TRAINFO reduces first responder delays at rail crossings by 71%

TRAINFO

City of Winnipeg Case Study

WINNIPEG FIRST RESPONDERS FREQUENTLY DELAYED BY TRAINS

Winnipeg is the capital city of the Province of Manitoba in Canada. It has a growing population of 800,000 and land area of 180 square miles. There are two Class 1 railroads with mainline tracks running through the city, resulting in over 100 rail crossings and upwards of 50 trains moving through the city per day. Winnipeg Fire Paramedic Service (WFPS) provides fire and EMS services to the city, operating from 27 fire stations, 3 stand-alone ambulance stations, and 6 hospitals. WFPS responders complete around 3,000 trips per week with approximately 15% of trips crossing railway tracks.

WFPS dispatchers and call-takers do not know if or when a rail crossing will be blocked when they select units and routes to respond to an emergency. When first responders encounter a blocked rail crossing, they radio dispatch and await instructions. Dispatchers do not know when the crossing will be clear and cannot judge if it's faster for the unit to re-route, wait for the train to clear, or dispatch a second unit. Depending on the situation, one or more of these options are used. For certain call locations, dispatchers will automatically send multiple units in case a train is blocking the primary route. Dispatchers have the option to contact the railroad and request that the train be cut to allow first responders through. However, this process usually takes more time than the other options and is rarely used.
WFPS explored various approaches

WINNIPEG

- **100+ rail crossings**
- **50 trains moving through the city per day**
- **27 fire stations**
- **6 hospitals**
- **3,000 first responder trips per week**
- **15% of first responder trips cross railway tracks**

to address first responder delays at rail crossings. One approach was grade separation (building over- or underpasses at rail crossings), however, this was cost prohibitive and infeasible in dense parts of the city. A second approach involved WFPS requesting live train location data directly from the railroads, but the railroads were unable to share this information. A third approach was to pull a signal from the flashing lights and bells at the crossing when they were activated. This approach, known as an interconnected crossing, is occasionally used to adjust traffic signals so that vehicles do not get stuck on the tracks when trains are approaching. Interconnection requires a physically-wired connection from the railroad's cabinet at the crossing to a city-owned cabinet on public right-of-way. WFPS concluded that this approach was infeasible, since only a few crossings in Winnipeg were interconnected, the interconnection data did not provide enough prediction to avoid blockages, and they did not have the internal resources to manage this system.

TRAINFO MEASURES FIRST RESPONDER DELAYS CAUSED BY TRAINS

WFPS turned to TRAINFO to help solve this problem. To start, WFPS used TRAINFO's EMS Risk Model to:

- Quantify the frequency and duration of first responder delays at rail crossings in Winnipeg.
- Identify which areas of the city were most impacted by these delays.
- Determine if real-time and predictive train information could reduce these delays.

This involved (1) installing train detection sensors at various crossings in the city, (2) importing WFPS call log and AVL data into the model, (3) running the model to determine which first responder trips were delayed by trains and (4) simulating re-route options to calculate travel time savings. Figure 1 shows a map of call origins and destinations, hospitals, and rail crossings.

TRAINFO reviewed Winnipeg's road and rail network to determine how many train sensors were needed and where they needed to be installed. Using our proprietary rail network classification scheme, we were able to produce accurate blockage data for the city's 110 rail crossings using 19 train detection sensors. TRAINFO met with city traffic engineers and technicians to identify the train sensor locations and coordinate installation. We used Google

