MANITOBA INFRASTRUCTURE
15M-00972-02-201

PTH 101 & PTH 59N NOISE STUDY

2020 TRAFFIC NOISE REVIEW

AUGUST 2021

wsp

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PROJECT NO.: 15M-00972-02-201
DATE: AUGUST 2021

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August 24, 2021

Manitoba Infrastructure
316 - 323 Main Street
Steinbach, MB R5G 1Z2

Attention: AJ Miller, P. Eng., Technical Services Engineer

Dear Mr. Miller:

Subject: PTH 101 & PTH 59N Noise Study - 2020 Traffic Noise Review

Please find enclosed the final report for the PTH 101 and PTH 59N Noise Study. Thank you for the opportunity to assist Manitoba Infrastructure with this important project. If you have any questions or require further assistance, please do not hesitate to contact me at 204-259-5423, or via email at diana.emerson@wsp.com.

Yours sincerely,

Diana Emerson

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DE/cs
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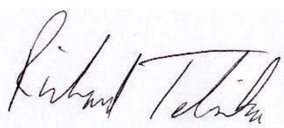

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1 INTRODUCTION

WSP Canada Inc. (WSP) was retained by Manitoba Infrastructure (MI) to review noise levels around the interchange located at PTH 101 and PTH 59N, compare the findings to noise forecasts done prior to construction of the interchange, provide a discussion on noise criteria used by MI and other Canadian jurisdictions, and prepare an informational fact sheet on noise criteria used by MI and the results of this study.

1.1 BACKGROUND

The interchange at PTH 101 and PTH 59N was constructed between 2015 and 2018, fully opening to traffic on October 31, 2018. The interchange construction included realignment of PTH 101 in the vicinity of the interchange and construction of a grade separated crossing under PTH 101 west of the interchange for the Northeast Pioneers Greenway active transportation path and emergency services access. **Figure 1.1** shows the PTH 101 and PTH 59N interchange.

Figure 1.1: PTH 101 & PTH 59N Interchange (Source: GoogleEarth, Imagery Date: 4/21/2020)

1.2 TRAFFIC NOISE STUDIES

Traffic noise studies are conducted to review the impact of sound created by cars and trucks on a road on surrounding residences to determine if the noise will disturb people in recreational areas of those residences.

1.2.1 NOISE MODELING

Traffic noise studies make use of sophisticated computer models to predict noise levels in the vicinity of highways. Future noise levels can also be forecast through modeling. Model inputs include existing sound levels, traffic volumes on the highway, and geographical features including ground elevation data, terrain type and tree cover.

To determine existing traffic noise levels, a recording sound level meter (SLM) is set up between the road and the residences. The location of the SLM is recorded so that the distances from the road and from the houses can be charted. In setting up the SLM, a location close to the road and away from other noise sources is chosen such that the predominant noise detected is traffic noise. This allows for the model to project the traffic noise back to the residences. A sound level recording is taken and is listened to in order to characterize the sounds and filter out any instances of significant non-traffic related background noise (such as a jet plane overhead).

As noise travels through the air some of the noise is absorbed by the air. The longer the distance from the source, the more noise is absorbed. **Figure 1.2** illustrates how distance reduces noise.

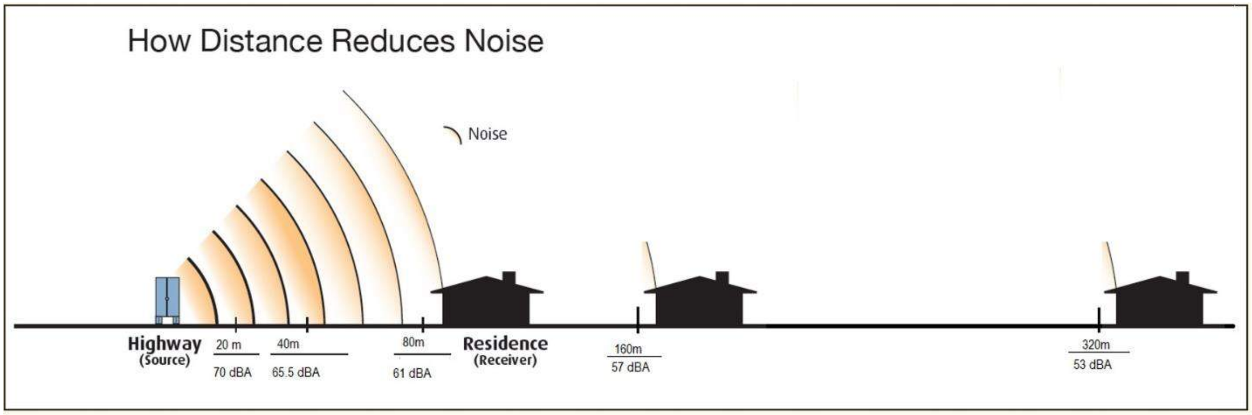


Figure 1.2: How Distance Reduces Noise

As mentioned above, a traffic count is conducted in order to relate the noise level to the number of cars and trucks. Other factors including type of terrain, presence of trees and land type are also noted in order to calculate how much noise is absorbed between the road and the residences. As sound bounces off soft ground or through treed areas, some noise is absorbed. **Figures 1.3** and **1.4** illustrate sound absorption.

