Brant County Adaptive Project

Performance Evaluation Report

September 25, 2024

1.0 Introduction

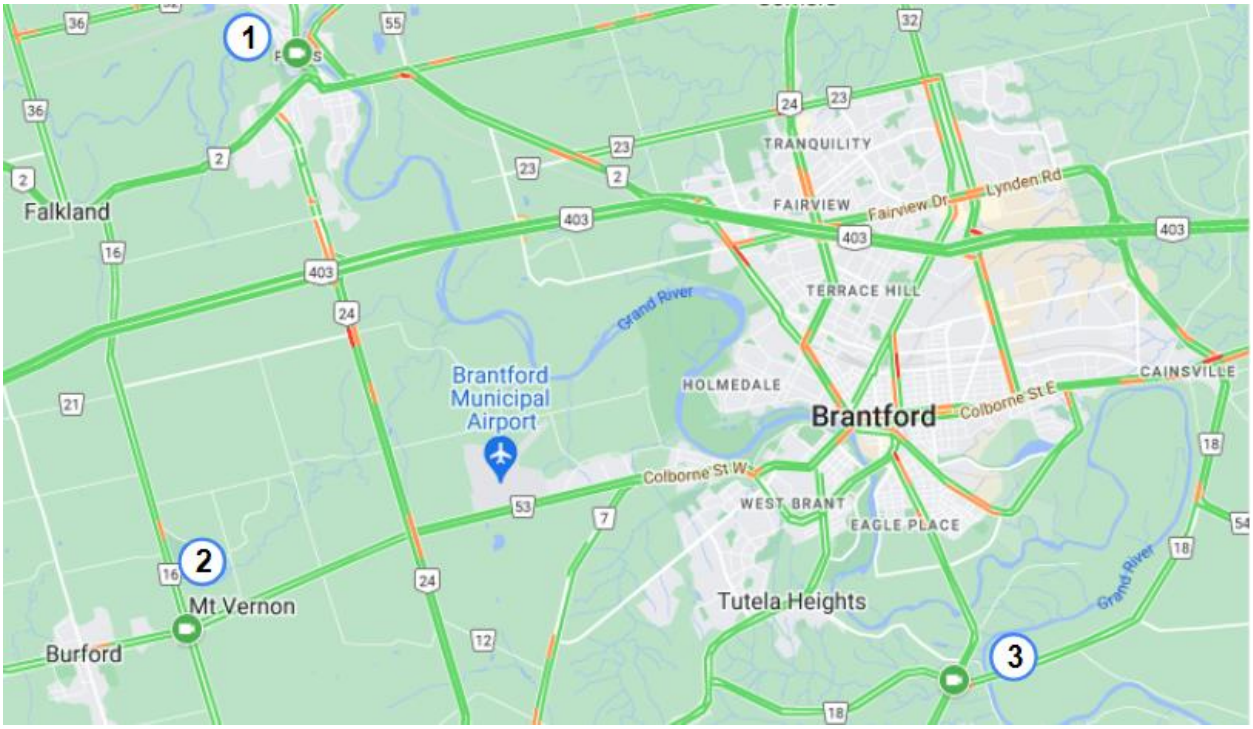
This document summarizes the Miovision Adaptive deployment in Brant County and the performance evaluation results. The purpose of this document is to provide a measured and evaluated outcome of the overall performance of the three intersections across a longer period of time than the initial on/off testing report (May 2024) which only looked at two weeks of data. This will provide the County with a better understanding of how effectively the adaptive system is working at these locations.

2.0 The Deployment Overview:

The figure below shows the location of the three intersections where Miovision Adaptive was deployed in the County.