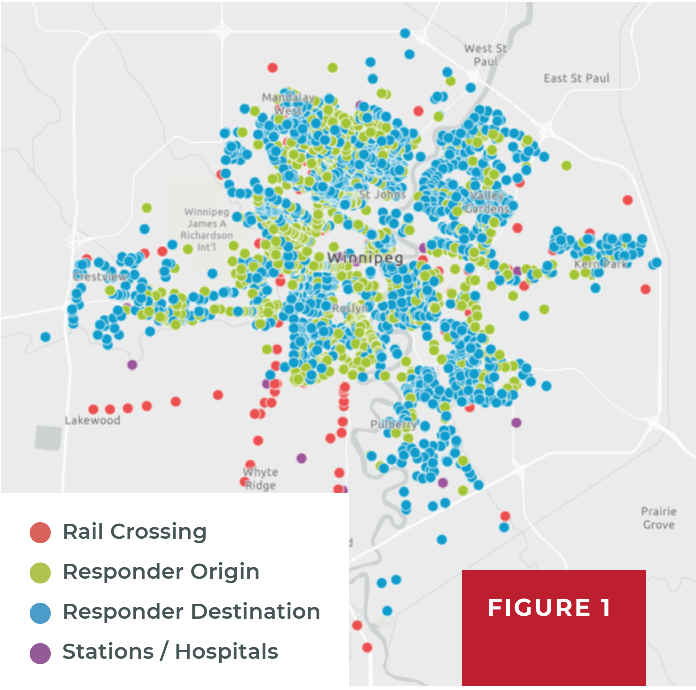


FIGURE 1

Streetview to identify candidate poles for which to install each train sensor. Candidate poles included any pole within 100 feet of the crossing and with 120 VAC power supply for the sensor. Figure 2 shows the train sensor installed on a traffic signal pole at the Shaftesbury rail crossing.

TRAINFO delivered the sensors to City technicians for installation. Installation required two electricians and a boom truck and took about one hour per location to complete. The sensors used direct power from the poles and had a backup battery to provide up to 2 days of operation if needed. Once the technicians turned on the sensor, a wireless signal was sent to TRAINFO to confirm that it was operational. After receiving this signal, TRAINFO initiated its remote calibration process and after 2 days the system was ready to use.

TRAINFO collected one year of train data and obtained the corresponding year of call log and AVL data from WFPS. Call log data included timestamped records with unit status, lat/lon, unit type (fire, paramedic), and unit ID. AVL data included the call origin and destination, origin departure time and destination arrival time, waypoint locations, waypoint arrival time and departure time, and unit ID. WFPS removed any personally identifiable information prior to sharing with TRAINFO.

TRAINFO imported the train, call log, and AVL data into the EMS Risk Model for analysis. The model generated responder trip paths and identified units that were potentially delayed by trains when three conditions were met: (1) the unit's route crossed railway tracks, (2) a train was blocking the crossing during the unit's travel time, and (3) the unit's actual response time was longer than the expected response time. Expected travel times for units were estimated based on the time-of-day, day-of-week, speed limit, number of lanes, and traffic volume characteristics. The model compared the expected travel time to the actual travel time for units meeting the three conditions and calculated the amount of delay caused by the train. For units that were delayed, the model simulated travel times along alternative routes to determine if delayed trips could have saved time by re-routing and estimated how much time would have been saved.

FIGURE 2

TRAINFO REVEALS RISKIEST RAIL CROSSINGS FOR FIRST RESPONDERS

TRAINFO imported train and unit call log and AVL data into the EMS Risk Model to produce risk scores which indicate the frequency of first response delays caused by blocked rail crossings. The Crossing Risk Score, shown in Figure 3, reveals which crossings cause the most risk for first responders (measured as units delayed per month) and the Area Risk Score, shown in Figure 4, reveals which areas of the city had the highest risk of experiencing first responder delays due to trains (measured as units delayed per month). Crossing Risk Scores larger than 1.5 units delayed per month and Area Risk Scores larger than 0.5 units delayed per month indicate a high risk.

