrangements (as described by Principles #30 and #31) in the future as part of negotiations of a draft hosting agreement and/ or subsequent studies/ discussions if the South Bruce Area is ultimately selected as the Project location. For clarity, development of these types of agreements/arrangements is not part of the objectives / work plan for this study.

8 References

AECOM Canada Limited. (September 2021). *Deep Geological Repository Transportation Conceptual Design Report, Crystalline / Sedimentary Rock Environment*. Nuclear Waste Management Organization. https://www.nwmo.ca/~/media/Site/Reports/2021/09/21/19/56/APMREP004400209.ashx?la=en

Centre for Transportation Research and Education (2009). Improving Safety for Slow Moving Vehicles on Iowa's High-Speed Rural Roadways, Online Publication. http://publications.iowa.gov/19995/1/IADOT_tr_572_Improving_Safety_Slow_Moving_Vehicles_Rural_Roadways_May_2009.pdf

County of Bruce. (2020). *Preferred Route Map to Bruce Power*.

County of Bruce. (2021). *Master Transportation Plan, Final Repot.* RFT-BC-TES-20-14 *https://www.brucecounty.on.ca/sites/default/files/master%20transportation%20plan%20AODA.pdf*

DPRA Canada. (2021). *Southwestern Ontario Local Traffic Study Work Plan*. Prepared for the Nuclear Waste Management Organization.

Global Strava Metro (2022). Cyclist Activity Heatmaps Southwestern Ontario. https://www.strava.com/heatmap#7.00/-123.08984/49.25155/hot/all

Google Earth. (2022). Imagery of Bruce & Huron Counties. https://earth.google.com/web/

Heimlich, D. (2021). *APM 2021 DGR Lifecycle Cost Estimate Update Cost Summary Report*. Nuclear Waste Management Organization. NWMOTR202111-APM-2021-DGR-Lifecycle-Cost-Estimate-Update.ashx

Keir Corp. (2022a.) *Housing Needs & Demand Analysis Study Report –Southwestern Ontario Community Study*. Prepared for the Nuclear Waste Management Organization and the Municipality of South Bruce.

Keir Corp. (2022b). *Aggregate Resources Study Report –Southwestern Ontario Community Study*. Prepared for the Nuclear Waste Management Organization and the Municipality of South Bruce.

Keir Corp. (2022c). *Workforce Development Study Report –Southwestern Ontario Community Study.* Prepared for the Nuclear Waste Management Organization.

McKillop, R. (January 2022). NWMO Southwestern Ontario Aggregate Resources Study Memorandum. Palmer. Appendix D of Keir Corp. 2022b *Aggregate Resources Study Report –Southwestern Ontario Community Study*. Prepared for the Nuclear Waste Management Organization and the Municipality of South Bruce.

Mergel J. (July 1997). An Overview of Traffic Monitoring Programs in Large Urban Areas. Center for Transportation Information Volpe National Transportation Systems Center US Department of Transportation Cambridge, MA 02142

metroeconomics (February 2022). *South Bruce and Area Growth Expectations Memorandum.* Prepared for MDB Insight (now Deloitte LLP) and the Municipality of South Bruce.

Morrison Hershfield. (2022). *Road Conditions Study Report – Southwestern Ontario Community Study.* Prepared for the Nuclear Waste Management Organization.

Municipality of South Bruce. (2017). *Map Location of Old Order and Orthodox Mennonite Churches and Schools in Kinloss Township*.

Naserifard, N., Lee, A., Birch, K., Chiu, A., & Zhang, X. (2021). *Deep Geological Repository Conceptual Design Report Crystalline/Sedimentary Rock*. Nuclear Waste Management Organization. https://www.nwmo.ca/~/media/Site/Reports/2021/09/22/18/43/APMREP004400211.ashx?la=en

National Academies of Sciences, Engineering, and Medicine. 2016. *Planning and Preliminary Engineering Applications Guide to the Highway Capacity Manual*. Washington, DC: The National Academies Press. https://doi.org/10.17226/23632

Nuclear Waste Management Organization. (November 2021). *Community Studies Planning Assumptions – South Bruce Traffic* (Confidential)

Nuclear Waste Management Organization. (October 2021). *Community Studies Planning Assumptions* (Confidential)

Ontario Ministry of Transportation. (2020). *Connecting the Southwest: A Draft Transportation Plan for Southwestern Ontario*. Queen's Printer for Ontario. https://files.ontario.ca/connecting-the-southwest-english.pdf

Ontario Ministry of Transportation. (2020). *MTO iCorridor*. Visualizing a Changing Ontario through Maps. Traffic Volume Data. https://icorridor-mto-on-ca.hub.arcgis.com

Ontario Ministry of Transportation. (2020). *MTO Technical Publications*. Traffic Volume Data. https://www.library.mto.gov.on.ca/SydneyPLUS/TechPubs/Portal/tp/tvSplash.aspx

Ontario Ministry of Transportation. (2022). *Ontario's Highways Programs*. Queen's Printer for Ontario. https://www.ontario.ca/page/ontarios-highway-programs

Texas Department of Transportation Research and Technology Implementation Office (2003) Truck Accommodation Design Guidance: Policy Maker Workshop. Report No. FHWA/TX-04/4364-3. https://static.tti.tamu.edu/tti.tamu.edu/documents/4364-3.pdf

Township of Huron-Kinloss. (2020.) *Roads*. https://www.huronkinloss.com/en/live-here/roads.aspx#Half-load-limits

Trip Generation Manual (10th edition), Institute of Transportation Engineers, Washington DC, 2017

U.S. Department of Transportation Federal Highway Administration Office of Highway Policy Information (May 2001). Traffic Monitoring Guide. http://www.bv.transports.gouv.qc.ca/mono/1162134.pdf

APPENDIX A- List of Socio-Economic Community Studies

List of Socio-Economic Community Studies

Study Name	Study Proponent	Lead Consultant
Local Economic Development Study and Strategy	MSB	MDB Insight (now Deloitte LLP)
Economic Development Study on Youth	MSB	MDB Insight (now Deloitte LLP)
Local Hiring Effects Study & Strategy	MSB	MDB Insight (now Deloitte LLP)
Agriculture Business Impact Study	MSB	MDB Insight (now Deloitte LLP)
Fiscal Impact and Public Finance Study	MSB	Watson & Associates Economists
Tourism Industry Effects Study and Strategy	MSB	MDB
Housing Needs and Demand Analysis Study	NWMO, MSB	Keir Corp.
Labour Baseline Study	NWMO	Keir Corp.
Workforce Development Study	NWMO	Keir Corp.
Regional Economic Development Study	NWMO	Keir Corp.
Effects on Recreational Resources	MSB	Tract Consulting
Local/Regional Education Study	NWMO, MSB	DPRA
Land Use Study	NWMO, MSB	DPRA
Social Programs Study	NWMO, MSB	DPRA
Emergency Services Study	NWMO	DPRA
Vulnerable Populations Study	NWMO	DPRA
Community Health Programs and Infrastructure Study	NWMO	DPRA
Aggregate Resources Study	NWMO, MSB	Keir Corp.
Infrastructure Baseline and Feasibility Study	NWMO	Morrison Hershfield
Local Traffic Study	NWMO	Morrison Hershfield
Road Conditions Study	NWMO	Morrison Hershfield

APPENDIX B - Inventory of Knowledge Holder Interviews

The table below includes an inventory of Knowledge Holders interviewed in 2021 applicable to the *Local Traffic Study*. Names and titles have been excluded to respect the privacy of individuals.

Date	Knowledge Holder Organization	Applicable Studies
Oct 13, 2021	Bruce County	Road Conditions Local Traffic
Oct 14, 2021	Municipality of South Bruce, Public Works	Road Conditions Local Traffic Aggregate
Oct 14, 2021	Huron County	Road Conditions Local Traffic
Oct 20, 2021	Township of Huron-Kinloss	Road Conditions Local Traffic
Aug 11, 2021	Teeswater Concrete	Road Conditions Local Traffic

APPENDIX C - Traffic Data Collection Summary Reports

Provided as a stand-alone pdf file

APPENDIX D - Road Safety Field Observations Memorandum

Provided as a stand-alone pdf file

APPENDIX E - Travel Demand Forecasting Estimates

Provided as a stand-alone pdf file

APPENDIX F - Intersection Capacity Analysis Memorandum

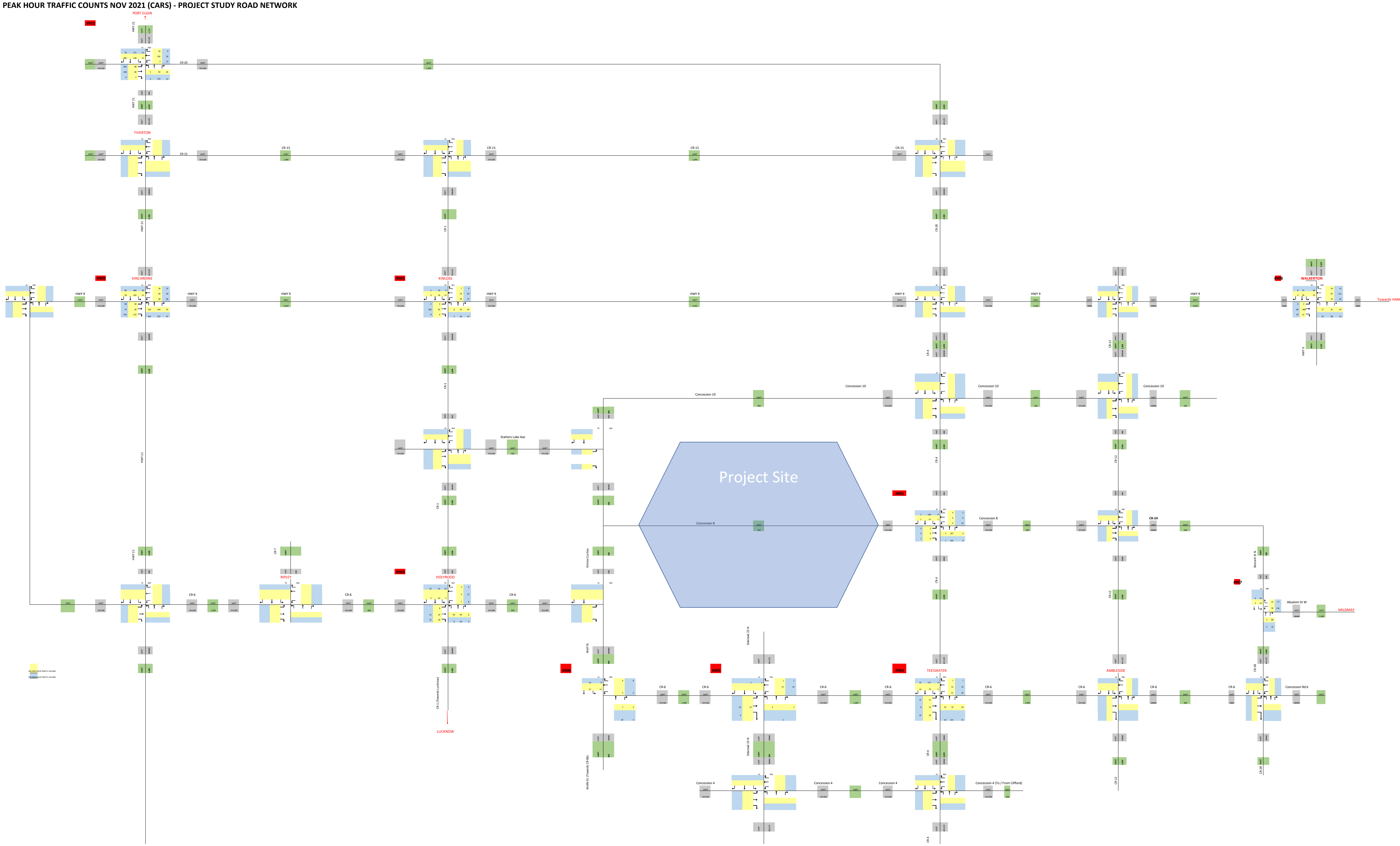
Provided as a stand-alone pdf file

APPENDIX G- List of Acronyms

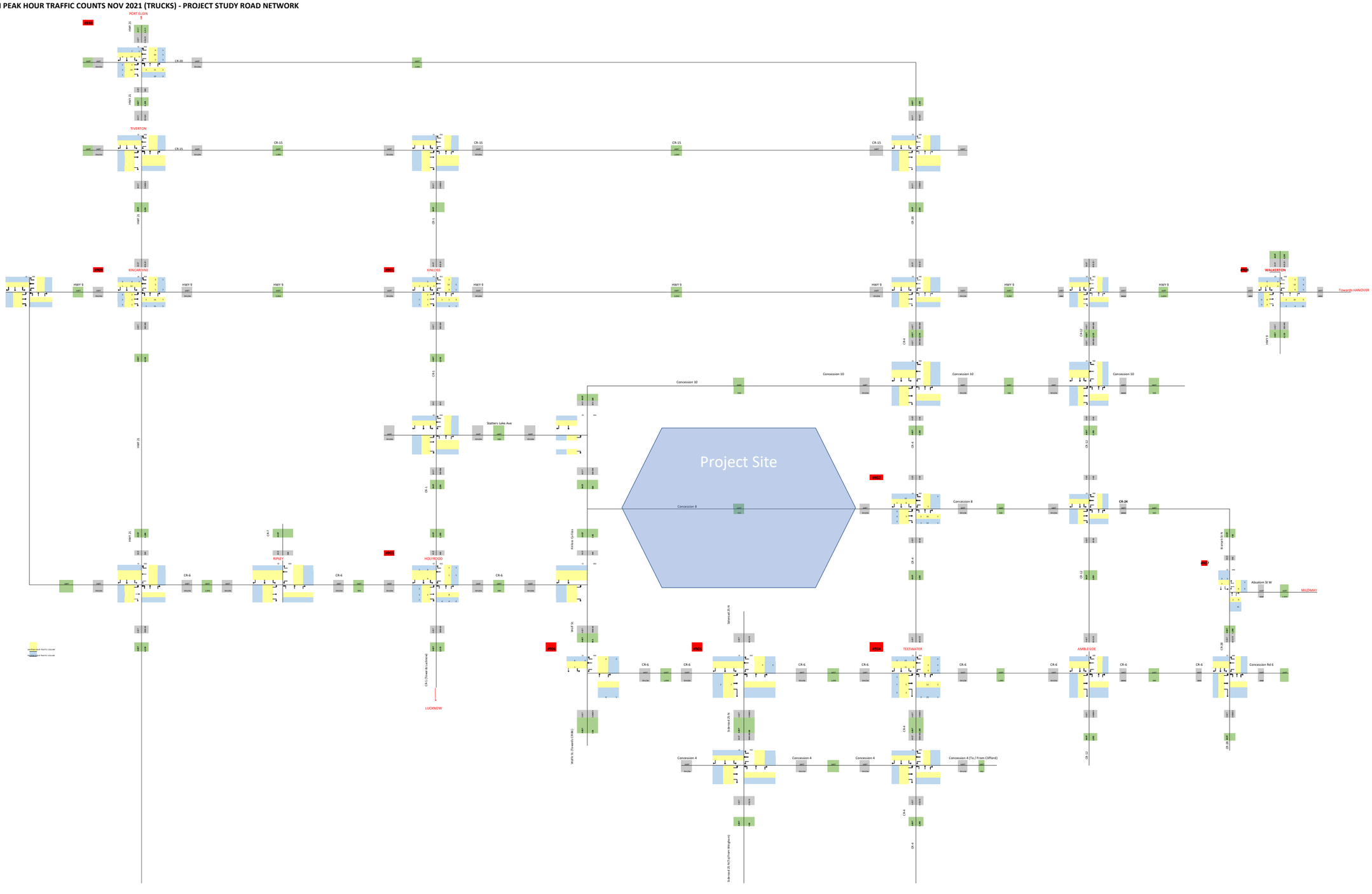
AADT ..... Annual Average Daily Traffic
APM..... Adaptive Phased Management
CITE ..... Canadian Institute of Transportation Engineers
CHBDC..... Canadian Highway Bridge Design Code
CoE..... Centre of Expertise
CR(s) ..... County Road(s)
DGR..... Deep Geological Repository
DPRA..... DPRA Canada Inc.
GIS ..... Geographic Information Systems
GTA ..... Greater Toronto Area
HCM ..... Highway Capacity Manual
IA ..... Impact Assessment
ICU ..... Intersection Capacity Utilization
ICU-LOS ..... Intersection Capacity Utilization – Level of Service
ITE..... Institute of Transportation Engineers
MCR ..... Major Component Replacement
MECP ..... Ontario Ministry of the Environment, Conservation and Parks
MSB..... Municipality of South Bruce
MTO..... Ontario Ministry of Transportation
MUTCD..... Manual of Uniform Traffic Control Devices
NCHRP..... National Cooperative Highway Research Program
NWMO..... Nuclear Waste Management Organization
ORSAR..... Ontario Road Safety Annual Reports
SADT ..... Summer Average Daily Traffic
SMV..... Slow Moving Vehicles
TAC ..... Transportation Association of Canada
TDM..... Travel Demand Management
TIS..... Traffic Impact Study
TMP ..... Transportation Master Plan
UFTP ..... Used Fuel Transportation Package
UFTS ..... Used Fuel Transport System
UNF ..... Used Nuclear Fuel
VPD ..... Vehicles Per Day