These intersections include:

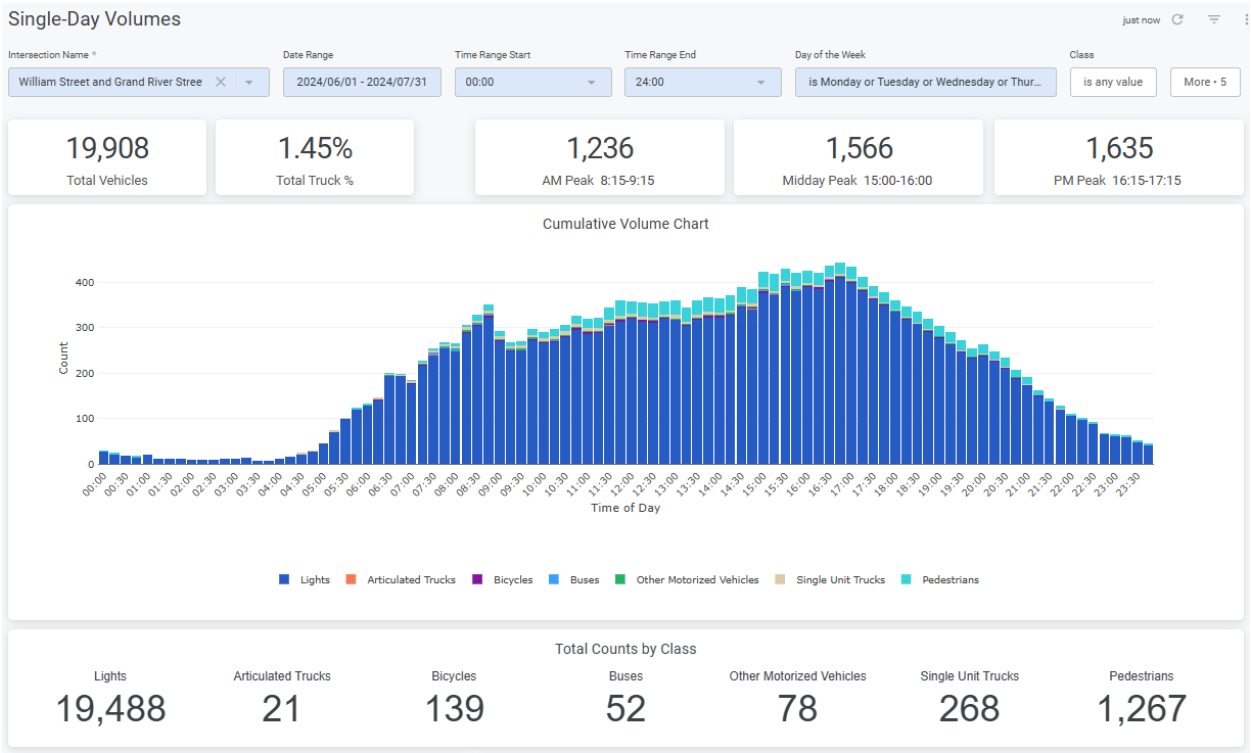
1. William Street and Grand River Street North in Paris
2. King Street and Bishopsgate Road in Bishopsgate
3. Phelps Road and Cockshutt Road



3.0 Traffic Volume Analysis

3.1 William Street and Grand River Street North in Paris

June through July 2024 - Average Weekday Volume



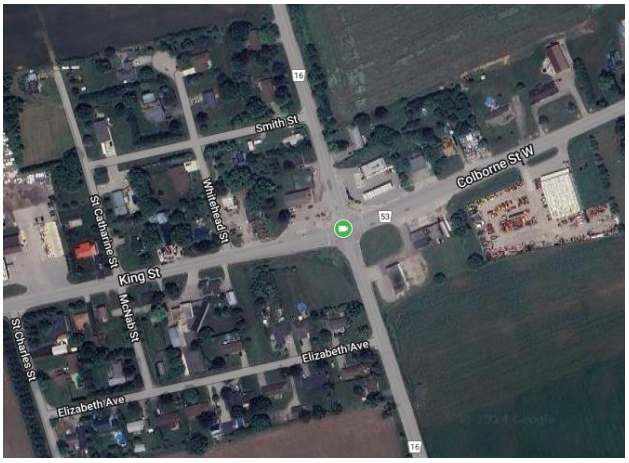
Key Insights:

1. **Total Volume**:
    - **Total Vehicles**: 19,908
    - **Total Truck %**: 1.45%
    - This intersection handles a moderate amount of traffic, with nearly 20,000 vehicles in a single day. The percentage of trucks (1.45%) indicates relatively low heavy vehicle traffic in comparison to light vehicles.

