City of Winnipeg

2021 Traffic Signals Branch Annual Report

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EXECUTIVE SUMMARY

The 2021 Traffic Signals Annual Report provides an overview of the activities of the City of Winnipeg's Traffic Signals branch, including an introduction to the branch, key performance indicators (KPIs), and current projects.

Traffic Signals is responsible for designing, procuring, building, setting timing for, operating, and maintaining all electrified traffic displays within the city. We manage signalized intersections, flashing pedestrian corridors, keep-right flashers, speed display devices, and prepare-to-stop signs. Traffic Signals also operates the Transportation Management Centre (TMC) – a real-time response unit that helps keep traffic moving and Winnipeggers informed of delays.

As Winnipeg has no true freeways and an abundance of railway crossings, traffic signals play an unusually large role in moving people and goods efficiently through the city. Demand on traffic signal infrastructure has also increased due to a number of timely factors:

1. The population of Winnipeg has grown steadily in recent years, from 677,800 in 2011 to 766,900 in 2020 (an increase of 1.4 percent per year)[1]
2. The total number of lane-kilometres of regional streets in Winnipeg has not increased at the same rate, increasing only 0.5 percent from 1,815 lane-kilometres in 2015 to 1,824 lane-kilometres in 2020;[2] this means more drivers use the same volume of roadways, which causes more congestion
3. The number of registered vehicles has steadily increased from 497,549 vehicles in 2011 to 569,834 vehicles in 2017
4. The number of vehicles per person also increased at about 0.5 percent per year from 2011 to 2017[3]

Despite these challenges, Signals has helped achieve a number of milestones for the transportation network.

1. Low traffic signal malfunction rates, including a significant decrease in malfunctions since 2012.
2. Faster response times to traffic signal damages and maintenance issues.
3. A threefold increase in temporary signal timing changes in response to road conditions (e.g. construction, special events) from 2017 to 2018 and a further increase of 47 percent from 2018 to 2019. Temporary timings changes declined from 1,831 in 2019 to 1,074 in 2020, due to reduced congestion and unplanned incidents from the COVID-19 pandemic. In 2021, temporary timings increased to 1,274.
    - Prior to 2017, Signals did not have the capability to provide temporary timings.
4. A 65.5 percent reduction in 311 cases relating to signal timing from 2016 to 2021 and a 79.8 percent drop in the average number of days required to resolve these cases over the same period.

On top of these day-to-day operational achievements, the branch engages in a wide variety of value-added projects.

- ***Data collection***: Gathering data that provides new situational awareness. Signals is currently working on developing data for traffic flow and internal operational data, among others.

[1] https://winnipeg.ca/cao/pdfs/population.pdf
[2] https://www.winnipeg.ca/cao/pdfs/CommunityTrendsandPerformanceReportVolume1_2019.pdf (pg. 53), https://www.winnipeg.ca/cao/pdfs/CommunityTrendsandPerformanceReportVolume1_2021.pdf (pg. 108)
[3] MPI Vehicle Registration 2006-2017.xlsx

- ***Data analysis, reporting, and automation***: Collecting data is not enough - it is crucial to also have systems in place to actually use collected data in valuable ways. Some specific activities in this area include automated power reporting to Manitoba Hydro, implementing reporting tools, and publishing corridor reports.

- ***Investigating and testing new signals technologies***: Technology related to Traffic Signals is always changing and improving, which means that Signals must stay abreast of trends and investigate the feasibility of implementing technologies.

- ***Improving traffic signals infrastructure***: Signals is constantly working to improve safety and efficiency of traffic signals infrastructure through revitalization and upgrades. Some notable current projects include completed installation of city-wide Audible Pedestrian Signals (APS) and significant completion of Pedestrian Countdown Signals (PCS), use of an integrated push button with touchless activation and APS that can provide a locator tone for the visually impaired at pedestrian crossings, and upgrades to existing signed crosswalks with Rectangular Rapid Flashing Beacons (RRFB).

- ***Process improvement***: Signals is constantly working to improve the efficiency of internal processes, including process documentation and automating internal workflows.

TRAFFIC SIGNALS FAST FACTS

The table below provides a quick overview of the main performance indicators for the Traffic Signals Branch, comparing previous and current reporting years.

Area	Indicator		Previous Year (2020)	Current Year (2021)
Infrastructure	# vehicle intersections	Regular	656	658
		Half-signal	21	22
		Flashing red light	7	7
	# pedestrian corridors[4]		183	186
	# Rectangular rapid flashing beacon (RRFB) crosswalks		4	7
	% Vehicle intersections equipped with accessible pedestrian signals (APS)		100.0%	100.0%
	% Vehicle intersections equipped with pedestrian countdown signals (PCS)		97.1%	100.0%
	Replacement value of infrastructure*		-	$38,018,294
	Total replacement value of infrastructure in poor condition*		-	$704,590
Operations	# Traffic signal malfunctions**		786	314
	Average response time to malfunctions (hours)		3.62	3.76
	# Traffic signal damages		337	321
	% Damages recovered		58.2%	64.8%
Design	# Design drawings created		467	476

[4] Note that 3 pedestrian corridors were converted into vehicle intersections in 2019.

	# Construction drawings without as-built drawings	182	169
Signal Timing	# Temporary timing changes	1,074	1,274
	# permanent timing changes[5]	716	357
TMC	# Cameras in operation	171	174
	% of Regional road network visible to cameras	60.9%	61.0%
	Kilometres of regional road network visible to cameras	575	594
	# Incidents in TMC incident manager	54,436	67,749
	# Tweets	2,939	3,074
	# Twitter impressions	8,014,000	8,143,000
	# Twitter profile visits	118,258	928,600
	# Twitter mentions	651	696
	# New twitter followers	1,066	1,451
	# Courtesy tows	15	19
	# Accommodated WPS requests for TMC camera information	169	153
	# Accommodated public requests for TMC camera information accommodated	12	7

*For 2021 reporting, Traffic Signals developed an updated database tracking replacement value of infrastructure which tracks asset values in more detail and improves the ability to connect material values to the Signals Inventory asset tracking database. This change in tracking limits the ability to compare 2021 figures to previous data.
**The database operations staff use to track detailed signals malfunction data was not in operation for a 1 to 2-month period in early 2021, contributing to some extent to the decline in malfunctions.

[5] The 2018 Annual Report calculated this metric as the number of work orders approving signal timing changes. Since 2019, the metric has changed to show the number of individual intersections that received permanent timing changes.

INTRODUCTION

The 2021 Traffic Signals Annual Report provides an overview of the activities of the City of Winnipeg's Traffic Signals branch including an introduction to the branch, key performance indicators (KPIs), and current projects.

Traffic Signals is responsible for designing, procuring, building, setting timing for, operating, and maintaining all electrified traffic displays within the city. These displays include signalized intersections, flashing pedestrian corridors, keep-right flashers, and speed/prepare-to-stop signs. Traffic Signals also operates the Transportation Management Centre (TMC) – a real-time response unit that helps keep traffic moving and Winnipeggers informed of delays.

The report is divided into the following sections:

- ***Overview of Traffic Signals branch***: Provides contextual information about Signals, including its role within the City of Winnipeg, branch-level objectives, and the main groups contained within the branch

- ***Key performance indicators (KPIs)***: A selection of KPIs outlining performance in various areas, including infrastructure, operations, design, signal timing, and the Transportation Management Centre (TMC)

- ***Current and ongoing projects***: An overview of projects above and beyond day-to-day operational work

OVERVIEW OF TRAFFIC SIGNALS BRANCH

The Traffic Signals Branch is responsible for the design, building, operation, and maintenance of all electrified traffic displays within the City of Winnipeg. This includes signalized intersections, flashing pedestrian corridors, keep-right flashers, and speed / prepare-to-stop signs.

As Winnipeg has no true freeways and an abundance of railway crossings, traffic signals play an unusually large role in moving people and goods efficiently through the city. Demand on traffic signal infrastructure has also increased due to a number of timely factors.

Also contributing to these challenges is the fact that the population of Winnipeg has grown steadily in recent years, from 637,200 in 2001 to 766,900 in 2020 (an increase of 20 percent).[6] A growing city means growing demands on the transportation infrastructure, (e.g. more traffic, more congestion, longer travel times, and increased frequency of collisions).

To meet these increasing demands on traffic signal infrastructure, Signals focuses on two main goals:

1. ***Safety***: Improving the safety of drivers and pedestrians on Winnipeg roadways
2. ***Efficiency***: Reliable and predictable movement or people and goods on Winnipeg roadways achieved at a low cost

BRANCH SERVICE AREAS

Traffic Signals consists of five main service areas: operations, design, procurement, timings, and the Transportation Management Centre (TMC).

Operations

The traffic signals operations team consists of electricians and technologists responsible for installing and maintaining all traffic signals infrastructure in the field. This includes two 24-hour on-call emergency response staff who respond to unexpected traffic signal malfunctions or damages. Since 2020, operations is also responsible for contractor management, facility management, and yard maintenance.

Design

The design team is responsible for the design of signalized intersections. Activities include producing construction drawings, as-built drawings, and cost estimates for new signalized intersections, new pedestrian corridors, and upgrades/rehabilitation of existing traffic signals infrastructure. The design team is also responsible for managing installation of traffic signals underground infrastructure.

Procurement

Procurement is responsible for purchasing required materials to support the construction and maintenance of infrastructure, ensuring operations and other areas have the inventory required to perform their tasks, and ensuring all RFPs are completed.

Timings

The timings team consists of four timing engineers and one supervisor responsible for coordinating the timing of traffic signals. Traffic signal timing is done through proactive corridor reviews as well as in response to issues raised

[6] https://winnipeg.ca/cao/pdfs/population.pdf

directly by citizens through 311. The timing engineers also provide support to the TMC by changing traffic signal timing in response to unusual congestion or traffic incidents. They also provide traffic modelling analysis and internal engineering guidance to other branches on intersection functionality.

Transportation Management Centre (TMC)

The TMC serves as a control center to monitor, manage and control daily road activity. It provides Signals with unprecedented ability to respond to incidents in real time, acting upon real-time data from cameras set up at 174 intersections (providing visibility to 594 km of regional roadway in the City), as well as data on roadway incidents and traffic jams from 311 and Waze[7]. The TMC also conducts data management and coordinates with other internal and external stakeholders.

Figure 1 illustrates the organizational chart of the branch and its relationship with the broader Transportation division and Public Works Department.