Port Elgin
Tiverton
J&I Side Rd
Concession 2
Side Road 20
21
20
6
10
Potential South Bruce Project Site
Potential Material/Supply Routes
Potential Commuter Routes
Peak Hour Intersection Counts
County Rd 15
15
10
3
19
Gray Rd 10
Queen St
Kincardine Av
1
20
6
Bruce Rd 3
2
4
Walkerton
9
7
Flesherton
Absalom St E
County Rd 6E
Mildmay
Absalom St W
Concession 10
Concession 8
24
Amberley Rd
Bluewater Hwy
Bruce Rd 1
County Road 6
Sideroad 25
Glenannon Rd
Teeswater
Wolfe St
Holmes Line
London Rd
Markdale
Side Rd 15
Howick Turnberry Rd
London Rd
Josephine St
Amberley Rd
Harriston Rd
Durham
Concession 4
Concession 2
Bruce Rd 12
Bruce Rd 28
Field Rd
Heron Bruce Rd
Fordwich Line
Clifford
Tiverton
Kincardine

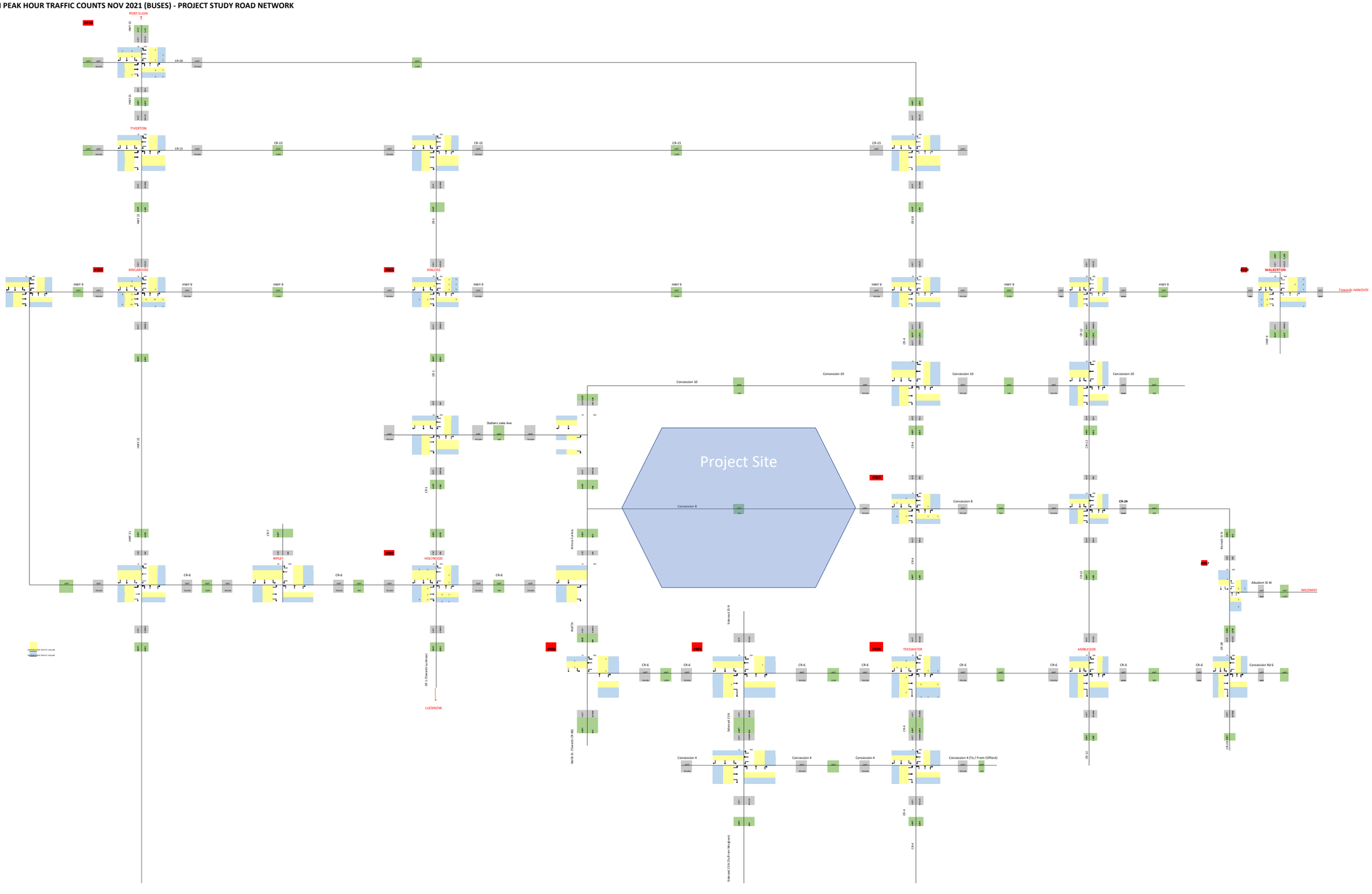