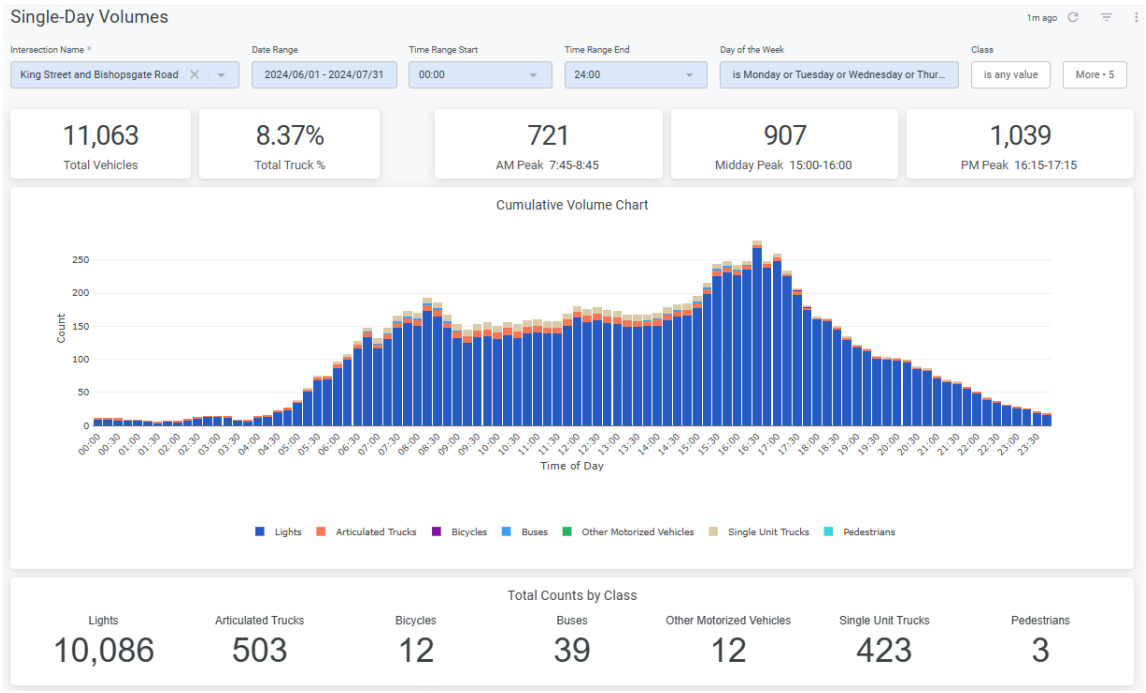
2. **Peaks in Traffic**:
    - **AM Peak**: 1,236 vehicles between 8:15 - 9:15 AM.
    - **Midday Peak**: 1,566 vehicles between 3:00 - 4:00 PM.
    - **PM Peak**: 1,635 vehicles between 4:15 - 5:15 PM. The peak times suggest standard commuter patterns with a busy morning and a late-afternoon rush hour. The midday peak is also significant, indicating that this area experiences steady traffic throughout the day.
3. **Traffic Composition**:
    - **Light Vehicles**: 19,488 (dominating the overall traffic volume).
    - **Articulated Trucks**: 21 (a minor component of the total traffic).
    - **Bicycles**: 139 (low number but indicates the intersection is used by cyclists).
    - **Buses**: 52.
    - **Other Motorized Vehicles**: 78.
    - **Single Unit Trucks**: 268.
    - **Pedestrians**: 1,267 (a notable number, highlighting a pedestrian presence).

This breakdown provides insights into the multimodal nature of the intersection. With light vehicles dominating, there's also a significant pedestrian presence.

3.2 King Street and Bishopsgate Road in Bishopsgate



June through July 2024 - Average Weekday Volume



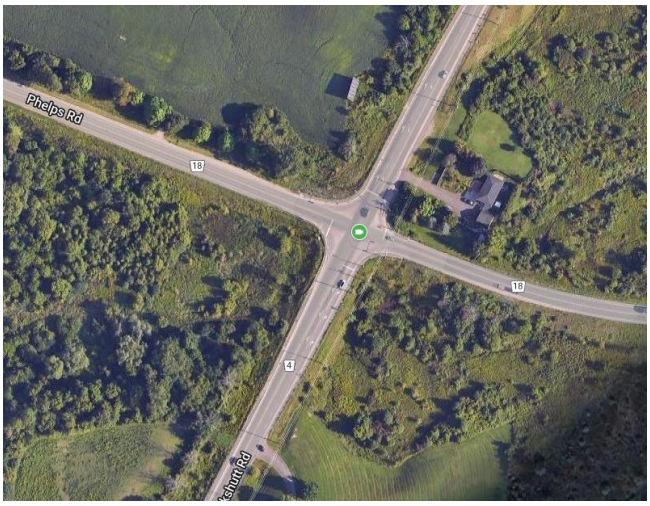
Key Insights:

1. **Total Volume**:
    - **Total Vehicles**: 11,063
    - **Total Truck %**: 8.37%
    - This intersection experiences a moderate amount of traffic, with just over 11,000 vehicles in a single day. The percentage of trucks is higher compared to the previous intersection (8.37%), suggesting this area might serve more commercial or industrial traffic.
2. **Peaks in Traffic**:

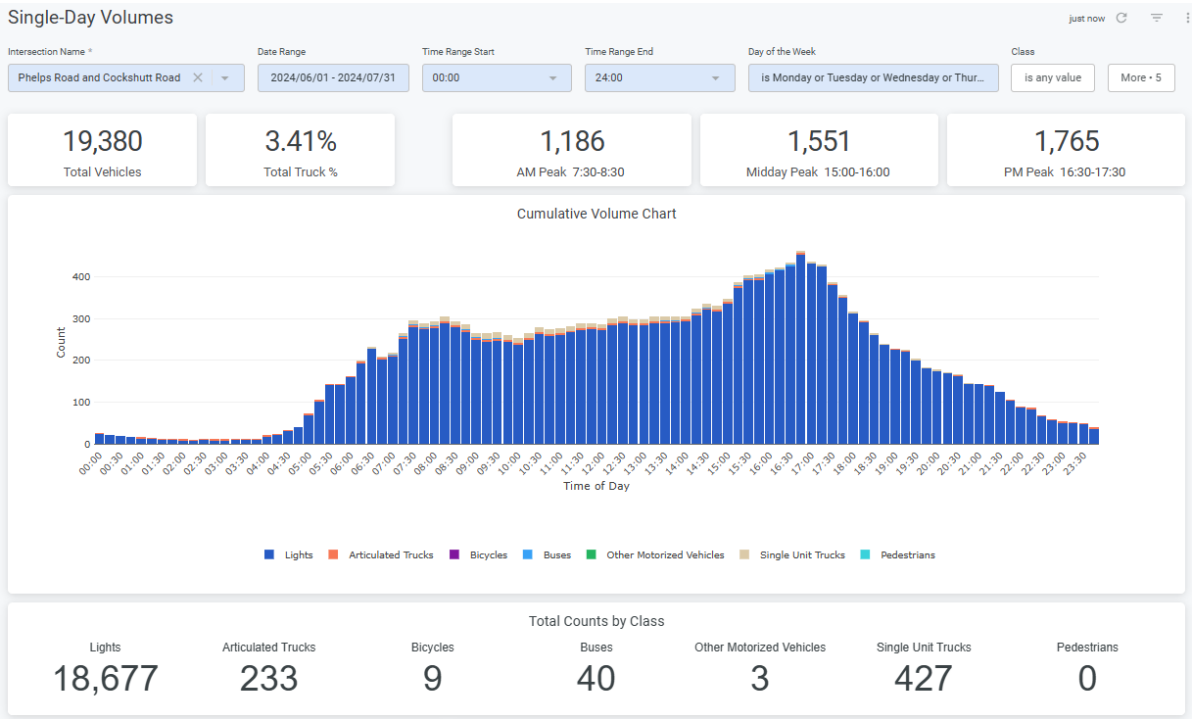
    - **AM Peak**: 721 vehicles between 7:45 - 8:45 AM.
    - **Midday Peak**: 907 vehicles between 3:00 - 4:00 PM.
    - **PM Peak**: 1,039 vehicles between 4:15 - 5:15 PM. The peak times suggest standard commuter traffic patterns, with the PM peak being the busiest period. The relatively high midday peak indicates steady traffic throughout the day, likely due to both personal and commercial traffic.
3. **Traffic Composition**:
    - **Light Vehicles**: 10,086 (dominating the overall traffic volume).
    - **Articulated Trucks**: 503 (a significant component of the traffic).
    - **Bicycles**: 12.
    - **Buses**: 39.
    - **Other Motorized Vehicles**: 12.
    - **Single Unit Trucks**: 423.
    - **Pedestrians**: 3 (negligible pedestrian activity).