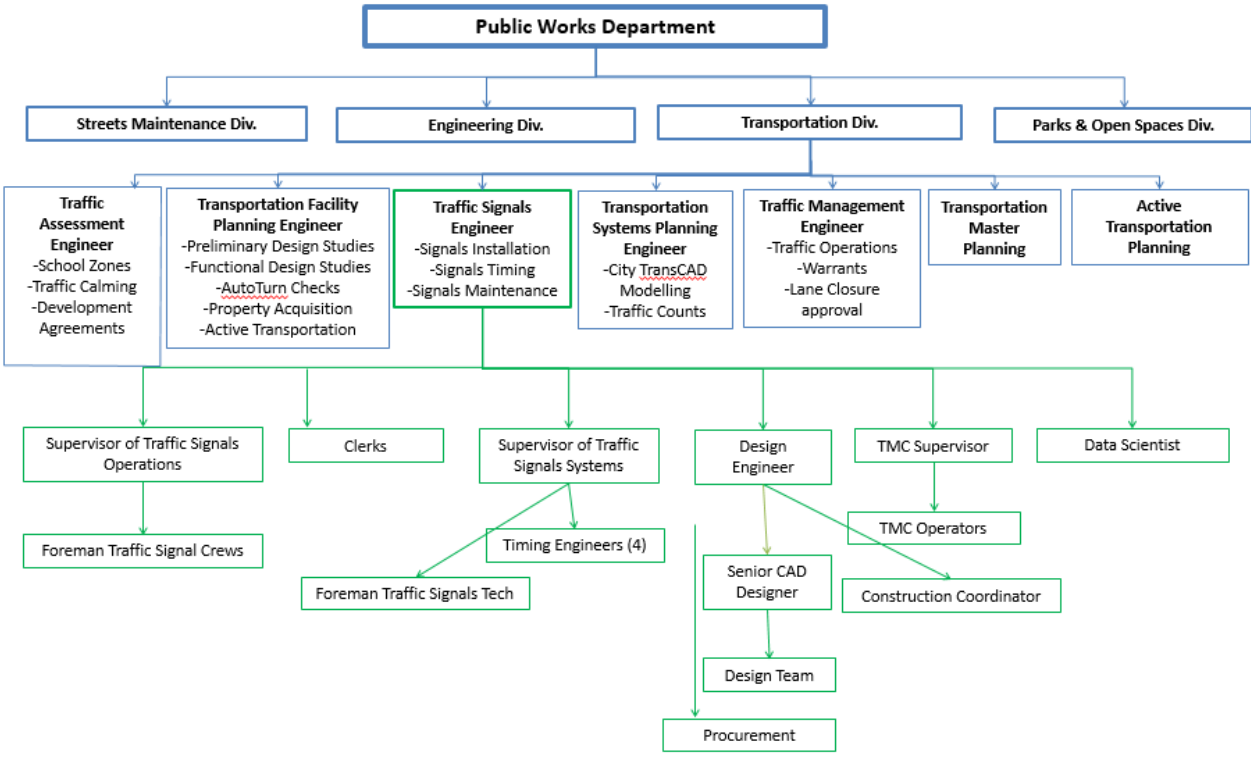

Figure 1: Traffic Signals Branch Organization Chart, current as of May 2021
Traffic Signals branch positions marked with green

[7] Waze is a community-based GPS Navigation App owned by Google (https://www.waze.com/). The Traffic Signals Branch engaged in a partnership with Google and the Waze Connected Citizens Program, which enables the city to access anonymized data from Waze on road incidents and traffic Jams. The City of Winnipeg was the 2nd municipality in Canada to become a Waze partner.

KEY PERFORMANCE INDICATORS

Signals collects data to gain situational awareness, implement more efficient processes, and report and monitor performance.[8] This section describes some of key performance indicators resulting from these data sources.

INFRASTRUCTURE, OPERATIONS, AND DESIGN

KPIs within this group fall in the following categories:

- Number of intersections under management
- Traffic signal malfunctions
- Traffic signal damages
- Expenditures
- Work orders
- As-built and construction drawings

NUMBER OF INTERSECTIONS UNDER MANAGEMENT

As of late 2021, the branch manages: 658 regular vehicle intersections; 22 half signal intersections; 7 flashing red light intersections; 186 pedestrian corridors; and 7 rectangular rapid flashing beacon (RRFB) crosswalks. Figure 2 and Figure 3 illustrate the prevalence of Winnipeg's signalized intersections.

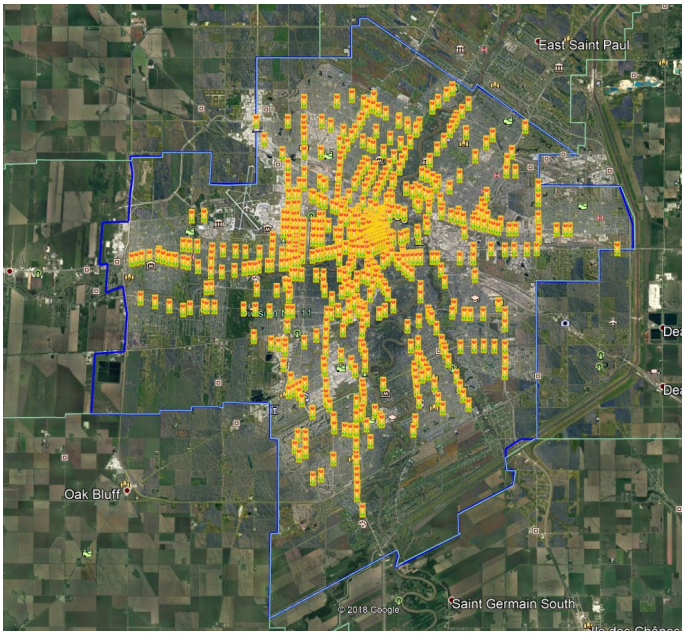

Figure 2: Active vehicle intersections in the City of Winnipeg, as of January 2019

[8] Signal's ability to report on performance aligns with recent Audit recommendations to "develop and report on a comprehensive set of performance measures for each key area of the business".

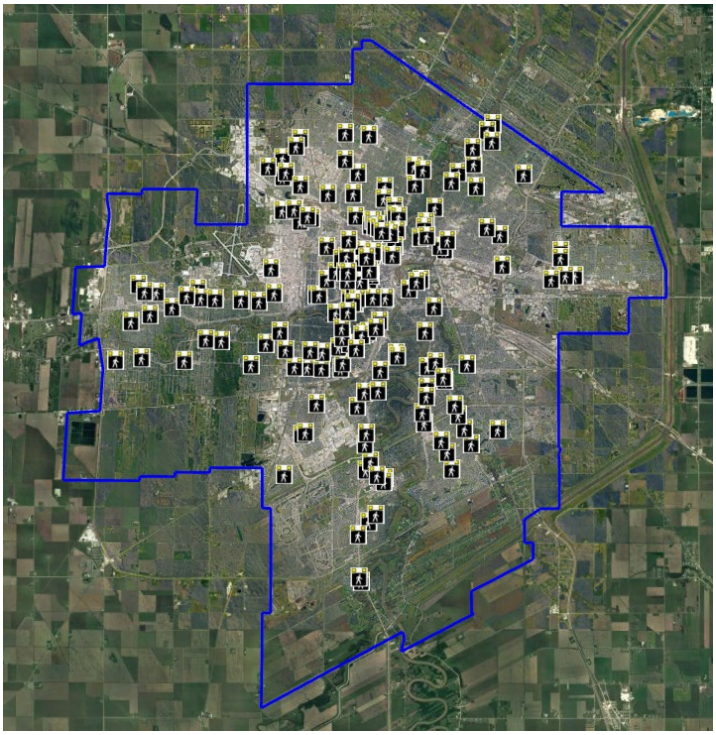

Figure 3: Active pedestrian corridors in the City of Winnipeg, as of January 2019

As illustrated in Figure 4 and Figure 5, both vehicle intersections and pedestrian corridors have steadily increased over time.[9]

[9] There is a delay between the time intersections are created and when the data is added to Signals Inventory. As a result, the charts may not contain some new intersections, and the dates intersections were added is a close approximation.

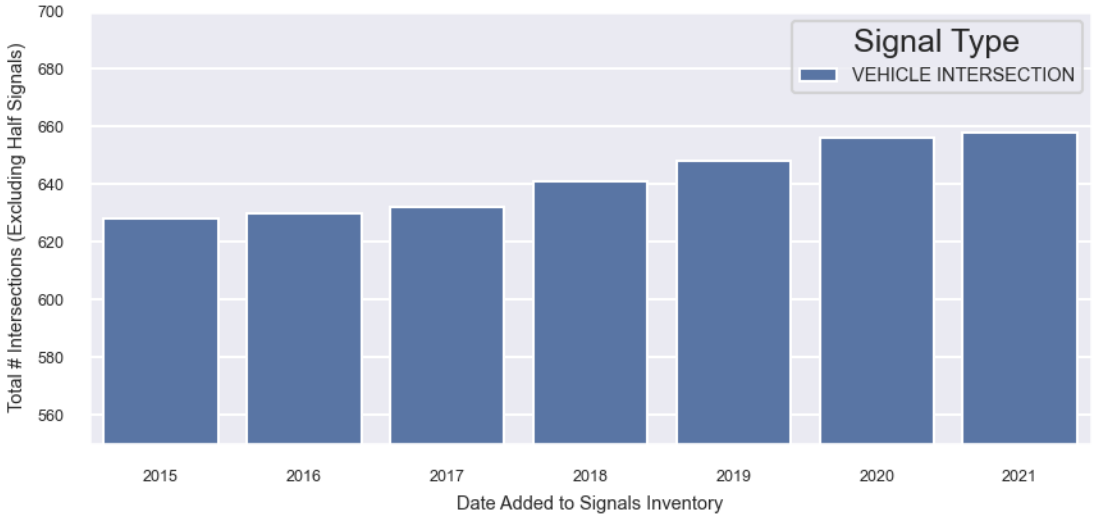

Figure 4: Number of vehicle intersections under management, from 2015 to 2021

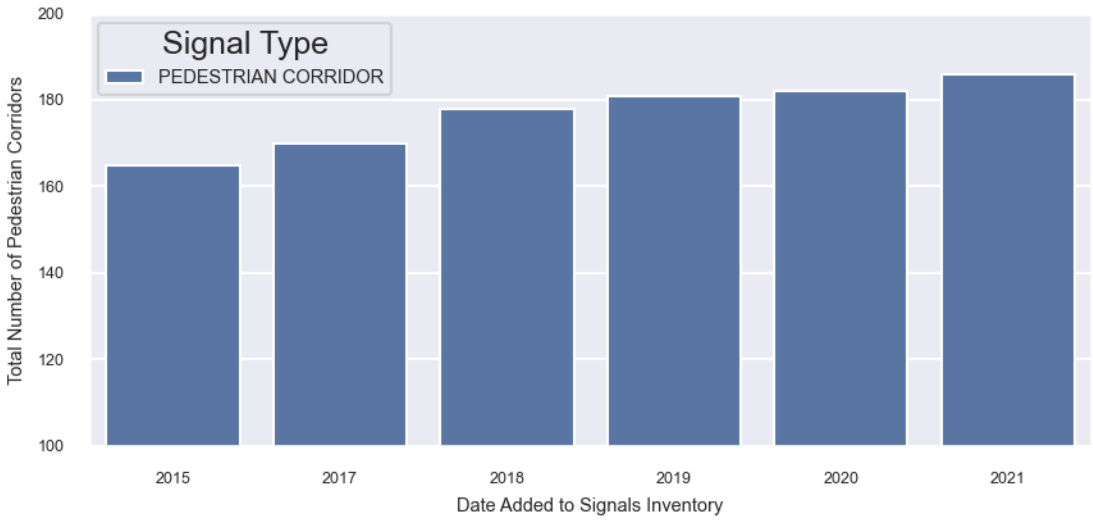

Figure 5: Number of pedestrian corridors under management, from 2015 to 2021

Accessibility and pedestrian safety at signalized intersections and crossings has increased as the branch works toward the goal of equipping every vehicle intersection in the city with accessible pedestrian signals (APS) and pedestrian countdown signals (PCS). Signals achieved both goals in 2021 with 100 percent of vehicle intersections equipped with APS and PCS.

TRAFFIC SIGNAL MALFUNCTIONS

Since 2012, the incidence of malfunction reports has significantly decreased. Fewer malfunctions leads to less reactionary overtime, increased proactive maintenance, and increased resources available for maintenance of new equipment (e.g. cleaning/maintaining traffic monitoring cameras). See Figure 6.

(Please note: 2021 numbers should be considered an outlier, as the malfunction tracking database was inoperable for up to two months in 2021 due to technical issues.)