AM-PM PEAK HOUR TRAFFIC COUNTS NOV 2021 (CARS) - PROJECT STUDY ROAD NETWORK



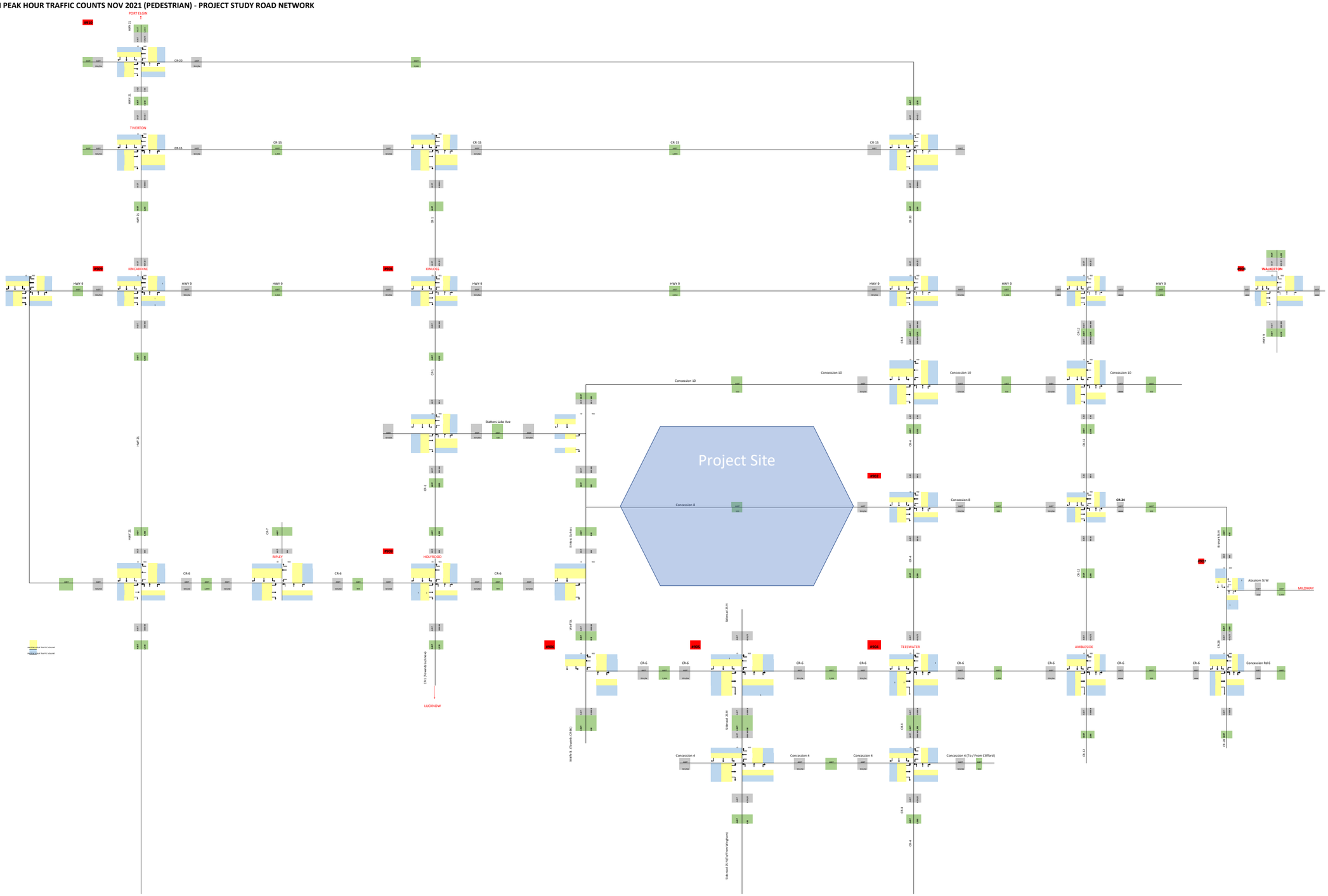
AM-PM PEAK HOUR TRAFFIC COUNTS NOV 2021 (TRUCKS) - PROJECT STUDY ROAD NETWORK



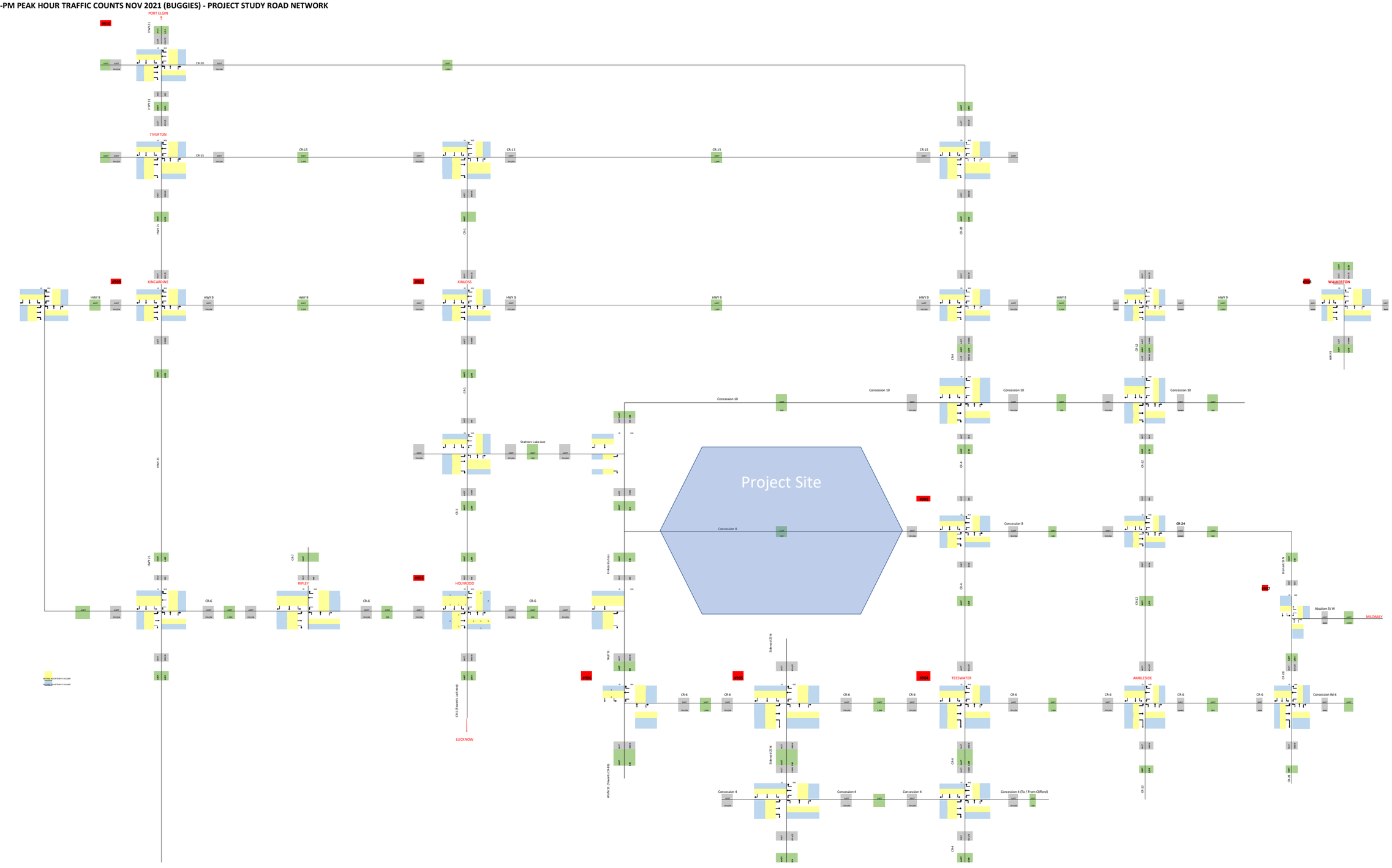
AM-PM PEAK HOUR TRAFFIC COUNTS NOV 2021 (BUSES) - PROJECT STUDY ROAD NETWORK



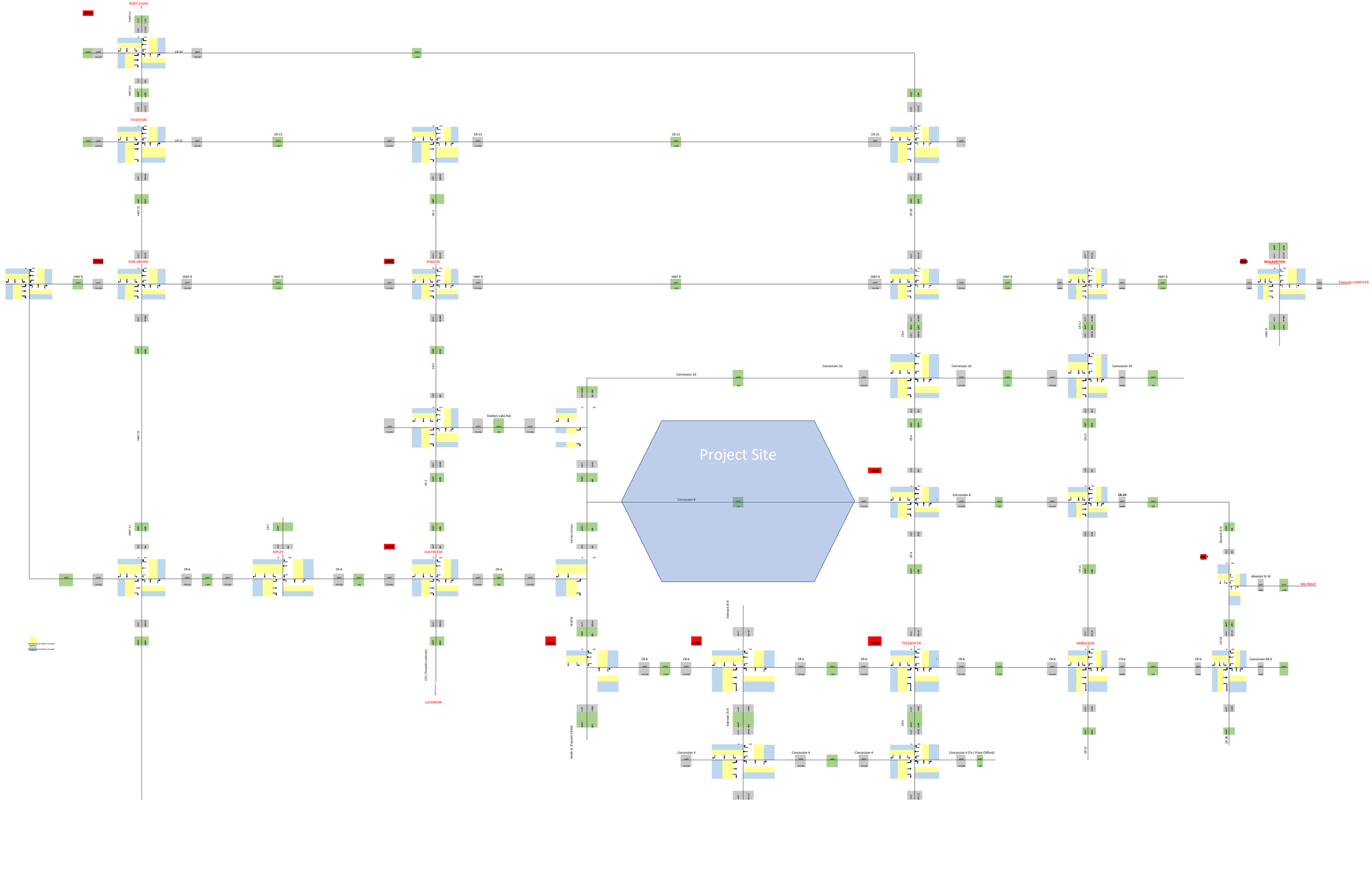
AM-PM PEAK HOUR TRAFFIC COUNTS NOV 2021 (PEDESTRIAN) - PROJECT STUDY ROAD NETWORK



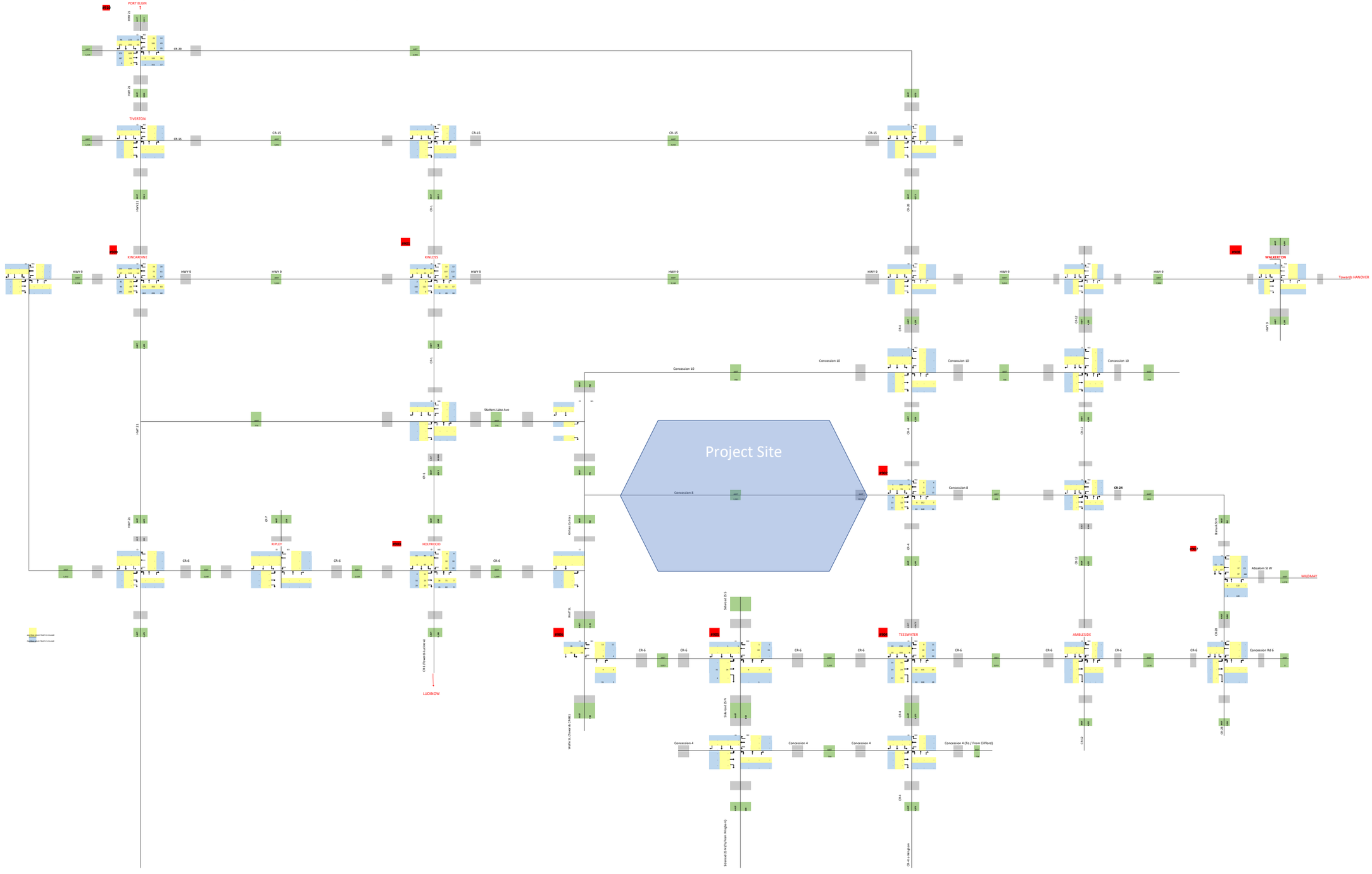
AM-PM PEAK HOUR TRAFFIC COUNTS NOV 2021 (BUGGIES) - PROJECT STUDY ROAD NETWORK



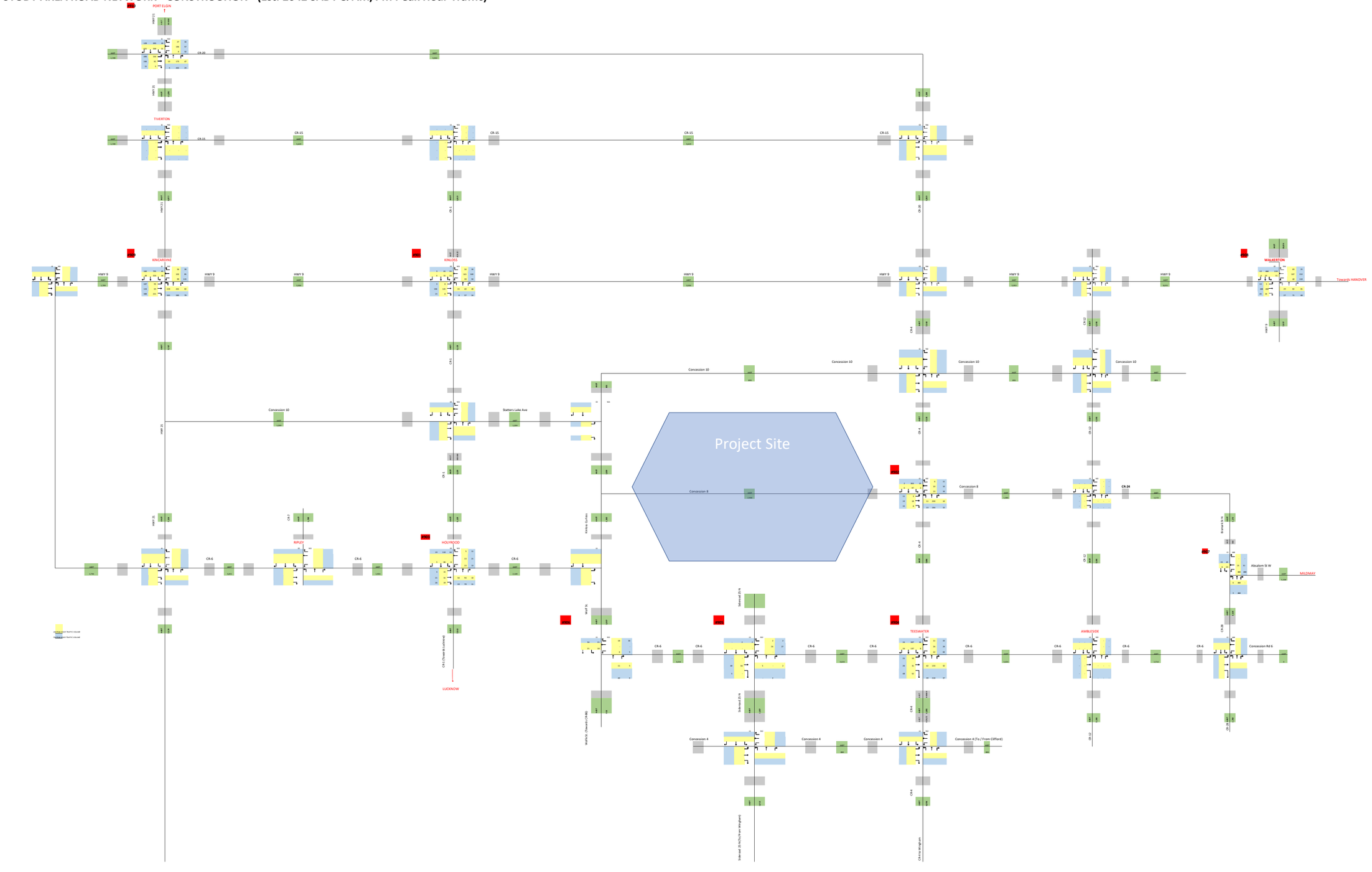
AM-PM PEAK HOUR TRAFFIC COUNTS NOV 2021 (BICYCLES) - PROJECT STUDY ROAD NETWORK



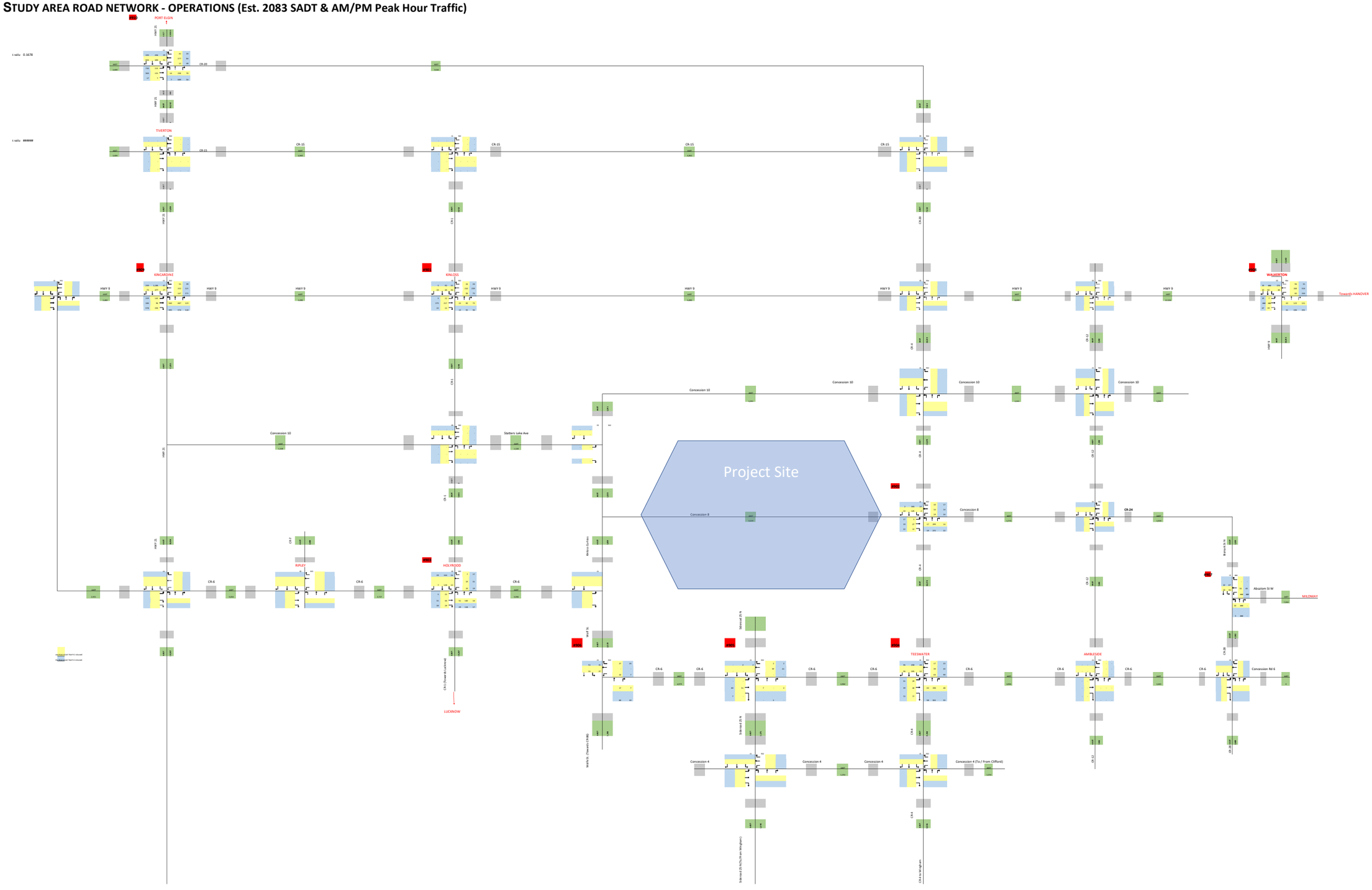
STUDY AREA ROAD NETWORK - PRECONSTRUCTION -(Est. 2032 SADT & AM/PM Peak Hour Traffic)