This breakdown highlights that this intersection has a notable volume of trucks, which may indicate that it serves a more industrial or logistics-heavy area. Pedestrian and bicycle traffic are extremely low, suggesting this intersection is not used frequently for walking or cycling.

3.1 Phelps Road @ Cockshutt Road @ County Road #18



June through July 2024 - Average Weekday Volume



Key Insights:

1. **Total Volume**:
    - **Total Vehicles**: 19,380
    - **Total Truck %**: 3.41%
    - This intersection handles a significant amount of traffic, just under 20,000 vehicles in a single day. The truck percentage (3.41%) indicates a notable

presence of heavier vehicles, though they form a relatively small portion of the total.

2. **Peaks in Traffic**:
    - **AM Peak**: 1,186 vehicles between 7:30 - 8:30 AM.
    - **Midday Peak**: 1,551 vehicles between 3:00 - 4:00 PM.
    - **PM Peak**: 1,765 vehicles between 4:30 - 5:30 PM. The traffic peaks during standard commuting hours, with the PM peak being the heaviest, indicating a strong commuter flow in the afternoon. The AM peak is also significant but not as intense as the PM peak.
3. **Traffic Composition**:
    - **Light Vehicles**: 18,677 (dominates the total traffic).
    - **Articulated Trucks**: 233 (a small but noticeable portion).
    - **Bicycles**: 9 (low volume).
    - **Buses**: 40.
    - **Other Motorized Vehicles**: 3.
    - **Single Unit Trucks**: 427 (a considerable amount for the intersection).
    - **Pedestrians**: 0 (no pedestrian activity recorded).

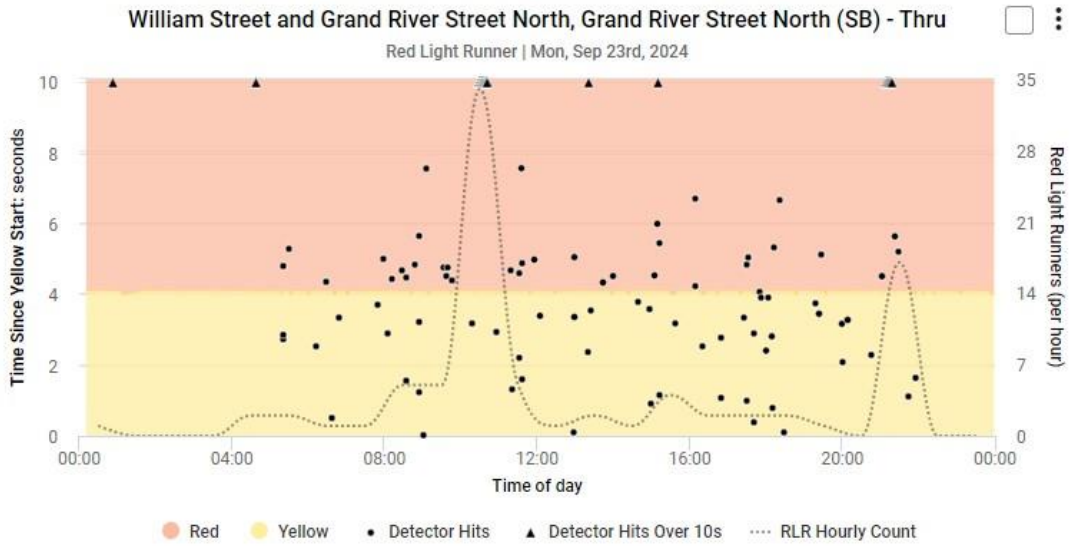
The traffic composition indicates that this intersection is primarily used by light vehicles, with some truck traffic, which is relatively higher than in purely residential areas. The intersection sees minimal bicycle and pedestrian activity, making it more of a vehicular-oriented location.