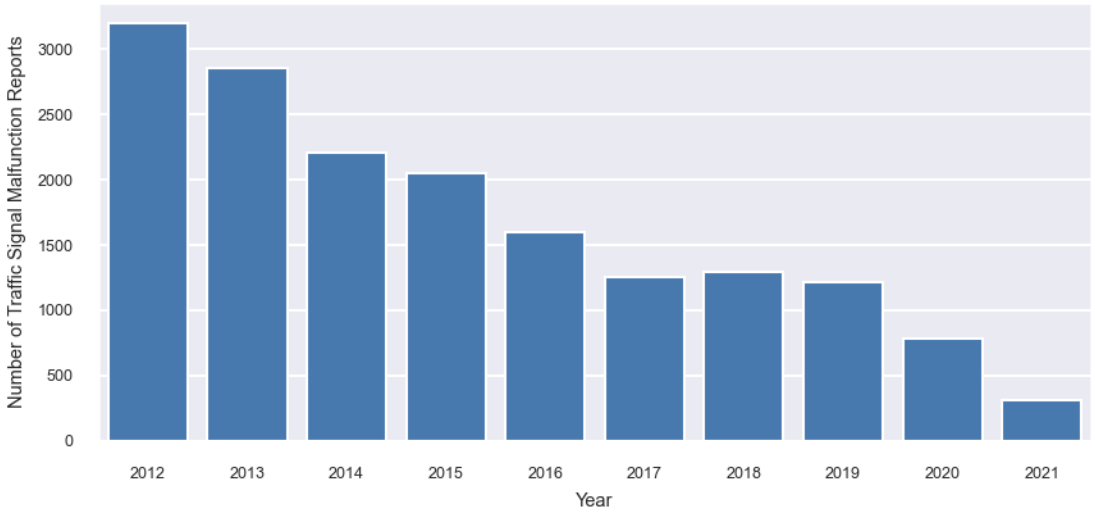

Figure 6: Number of traffic signals malfunctions, by year (2012-2021)

Figure 7 illustrates the trend in response times to malfunctions from 2012 to 2021.

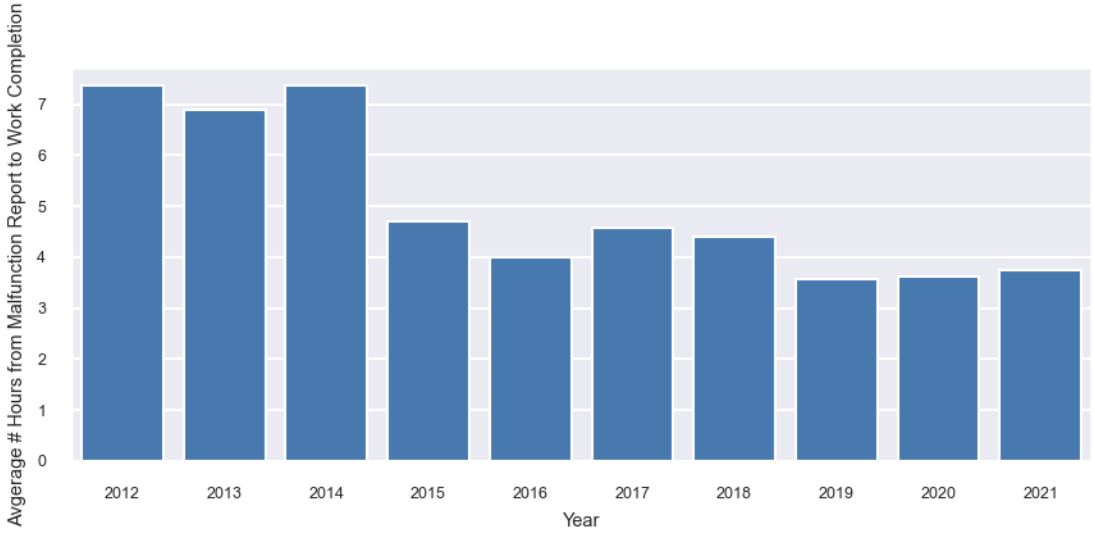

Figure 7: Overall average response times for traffic signal malfunctions, by year (2012-2021)

Overall response times can be divided into two subcategories: the time between when the malfunction is first reported and when crews arrive on site (Figure 8), and the time between when crews arrive on site and when the malfunction is resolved (Figure 9).

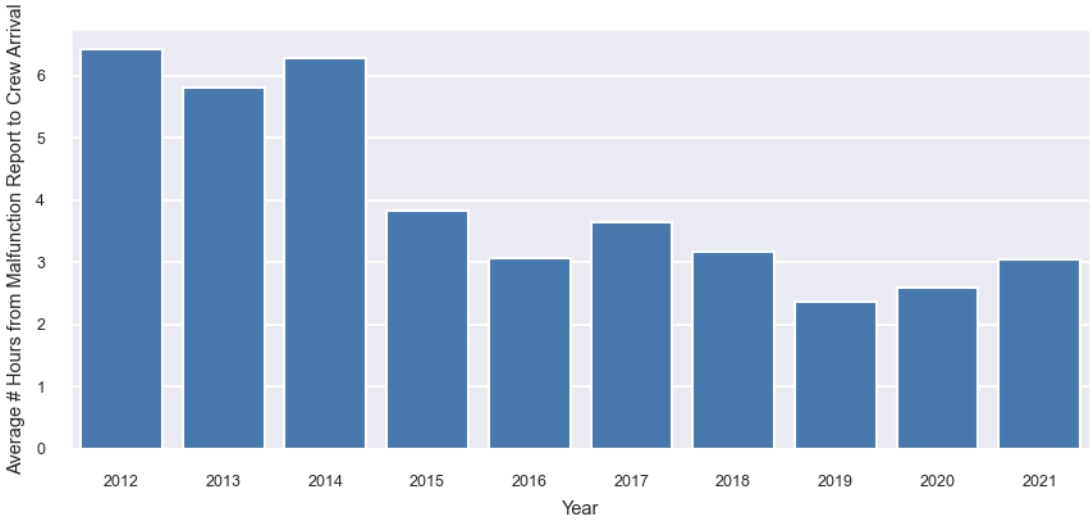

Figure 8: Average time from malfunction report to traffic signal emergency crew arrival, by year (2012-2021)

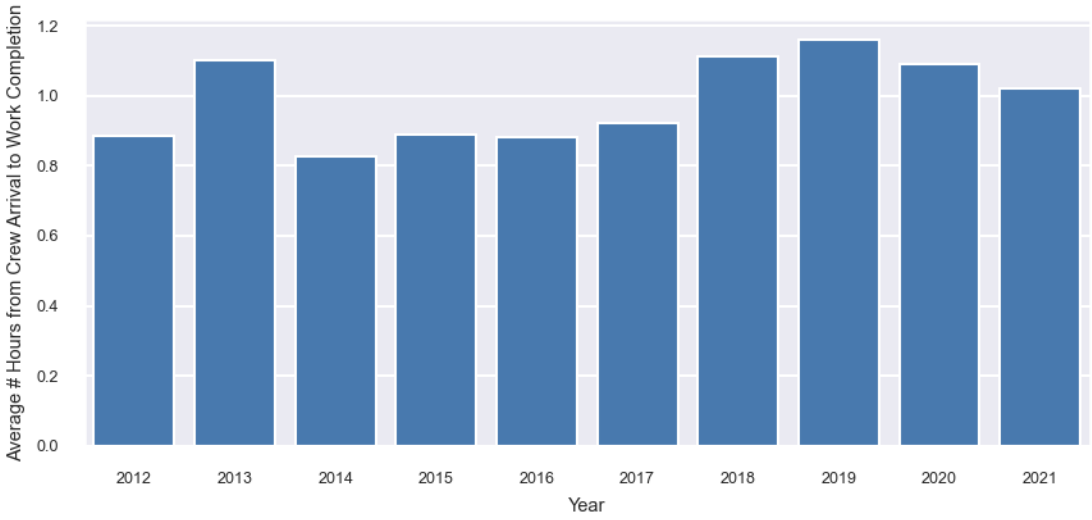

Figure 9: Average time from traffic signal emergency crew arrival to malfunction resolution, by year (2012-2021)

TRAFFIC SIGNAL DAMAGES

Since 2011, damages have remained fairly consistent and average approximately 370 per year. See Figure 10.

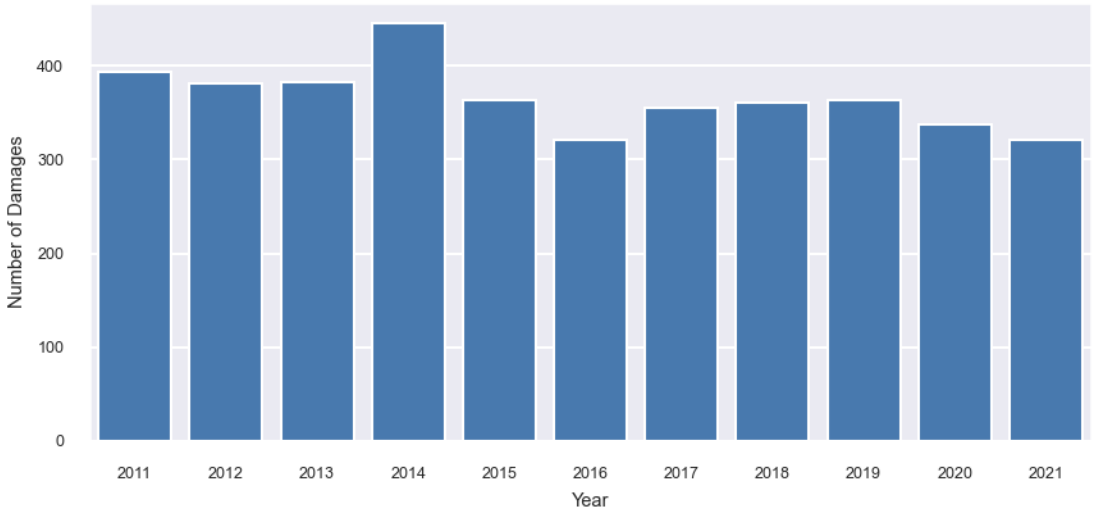

Figure 10: Number of traffic signal damages, by year (2011-2021)

Damages are most caused by vehicle collisions. Signals has increasingly recovered costs via license plate capture and a subsequent Manitoba Public Insurance claim. Recoveries increased from 37.3 percent of damages in 2011 to 64.8 percent in 2021. Figure 11 and Figure 12 show the trend in recoverable damages and percentage of damages recoverable. Updates to relevant databases in 2021 enabled tracking damages that occurred due to snow clearing operations.