STUDY AREA ROAD NETWORK - CONSTRUCTION - (Est. 2042 SADT & AM/PM Peak Hour Traffic)



STUDY AREA ROAD NETWORK - OPERATIONS (Est. 2083 SADT & AM/PM Peak Hour Traffic)



MEMORANDUM

MORRISON HERSHFIELD

TO	Project File	**FOR INFO OF:**	Andres Baez, MH PM
FROM:	Sara Fadaee, MH Traffic		
		PROJECT No.:	2035249.00
RE:	South Bruce – Transportation / Infrastructure Baseline – Observations from Site Visit / Corridor Drive Throughs	**DATE:**	12/17/2021

\\EGNYTEDRIVE\MH CLOUD\PROJ\2020\203524900-NWMO DPRA - BRUCE SITE - BASELINE\08. WORKING\SITE VISIT NOV 10, 2021\OBSERVATIONS FROM SITE VISIT - CORRIDOR DRIVE THROUGHS.DOCX

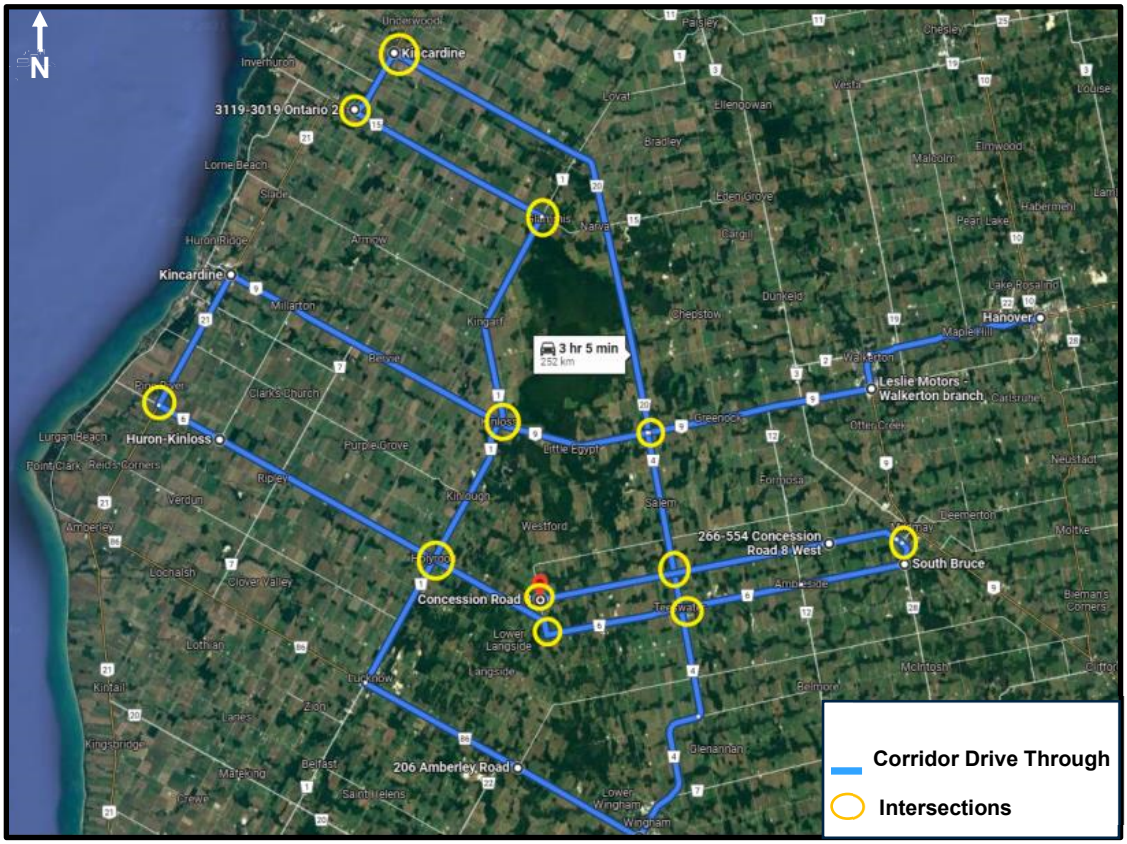
1. Introduction

The traffic team conducted a site visit / corridor drive through on November 10th, 2021. The site visit covered the following time periods:

- Mid-day (1:00 PM) – to observe the off-peak period;
- Afternoon / PM peak period (5:00 PM) – to observe the evening commuter peak traffic; and
- Evening (6:30 PM) – to observe roadway conditions during the darker evening hours.

The site visit included a review of roadway geometry, signing and pavement markings, access management, vulnerable road user facilities, lighting conditions, and operational issues. The following sections provide summaries of the observations that were made during the site visit / corridor drive through. The study area for this assignment is illustrated below in **Figure 1**.

Figure 1: Study Area – Highway 138 and Headline Road



2. General Observations

Based on 2021 Master Transportation Plan (MTP), the typical capacity limits of highway sections and County Roads are approximately 900 vehicles per lane per hour. It is noted the section of Highway 21 between Port Elgin and Southampton are four-lane highways. The remaining highways and County roads currently operate as two-lane facilities.

Typically, it took the traffic team 3 hours to drive the South Bruce Corridor from end to end. Moderate traffic volumes were observed during the drive and capacity constraints never seemed to be an issue. As a result, travel times were consistent for both travel directions during the various periods. In addition, large commercial vehicles (i.e., trucks), school buses, horse-carriers, and horse buggies were observed during the drive.

The regulatory posted speed limit is in the range of 50 to 80 km/hr. Visibility is more of an issue during the nighttime hours, as there is limited lighting along the corridor. The majority of drivers during our drive along the corridor was able to abide by the posted speed limit.

3. Safety Issues

The objective of the site visit was to identify both corridor-wide and location specific (i.e., intersections) safety issues and provide mitigation solutions . A detailed summary of the safety issues identified, and corresponding mitigation measures are summarized below.

3.1 County Road 4 (Hanover - Walkerton)

The estimated 2018/2019 two-way Annual Average Daily Traffic (AADT) volumes on County Road 4 (CR 4) between the Town of Hanover and Town of Walkerton were in the order of 5,490 to 9,450 veh/day. Summer traffic (SADT) was 22% higher than AADT.

The section of CR 4 (Walkerton – Jackson Street to Durham Bridge) has high Design Hour Volumes (i.e., in excess of 900 veh/hr/ln). Based on the 2021 MTP, there was a total of 52 collisions on CR 4 between McNab Street and County Road 22 (7.7 km) with a collision rate of 0.81.

Issue 1: Information Sign Content

The information sign on the "northeast" corner of the signalized CR 4 / 7th Avenue intersection (in the Town of Hanover) contains too much information. The sign refers to 8 businesses, which is excessive; most drivers can process only 2-3 lines properly. It appears that no similar sign is provided in the other direction on the CR 4. Driver distraction from trying to read roadside signs can lead to various collisions. In addition, a second sign should be placed much further upstream of the intersection so that vehicles can pull over to read it; space can be provided near the sign for vehicles to pull over.

Issue 2: Poor Pavement Condition

At several locations along CR4, there was considerable damage to the pavement. MH suggests the County consider repairing pavement damages.

Issue 3: Absence of Shoulders

Paved shoulders are absent throughout the corridor, and gravel shoulders are inconsistent and even where provided they lack functionality.

Shoulders are needed for several purposes: to provide off-road storage for stalled vehicles or post-collision care; for emergency vehicles to use for passing; and for pedestrian and bicycle movements where sidewalks are absent. The lack of adequate shoulders can result in the vulnerability of active road users to roadway traffic due to insufficient width, pedestrians / cyclists using the road, and unsafe passing.

If it is not feasible to provide paved shoulders or rumble strips, then gravel shoulders will still be helpful. However, gravel shoulders do not provide a good surface for cyclists, and some of the gravel will end up on the roadway, which could affect the road-tire friction.

Issue 4: Pedestrian Crossing Opportunities at Intersections

Traffic team noted that pedestrian crosswalks and stop bars are not marked at the unsignalized CR 4 / Victoria Street intersection within the Town of Walkerton. As a result, pedestrian movements occur in various directions in the vicinity of the intersection, and they may not be directly in the field of view of motorists proceeding through or turning at the intersection.

During the corridor drive throughs, MH team observed that a pedestrian was crossing CR 4 north of Victoria Street and one cyclist was using the sidewalk.

MH suggests that the County consider providing the appropriate pavement markings at this intersection.

3.2 CR 4 (Jackson Street / Yonge Street)

The estimated 2018/2019 two-way AADT volumes on Jackson Street were 6,220 veh/day. SADT volumes (7,590) were 22% higher than AADT. The regulatory posted speed limit along Jackson Street is 50 km/hr.

The recommended MTP strategy includes road capacity improvements for CR 4 between Elgin Street and County Road 19. Recommended improvements include parking control, dedicated turn lanes and widening of through traffic lanes. These improvements are anticipated between 2031 and 2035.

Issue 1: Road Geometry

Yonge Street South has an acute angle with Jackson Street. Thereby the southbound vehicles along Jackson Street are slowing down to make the right turn to Yonge Street. This creates conflicts with following vehicles and would cause rear end collisions.

The traffic team also noticed that the left turn arrow on the exclusive northbound left turn lane along Jackson Street is missing at the Yonge Street South intersection. In addition, the stop bars at Elgin Street and Yonge Street South intersections are unmarked.

Little can be done to change the geometric of the roadway or to relocate established intersection. Therefore, it is suggested that improvements concentrate on improving the pavement markings and installing additional signage to direct motorists.

3.3 Highway 9 (from CR 4 to CR 20)

The King's Highway 9 is an east-west undivided rural highway with a two-lane cross-section and a regulatory posted speed limit of 80 km/hr. The 2016 two-way AADT volumes on Highway 9 were in the order of 3,200 to 4,850 veh/day. 2016 SADT volumes were approximately 22% higher than AADT. The traffic pattern in this section of Highway 9 is Commuter Recreation (CR).

Issue 1: Absence of Speed Sign

The intersection of CR 4 / Highway 9 is a major junction in the road network, but no signs referring to the posted speed along Highway 9 are provided on the west leg along Highway 9. This lack of guidance and warning can confuse drivers. Speed signs close to intersections would encourage drivers to accelerate as merging from a county road to a highway.

3.4 County Road 20 (from Hwy 9 to Hwy 21)

The estimated 2018 / 2019 two-way AADT volumes on County Road 20 (CR 20) were 5,810 veh/day. SADT volumes (6,860) were 18% higher than AADT. The regulatory posted speed limit along CR 20 is 80 km/hr.

The recommended MTP strategy includes road capacity improvements for CR 20 between Highway 21 to Tie Road / County Road 33. Recommended improvements include parking control, dedicated turn lanes and widening of through traffic lanes. These improvements are anticipated between 2031 and 2035.

Issue 1: Construction Sites Close to the Edge of the Road

During the corridor drive throughs, MH team observed two small construction sites very close to the edge of the road, separated by a concrete barrier and traffic cones. Construction warning devices such as warning signs, flashing beacons, pavement markings, portable changeable message signs, dynamic message signs and arrow boards are usually sufficient to alert and guide drivers safely around or through work zones.

Based on OTM Book 7, an offset distance of at least 0.5 m from the edge of a lane to the barrier is desirable. At a barrier offset of 1.0 m, traffic flow is likely to be unaffected.

The traffic cones and TC-54 flexible drum (barrel) may be used to provide separation between a construction work site and the flow of traffic. When located near traffic lanes, traffic cones and drums may reduce capacity. Traffic cones and drums should be placed with care to reduce the likelihood of impact. Based on OTM Book 7, an offset of 0.3 to 0.6 m between traffic cones and flexible drums (barrels) and the edge of the travelled lane should be maintained.

Issue 2: Pedestrian Crossing

During the corridor drive throughs, pedestrians were seen using the shoulders along the northern side of CR 20. Considering the level of traffic (i.e.,6,000 veh/day) and the tendency for motorists to speed up in areas that have a wider cross-section, crossing pedestrians are considered to be at risk. MH team suggests the County consider providing active transportation corridors as a mean of linking communities together while providing alternatives to private vehicle use.

Issue 3: Gravel and Dirt on the Roadway

Due to the gravelled shoulders and multiple driveways to the surrounding farms, a lot of gravel and dirt end up on the main road surface. If severe, this can affect the road surface performance and friction as well as obscured part of the roadway and pavement markings. Loose gravel on the roadway can also in turn get kicked up to vehicle windshield, causing damage and startling drivers. Larger pieces of dirt will also cause vehicles to swerve or brake to try to avoid them.

Paving farm entrances would reduce this phenomenon. Another reactive approach to this issue would be to have street sweeping conducted more regularly so that loose gravel or dirt do not remain on the road surface.

3.5 Highway 21 (from CR 20 to CR 15)

The King's Highway 21 is an undivided rural highway with a two-lane cross-section and a regulatory posted speed limit of 80 km/hr. It is noted that the section of Highway 21 between Port Elgin and Southampton is currently a Four-lane highway.

The 2016 two-way AADT volumes on Highway 21 were approximately 5,250 veh/day. Summer traffic (2016 SADT = 6,400 veh/day) was 22% higher than AADT. The traffic pattern in this section of Highway 21 is Commuter Tourist Recreation (CTR).

Based on the MTP, County work with MTO to plan for improvements to the following highway 21 sections:

- Highway 21 through Kincardine;
- Highway 21 from Kincardine to Port Elgin; and
- Highway 21 from Port Elgin to Southampton.

The recommended MTP strategy includes operational and safety measures. Traffic reviews are recommended to address operational issues and confirm the appropriate improvement for the following locations:

- CR 3 at Highway 21 intersection (intersection operation and warrant for roundabout);
- CR 13 at Highway 21 intersection (intersection operation and warrant for roundabout); and
- CR 20 at Highway 21 intersection (opportunity for added traffic control including signage and pavement markings).

During the site visit, the traffic team visited the CR 20 at Highway 21 intersection and noted the opportunity to signalize this intersection

3.6 County Road 15 (between Hwy 21 and CR 1)

MTP mentioned that safety investigation / improvement at the following intersections should be included in all future alternatives:

- CR 15 at Highway 21 intersection; and
- CR 13 at Lake Street intersection.

During the corridor drive through, the traffic team visited the CR 15 at Highway 21 intersection, however they didn't feel safe to pull over and take pictures. This intersection is located at a horizontal curve and the traffic team noted the need to improve safety at this location.

Issue 1: Large Commercial Vehicles, Horse-Carriers, and Horse Buggies on Shoulders

Large commercial vehicles (i.e., trucks), horse-carriers, and horse buggies were observed parked on the CR 15 shoulders. Large vehicles parked so close to the road can obstruct sight lines, create distractions. The laws regarding parking are unclear, but if vehicles are parking closer to the edge of the road, then they should be ticketed.

Issue 2: Wildlife Collisions

A wildlife related collision was observed on CR 15 during the site visit. Some mitigation techniques could be employed to reduce the risk of encountering wildlife on the road such as vegetation management, exclusion fencing, intelligent warning systems, installing reflectors, implementing overpass and underpass, and increasing the wildlife warning signs.

3.7 County Road 1 (between CR 15 and CR 86)

The regulatory posted speed limit along CR 1 is 80 km/hr. The recommended MTP strategy includes operational and safety measures. Traffic reviews are recommended to address operational issues and confirm the appropriate improvement at the CR 1 / CR 6 intersection.