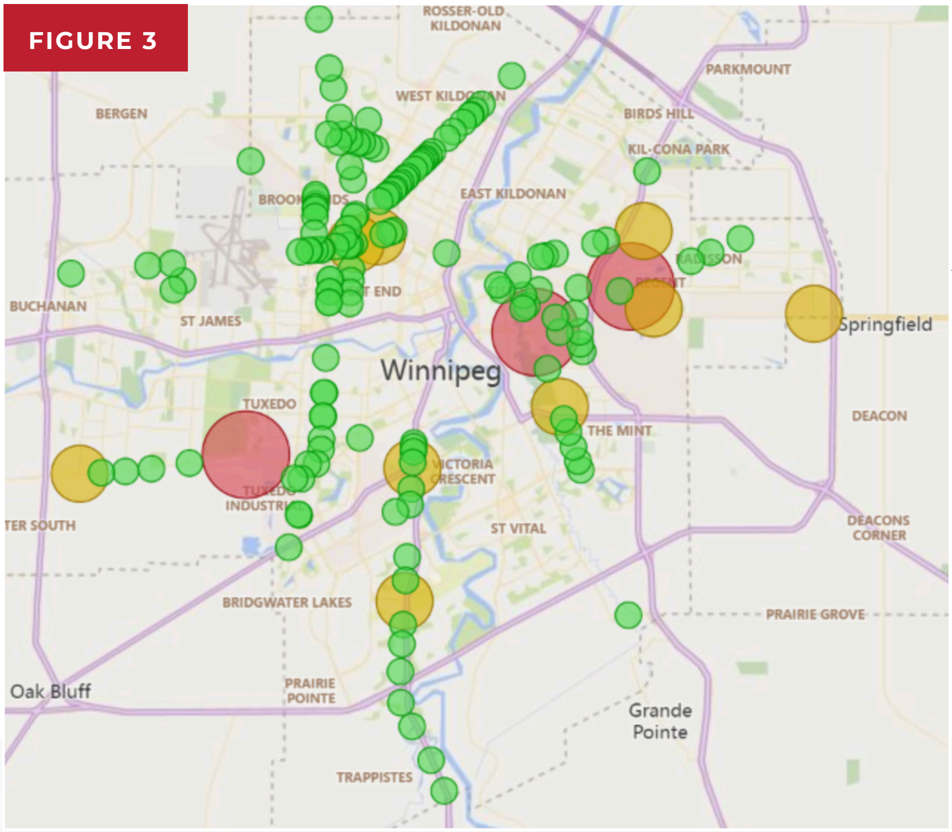
The model revealed several important findings, including:

3 crossings have a high Crossing Risk Score (exceeding 1.5 units delayed per month) and contributed to more than 30% of the delayed trips.

3 areas of the city have a high Area Risk Score (exceeding 0.5 units delayed per month) and 26% of the delayed trips were servicing 8 out of 2,688 areas of the city.

On average, nearly 5 first responder trips are delayed by a train each week.