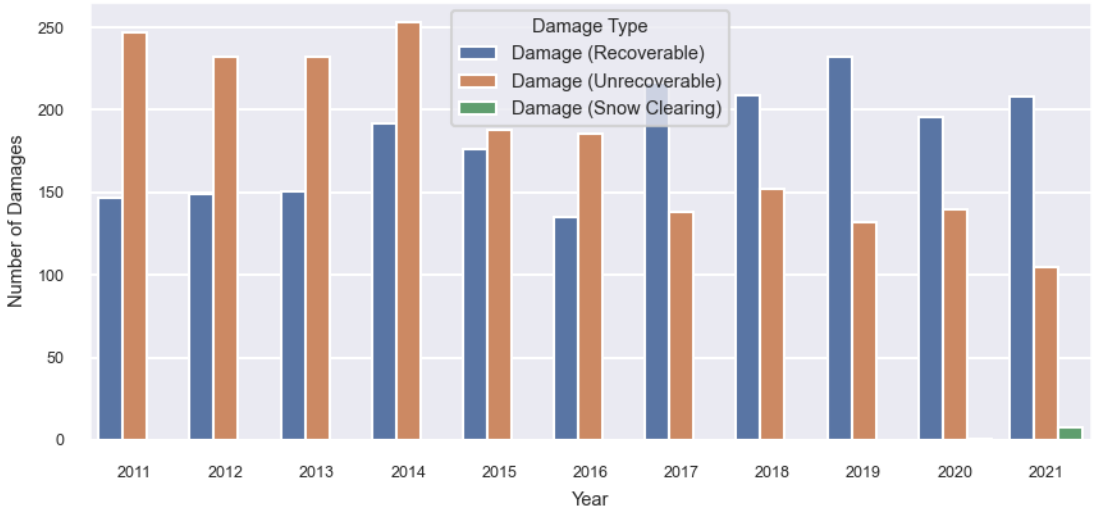

Figure 11: Number of recoverable and unrecoverable traffic signal damages, by year (2011-2021)

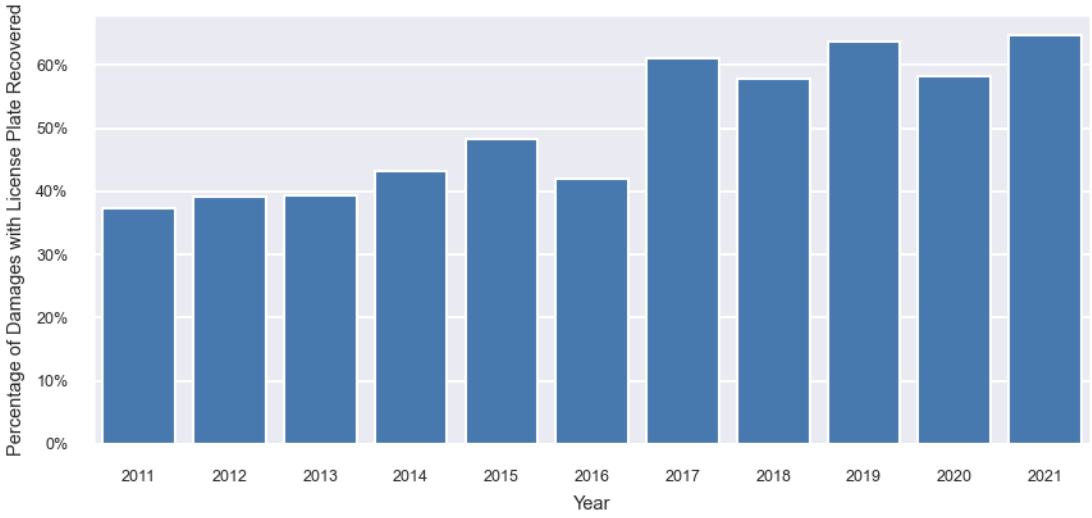

Figure 12: Percentage of traffic signal damages recoverable, by year (2011-2021)

EXPENDITURES

Expenditures fall into one of the following categories: underground contractor costs; purchases from internal stores; and material and labour costs logged through an internal work tracking system[10].

Underground contract expenditures were $810,138 in 2021, down from $1,257,3440 in 2020.

Figure 13 illustrates the total material and labour costs for 2021, Figure 14 subdivides these expenditures into various expense categories, and Figure 15 subdivides these expenses into the broader work order categories to which expenses are assigned.

[10] The "Traffic Signals Operations Database" replaced a legacy system called MMS, and enables much more detailed tracking of work orders, time, and materials associated with Traffic Signals Operations.

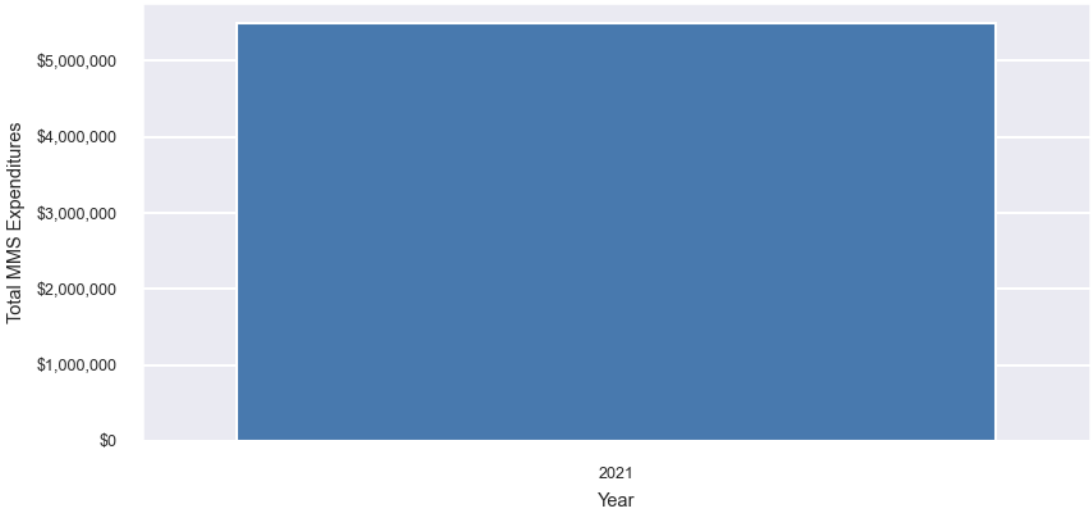

Figure 13: Value of expenses (2021)

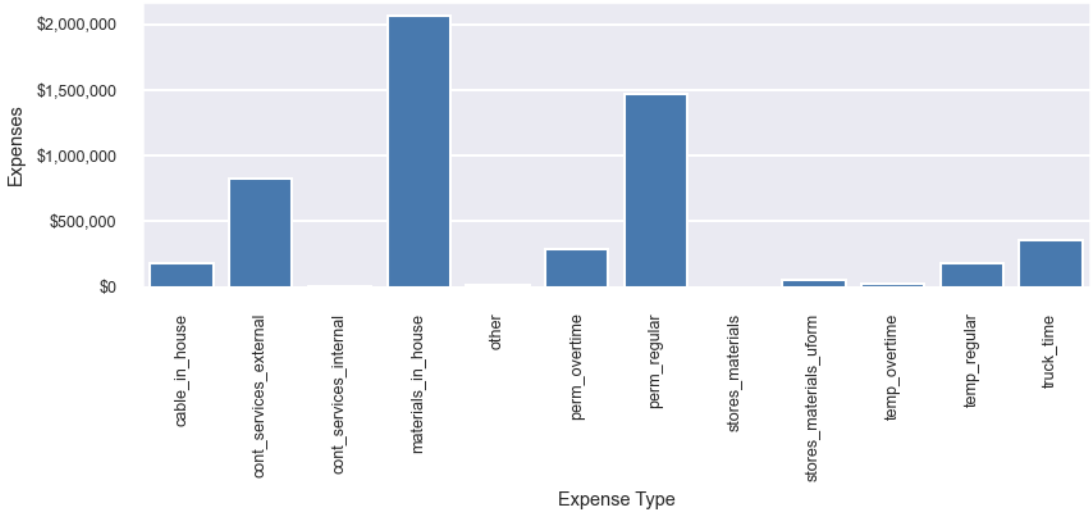

Figure 14: Value of expenses, by expense type (2021)

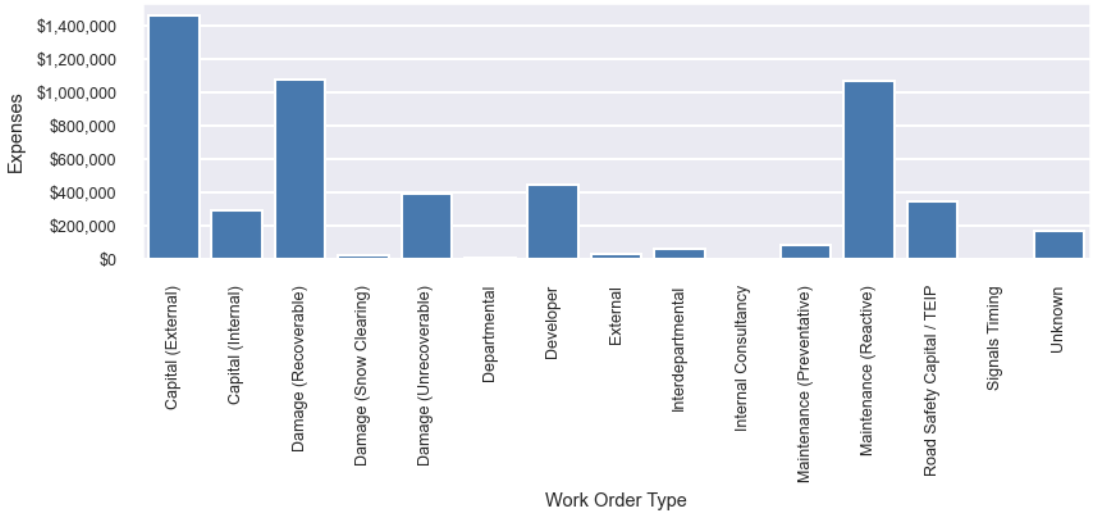

Figure 15: Value of expenses, by work order type (2021)

WORK ORDERS

A fundamental unit of work for traffic signals operations is the work order, which represents an identifiable job or task billed to an account. In 2021, Signals started 789 work orders, compared to 564 in 2020. The total number of work orders complete in 2020 was 381 while the number completed for 2021 was 528. Work orders vary in size in terms of the amount of work involved, so the total number of work orders does not necessarily reflect the total amount of work conducted.

AS-BUILT AND CONSTRUCTION DRAWINGS

The Signals design group produces two main types of drawings for signalized intersections: **construction drawings**, which illustrate planned construction of the intersection; and **as-built drawings**, which illustrate actual construction in the field.

Figure 16 describes the total number of drawings created each year from 2014 to 2021.

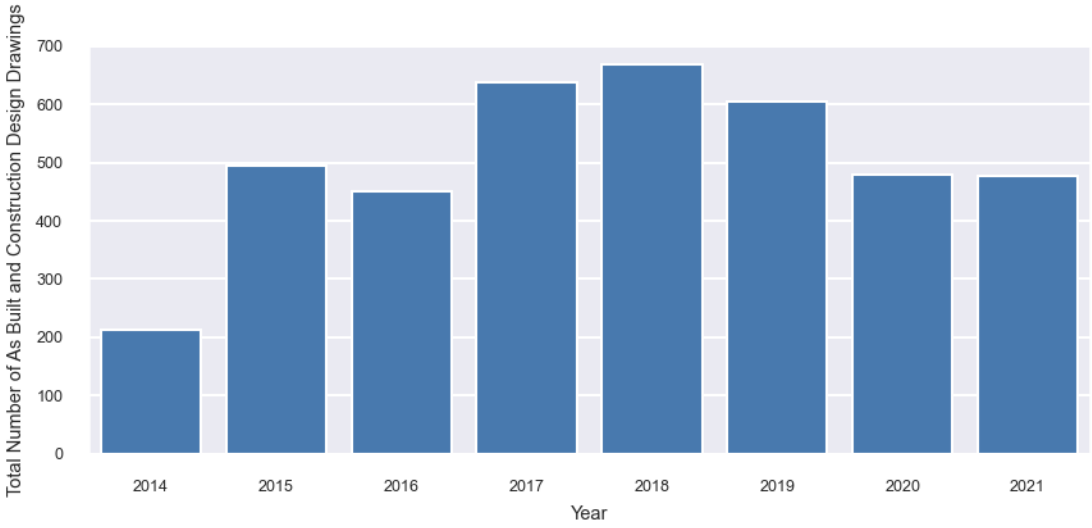

Figure 16: Number of design drawings, by year (2014-2021)

Figure 17 illustrates the number of each type of drawing over the same period.