Issue 1: Limited Visibility of CR 1 at the CR 1 / CR 6 Intersection

During the corridor drive through, the traffic team visited the CR 1 / CR 6 intersection. A horse-carrier was observed crossing the intersection and turned left into a private driveway on the south leg. However, the driveway is located on a vertical curve and entering / exiting into this property is a difficult maneuver due to the limited sight lines. This can also result in northbound drivers being surprised and braking rapidly when horse-carriers enter / exit into / from the driveway.

Providing signage can compensate for the limited visibility of the driveways and would make drivers more aware of possible movements.

3.8 County Road 86 (between CR 1 and CR 4)

The regulatory posted speed limit along CR 86 is 80 km/hr.

Issue 1: CR 1 / CR 86 Intersection

During the corridor drive through, the traffic team visited the CR 1 / CR 86 intersection. Since there is significant commercial development in the vicinity of the CR 1 / CR 86 intersection (within the Community of Lucknow), vehicles were observed parking very close to the intersection. Parking on the south corner poses a particular concern because the view of southbound traffic is obscured for the drivers of vehicles stopped on the CR 1 (Stauffer Street) approach. As a result, they can create inadequate gaps in the traffic stream and can become involved in a severe side-impact collision. In addition, traffic team noticed that a building located on the northeast quadrant of the intersection (625 CR 86) blocks the sightline of southbound left tun traffic.

The number of pedestrians along this section of CR 86 is high. Currently, pedestrians crosswalk is missing at this intersection. This exposes pedestrians to both vehicles on the roadway and smaller vehicles such as cyclists and carts at the roadside.

The county can check how close to the intersection a vehicle can legally park based on the intersection sight distance. However, due to the safety implications at this intersection, it is suggested that “no stopping” signs be posted within 20 meters of the intersection (or “no parking” if that is better understood by the public). In addition, a crosswalk should be provided at this location so that pedestrians can cross at designated locations.

Issue 2: Large Commercial Vehicles on Shoulders

Large commercial vehicles (i.e., trucks), horse-carriers, and horse buggies were observed on the CR 86 shoulders. Large vehicles can obstruct sight lines and slow down the traffic. The superior option is to provide passing opportunities.

Issue 3: Lack of Safe Passing Opportunities

Due the high volume of large vehicles, it is normal for vehicles to overtake others along the CR 86. However, since only one "lane" is provided per direction, overtaking typically occurs in the opposing half of the roadway. This is inherently unsafe. When insufficient passing opportunities are available, drivers tailgate others and frustration builds, and then they take risks to avoid further frustration and delay. Several traffic conflicts were observed with vehicles making evasive maneuvers to avoid oncoming overtaking traffic. Head-on collisions often result in severe injury and death due to the momentum generated in the crash.

The superior option to providing passing opportunities is to provide sections where passing is provided. A three-lane cross-section can be provided, such that the passing lane is provided in one direction at a time. Providing and maintaining proper signing and markings are critical for this option to work.

Issue 4: School Buses Stopping in the Travel Lane

It was observed that a school bus stopped on the approaching lane and unloaded students. Drivers travelling in both directions stopped at a safe distance for the stopped school bus with its upper red lights flashing and stop arm activated.

School buses often stop in the middle of the roadway or straddle the roadway and the shoulder. Vehicles rear ending a stopped school bus during loading / unloading can be potentially catastrophic.

School bus pullouts can assist in the loading and unloading of students, by minimizing risks during loading / unloading activity, and by providing a larger buffer between waiting kids and the travel lane. However, installing pullouts will require that the driving public be educated that they need to yield to allow school buses to re-enter the traffic stream.

If it is not possible to provide school bus pullouts, then educational and warning signs can be provided to alert the public of the possibility of stopped school buses in the roadway, and that they are not allowed to pass stopped school buses.

3.9 CR 4 (between CR 86 and Hwy 9)

Issue 1: CR 4 / CR 6 Intersection

During the corridor drive through, the traffic team visited the CR 4 and CR 6 intersection. Currently, pedestrians crosswalk is missing at this intersection. This exposes pedestrians to both vehicles on the roadway and smaller vehicles such as cyclists and carts at the roadside.

Issue 2: Hidden Intersection

There is a hidden intersection (Clinton Street and Ann Street) on CR 4, north of the CR 4 / CR 6 intersection. The visibility of Ann Street for motorists approaching either direction on CR 4 is obstructed by a vertical curvature. The intersection does not have overhead lighting, further making it unnoticeable during the night. Lack of awareness of the intersection reduces the driver's perception time and the ability to stop or make evasive maneuvers if required. However, two warning signs are installed along CR 4 on both directions to warn motorist about this hidden intersection.

3.10 Highway 9 (from CR 4 to Hwy 21)

The King's Highway 9 is an east-west undivided rural highway with a two-lane cross-section and a regulatory posted speed limit of 80 km/hr. The 2016 two-way AADT volumes on this section of Highway 9 were 2,050 veh/day. 2016 SADT volumes (2,450 veh/day) were approximately 20% higher than AADT. The traffic pattern in this section of Highway 9 is Intermediate Recreation (IR).

Issue 1: Vehicle parked on the Wrong Side of the Highway

During the corridor drive through, the traffic team observed that a car was parked on the wrong side of the highway. This could result in head-on collisions, which are severe in nature.

3.11 County Road 6 (between Hwy 21 and Concession Road 8)

Issue 1: Horse Buggies on Shoulders During the Nighttime

A horse buggy was observed on the shoulder of CR 6 during nighttime. The horse buggy was equipped with a flashing light. However, it was not as easily seen after dark as in the daylight. The horse buggies are in a dangerous position if a vehicle approaches from the front at the same time one is coming from the rear. Unless they have bright lights, they may not be seen as the lights of one vehicle may blind the driver of the other vehicle. The horse buggies should watch the vehicle from the rear in their mirror and flash their lights to be better seen.

3.12 Concession Road 8

Issue 1: Poor Night-Driving Conditions

The corridor is not illuminated. Where lighting is absent, drivers depend on roadway delineation. During dark conditions, it is more difficult to follow the road alignment, particularly for older and tired drivers. This can lead to off-road or head-on collisions.

If feasible, illumination should be provided throughout the corridor and reflective delineation posts should be provided along curves, as well as at driveway locations, so that they can be seen at night.

Trip Generation Analysis (Part 1)

Table 1: Labour (FTE) Projection by Phase and Location

Location	Phase	NWMO Staff	Surface Trades	Underground Trades	Totals
On-Site	Pre-construction (2028)	20	0	0	20
	Construction (2033)	40	300	130	470
	Operations (2043)	510	10	60	580
	Extended Monitoring (2089)	60	0	0	60
	Decom & Closure (2159)	70	110	50	230
Off-Site	Pre-construction (2028)	180	0	0	180
(CofE)	Construction (2033)	170	0	0	170
	Operations (2043)	120	0	0	120
	Extended Monitoring (2089)	30	0	0	30
	Decom & Closure (2159)	20	10	0	30
Total	Pre-construction (2028)	200	0	0	200
	Construction (2033)	210	300	130	640
	Operations (2043)	630	10	60	700
	Extended Monitoring (2089)	90	0	0	90
	Decom & Closure (2159)	90	120	50	260

CORE STUDY AREA (MICRO LABOUR-SHED)

Decision Weighting for Housing Choice

Population 2046	Dwelling	Distance	Employment	
25%	25%	25%	25%	100%

							To/From the facility				Scores				Weighted Score	
Core Study Area (micro-labour shed)		Population 2016	Pop 2016 (%)	Est. Pop 2046	Est. Dwellings 2046	Est. Employment 20	Distance (km)	Travel Time (min)	Route from Google	Probability	Population 2046	Dwelling	Distance	Employmer	Total	Attraction Share
	Teeswater	995	36%	3,182	1,199	708	6	5	Via CR/4 and Concession 8	100%	3.00	2.76	10	1.56	4.330952104	13%
South Bruce	Formosa	525	19%	1,679	633	374	15.3	13	Via CR-12 and Concession 8	100%	-	-	7.047619	-	1.761904762	5%
	Mildmay	1219	45%	3,899	1,469	868	18.8	16	Via Concession 8 all the way	100%	4.43	4.08	5.9365079	2.31	4.18770307	12%
	Ripley	600	27%	2,986	1,104	652	23.4	19	Via CR-6 and Concession 8	100%	2.61	2.30	4.4761905	1.30	2.670498896	8%
Huron-Kinloss	Lucknow	1121	51%	5,580	2,062	1,218	20.5	16	Via CR-1, CR-6 and Concession 8	100%	7.79	6.97	5.3968254	3.94	6.023760636	17%
	Shoreline	497	22%	2,474	914	540	37.5	29	Via CR-6 and Concession 8	100%	1.59	1.37	0	0.78	0.934024003	3%
Brockton	Walkerton	4,517	48%	6,689	2,683	2,516	27.4	22	via Hwy 9, CR-4, Concession 8	100%	10.00	10.00	3.2063492	10.00	8.301587302	24%
North Huron	Wingham	2,934	59%	4,170	1,755	1,993	14.5	17	Via Sideroad 25N, Sideroad 25 S a	50%	4.97	5.47	7.3015873	7.56	6.326317278	18%
															34.53674805	100%
	min	497		1679.079956	632.5301205	373.7677985	6									
	max	4517		6688.845788	2683.177254	2516.075468	37.5									
	min score	0		0	0	0	0									
	mx score	10		10	10	10	10									

REGIONAL (LOCAL) MACRO-LABOUR SHED

							SCORES					Weighted Score				
Regional (Local) Study Area (macro-labour shed)	Population (Base Case) 20	Dwellings (Base Case)	Employment (Base Ca	Distance (km)	Travel Time (min)	Route from Google	Probability	Population		Dwellings	Distance		Employment	Total	Attraction Share
Saugeen Shores	22200	6760	7270	58.3	42	Via Hwy 21, CR-20, CR-4, Concession8		10		10		0	4.149895906	6.037474	12%
Kincardine	15400	5270	15700	36.7	29	Via Hwy 21, Concession 10, Kinloss Curl		6.265788029		7.214953	5.023255814		10	7.1259993	14%
West Grey	15110	5470	4230	54.6	43	Via Concession 10, CR-12,Concession 8		6.106534871		7.588785	0.860465116		2.040249827	4.1490087	8%
Arran-Elderslie	8200	2900	2590	41.8	30	Via CR-20, Concession 8		2.311916529		2.785047	3.837209302		0.902151284	2.459081	5%
Huron-Kinloss	11040	4080	2410	22.7	18	Via CR-6, Kinlos Curloss, Concession 8		3.871499176		4.990654	8.279069767		0.777238029	4.4796153	9%
Ashfield-Colborne-Wawanosh	5580	2230	3510	34.4	27	Via CR-1 through Lucknow, CR-6, Kinlos		0.873146623		1.53271	5.558139535		1.540596808	2.3761483	5%
South Bruce	8,760	3300	1950	15.3	13	CR 12, Concession 8		2.619439868		3.53271	10		0.458015267	4.1525414	8%
Minto	13,840	3490	5490	45	36	Hwy 9 to Mildmay, CR-24 which becom		5.40911587		3.88785	3.093023256		2.914642609	3.8261581	8%
Howick	3,990	1410	2860	41.9	31	CR-18 near Mildmay, CR-6, CR-12, Conc		0		0	3.813953488		1.089521166	1.1258687	2%
Morris-Turnberry	5,570	1690	1290	27.5	22	B-Line Rd near Wingham, CR-4 through		0.867655135		0.523364	7.162790698		0	2.1384526	4%
Brockton	14,010	5620	5270	31.7	23	Hwy 9, CR-4, Concession 8		5.50247117		7.869159	6.186046512		2.761970854	5.5799119	11%
Hanover	11,870	3630	6590	38.3	32	Hwy 9 near Walkerton, CR-4, Concessio		4.327292696		4.149533	4.651162791		3.678001388	4.2014974	8%
North Huron	7,010	2950	3350	28.7	23	Wolfe St from CR-86		1.658429434		2.878505	6.88372093		1.429562804	3.2125545	6%
Data from metronomics														50.964311	100%
min	3990	1410	1290	15.3											
max	22200	6760	15700	58.3											
min score	0	0	0	0											
mx score	10	10	10	10											

Trip Generation Analysis (Part 2)

				Micro-Shed								Macro-Shed													
Attraction Index				13%	5%	12%	8%	17%	3%	24%	18%	100%	12%	14%	8%	5%	9%	5%	8%	8%	2%	4%	11%	8%	6%
Phase	Direct NWMO Sta	80% from micro s	20% from macro	Teeswater	Formosa	Mildmay	Ripley	Lucknow	Shoreline	Walkerton	Wingham	Saugeen S	Kincardine	West Grey	Arran-Eld	Huron-Kin	Ashfield-Coll	South Bruc	Minto	Howick	Morris-Turnb	Brockton	Hanover	North Huro
Pre-construction (2028)	200	160	40	21	9	20	13	28	5	39	30	5	6	4	2	4	2	4	4	1	2	5	4	3
Construction (2033)	210	168	42	22	9	21	13	30	5	41	31	5	6	4	3	4	2	4	4	2	2	5	4	3
Operations (2043)	630	504	126	64	26	62	39	88	14	122	93	15	18	11	7	12	6	11	10	4	6	14	11	8
Extended Monitoring (2089)	90	72	18	10	4	9	6	13	2	18	14	3	3	2	1	2	1	2	2	1	1	2	2	2
Decom & Closure (2159)	90	72	18	10	4	9	6	13	2	18	14	3	3	2	1	2	1	2	2	1	1	2	2	2
	1220	976	244																					

				Micro-Shed								Macro-Shed													
				13%	5%	12%	8%	17%	3%	24%	18%	100%	12%	14%	8%	5%	9%	5%	8%	8%	2%	4%	11%	8%	6%
Phase	Total Trades	80% from Macro	20% from micro	Teeswater	Formosa	Mildmay	Ripley	Lucknow	Shoreline	Walkerton	Wingham	Saugeen S	Kincardine	West Grey	Arran-Eld	Huron-Kin	Ashfield-Coll	South Bruc	Minto	Howick	Morris-Turnb	Brockton	Hanover	North Huro
Near-term Pre-construction (2023-2032)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mid-term Construction (2033-2042)	430	344	86	11	5	11	7	15	3	21	16	41	49	29	17	31	17	29	26	9	15	38	29	22
Long-term Operations (2043-2083)	70	56	14	2	1	2	2	3	1	4	3	7	8	5	3	5	3	5	5	2	3	7	5	4
Extended Monitoring (2089 onwards)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Decom & Closure (2159)	160	128	32	5	2	4	3	6	1	8	6	16	18	11	7	12	6	11	10	4	6	15	11	9
	660	528	132																					

TOTAL labour by Origin/Destination by Phase

Phase	Teeswater	Formosa	Mildmay	Ripley	Lucknow	Shoreline	Walkerton	Wingham	Saugeen Sh	Kincardine	West Grey	Arran-Elderslie	Huron-Kin	Ashfield-Col	South Bruc	Minto	Howick	Morris-Turnl	Brockton	Hanover	North Huron
Near-term Pre-construction (2023-2032)	21	9	20	13	28	5	39	30	5	6	4	2	4	2	4	4	1	2	5	4	3
Mid-term Construction (2033-2042)	33	14	32	20	45	8	62	47	46	55	33	20	35	19	33	30	11	17	43	33	25
Long-term Operations (2043-2083)	66	27	64	41	91	15	126	96	22	26	16	10	17	9	16	15	6	9	21	16	12
Extended Monitoring (2089 onwards)	10	4	9	6	13	2	18	14	3	3	2	1	2	1	2	2	1	1	2	2	2
Decom & Closure (2159)	15	6	13	9	19	3	26	20	19	21	13	8	14	7	13	12	5	7	17	13	11