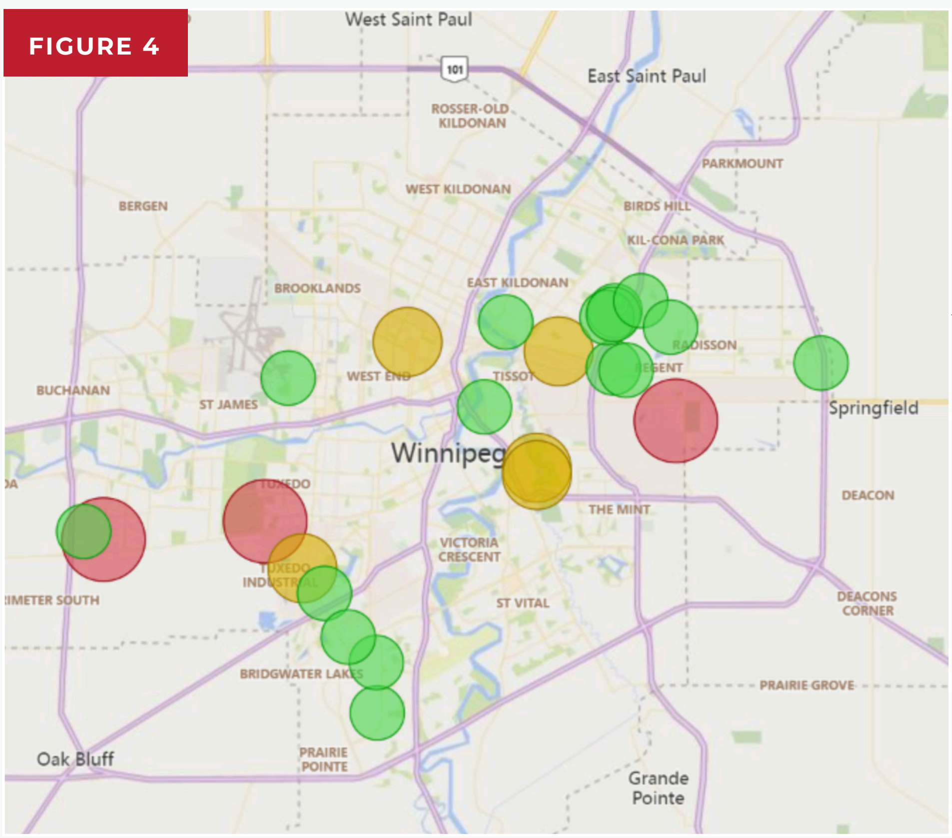
FIGURE 3



CROSSING RISK SCORE
Crossings that impact first responders most frequently

- >1.5 units delayed per month
- 0.5 to 1.5 units delayed per month
- <0.5 units delayed per month

FIGURE 4



AREA RISK SCORE
Areas most impacted by first responders delayed by trains

- >0.5 units delayed per month
- 0.3 to 0.5 units delayed per month
- <0.3 units delayed per month

PREDICTIVE TRAIN INFORMATION CAN REDUCE RESPONSE DELAYS BY 71% AT RAIL CROSSINGS

The EMS Risk Model produced detailed rail crossing blockage statistics and estimated the potential benefits of using predictive train information to re-route around blocked crossings. The Shaftesbury Blvd rail crossing provides a useful example of this feature. Figures 6-7-8-9 illustrate train information statistics for the Shaftesbury rail crossing. TRAINFO provided these graphs to WFPS through an online data portal which also allowed WFPS to download detailed, record-by-record rail crossing blockage event data at each crossing as a .csv file.

These figures show that there was an average of 37 trains per day with an average blockage duration of 6 minutes at the Shaftesbury crossing. Nearly 30% of blockages were longer than 6 minutes and the longest blockage lasted 6 hours and 45 minutes. Blockage events were evenly distributed throughout the week with slightly more blockages occurring in AM hours. The longest blockage durations occurred between Friday and Sunday and between 3:00 am and 11:00 am.

To estimate the potential travel time savings of re-routing around blocked crossings, the EMS Risk Model identifies which trips were delayed by trains and simulates alternative routes to determine the travel time difference. Figure 5 illustrates this process at the

SHAFTESBURY CROSSING STATISTICS

- **37 trains per day**
- **Average blockage duration of 6 minutes**
- **30% of blockages longer than 6 minutes**

Shaftesbury crossing. A senior complex near the rail crossing is a regular first responder destination with 11 calls per week. First responders that respond to emergencies at this complex and other locations north of the tracks typically travel north on Kenaston Blvd, turn west on Wilkes Ave, and then north on Shaftesbury over the tracks. When the crossing is clear, this is usually the fastest route. However, when the crossing is blocked, an alternate route would be continuing north on Kenaston, turning west on Grant Ave, and then turning onto Shaftesbury. Although this alternate route is nearly 2 miles further and takes about four minutes longer to reach the senior complex, if there was a 5-minute train at the Shaftesbury crossing, then it would be at least one minute faster.

The model found that three trips per week travel over the tracks, and that about 1-in-5 trips are delayed by a train, with an average delay of 184 seconds. The model indicated that 81% of trips delayed at the Shaftesbury crossing would have saved time by using the alternate route via Grant Ave and that the average time savings would have been 132 seconds (71% reduction in delay).