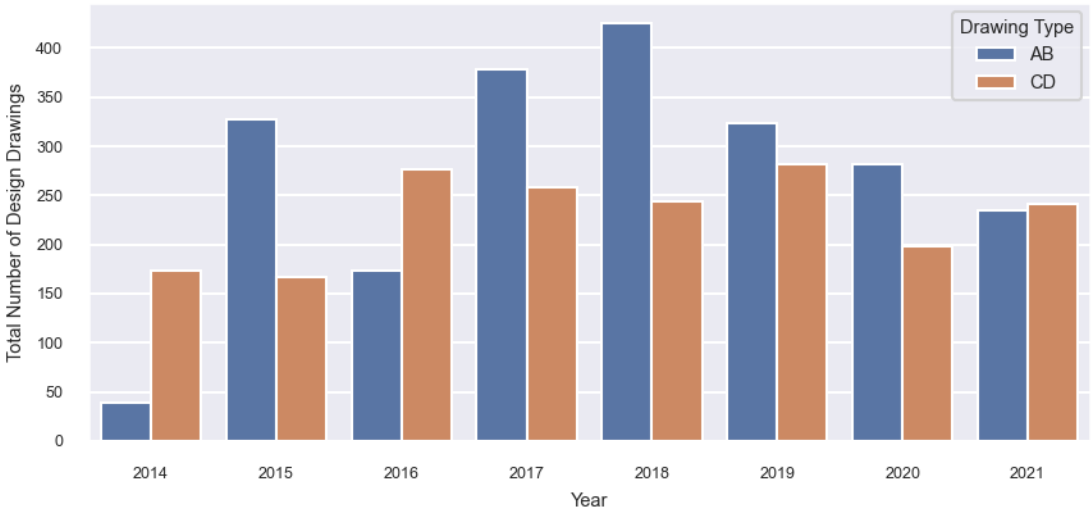

Figure 17: Number of construction and as-built design drawings, by year (2014-2021)

Every construction drawing must eventually have a corresponding as-built drawing created, as the actual construction in the field often differs slightly from the original specifications. Therefore, an important indicator for the design team is the number of outstanding construction drawings missing a corresponding as-built drawing. At the end of 2021, 169 of these drawings remained outstanding of a total 476 created. Figure 18 shows the trend over time.

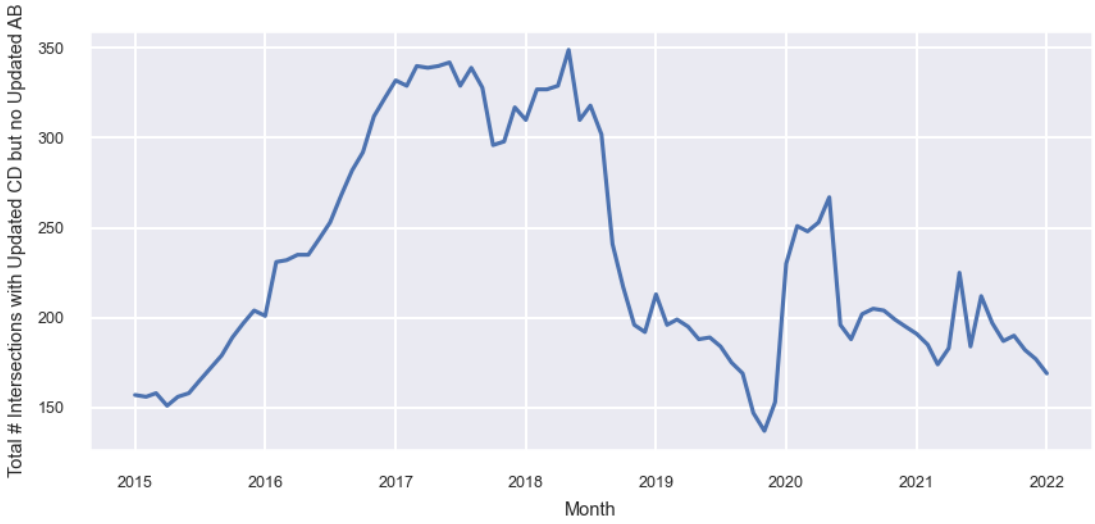

Figure 18: Number of intersections with updated construction drawings but no corresponding update to as-built drawings, by year (2014-2021)

SIGNAL TIMING

KPIs within this group fall in the following categories:

- Travel times
- Timing requests and clearance times
- Timing changes

TRAVEL TIMES

The City's most recent Winnipeg Community Trends and Performance Report (July 2021) describes average travel speeds overall across major routes from 2017 to 2020 (Henderson Highway, Main Street, Portage Avenue, and St. Mary's Road) during AM peak periods. [11] From 2017 to 2020, morning rush hour travel speeds increased along these routes, with the exception of Henderson Highway.

[11] https://winnipeg.ca/cao/pdfs/CommunityTrendsandPerformanceReportVolume1_2022.pdf

AM PEAK AVERAGE TRAVEL SPEED ON MAJOR ROUTES (KM/H)[12]	2017	2018	2019	2020
HENDERSON HWY	46.7	43.1	36.6	44.5
MAIN ST	40.0	35.1	34.3	40.1
PEMBINA HWY	38.9	N/A (Pembina Underpass Construction)	29.7	41.7
PORTAGE AVE	38.9	41.8	35.4	39.7
ST MARY'S RD	34.5	37.3	32.5	40.2

More work needs to be done to isolate the impact of traffic signal timings on travel time, since other factors, such as population size, number of registered vehicles, number of trips, weather, construction, special events, roadway infrastructure changes (e.g. number of lanes), and other unexpected events such as the COVID-19 pandemic also play a significant role.

TIMING REQUESTS AND CLEARANCE TIMES

As illustrated in Figure 19, the number of timings-related 311 cases has dropped by 65.5 percent, from 545 cases in 2016 to only 188 cases in 2021. The COVID-19 pandemic likely contributed to the very low number of timing-related requests in 2020 and 2021.

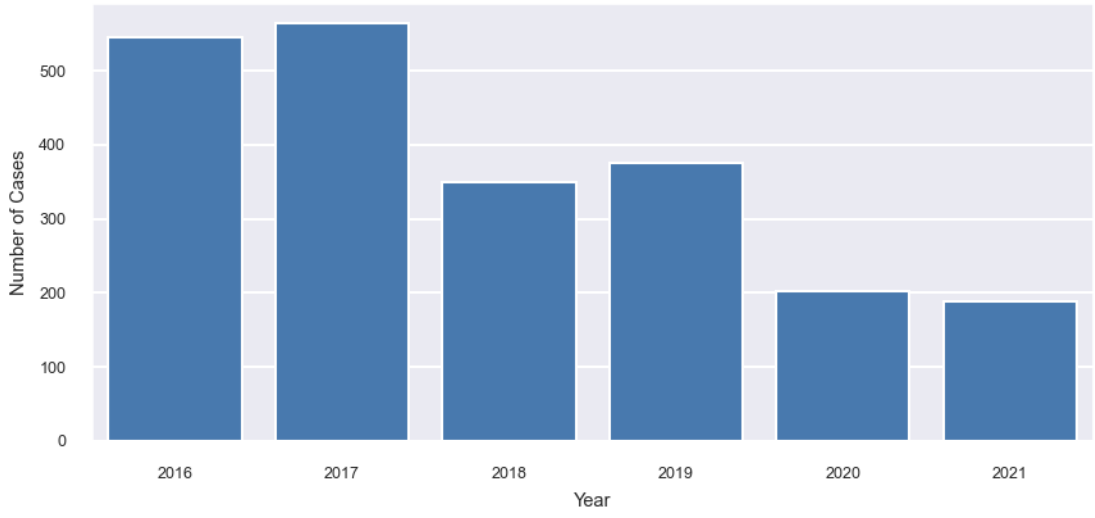

Figure 19: Total number of signal-timing related 311 concerns, by year (2016-2021)

[12] Starting 2019 travel speed information is collected using City's WAZE data platform. Please see this link on City website for WAZE data description: https://winnipeg.ca/publicworks/transportation/TMC/Waze/whatisWaze.stm

The timing group is now addressing cases at significantly greater speeds. As illustrated in Figure 20, the average number of days required to resolve 311 signal timing cases has decreased by 79.8 percent, from 165.5 days in 2016 to 33.5 days in 2021.

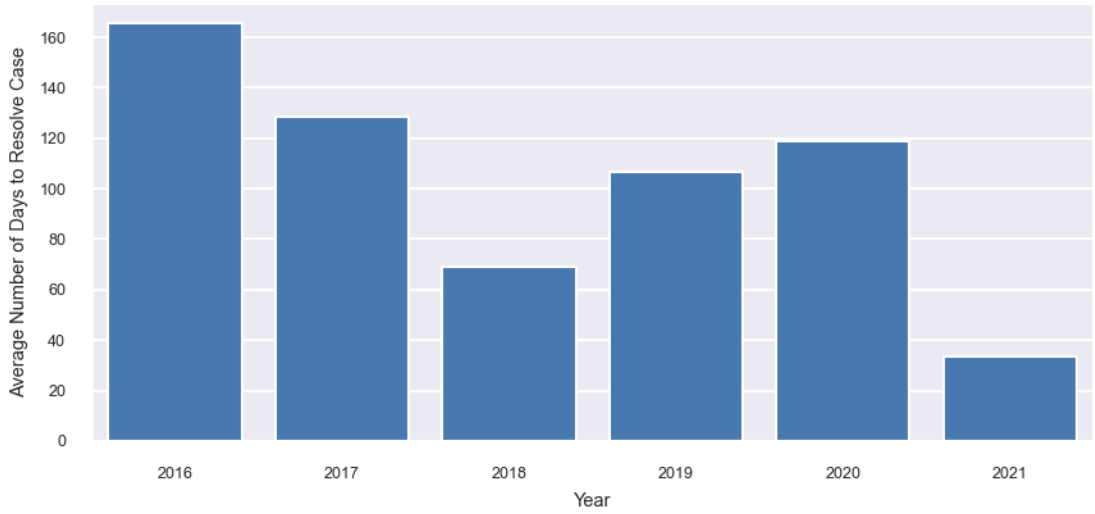

Figure 20: Average number of days required to resolve 311 concerns, by year (2016-2021)

TIMING CHANGES

Timing changes are divided into two main categories:

1. ***Temporary timing changes***: These changes are either planned in advance (e.g. to accommodate construction, special events) or unplanned (changing timing to real-time road conditions and unexpected events, such as a stalled car). The number of temporary timing changes varies depending on road conditions and staffing resources, among other factors.

2. ***Permanent timing changes***: These changes are used on an ongoing basis, which may be the result of a detailed corridor review by timing engineers, or a change from temporary timing to permanent timing.

Temporary timing changes have increased from 2020 to 2021, from 1,074 temporary timing changes to 1,274 changes; this rise comes after a significant drop in 2020 related to reduced traffic as a result of the COVID-19 pandemic. See Figure 21.

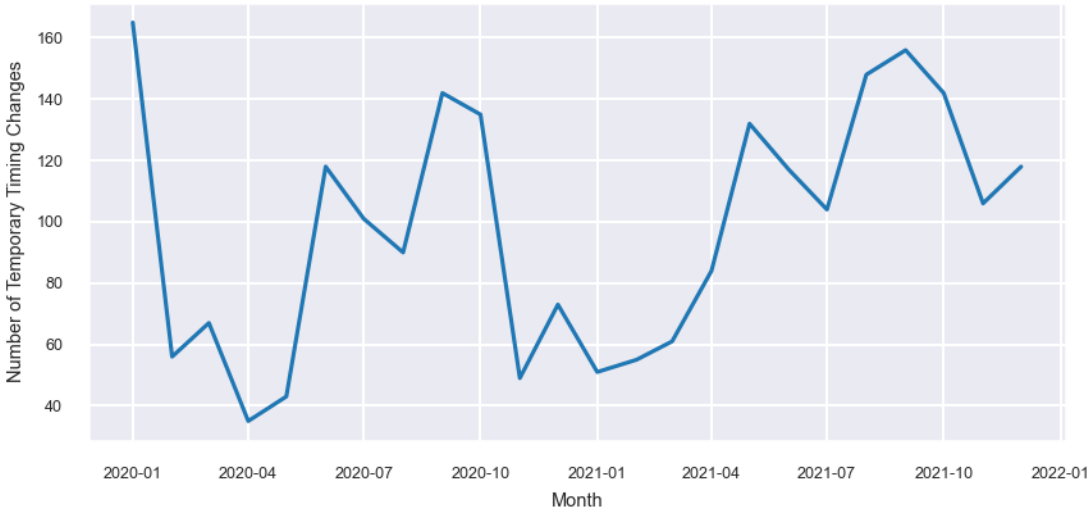

Figure 21: Number of temporary timing changes, by month (2020-2021)

Figure 22 shows temporary timings subdivided by type.