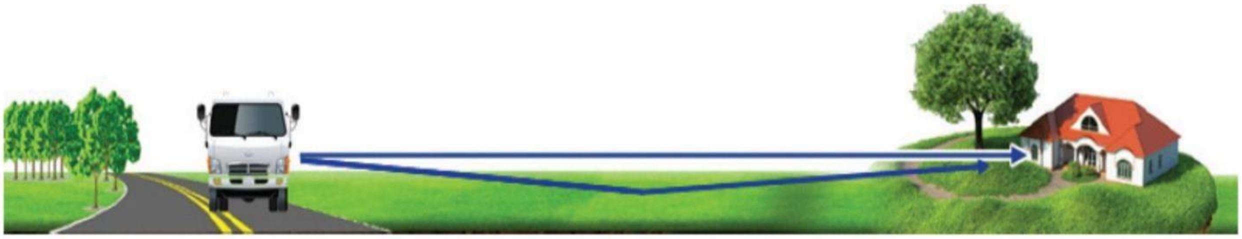


Figure 1.3: Sound Absorption

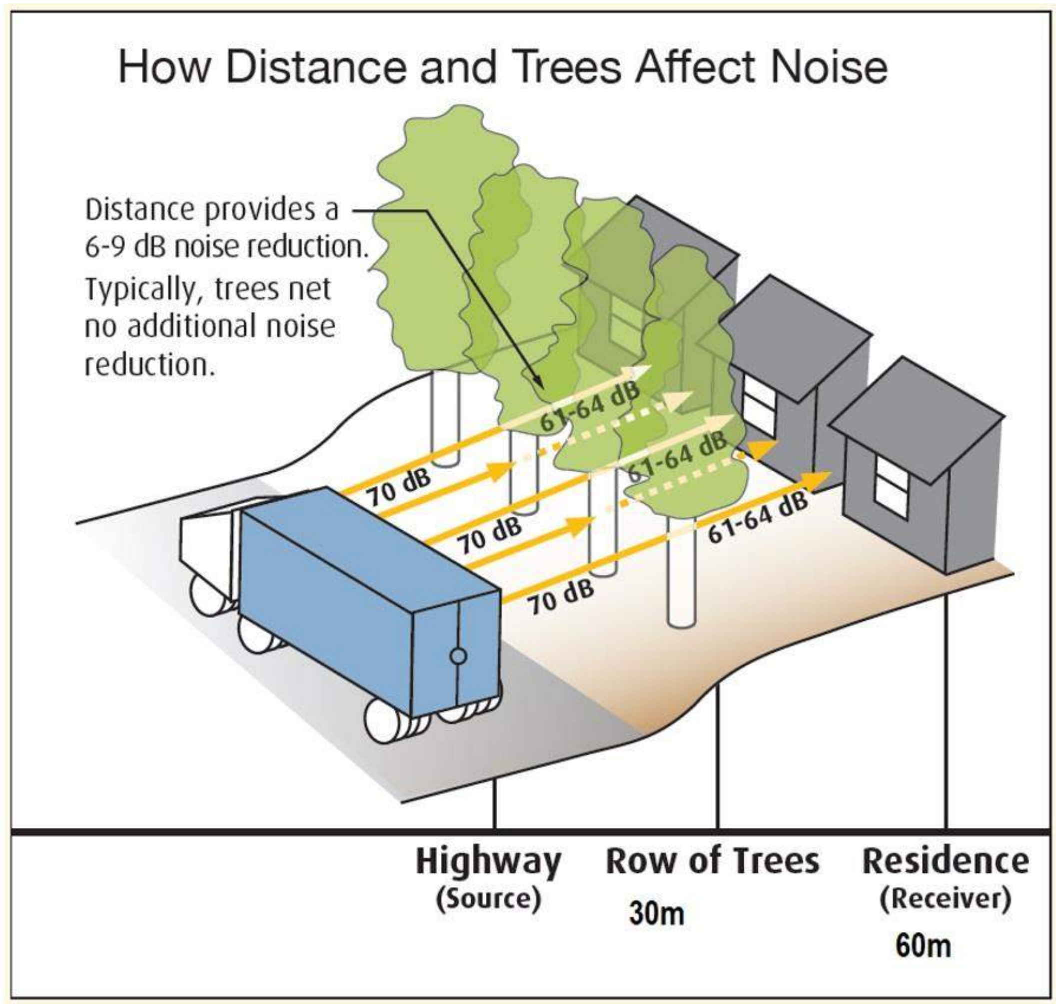


Figure 1.4: How Distance and Trees Affect Noise

The effect of sound blocking from proposed berms, sound walls and vegetation can also be predicted by the computer program by adding those features into the computer model.

1.2.2 NOISE ATTENUATION

When berms or sound walls are used to block the sound, they absorb sound near the source and create a sound shadow where some of the sound is blocked by the wall (see **Figure 1.5**). The first row of houses from a road or highway can also act like a barrier with a sound shadow behind the houses away from the noise source. While the wall or berm absorbs some of the sound, it also makes the sound travel farther.

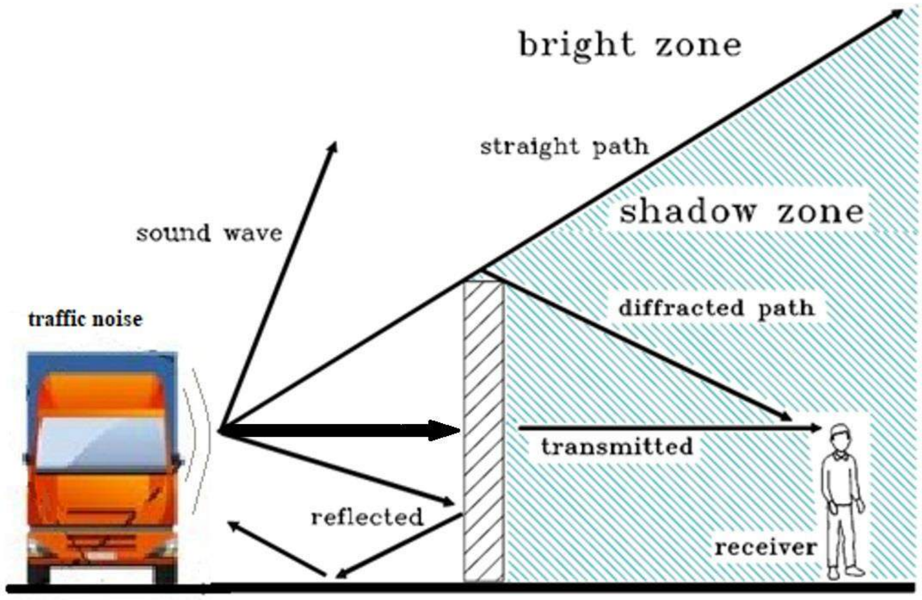


Figure 1.5: Sound Shadow Effect

To be effective, a wall has to be fairly high and close to the recreation area/residence. This is most effective where the distance from the road to the house is fairly small. If sound walls are placed near the source, the location has to be chosen to be careful not to bounce more noise back at residences on the opposite side of the wall. For example, a wall close to one side of a road can bounce noise back to houses on the other side of the road. At distances greater than 200 metres, the attenuation due to distance exceeds the reduction in noise due to the sound shadow effect of the wall.