3.2 Reducing Costs with Data-Driven Planning

This volume data is crucial in identifying peak traffic periods and the types of vehicles utilizing the intersection. By understanding the specific times and vehicle compositions, The County of Brant can strategically plan road improvements that address the most pressing congestion points, such as during AM and PM rush hours. This data allows the County of Brant to assess whether adjustments, such as signal timing changes or the addition of dedicated turn lanes, are needed. Moreover, knowing the proportion of trucks using the intersection helps ensure the infrastructure supports heavy vehicles without deteriorating quickly, reducing long-term maintenance costs.

With this detailed traffic analysis, the County of Brant can also prioritize areas that require immediate attention, optimizing the use of budgetary resources. By targeting improvements that reduce congestion during peak hours, The County of Brant can enhance traffic flow and reduce vehicle idling, which in turn lowers fuel consumption and emissions. Additionally, understanding where pedestrian and bicycle volumes are low helps avoid unnecessary spending on infrastructure that is not in high demand, ensuring funds are allocated to areas with the greatest need. This data-driven approach leads to cost-effective road improvements, minimizing disruption and long-term expenses.

4.0 Red Light Runner Example Report



This example report provides data on traffic violations related to red-light running at various intersections. The key metrics include:

1. **Average Duration Since Red Start (Less than 2 seconds)**: This shows the average time, in seconds, after the light turns red when vehicles cross the intersection. Instances below 2 seconds are considered "light" red-light running violations.
2. **Average Duration Since Red Start (Between 2 seconds and 10 seconds)**: This metric captures more severe red-light running events, where the vehicle runs the light between 2 and 10 seconds after it has turned red.
3. **Average Red Light Runner Count (Light Red - Less than 2 seconds)**: This column records the daily average number of vehicles that run the red light within the first 2 seconds.
4. **Average Red Light Runner Count (Deep Red - Between 2 and 10 seconds)**: This is the daily average number of vehicles running a deep red light, categorized as crossing after 2-10 seconds.

For instance, at the intersection of William street and Grand River North:

- **Light Red Violations**: 87 vehicles run the light within 2 seconds, on average, each day.
- **Deep Red Violations**: 9 vehicles, on average, cross after 2-10 seconds of the light turning red.

This information is critical for identifying intersections with high rates of red-light violations and can help prioritize traffic safety interventions.

5.0 Project Goals and Expectations

The largest goal of implementing any adaptive signal control system is to improve overall signal operations beyond what is possible with a typical time of day signal timing plan. Improvements in operations lead directly to citizen benefits including reductions in their commute time, fuel consumption and greenhouse gas emissions.

6.0 Special Considerations for the Brant County Context

In most existing deployments of Miovision Adaptive, the system has been implemented along key corridors or within grids of intersections, which is where it truly shines. These setups allow for the most impactful results, as they streamline traffic flow, reduce delays, and generate measurable fuel and emissions savings. The system's performance in such scenarios is easily quantifiable, with metrics showing notable improvements in travel times, making it easier to demonstrate the full range of benefits.

For this project, the system has been installed at standalone intersections. While the locations don't directly interact with one another, each intersection operates with the same advanced, real-time capabilities. Even in day-to-day conditions where traffic volumes may be low, Miovision Adaptive is poised to adapt and manage unexpected surges in volume effectively. For example, during events like festivals or seasonal peaks, the system automatically adjusts to handle the increased flow far more efficiently than pre-programmed plans would. Additionally, at intersections like King St and Bishopsgate, if there's an incident on Highway 403 that requires traffic to be diverted, Miovision Adaptive will ensure smooth and optimized traffic management in these situations, enhancing overall operations.

7.0 Deployment Overview

The Miovision deployment consisted of two phases, the first phase included the installation of Miovision Core units and Smartview 360 cameras at three intersections across the county. This phase of the project was completed in July 2023 and has been providing Intersection Monitoring, Performance Measures and Mobility Reports (multimodal turning movement counts) since then.

Intersection Monitoring provides a combination of real-time telemetry and alerts as well as on-demand insights that give Traffic Operations teams the ability to immediately see what’s happening, make informed decisions before going on-site, and dispatch the right technician with the right tools, at the right time. Performance Measures provides users with Automated Traffic Signal Performance Measures (ATSPMs) to understand how

intersections are operating from the perspective of the road user. Mobility Reports provide multi-modal turning movement count data.