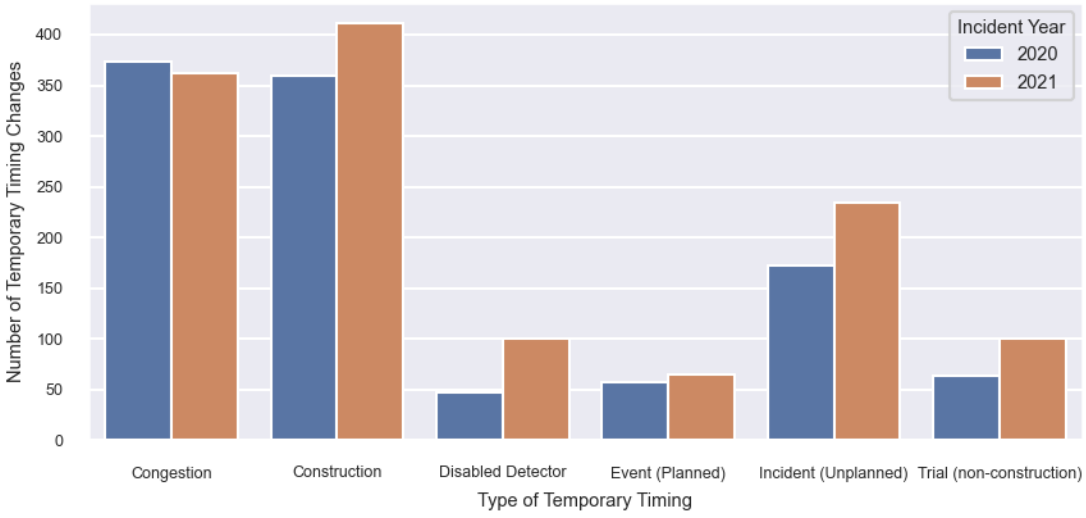

Figure 22: Number of temporary timing changes, by month (2020-2021)

Figure 23 shows the trend for each type by month.

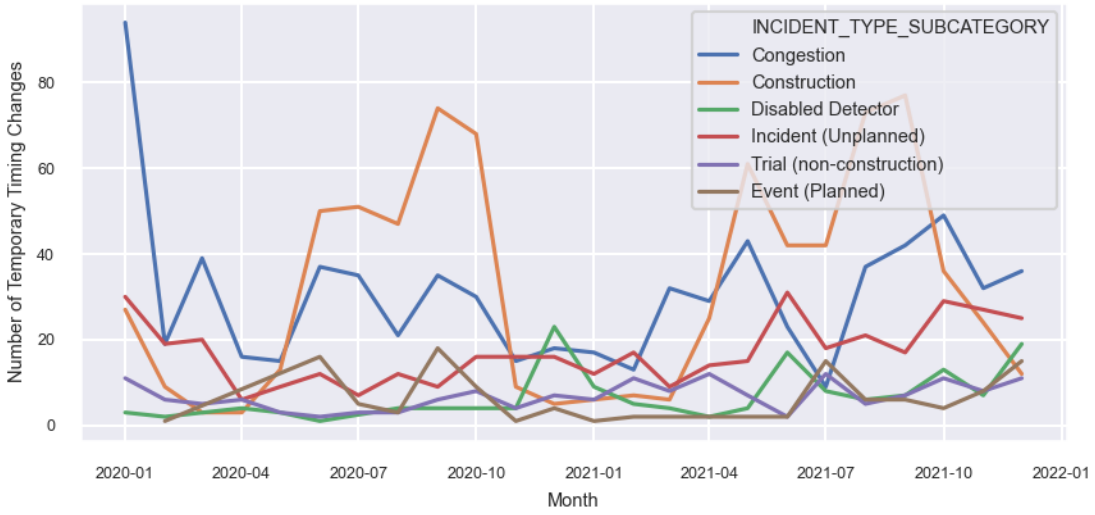

Figure 23: Number of temporary timing changes, by month and type (2020-2021)

Each temporary timing change contains information on the number of intersections receiving a timing plan change. The vast majority of timing changes affected a single intersection, although some affected multiple (40 intersections in one case).

Permanent timing changes have been tracked since 2018; there were 357 changes in 2021. Of these, 14 were the result of a corridor review and 42 were long-term temporary timing changes due to a temporary condition (e.g. multi-month construction lane reduction).

TMC

KPIs within the TMC fall in the following categories:

- Camera view area
- Incidents
- Twitter statistics
- Courtesy tows, Winnipeg Police Service investigations and FIPPA requests

CAMERA VIEW AREA

As of the end of 2021, 174 cameras provided 61.0 percent visibility of the regional road network. This translates into approximately 594 lane-kilometres[13].

These figures have increased steadily since the launch of the TMC. Figure 24 shows the number of TMC cameras operational over time and Figure 25 shows the corresponding percentage of the regional road network covered.

[13] This figure is calculated using City of Winnipeg map data that maps significant regional roads as dual-lines and moderate to small regional road as single line. As a result, the total visible area by lane-kilometres is higher than this figure, while the total visible area by centre-line measurement is lower.

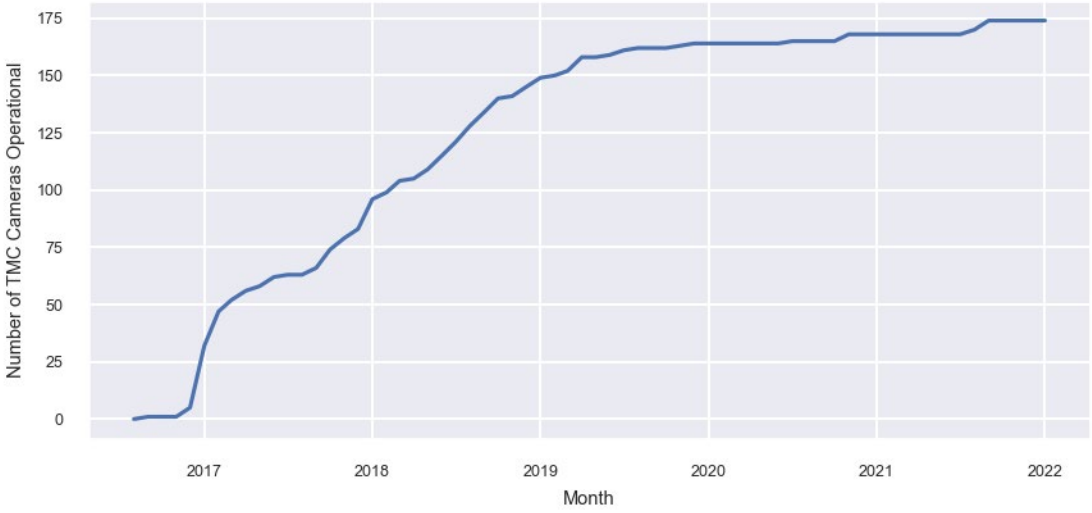

Figure 24: Number of cameras operational over time (2020-2021)

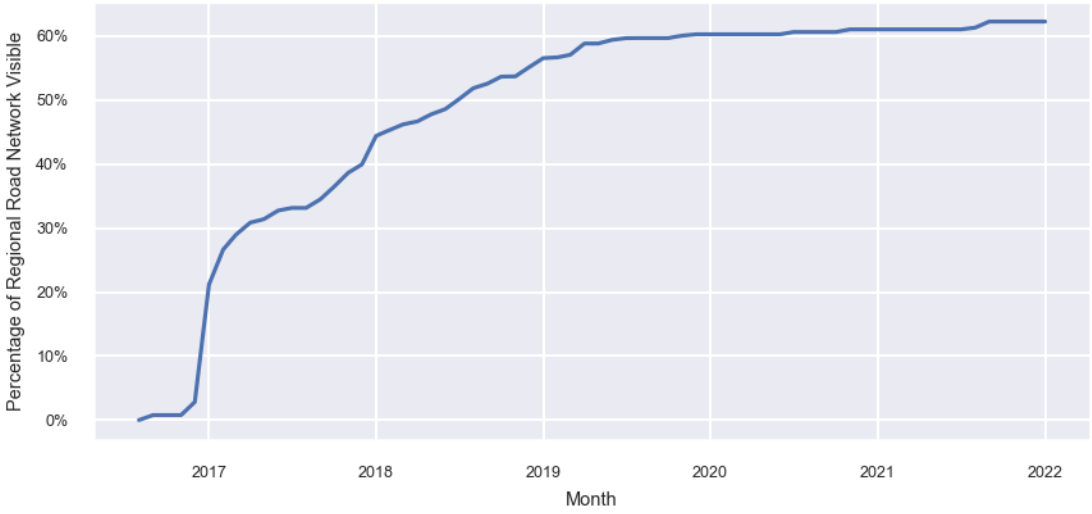

Figure 25: Percentage of regional road network visible to cameras over time (2020-2021)

INCIDENTS

TMC operators received a total of 67,749 incidents in 2021, up from 54,436 in 2020. Figure 26 illustrates the monthly trend of the number of incidents over this period.

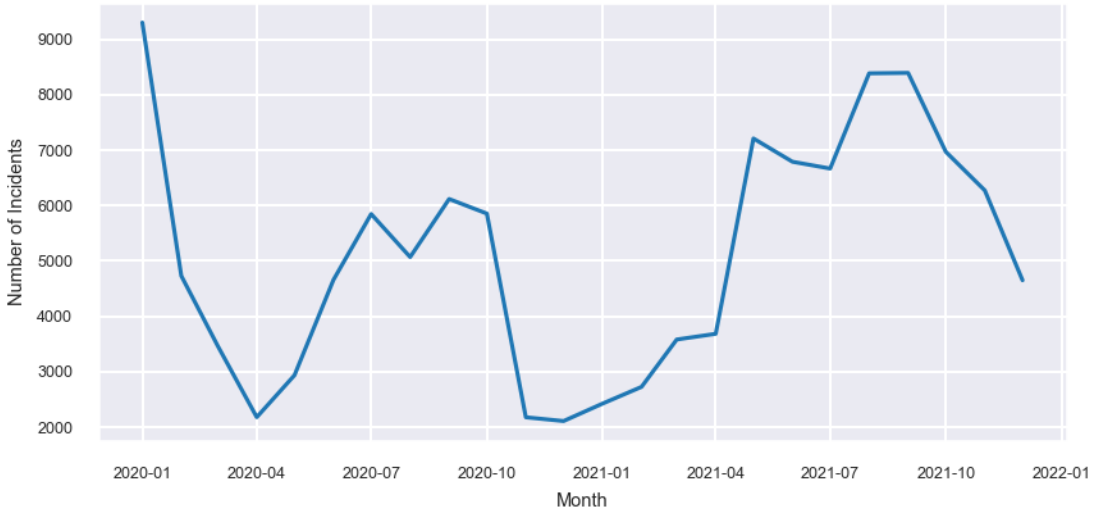

Figure 26: Total number of incidents reported in the Incident Manager (2020-2021)

As indicated by Figure 27, by far the most common source of incident data is Waze, followed by 311. Figure 28 illustrates the monthly trend in the number of incidents for each of these categories.