1.3 STUDY COMPONENTS

This study included the following components which are detailed in the sections that follow:

- A review of traffic volumes including conducting existing traffic counts at the interchange to capture all existing approach and ramp volumes, projecting traffic volumes to the future horizon year and reviewing historic counts and previously projected traffic volumes;
- A review of the City of Winnipeg Noise Policies and Guidelines including a comparison to other Canadian jurisdictions;
- An environmental noise study including field measurements, base geometry sound modeling, review and update of previous noise models of the interchange, development of potential sound mitigation concepts if needed, and assessment of the accuracy of previous noise forecasts; and
- Preparation of a brief informational fact sheet suitable for providing to the public and publishing on MI’s webpage.

2 PTH 101 & PTH 59N TRAFFIC VOLUME REVIEW

No recently completed traffic counts were available for the PTH 101 and PTH 59N interchange. The most recent counts on file with the Manitoba Highway Traffic Information System (MHTIS) were from 2014 prior to construction of the interchange. As a result, it was necessary to conduct new traffic counts to determine existing traffic volumes at the time of the noise monitoring. Miovision camera studies were conducted October 27 to 29, 2020 to determine existing traffic volumes at the interchange. During this time, the Winnipeg Metropolitan Region (WMR) including the City of Winnipeg was under Code Orange COVID-19 pandemic restrictions. However, due to increasing case numbers of COVID-19, the Province increased the pandemic restrictions to Code Red for the whole province on November 12, 2020. The increase in pandemic restrictions to Code Red would potentially result in further overall reduced traffic volumes across the province as compared to Code Orange level restrictions. This is because the increased restrictions resulted in more people working from home, increased limitations on gatherings, closure of restaurants other than drive-through, delivery and pick-up service, closure of personal services businesses, gyms and other recreational facilities, limitations to in-store shopping to essential items only, and other restrictions. Because the noise monitoring field studies were to be conducted under the increased pandemic restrictions, additional Miovision studies were conducted on November 25 and 26, 2020 to determine traffic levels under the Code Red restrictions.

Appendix A provides details of the traffic counts conducted and analysis to develop the existing 2020 estimated traffic volumes during the pandemic restrictions at the time of the noise monitoring, estimated 2020 traffic volumes for a scenario without pandemic restrictions, and projected 2035 (non-pandemic) traffic volumes. As described in **Appendix A**, it was necessary to develop pandemic restriction adjustment factors to produce the traffic estimates. All pandemic restriction adjustment factors, growth rates and traffic estimates were reviewed with MI Traffic Engineering Branch.

2.1 2020 TRAFFIC COUNTS

Estimated November 2020 traffic volumes for the PTH 101 and PTH 59N interchange (during pandemic restrictions) for 24-hour daily traffic, a.m. peak hour and p.m. peak hour are shown in **Figures 2.1, 2.2** and **2.3**, respectively.[1]

[1] Traffic volume estimates presented in this report have been rounded to the nearest five. The traffic figures presented in Appendix A are the raw unrounded figures.

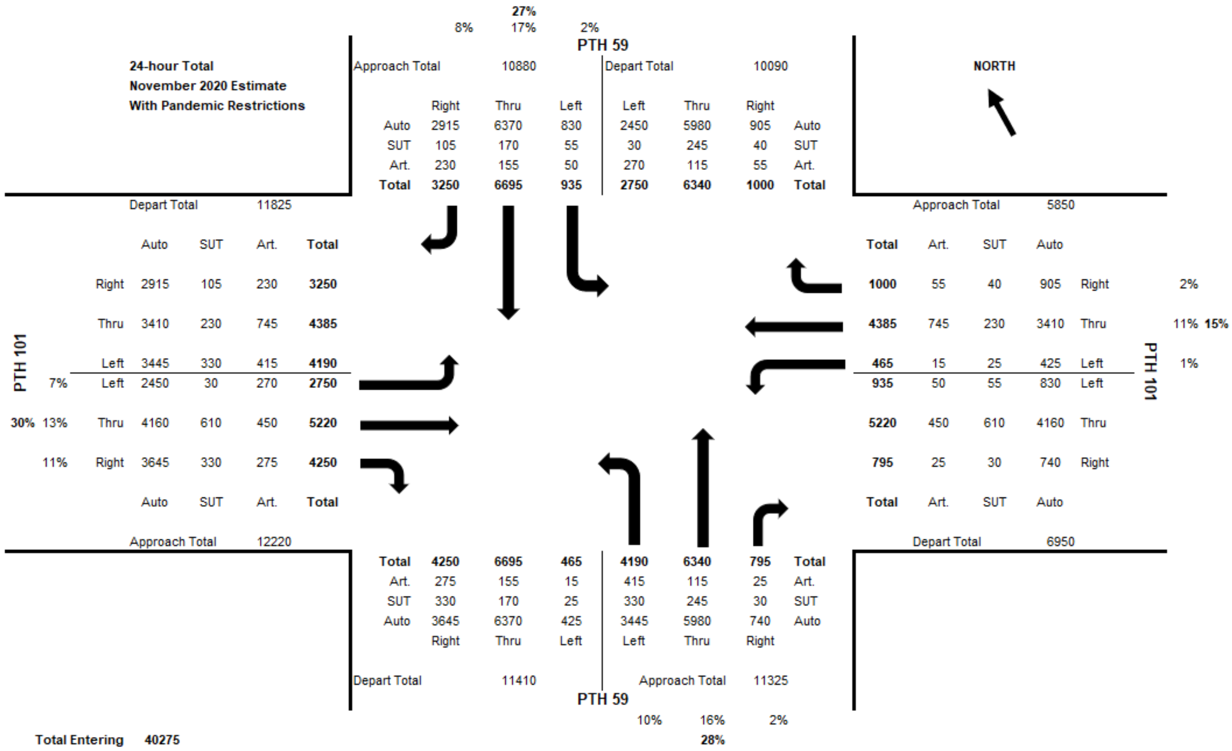


Figure 2.1: November 2020 Estimated 24-Hour Daily Traffic Volumes (During Pandemic Restrictions)