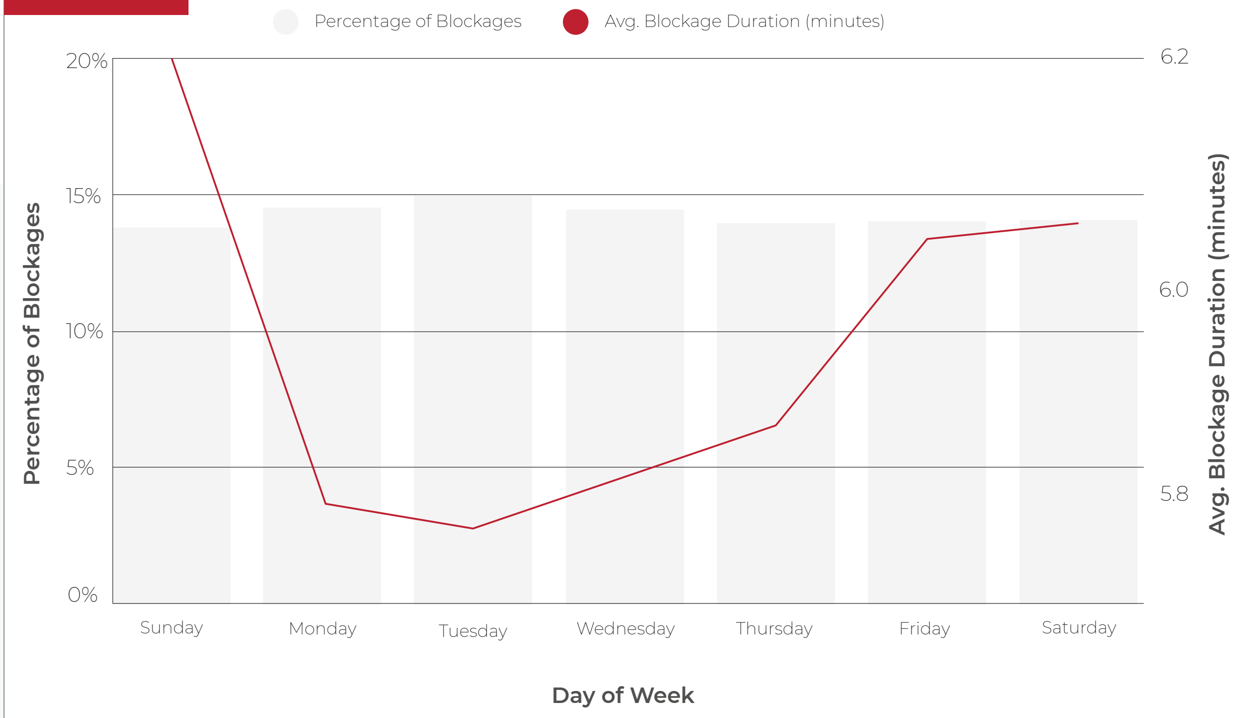
FINDINGS FOR SHAFTESBURY CROSSING

- **3 first responder trips per week travel over the tracks**
- **1-in-5 trips are delayed by a train**
- **Average delay per trip of 184 seconds**
- **81% of delayed trips would have saved time by re-routing**
- **Average time savings for re-routed trips would have been 132 seconds**