Assumed ITE Trip rate		Weekday	AM	PM	Pass-By	AM In	AM Out	PM In	PM Out
Industrial Park 130	Employees	3.34	0.47	0.46		86%	14%	20%	80%

Estimated ADTs (In and Out trips) for Projected Staff and Trades by Project Phase

Phase	Teeswater	Formosa	Mildmay	Ripley	Lucknow	Shoreline	Walkerton	Wingham	Saugeen Shores	Kincardine	West Grey	Arran-Elderslie	Huron-Kinloss	Ashfield-Colborne-Wawanosh	South Bruce	Minto	Howick	Morris-Turnberry	Brockton	Hanover	North Huron	Total (vpd)
Near-term Pre-construction (2023-2032)	70	30	67	43	94	17	130	100	17	20	13	7	13	7	13	13	3	7	17	13	10	705
Mid-term Construction (2033-2042)	110	47	107	67	150	27	207	157	154	184	110	67	117	63	110	100	37	57	144	110	84	2,208
Long-term Operations (2043-2083)	220	90	214	137	304	50	421	321	73	87	53	33	57	30	53	50	20	30	70	53	40	2,408
Extended Monitoring (2089 onwards)	33	13	30	20	43	7	60	47	10	10	7	3	7	3	7	7	3	3	7	7	7	334
Decom & Closure (2159)	50	20	43	30	63	10	87	67	63	70	43	27	47	23	43	40	17	23	57	43	37	905
Totals	484	200	461	297	655	110	905	691	317	371	227	137	240	127	227	210	80	120	294	227	177	

Phase	Near-term Pre-construction (2023-2032)	Mid-term Construction (2033-2042)	Long-term Operations (2043-2083)	Sub-Total (vpd)	
Teeswater	70	110	220	401	8%
Formosa	30	47	90	167	3%
Mildmay	67	107	214	387	7%
Ripley	43	67	137	247	5%
Lucknow	94	150	304	548	10%
Shoreline	17	27	50	94	2%
Walkerton	130	207	421	758	14%
Wingham	100	157	321	578	11%
Saugeen Shores	17	154	73	244	5%
Kincardine	20	184	87	291	5%
West Grey	13	110	53	177	3%
Arran-Elderslie	7	67	33	107	2%
Huron-Kinloss	13	117	57	187	4%
Ashfield-Colborne-Wawanosh	7	63	30	100	2%
South Bruce	13	110	53	177	3%
Minto	13	100	50	164	3%
Howick	3	37	20	60	1%
Morris-Turnberry	7	57	30	94	2%
Brockton	17	144	70	230	4%
Hanover	13	110	53	177	3%
North Huron	10	84	40	134	3%
Sub-Total (vpd)	**705**	**2,208**	**2,408**	**5321**	100%

Truck Trip Generation Analysis (Part 3)

Truck Traffic Volumes as Provide by NWMO (Community Studies Planning Assumptions – South Bruce Traffic, Nov 24, 2021). Appendix A

	Construction Period												
	1	2	3	4	5	6	7	8	9	10	Average truck t	**ADTs**	
Total Rock and material truck transport (includ	771	798	576	663	736	781	736	652	550	537	680	**136**	
Personnel (Buses)	149	149	149	149	149	149	149	149	149	149	149	**29.8**	
Personnel (Vehicles)	329	329	329	329	329	329	329	329	329	329	329	**65.8**	
Net Trucks for Material Transport	293	320	98	185	258	303	258	174	72	59	**202**		**40.4**

	Operations (year 11 to 56) Average truck trips pe	**ADTs**
Total Rock and material truck transport (includ	536	**107.2**
Personnel (Buses)	131	**26.2**
Personnel (Vehicles)	290	**58**
Net Trucks for Material Transport	115	**23**

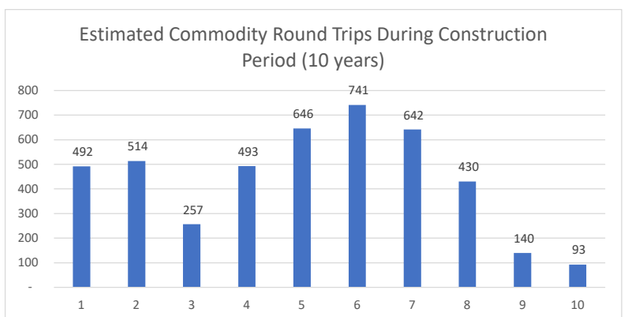
approximate capacity computations are still needed.

EXHIBIT 23-8. PASSENGER-CAR EQUIVALENTS ON EXTENDED FREEWAY SEGMENTS

Factor	Type of Terrain: Level	Rolling	Mountainous
E_T (trucks and buses)	1.5	2.5	4.5
E_R (RVs)	1.2	2.0	4.0

Project Phase	**Passenger Car Equivalent* (Round Trip)**										Mid-term Construction (2033-2042)		Long-term Operations (2043-2083)	
	Construction Period (Year)													
Material	1	2	3	4	5	6	7	8	9	10	Avrg. Trucks/Week	Avrg. Trucks/Day	Avrg. Trucks/Week	Avrg. Trucks/Day
Excavated Rock (to/from ERMA) (f)	66	47	122	227	269	296	263	176	38	9	151	31	56	12
Site Development	353	353	0	0	0	0	0	0	0	0	71	15	0	0
Mining	0	0	5	8	11	12	12	9	3	2	6	2	2	1
Concrete (a)	38	39	95	213	318	381	315	197	59	39	169	34	5	1
Roadworks, Drainage & Paving	0	39	0	0	0	0	0	0	0	0	4	1	0	0
Earthwork	5	3	0	0	0	0	0	0	0	3	1	1	0	0
Architectural	2	2	6	11	15	17	14	8	2	2	8	2	0	0
Electric Equipment	2	0	2	2	2	2	2	2	2	2	1	1	0	0
Mechanical Equipment	2	3	2	3	2	2	2	2	2	2	2	1	18	4
Mobile Equipment	0	2	0	0	0	0	0	2	2	2	1	1	0	0
Pipework & Fittings	2	2	2	3	3	3	5	5	2	2	3	1	2	1
Structural Steel	3	3	2	3	2	2	2	2	3	2	2	1	3	1
Wire & Cable	2	2	2	2	3	3	3	3	2	2	2	1	2	1
Miscellaneous Supplies	2	2	2	2	0	2	2	2	2	2	1	1	27	6
Bentonite	0	0	0	0	0	0	0	0	0	0	0	0	41	9
Used Fuel Transportation Packages(b)	0	0	0	0	0	0	0	0	0	0	0	0	24	5
UFTP and BTP Escort Vehicles (c)	0	0	0	0	0	0	0	0	0	0	0	0	24	5
Fuel and Lubricants (d)	9	9	9	9	9	9	9	9	9	9	9	2	6	2
Waste and Recycling (e)	9	9	9	9	9	9	9	9	9	9	9	2	6	2
Sub-Total	**492**	**514**	**257**	**493**	**646**	**741**	**642**	**430**	**140**	**93**	**439**	**97**	**213**	**50**

**** PCE = 1.5 Based on HCM 2002 Chapter 23- Basic Freeway segments Methodology, Page 23.-9 Exhibit 23-8 Passenger-Car Equivalents on extended Freeway segments for Level terrain Et (trucks and buses)***



To/From	Routing	Split	Construction (vpd)	Operation (vpd)
North-East 1	from Hwy 9 and CR-4 and Concession 10	20%	20	10
North 2	From Hwy 21, CR 20, and Concession 10	20%	20	10
South 1	From CR 86, Wolf St and CR 6	15%	15	8
South 2	From Hwy 9 , Concession 4, Sideroad 25 N	25%	25	13
South 3	CR-1 (from Mines near Lucknow), CR-6	10%	10	5
East	East of Teeswater (CR-6 and Sideroad 25 S)	5%	5	3
West	Hwy 21 (south), CR-6	5%	5	3
		100%	100	52

MEMORANDUM

MORRISON HERSHFIELD

TO:	Click here to enter recipients	**FROM:**	Andres Baez, P.Eng. Stanley Li, P.Eng., PTOE
		PROJECT No.:	2035249.00
RE:	Nuclear Waste Management– Synchro Analysis Results	**DATE:**	2/24/2022

X:\PROJ\2020\203524900-NWMO DPRA - BRUCE SITE - BASELINE\08. WORKING\5. COMMUNITY STUDIES\2. TRAFFIC\203524900_NWMO_SYNCHRORESULTS_2022FEB24_SJL.DOCX

The purpose of this memo is to summarize Synchro capacity analysis results for the APM PROJECT SITE project for the following scenarios:

- Year 2022 Total Vehicular Traffic (cars, trucks and buses) with seasonal adjustment factor (21%)
  - AM Peak Hour
  - PM Peak Hour
- Year 2042 Total Vehicular Traffic (cars, trucks, and buses) with seasonal adjustment factor (21%) and an annual growth rate of 1.6%
  - AM Peak Hour
  - PM Peak Hour
- Year 2083 Total Vehicular Traffic (cars, trucks, and buses) with seasonal adjustment factor (21%) and an annual growth rate of 1.6%
  - AM Peak Hour
  - PM Peak Hour

Based on the turning movement counts collected in year 2021 and existing intersection configurations (**Appendix A**), the results of the above scenarios are summarized in the tables below (**Table 1**, **Table 2**, and **Table 3**).

Table 1: Year 2022 Total Vehicular Traffic – Synchro Analysis Results – AM Results (PM Results)

Intersections	Critical Movements	Delay (s)	Delay LOS	ICU LOS	Max v/c Ratio	95th Queue (m)
#901: Hwy 9 & Bruce Rd 1	**Overall**	**4.2 (3.9)**	**A (A)**	**A (A)**	**0.12 (0.12)**	**-**
#902: Hwy 4 & Concession Rd 8	**Overall**	**1.9 (2.0)**	**A (A)**	**A (A)**	**0.04 (0.06)**	**-**
#903: Hwy 1 & Hwy 6	**Overall**	**7.9 (7.7)**	**A (A)**	**A (A)**	**0.14 (0.15)**	**-**
#904: Hwy 4 & Hillcrest St	**Overall**	**4.5 (4.2)**	**A (A)**	**A (A)**	**0.12 (0.22)**	**-**
#905: Sideroad 25 N & Hwy 6	**Overall**	**0.8 (0.4)**	**A (A)**	**A (A)**	**0.01 (0.00)**	**-**
#906: Wolfe St & Hwy 6	**Overall**	**4.3 (2.7)**	**A (A)**	**A (A)**	**0.02 (0.02)**	**-**
#907: Bismark St N & Absalom St W	**Overall**	**4.7 (6.3)**	**A (A)**	**A (A)**	**0.14 (0.23)**	**-**
#908: Yonge St (Hwy 9) & Kincardine Hwy (Hwy 9)	**Overall**	**11.0 (12.1)**	**B (B)**	**A (A)**	**0.25 (0.25)**	**-**
#909: Hwy 21 & Broadway St (Hwy 9)	**Overall**	**12.4 (18.3)**	**B (B)**	**B (E)**	**0.54 (0.84)**	**-**
#910: Hwy 21 & CR 20	**Overall**	**5.3 (181.5)**	**A (F)**	**B (C)**	**0.46 (1.87)**	**-**
	EBLT & EBR	**21.1 (430.0)**	**C (F)**	**-**	**0.46 (1.87)**	**18.8 (331.8)**

Table 2: Year 2042 Total Vehicular Traffic – Synchro Analysis Results – AM Results (PM Results)

Intersections	Critical Movements	Delay (s)	Delay LOS	ICU LOS	Max v/c Ratio	95th Queue (m)
#901: Hwy 9 & Bruce Rd 1	Overall	4.7 (4.4)	A (A)	A (A)	0.18 (0.19)	-
#902: Hwy 4 & Concession Rd 8	Overall	2.0 (2.2)	A (A)	A (A)	0.05 (0.08)	-
#903: Hwy 1 & Hwy 6	Overall	8.3 (8.1)	A (A)	A (A)	0.20 (0.20)	-
#904: Hwy 4 & Hillcrest St	Overall	5.0 (5.7)	A (A)	A (A)	0.18 (0.40)	-
#905: Sideroad 25 N & Hwy 6	Overall	0.8 (0.7)	A (A)	A (A)	0.01 (0.00)	-
#906: Wolfe St & Hwy 6	Overall	4.4 (2.8)	A (A)	A (A)	0.03 (0.03)	-
#907: Bismark St N & Absalom St W	Overall	5.0 (7.0)	A (A)	A (A)	0.19 (0.32)	-
#908: Yonge St (Hwy 9) & Kincardine Hwy (Hwy 9)	Overall	11.6 (12.6)	B (B)	A (A)	0.32 (0.34)	-
#909: Hwy 21 & Broadway St (Hwy 9)	Overall	14.9 (82.1)	B (F)	D (H)	0.71 (2.00)	-
	WBL	17.3 (239.8)	B (F)	-	0.31 (1.34)	21.0 (59.6)
	NBL	20.5 (493.1)	C (F)	-	0.59 (2.00)	45.8 (99.3)
#910: Hwy 21 & CR 20	Overall	11.9 (4228.9)	B (F)	B (E)	0.85 (3.67)	-
	EBLT & EBR	60.5 (High)	F (F)	-	0.85 (3.67)	59.0 (High)
	WBLTR	21.4 (630.2)	C (F)	-	0.53 (2.02)	24.0 (88.5)

Table 3: Year 2083 Total Vehicular Traffic – Synchro Analysis Results – AM Results (PM Results)

Intersections	Critical Movements	Delay (s)	Delay LOS	ICU LOS	Max v/c Ratio	95th Queue (m)
#901: Hwy 9 & Bruce Rd 1	Overall	6.5 (6.8)	A (A)	A (A)	0.35 (0.43)	-
#902: Hwy 4 & Concession Rd 8	Overall	2.3 (2.9)	A (A)	A (A)	0.10 (0.18)	-
#903: Hwy 1 & Hwy 6	Overall	9.6 (9.2)	A (A)	A (A)	0.33 (0.32)	-
#904: Hwy 4 & Hillcrest St	Overall	7.4 (32.9)	A (D)	B (C)	0.41 (1.23)	-
	EBLTR	16.7 (39.4)	C (E)	-	0.35 (0.61)	12.5 (29.1)
	WBLTR	24.7 (211.3)	C (F)		0.41 (1.23)	15.7 (84.7)
#905: Sideroad 25 N & Hwy 6	Overall	0.8 (0.5)	A (A)	A (A)	0.01 (0.00)	-
#906: Wolfe St & Hwy 6	Overall	4.4 (2.9)	A (A)	A (A)	0.04 (0.04)	-
#907: Bismark St N & Absalom St W	Overall	5.7 (9.5)	A (A)	A (A)	0.32 (0.55)	-
#908: Yonge St (Hwy 9) & Kincardine Hwy (Hwy 9)	Overall	12.9 (14.2)	B (B)	A (B)	0.48 (0.50)	-
#909: Hwy 21 & Broadway St (Hwy 9)	Overall	54.3 (297.9)	D (F)	F (H)	1.32 (4.61)	-

Intersections	Critical Movements	Delay (s)	Delay LOS	ICU LOS	Max v/c Ratio	95th Queue (m)
	EBTR	11.0 (288.0)	B (F)	-	0.60 (1.57)	46.3 (257.7)
	WBL	37.9 (508.1)	D (F)	-	0.70 (2.00)	46.2 (86.3)
	NBL	190.0 (High)	F (F)	-	1.32 (4.61)	109.9 (173.6)
	NBT	67.4 (17.9)	E (B)	-	1.06 (0.73)	191.6 (125.4)
#910: Hwy 21 & CR 20	Overall	1468.2 (High)	F (F)	F (H)	33.99 (High)	-
	EBLT & EBR	High (High)	F (F)	-	33.99 (16.23)	High (High)
	WBLTR	132.8 (High)	F (F)	-	1.15 (High)	118.4 (High)

The intersection that will be approaching or over capacity, as well as potential mitigation measures, are summarized below (**Table 4, Table 5, and Table 6**).