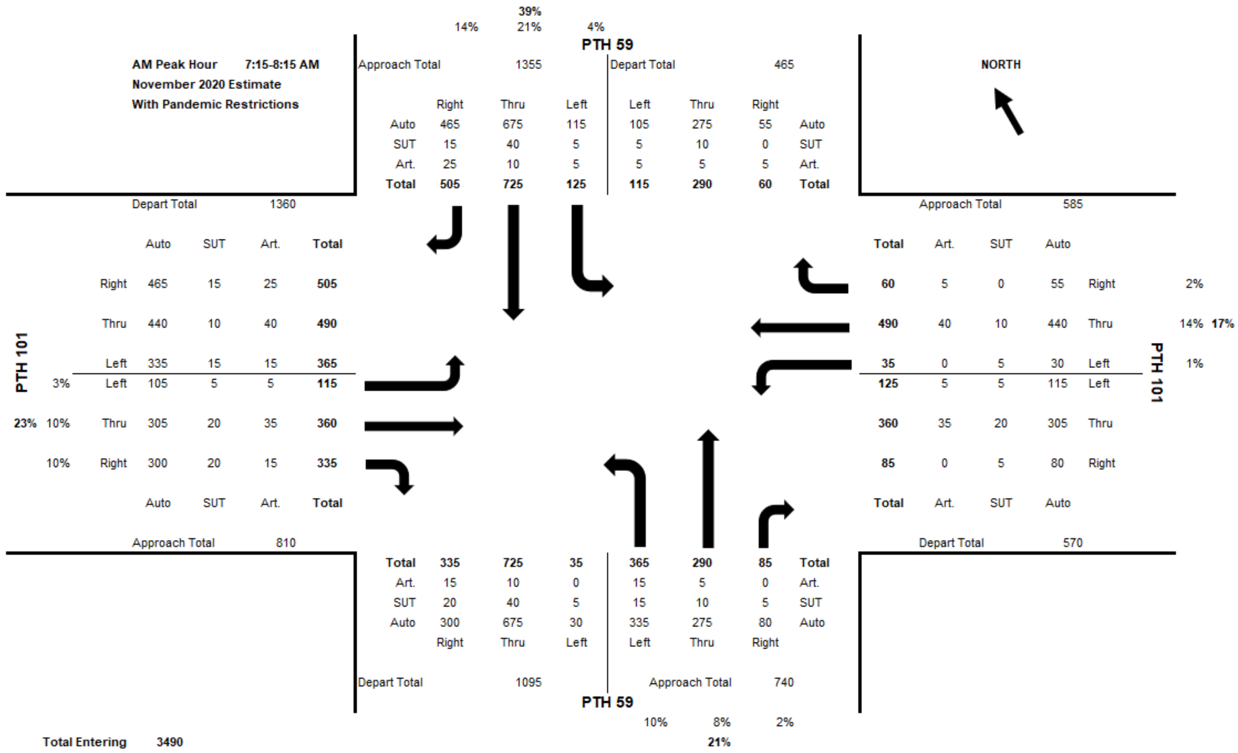


Figure 2.2: November 2020 Estimated A.M. Peak Hour Traffic Volumes (During Pandemic Restrictions)

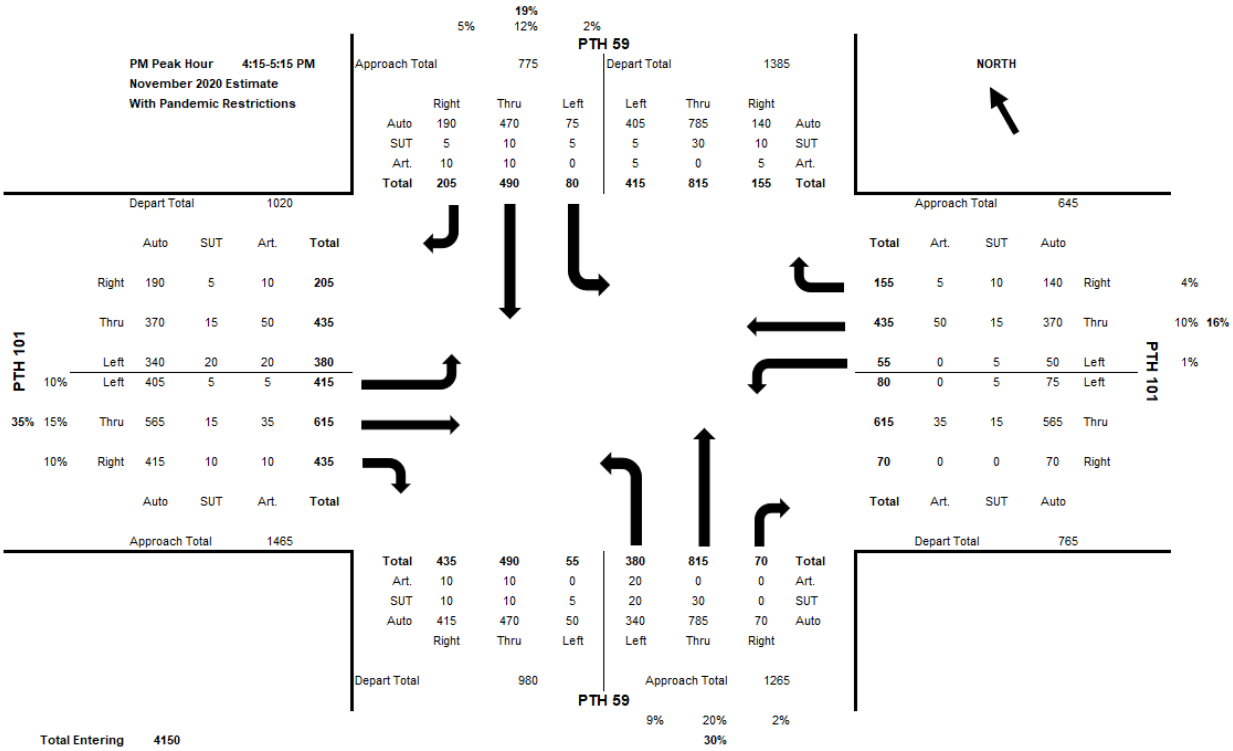


Figure 2.3: November 2020 Estimated P.M. Peak Hour Traffic Volumes (During Pandemic Restrictions)