FIGURE 5

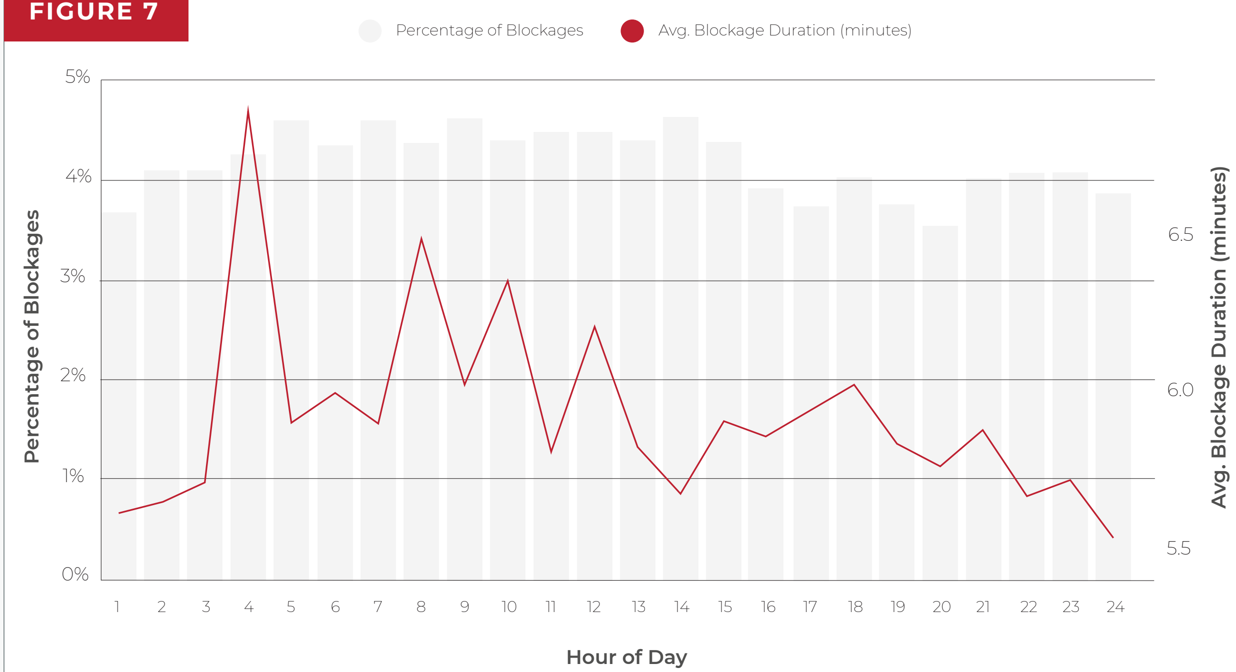
Percent of blockages by blockage duration

FIGURE 6



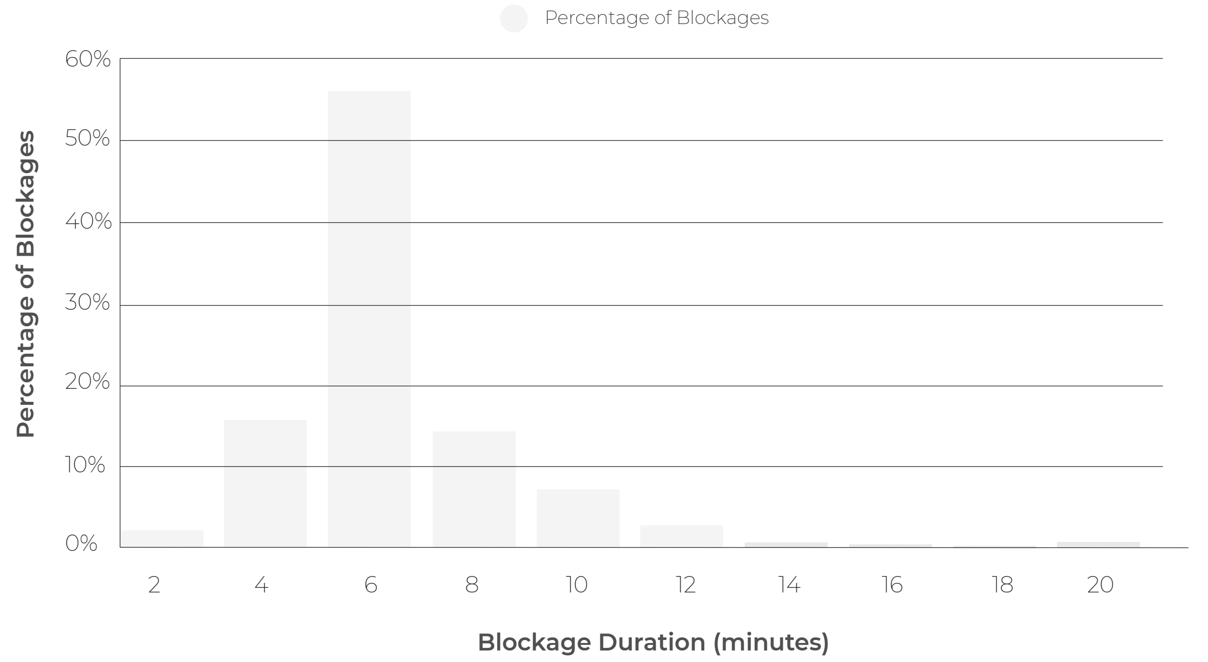
Number of blockages and average duration by hour of day