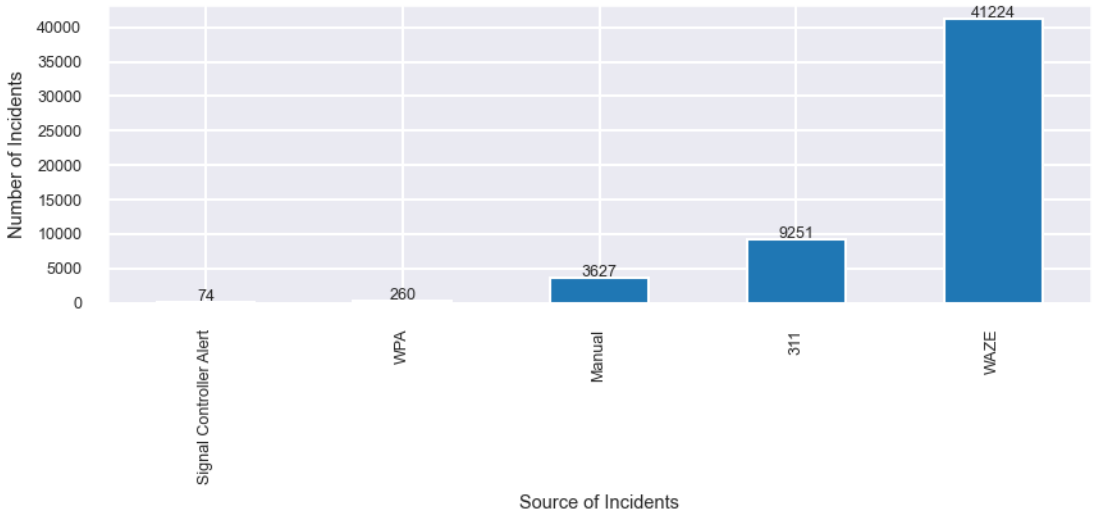

Figure 27: Total number of incidents reported in the Incident Manager, by type (2020-2021)

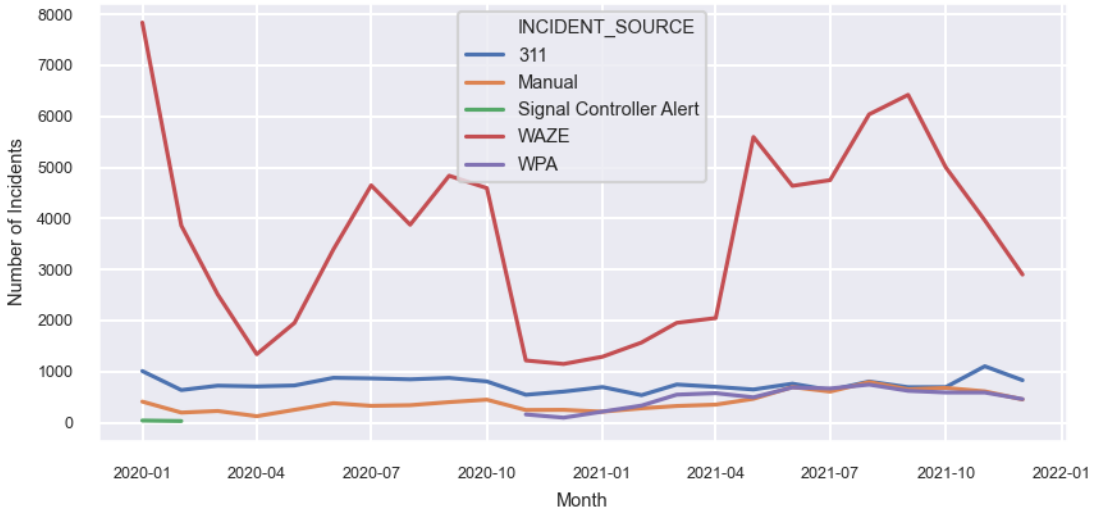

Figure 28: Monthly trend in total number of incidents reported in the Incident Manager, by type (2020-2021)

TWITTER STATISTICS

The TMC regularly provides real-time information on incidents through the TMC Twitter feed, which started in September 2017. In 2021:

- TMC issued 3,074 tweets
- The account had 8,143,000 impressions
- 928,600 visitors (not necessarily unique) viewed the profile
- @TMCWinnipeg was mentioned by other users 696 times

COURTESY TOWS

One important service provided by the TMC is the courtesy tow, which is triggered when operators notice a stalled car blocking traffic in a major regional road. The number of courtesy tow requests made by the TMC for 2020 and 2021 was 15 and 19, respectively.

POLICE / PUBLIC INFORMATION REQUESTS

The TMC receives requests for information related to the cameras from both the public and Winnipeg Police Service. Table 1 and Table 2 describe the total number of requests and the number accommodated by the TMC. The total number of requests more than doubled from 2020 to 2021 for both police and public requests.

The most common reason for denying a request is that the data is past the retention period (7 days). Other reasons include the camera pointing in the incorrect direction, vague or incomplete requests, or requests not meeting FIPPA (Freedom of Information and Protection of Privacy Act) requirements for release.

Table 1: Police Requests for TMC Camera Information, 2017-2021

Year	Total # Requests	# Requests Accommodated
2017	52	33
2018	121	55
2019	152	90
2020	238	169
2021	192	153

Table 2: Public Requests for TMC Camera Information , 2017-2021

Year	Total # Requests	# Requests Accommodated
2017	30	12
2018	67	16
2019	113	24
2020	99	12
2021	49	7

STATE OF THE INFRASTRUCTURE (SOIR)

State of the Infrastructure Reporting (SOIR) provides an estimate of the replacement cost of above-ground infrastructure based on condition. The total estimated value of the branch's Infrastructure is $38,018,294. Most of these costs are associated with pole and cabinet bases, followed by poles and arms, hardware, cabinets, controllers, and pedestrian, bike, and vehicle display heads. See Figure 29.

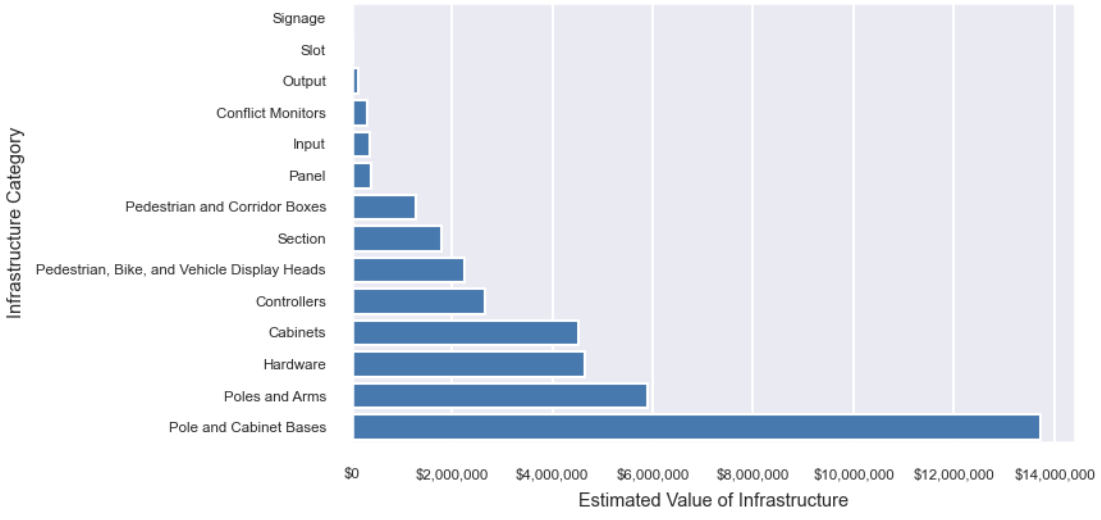

Figure 29: Total estimated value of infrastructure, by infrastructure type, 2021

Figure 30 provides more detail about condition within each of these categories. The vast majority of above-ground infrastructure is in fair to very good condition. Only about $704,590 of the replacement value of infrastructure is

for equipment currently in poor or very poor condition, which translates into approximately 1.9 percent of the total replacement value of traffic signal infrastructure.

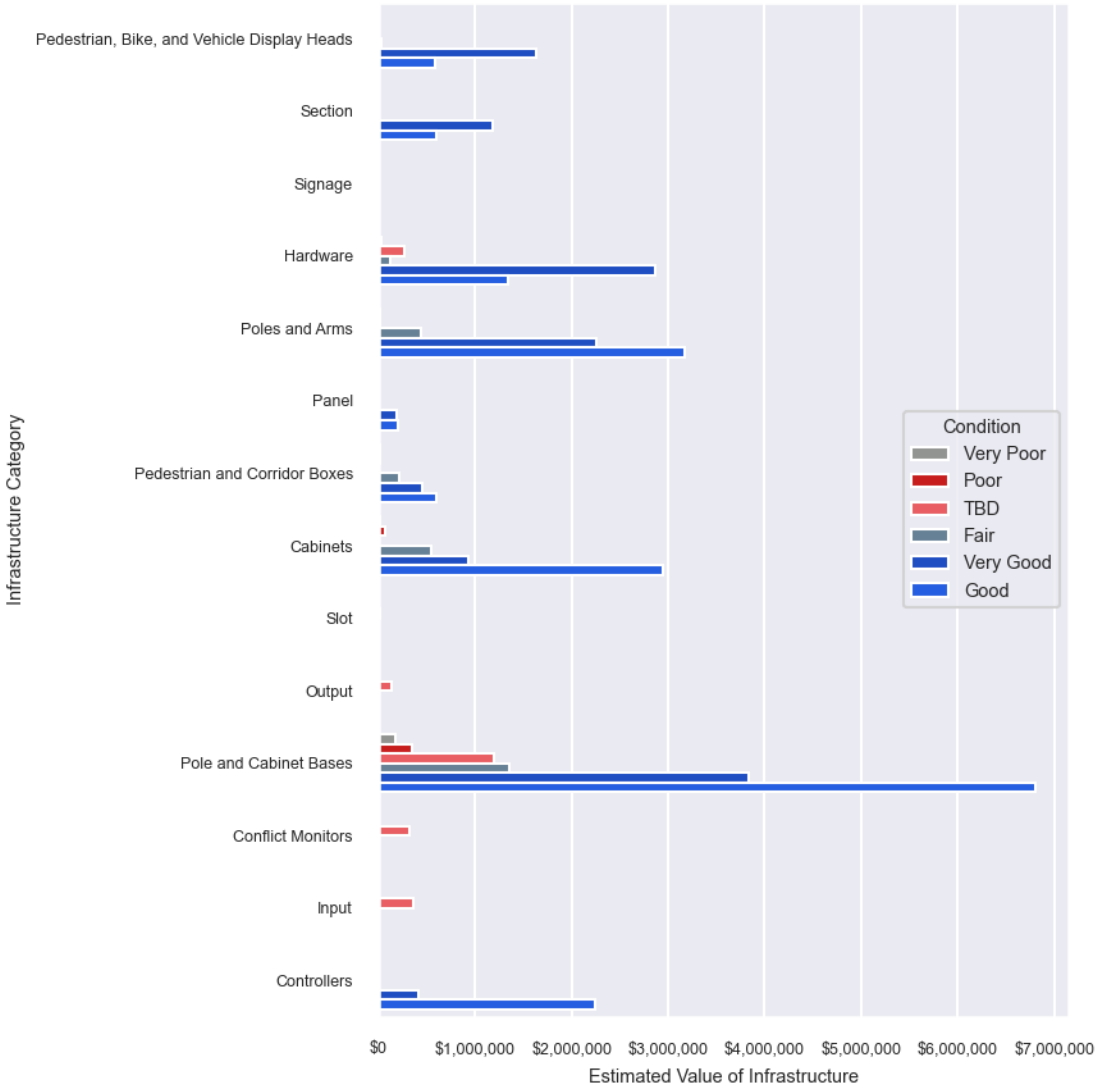

Figure 30: Total estimated value of infrastructure, by infrastructure type and condition, 2021

ONGOING ACTIVITIES

Signals engages in a wide variety of ongoing activities that support operations and facilitate achievement of our key performance indicators. These activities include:

- Data collection
- Data analysis, reporting, and automation
- Investigating and testing new signals technologies
- Improving traffic signals infrastructure
- Partnerships
- Process improvement

DATA COLLECTION

Data is collected to provide the branch with new situational awareness on a broad variety of topics. This makes the branch more efficient, as it facilitates better planning, productivity, and allocation of resources. It also promotes safety by providing critical metrics about the condition of infrastructure and other intelligence to understand any significant risks to the public.