To develop traffic projections for the future horizon year, it was necessary to develop 2020 traffic volume estimates for a scenario without pandemic conditions. 2020 traffic volumes without pandemic restrictions were estimated using pandemic adjustment factors developed from MI permanent count station data. **Appendix A** provides the pandemic adjustment factors and details of how they were determined. **Figures 2.4, 2.5** and **2.6** illustrate the estimated 2020 traffic volumes without pandemic restrictions for 24-hour daily traffic, a.m. peak hour and p.m. peak hour, respectively.

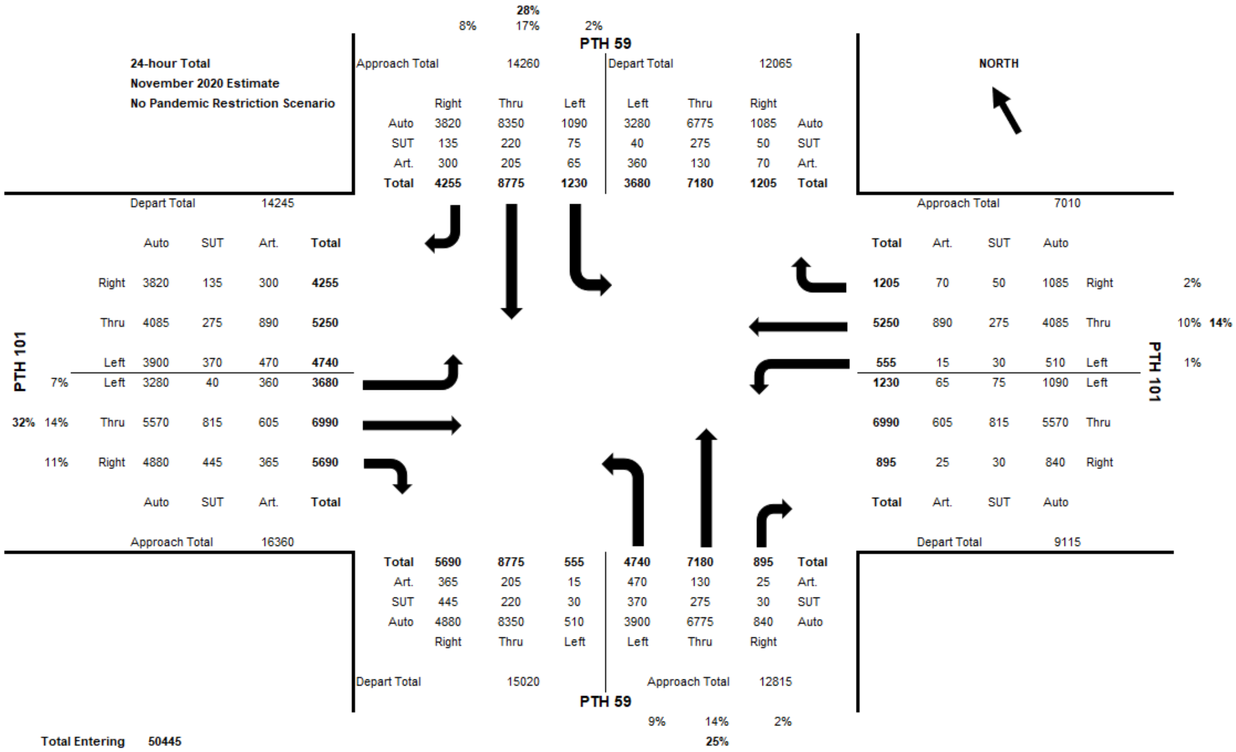


Figure 2.4: November 2020 Estimated 24-Hour Daily Traffic Volumes (No Pandemic Restrictions)