The second phase included the deployment of the Miovision Adaptive Traffic Management system which was completed in April 2024. The Adaptive system deployment was delayed on several occasions due to internal Miovision resource constraints as well as reconfiguration of the Adaptive models when errors in the timing plans were discovered relating to phase orientation. Based on these delays, Miovision has recognized that additional resource management was required and has implemented new strategies related to deployment scheduling and resource allocation. With this new strategy, Miovision does not expect similar deployment delays as experienced with this initial implementation should Brant County choose to expand the current deployment.

As a result of these delays as well as the tight timeline to present the results to council in June 2024, the initial evaluation period was limited to the period of May 10th through May 22, 2024. Now that the adaptive system has been deployed for several months, a longer term analysis could be conducted, the results of which are presented below.

8.0 Evaluation Method

As noted in the previous report submitted in May 2024, the adaptive system remained in an “on” state following the end of the on/off testing period. As such, a longer-term evaluation needed to be conducted for a better understanding of the improvements made by Adaptive Traffic Light Technology. The evaluation periods for this analysis include the “off” period of October 2023 through April 2024 and “on” period of June and July 2024. These periods were selected as Brant County was interested in a longer term evaluation and these were the dates available where data was collected.

9.0 Metrics of Evaluation

Various performance metrics were used to provide a clear indication of percentage change between the on period and the off period. These metrics are in chart form and are built directly into Miovision One. They were used to answer various performance questions through the evaluation period. They include:

9.1 Vehicle Delay:

- Simple Delay: The simple delay reports the time between when the stop-bar detector is actuated during the red phase and when the phase turns green. Simple Delay does not account for startup delay, deceleration, or queue length outside of the detection zone. Delays are binned into 15-minute intervals
- Minor Street Simple Delay: Reports the median simple delay experienced by vehicles on the minor street.

9.2 Split Failures:

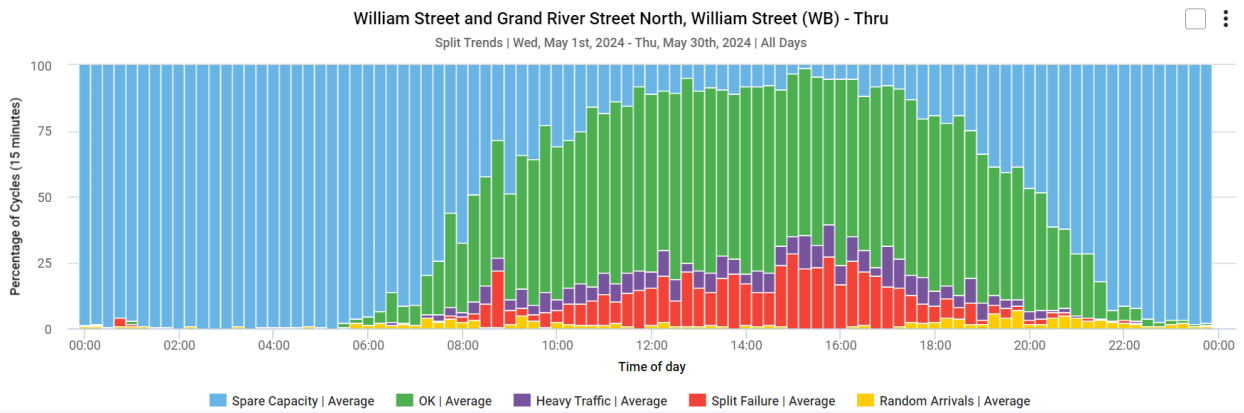
Split failures occur when vehicles fail to clear the queue during the green phase and remain in the detection zone as the light transitions to yellow and red.

- Intersection → Split failures are reported as the average across the selected date / time range for all movements.

9.3 Split Trends: charts each signal cycle comparing the Green Occupancy Ratio (GoR) to the first 5 seconds of Red Occupancy Ratio (RoR5). They are then placed into a 24-hour chart. It can be used to understand which movements at an intersection are operating well versus which ones might require more green time.