FIGURE 7



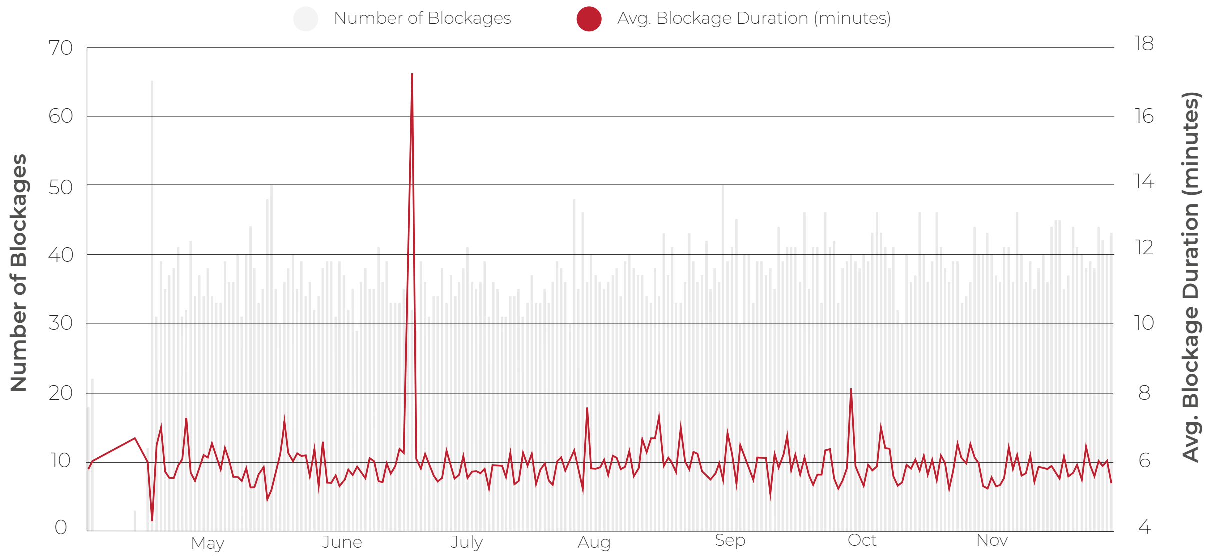
Number of blockages and average duration by day of week

FIGURE 8



Number of blockages and average blockage duration

FIGURE 9



END FIRST RESPONDER DELAYS AT RAIL CROSSINGS

WFPS is in the process of changing their CAD system. Once the new system has been implemented, they are planning to incorporate TRAINFO's real-time and predictive train information to help first responders across the city avoid delays at rail crossings. With TRAINFO, trains are no longer a surprise for first responders.

To join the City of Winnipeg in reducing traffic delays at rail crossings, reach out to TRAINFO at contact@trainfo.ca and visit us at **trainfo.ca.**

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