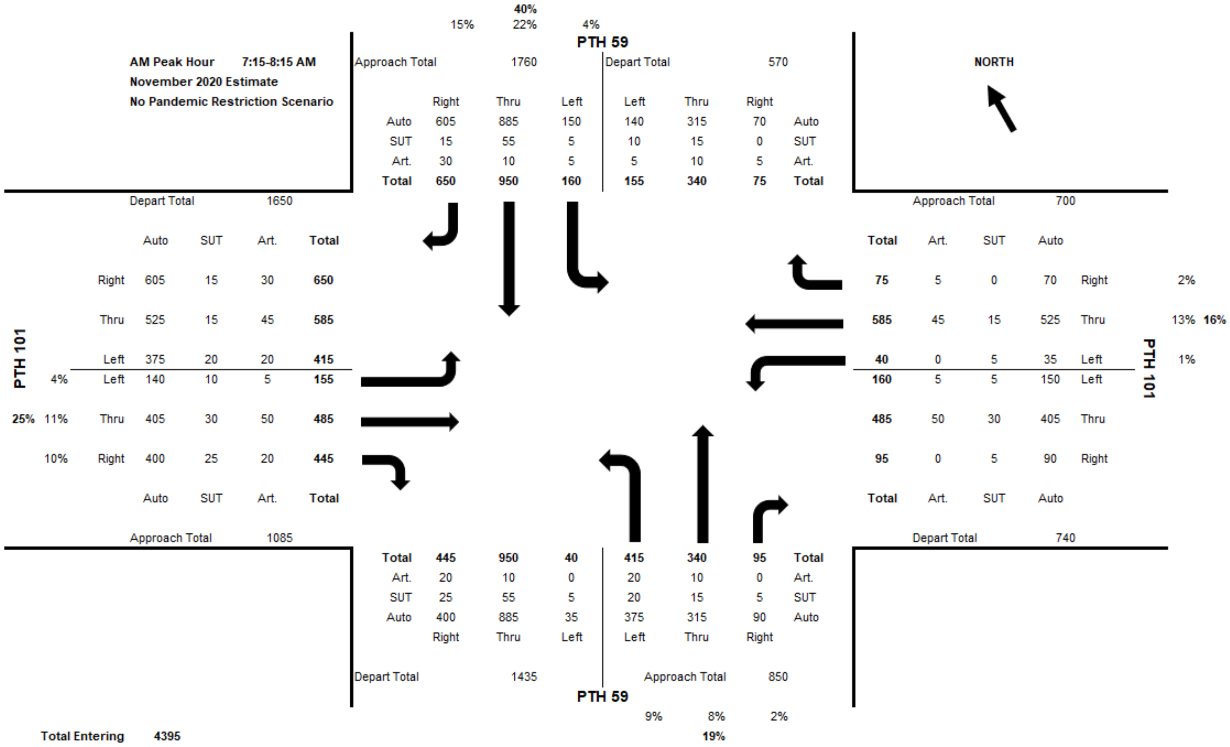


Figure 2.5: November 2020 Estimated A.M Peak Hour Traffic Volumes (No Pandemic Restrictions)

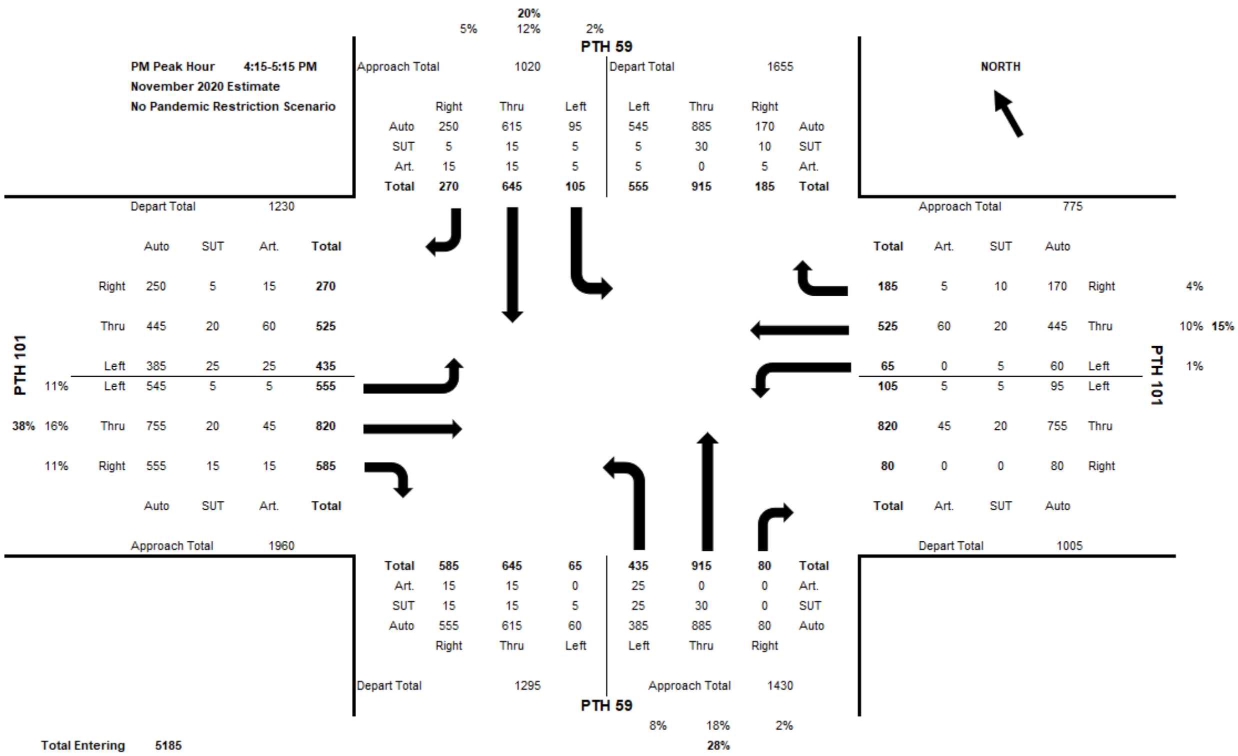


Figure 2.6: November 2020 Estimated P.M Peak Hour Traffic Volumes (No Pandemic Restrictions)

2.2 2035 TRAFFIC PROJECTIONS

2035 was selected as the future horizon year in consultation with MI and on the basis of 2035 having been the horizon year reviewed in the most recent previous noise study for the interchange. Projected 2035 traffic volumes at the interchange were estimated using growth factors developed for each approach to the interchange and applied to the 2020 estimated traffic volumes without pandemic restrictions. **Appendix A** provides details of how the growth rates were determined. **Figures 2.7, 2.8** and **2.9** illustrate the projected 2035 traffic volumes for 24-hour daily traffic, a.m. peak hour and p.m. peak hour, respectively.