The data is binned into five different categories, which include:
Split Failures (GoR and RoR5 > 80%): Indicates Split Failures, that is, left-over demand for the specified movement.
Heavy Traffic (60% < GOR and ROR5 <80%): Highly saturated but not failing. Indicates a potential but not imminent problem.
OK (Good) (GoR > 80%, low RoR5): Indicates excellent green utilization.
Random Arrivals (low GoR, RoR5 > 80%): Indicates random arrival of vehicles, possibly caused by mid-block sources.
Spare Capacity (both GoR and RoR5 are low): Indicates excess capacity on the particular movement

An example of a split trend chart can be seen below.



9.4 Arrivals on Red:

Arrivals on Red provides the number of vehicles arriving at an intersection during the red for a specific phase. This metric provides an indication of progression through the intersection. If the goal of the County of Brant is to have good progression, the aim should be to have relatively low arrival on red percentages for the major street approaches.

10.0 Results

10.1 Summary of Results

Simple delay refers to the time a vehicle waits at a stoplight from the moment it triggers the stop-bar detector during the red light until the light turns green

- Compared operations of the intersections October 2023 - April 2024 (no adaptive) to June and July 2024 (adaptive operational since end of May 2024)
- Results showed:
    - Increase in volume between off and on periods up to 25% during “on” period needs to be highly considered in evaluating the results.
    - Improvement in simple delay at William Street and Grand River Up to 23 % improvement average on all directions.
    - Improvement in simple delay at King Street and Bishopsgate of 19% average on all directions
    - Improvement in simple delay at Phelps Road and Cockshutt Road of 17% average on all directions

10.2 Simple Delay (Key Factor Results)

The following section shows delay per movement at each intersection during the “On” and “Off” testing periods. Delay was examined between 6 AM and 10 PM since that is when the majority of vehicles are using the intersections.

Intersection	**Average simple delay per direction (s) “off”**	**Average simple delay per direction (s) “on”**	**Compound difference of 4 vehicles**
William Street and Grand River Street North	1:17 (77s)	59s	72s
King Street and Bishopsgate Road	27s	21s	24s
Phelps Road and Cockshutt Road	37s	31s	24s

11.0 Citizen Impacts

Where simple delay was significantly reduced between the “off” and “on” periods at William Street and Grand River Street North, a high level calculation was done in order to understand the annual impact that such an improvement could potentially have on road users.

The following assumptions were made for this calculation:

- AM period was 6 AM to 10 AM
- PM period was 3 PM to 7 PM
- Simplified delay was compared between “off” and “on” periods to show time savings due to the adaptive system
- Savings will hold for 250 days per year
- Cost of gasoline used was $1.66 / L
- Cost of CO2 emissions used was $50 / ton
- Time value of money for passenger vehicle used was $15.47 / hour
- Time value of money for commercial vehicle used was $102.12 / hour

The annualized savings from the initial deployment of the adaptive solution at William Street and Grand River Street North are as follows:

User cost: $117,700
(3265 hours of delay)

Fuel cost: $17,435
(10,750 litres of fuel)

CO2 cost: $1,370
(28 tons of CO2)

Overall, it is estimated that citizens will save over $136,500 across one year as a result of the deployment at William Street and Grand River Road North

12.0 Conclusion and Recommendations

The Miovision Adaptive system has demonstrated significant benefits Even more impressive is that during this period, volumes increased by up to 25% across all three intersections, showcasing the system's ability to manage increased traffic efficiently. Additionally, citizens have seen real value, with estimated savings of over $136,500 due to the improved traffic flow at these key locations.

There are several key considerations that further highlight the system’s effectiveness:

1. **Consistent Efficiency**: Under normal traffic conditions, the adaptive system is expected to perform as well as, if not better than, traditional signal timing plans. This means consistent, smooth operations, no matter the day-to-day fluctuations.
2. **Exceptional Performance During Peak Events**: During periods of significant traffic changes, such as rerouting from Highway 403 or during busy local festivals, the adaptive system is expected to outperform traditional systems, providing enhanced management during critical times.
3. **Increased Volumes as an Opportunity**: While volumes increased significantly during the testing period (by up to 25%), the adaptive system handled this rise seamlessly. This suggests that the system is robust enough to handle future increases, providing long-term scalability and value.
4. **Corridor Potential**: While this deployment focused on partially isolated intersections, the adaptive system has the potential to deliver even greater benefits when deployed along a corridor with interconnected adaptive-controlled intersections, offering even more opportunities for optimized travel times.