Table 4: Potential Mitigation Measures for 2022 Total Traffic Scenario

Intersection	Potential Mitigation Measure
#910: Hwy 21 & CR-20	Signalization

Table 5: Potential Mitigation Measures for 2042 Total Traffic Scenario

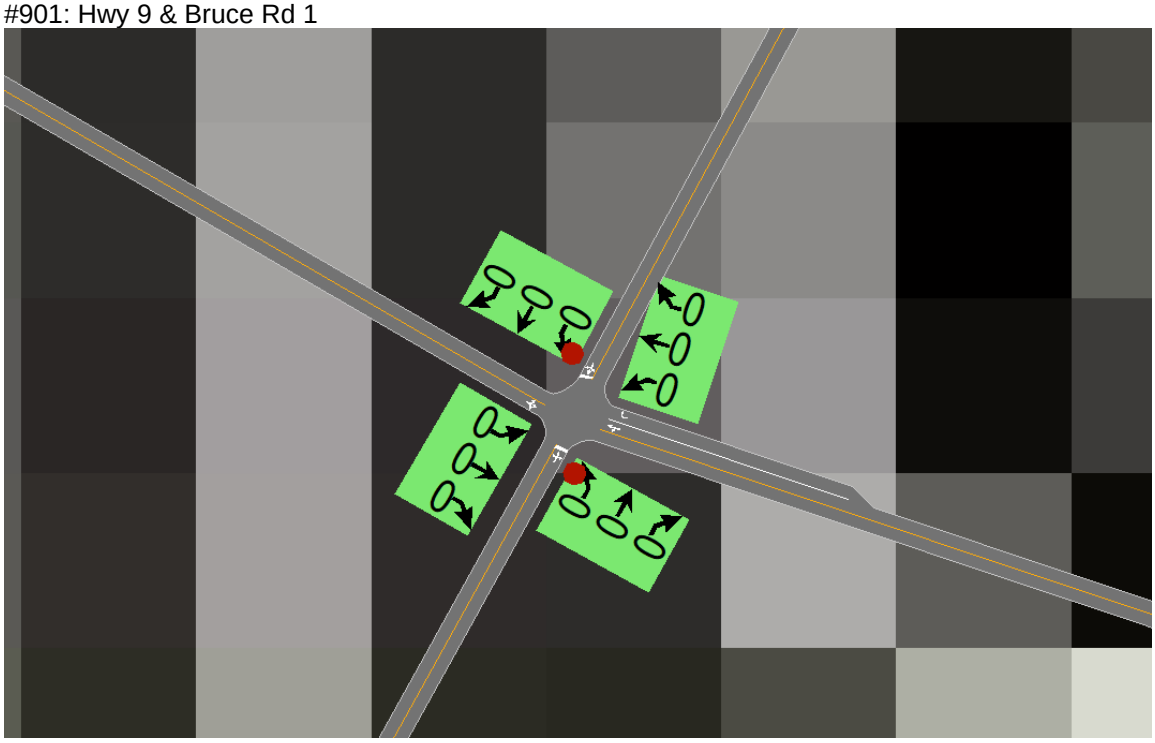
Intersections	Potential Mitigation Measures
#909: Hwy 21 & Broadway St (Hwy 9)	Upgrade WBL and NBL movements to protected + permissive phasing Additional lanes/capacity
#910: Hwy 21 & CR-20	Signalization, Additional lanes/capacity

Table 6: Potential Mitigation Measures for 2083 Total Traffic Scenario

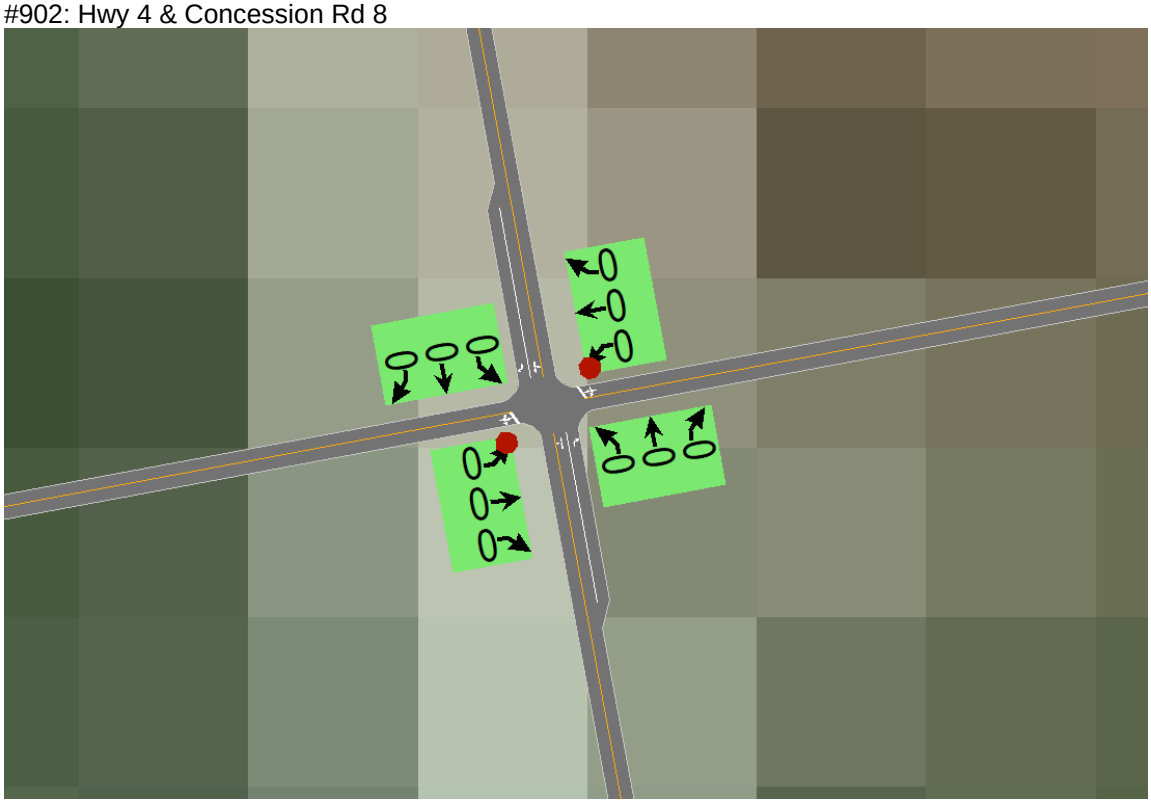
Intersections	Potential Mitigation Measures
#904: Hwy 4 & Hillcrest St	Signalization
#909: Hwy 21 & Broadway St (Hwy 9)	Additional lanes/capacity
#910: Hwy 21 & CR-20	Signalization, Additional lanes/capacity