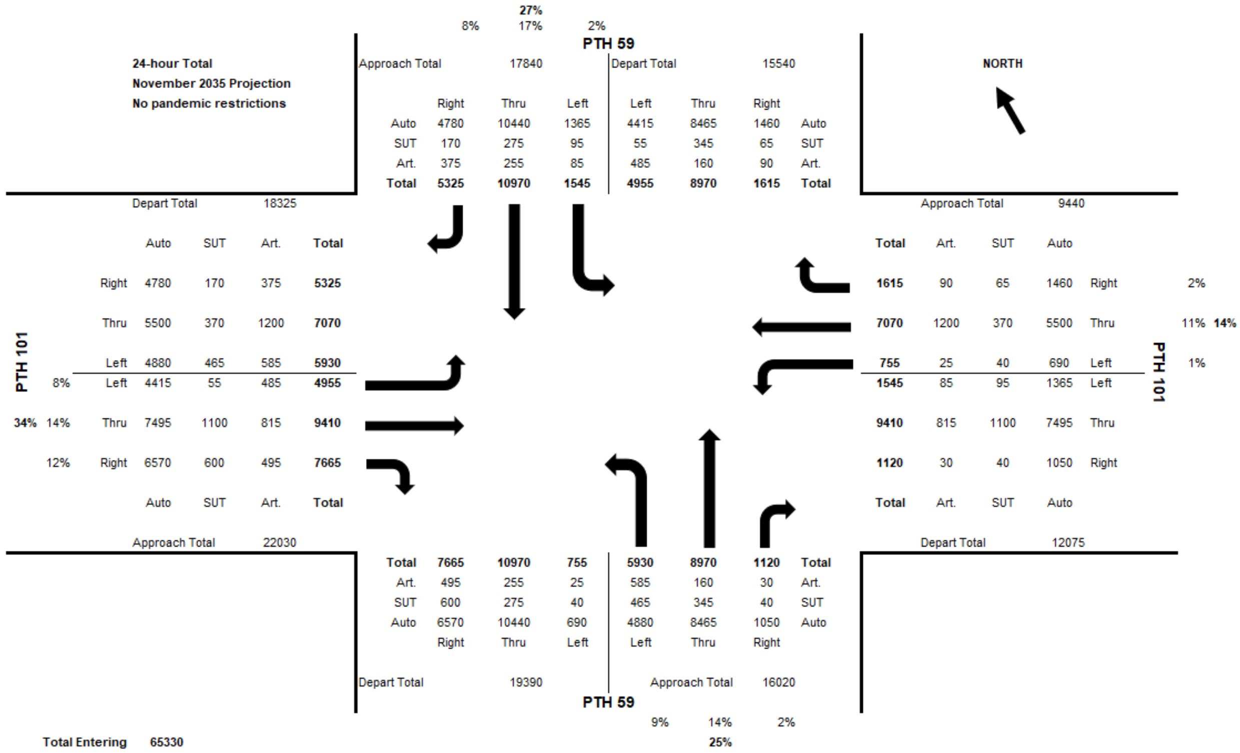


Figure 2.7: Projected 2035 24-Hour Daily Traffic Volumes

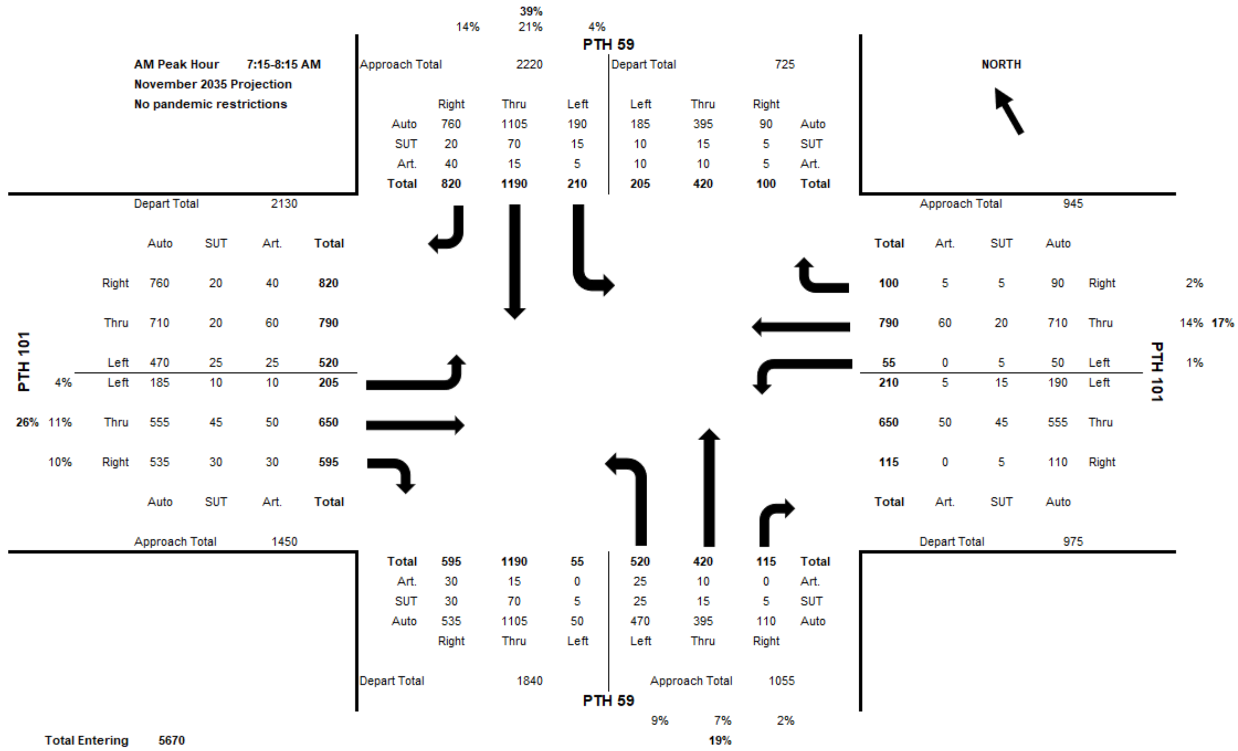


Figure 2.8: Projected 2035 A.M Peak Hour Traffic Volumes

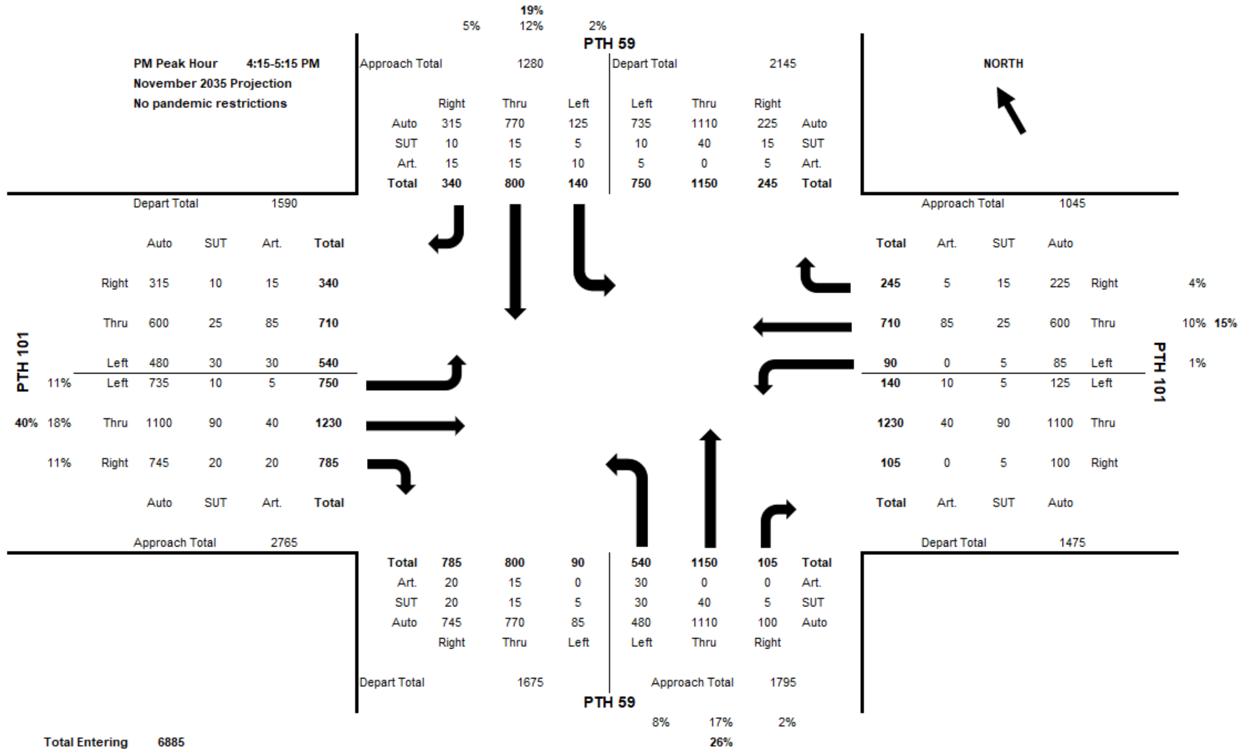


Figure 2.9: Projected 2035 P.M Peak Hour Traffic Volumes

2.3 HISTORIC COUNTS AND PREVIOUSLY FORECAST VOLUMES

2.3.1 HISTORIC COUNTS

As noted above, the most recent available historic counts for the PTH 101 and PTH 59N intersection were completed in May 2014 prior to the interchange construction. At that time, the intersection consisted of two offset T-intersections, each under traffic signal control, plus a fly-over for the eastbound to northbound movement as shown in **Figure 2.10**. Three separate Miovision camera studies were conducted by MI for the south intersection, the north intersection and the fly-over on May 15 to 19, 2014.

Figure 2.10: PTH 101 & PTH 59N Intersection Configuration in 2014 (Source: GoogleEarth, Imagery Date: 9/24/2014)

Table 2.1 provides a summary of the daily entering volumes for 2014 and the 2020 non-pandemic scenario. In order to compare consistent metrics, the 2014 and 2020 volumes were converted to annual average daily traffic estimates using month of year factors for Annual Average Daily Traffic (AADT) obtained from MI's *2019 Traffic on Manitoba Highways (*November is 95% of AADT, May is 105% of AADT).

Table 2.1: 2014 and 2020 No Pandemic Average Daily Traffic (24-Hour)

DIRECTION	MAY 2014 COUNT	2014 ESTIMATED ANNUAL AVERAGE DAILY TRAFFIC**	NOVEMBER 2020 NO PANDEMIC ESTIMATE	2020 ESTIMATED ANNUAL AVERAGE DAILY TRAFFIC (NO PANDEMIC)***
Southbound Entering	17,251*	16,430	14,260	15,010
Northbound Entering	18,401	17,525	12,815	13,490
Eastbound Entering	18,037	17,178	16,360	17,220
Westbound Entering	6,240	5,945	7,010	7,380