Signals is continually working on developing new data sources to fill gaps in situational awareness. These include:

- ***Signals inventory updates***: The branch is continually adding new equipment to its infrastructure. This means that the Signals Inventory Database needs to be regularly updated and modified to reflect this new equipment.

- ***Internal operational data***: While the branch collects a significant amount of data on internal processes and operations, much of it is stored in inaccessible legacy or paper-based systems that cannot be easily queried or connected with other data. The branch is working to develop systems to digitize and store this information in proper databases that can inform operations and improve process efficiency.

DATA ANALYSIS, REPORTING, AND AUTOMATION

Collecting data is not enough; it is crucial to also have systems in place to analyze and use collected data in meaningful ways. Our data collection touches a number of activities.

- ***Power reporting***: Traffic Signals consume a large amount of power and this usage must be regularly reported to Manitoba Hydro for billing. Previously, this was done using a manual and time-consuming process. Now, Signals collects power data on equipment and in 2019 has built a system that estimates power use in a fast, automatable, and repeatable way.

- ***Implementing reporting tools***: Data sitting in a database is not inherently useful. For it to be of value, staff need ways to query and interact with it. Some specific efforts in this area include:

    - Implementing and promoting staff adoption of Business Intelligence (BI) tools such as Microsoft Power BI, which provide interactive reporting on data for staff in a usable format

- Developing a Traffic Signals Branch Report and corresponding key performance indicators
- Creating interactive dashboards reporting on a variety of information such as key performance indicators, comparing historical incident data to current trends, understanding infrastructure condition for maintenance prioritization, monitoring modem communication errors, prioritizing work based on planned construction, and more
- Contributing to a broader Public Works initiative to build a department-wide data warehouse and dashboard platform

- ***Publishing Corridor Reports***: The timings group creates concise documents for corridor reviews that outline findings and possible improvements to timings. Notable signal timing changes and completed projects are reported on winnipeg.ca.[14]

INVESTIGATING AND TESTING NEW SIGNALS TECHNOLOGIES

Technology related to traffic signals is constantly changing and improving, which means the branch must stay informed and investigate the feasibility of implementing a variety of new technologies. Some examples of technologies currently under research are discussed below.

- ***Video analytics***: The TMC camera infrastructure provides the possibility of implementing automated video analytics for a variety of applications. For example, this technology could be used to automatically count pedestrians or cars to understand traffic flow, or automatically detect collisions or other incidents that TMC operators should act upon.

- ***Low amber flashing beacons***: Low amber flashing beacons were tested at three pedestrian corridors; an increase in driver compliance was found at two locations. The additional flashers were generally received positively and as a result, these are now part of the standard pedestrian corridor designs.

- ***Rectangular rapid flashing beacons (RRFBs)***: RRFBs are lights designed to enhance safety of pedestrians by increasing visibility of activated pedestrian crossings. Integrated push buttons with touchless activation and audible pedestrian signals are being used for the first time in Winnipeg at the RRFB crosswalks. These push buttons provide a tactile arrow on the push button, have “wave” touchless activation and an integrated audible pedestrian signal that can provide a locator tone at pedestrian crossings for the visually impaired.

- ***Permanent count stations***: The branch is supporting the Traffic Studies branch through the installation and maintenance of permanent count stations that can count, classify, and record speeds of vehicles at several locations.

IMPROVING TRAFFIC SIGNAL INFRASTRUCTURE

The branch is constantly working to improve safety and efficiency of its traffic signals infrastructure through revitalization and upgrade efforts.

[14] https://winnipeg.ca/publicworks/transportation/trafficsignals/signaltimingupdates.stm

- ***Accessible pedestrian signals (APS)***: As part of an agreement with the Manitoba Human Rights Commission (MHRC), the City committed to equip all signalized intersections with APS speakers to aid those with impaired vision by 2023. These efforts were completed in 2020.

- ***Highway head replacement***: All signal heads with a 12-inch red, 8-inch amber, and 8-inch green indicators are in the process of being updated. For safety reasons, these are being replaced by heads with all 12-inch indicators, providing greater visibility. Only 4 of the old model remain.

- ***Reflective heads***: All traffic signal heads are being outfitted with reflective tape to increase visibility and safety; 76.5 percent of all signals have been retrofitted to date. Figure 31 illustrates the trend in the number of reflective heads installed over time.

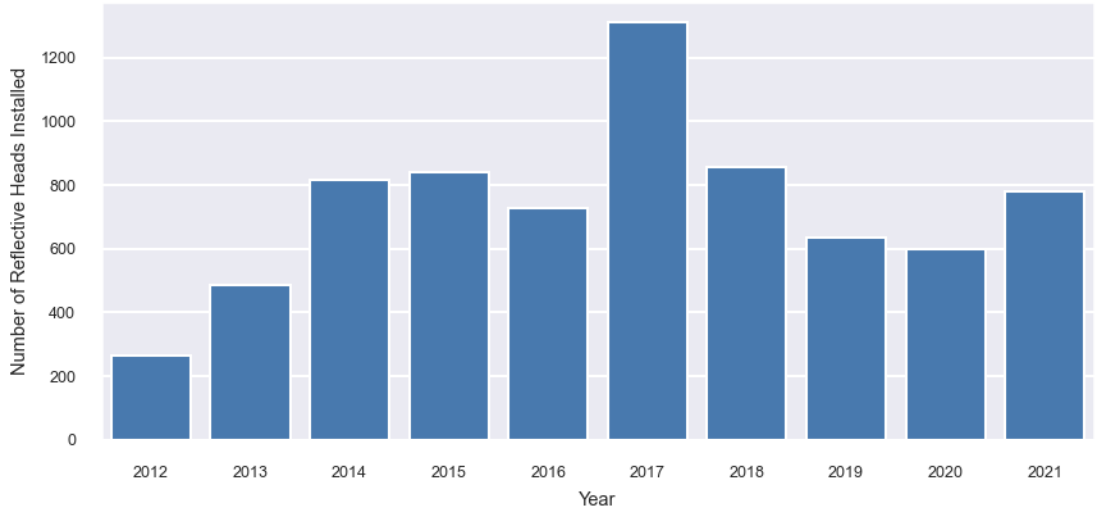

Figure 31: Number of reflective head purchases, by year (2012-2021)

- ***Controller replacement***: Traffic signal controllers are devices installed at each intersection that control the operation of the intersection. Signals is replacing older 170 style controllers with new advanced traffic controllers. The new controllers have many benefits, such as high-resolution logs which help the timing engineers make better informed decisions. They are also much more compatible with future connected vehicle technologies. The figure below illustrates the trend in the total number of new advanced controllers operational over time.

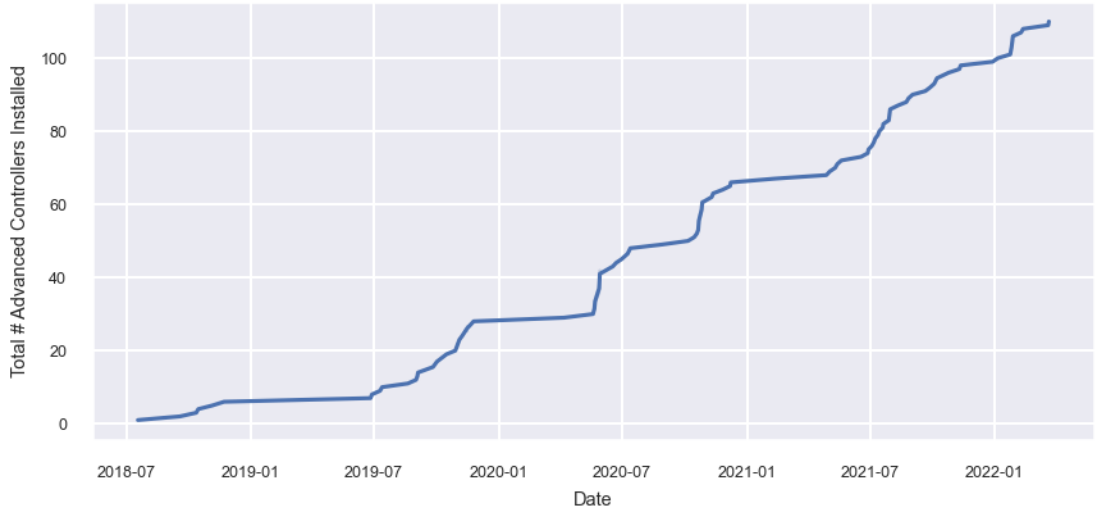

Figure 32: Total number of advanced controllers operational over time

- ***Preventative maintenance program***: In accordance with recommendations from a recent audit, the branch is creating and implementing a comprehensive preventative maintenance program for its infrastructure. The program began in 2020, focusing on renewing infrastructure in the worst condition.

- ***Uninterrupted power supplies***: In compliance with Transport Canada regulations the branch has installed battery backup power supplies at all signalized intersections that are interconnected with the rail line. The roll out of battery backup power supplies has been extended to include large intersections on high speed routes.

PARTNERSHIPS

Since the branch's work is relevant to many stakeholders, there can be significant benefits partnering with stakeholders with shared interests. Signals cultivates partnerships with two broad categories of stakeholders.

1. ***Interdepartmental partnerships***: Notable projects in this area include working with Winnipeg Police Service to investigate installation of downtown safety cameras, as well as efforts to promote training for emergency vehicle operators to promote efficient and safe lane closure procedures.

2. ***University and private sector partnerships***: The branch frequently communicates with university researchers and private companies specializing in traffic engineering and data analysis, examining opportunities for data sharing and mutually beneficial research. We are currently working with industry partners to share traffic signal phase and timing information directly from its traffic signals management system. This project leverages the previous investment in connectivity at all signalized intersections along with McCain's Transparity software for traffic signal management.

PROCESS IMPROVEMENT

Signals is constantly working to better improve the efficiency and effectiveness of internal processes. These efforts fall into three primary categories.

1. ***Documenting processes***: The first critical step to improving processes is fully understanding what the processes are and documenting them so they can be evaluated, improved, and repeated.

2. ***Migrating filesystems***: In 2020, the branch began a process of designing an improved folder structure and migrating documents on the network drive to this new folder structure. This improves the ability to find appropriate documents and also facilitates automated scripting and data collection of filesystem information.

3. ***Digitizing and automating workflow***: Efficiencies have been achieved by moving from paper-based to database-driven processes. The branch continues to work to digitize paper-based processes and access data hidden in legacy systems.

CONCLUSION

The Traffic Signals branch continues to operate at a high level, with low malfunction rates, quick response times, advanced signal timing capabilities, well-maintained infrastructure, and an unprecedented ability to see and address roadway incidents in real time. Signals achieves this through its highly skilled staff, along with investments in data and a variety of innovative projects. Signals plans to maintain this high operational performance while moving forward its innovative projects.