Appendix A: Existing Intersection Configurations

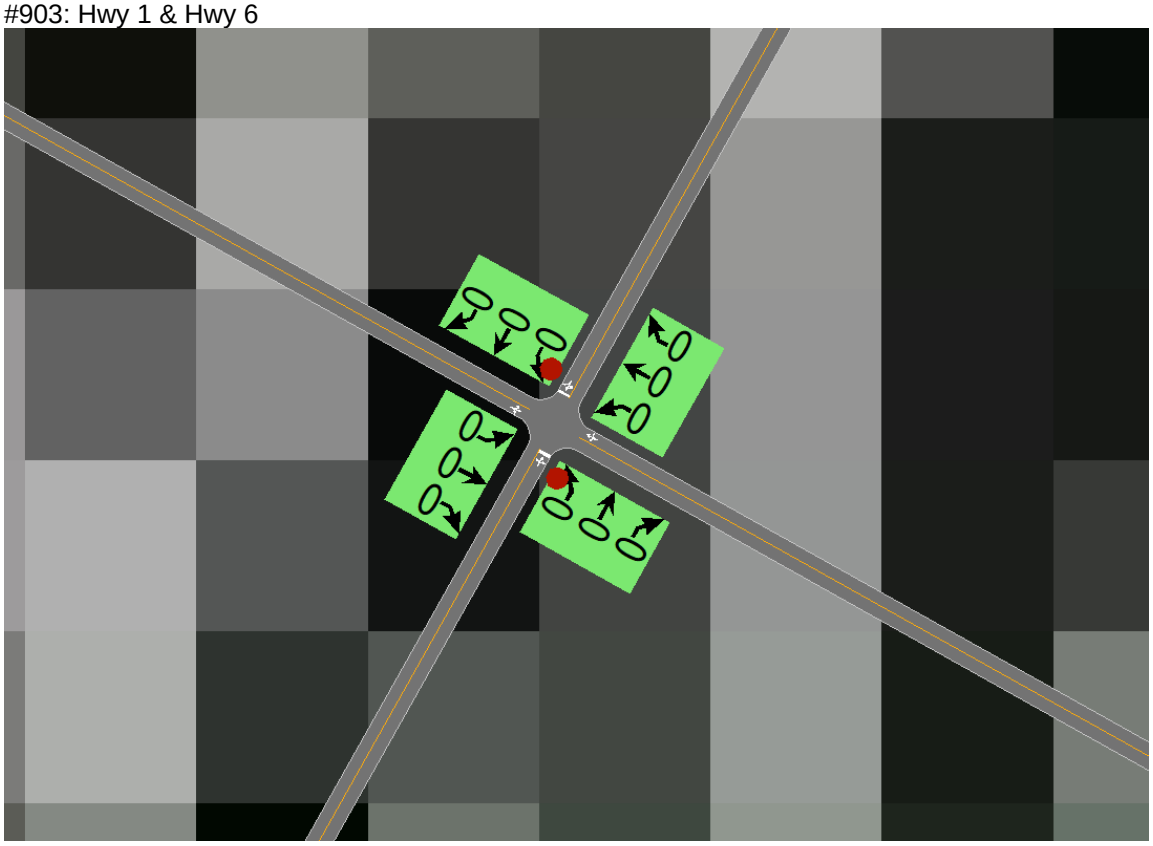
#901: Hwy 9 & Bruce Rd 1



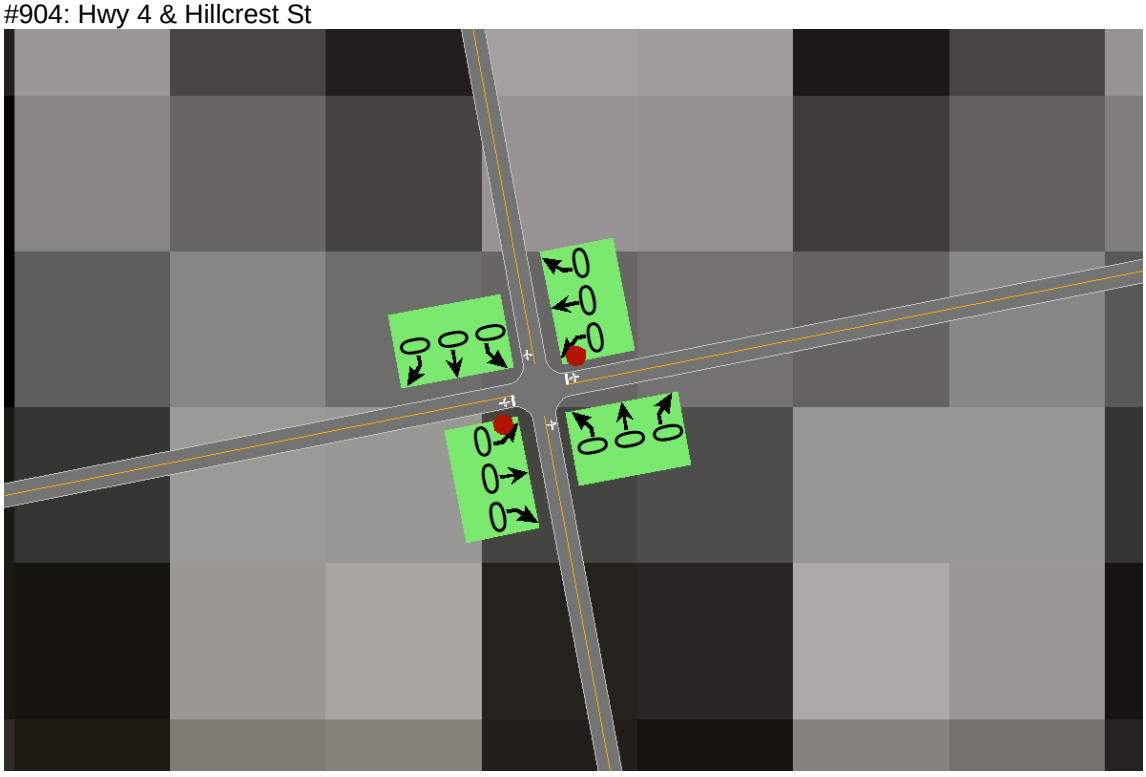
#902: Hwy 4 & Concession Rd 8



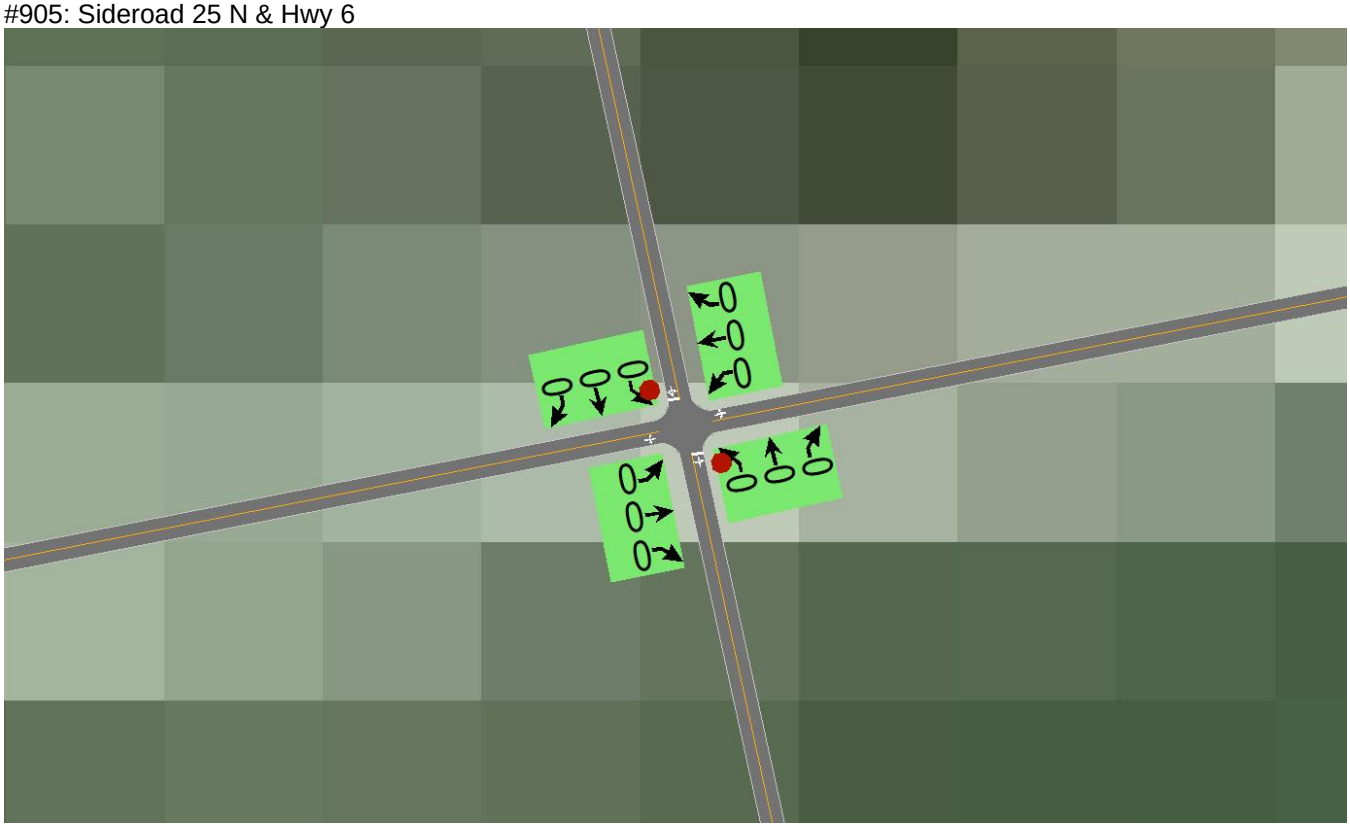
#903: Hwy 1 & Hwy 6



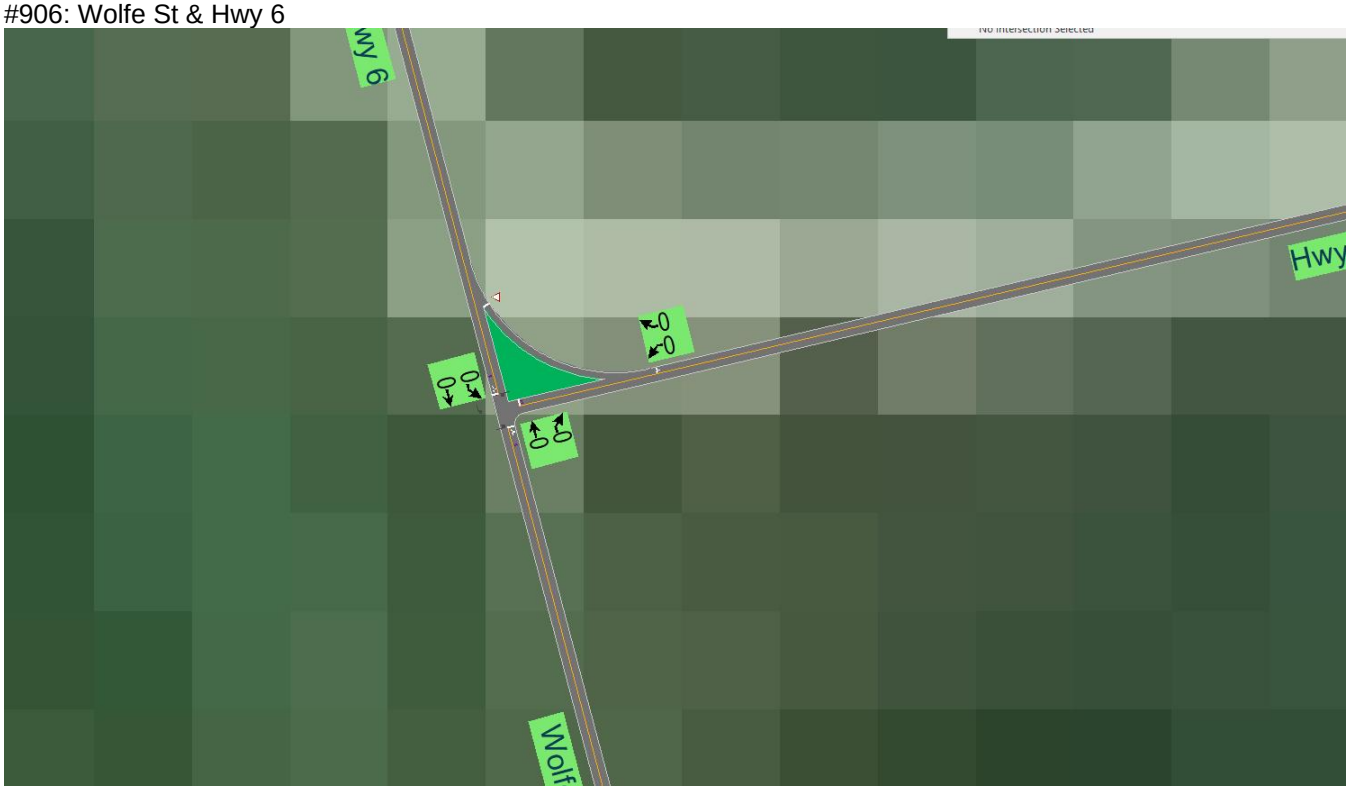
#904: Hwy 4 & Hillcrest St



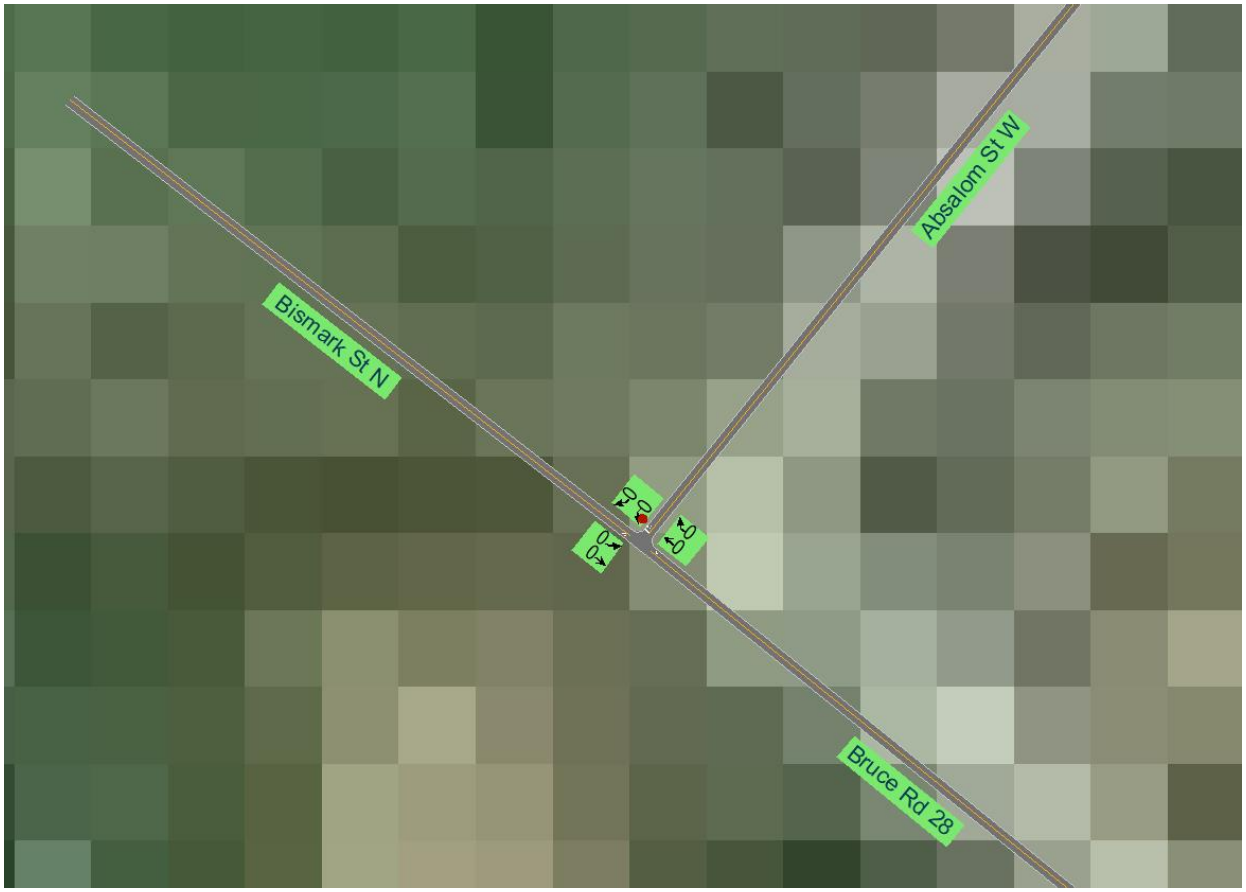
#905: Sideroad 25 N & Hwy 6



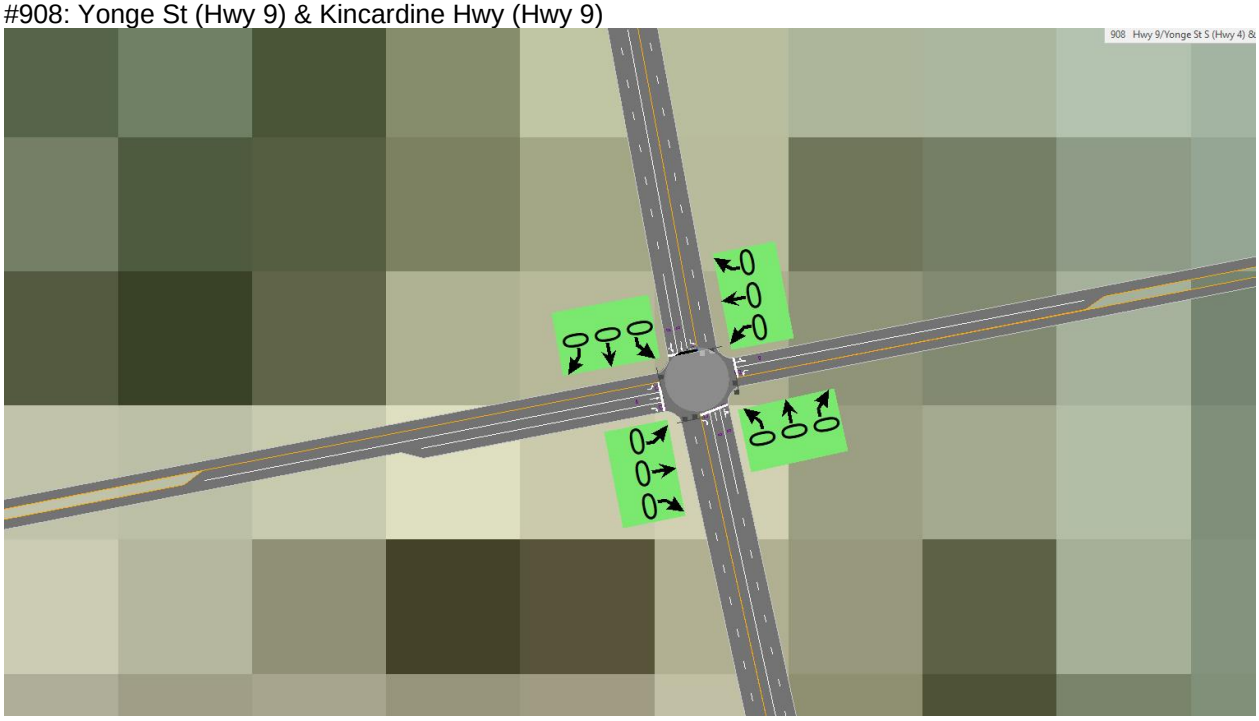
#906: Wolfe St & Hwy 6



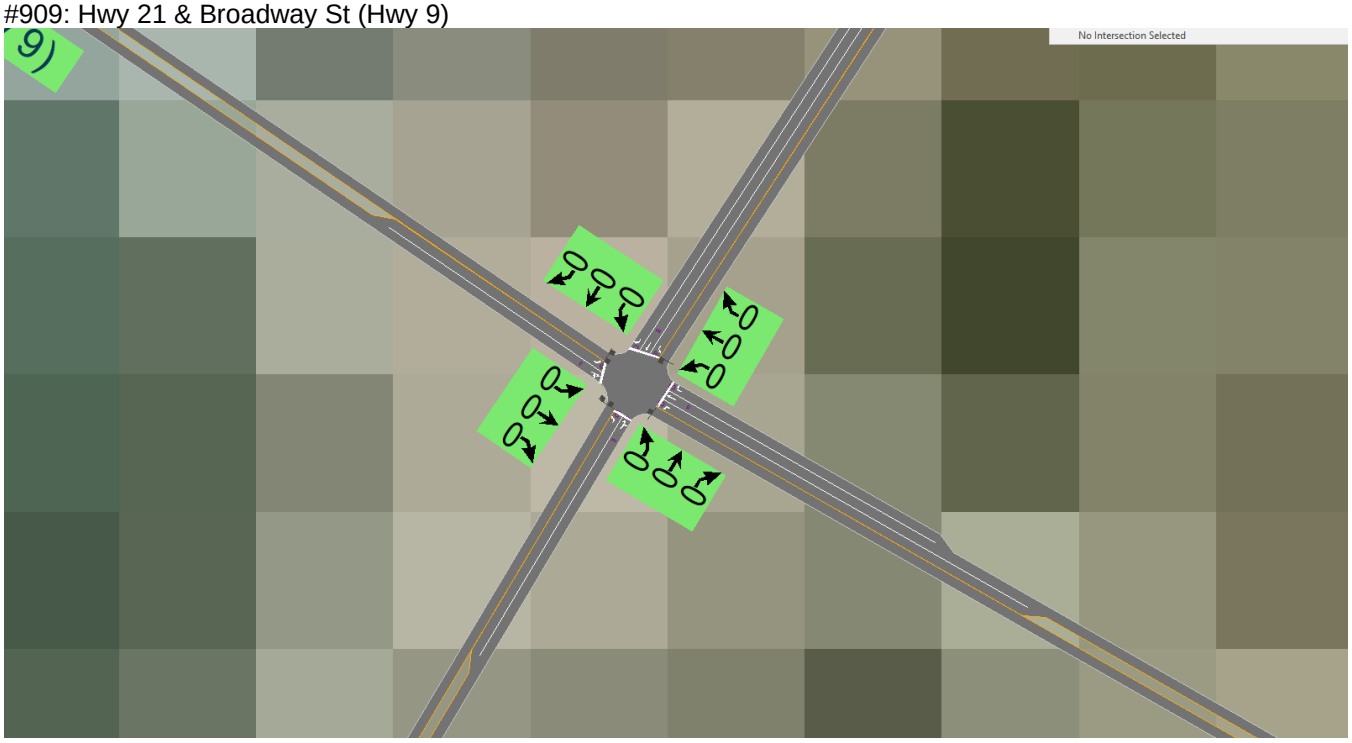
#907: Bismark St N & Absalom St W



#908: Yonge St (Hwy 9) & Kincardine Hwy (Hwy 9)



#909: Hwy 21 & Broadway St (Hwy 9)



#910: Hwy 21 & Hwy 20