TOTAL ENTERING	59,929	57,075	50,445	53,100

*The 2014 counts did not capture the southbound to westbound movement and to estimate the total southbound entering traffic volume, it was assumed that this movement was the same as the eastbound to northbound movement captured by the camera study of the eastbound to northbound fly-over.

**The estimated 2014 annual daily traffic was calculated from the May 2014 counts using a factor of 1.05 based on MI Permanent Count Station No. 86 (Manitoba Highway Traffic Information System, Traffic on Manitoba Highways 2019).

*** The estimated 2020 annual daily traffic was calculated from the November 2020 No Pandemic counts using a factor of 0.95 based on MI Permanent Count Station No. 86 (Manitoba Highway Traffic Information System, Traffic on Manitoba Highways 2019).

Compared to the 2014 volumes, the estimated 2020 traffic volumes for the non-pandemic scenario appear to be down. In the 2014 counts, the estimated annual average daily volume entering the intersection was 57,075 vehicles compared to 53,100 for the 2020 non-pandemic scenario estimate.

To investigate the apparent reduction in traffic volume further, data was obtained from MI Traffic Engineering Branch for permanent count stations near the interchange. Data from November 2019 (prior to the pandemic) was reviewed for the following permanent count stations:

- Station 86 located on PTH 101 1.0 km east of Wenzel Road
- Station 20 located on PTH 101 1.4 km east of PTH 8 (west of PTH 9)

In November 2019, the weekday daily volumes on PTH 101 at Station 86 were 6,610 vehicles westbound and 7,262 vehicles eastbound. As shown on **Figure 2.4**, the estimated 2020 weekday non-pandemic daily volumes on PTH 101 east of the interchange is 7,010 vehicles westbound and 9,115 eastbound. Considering one year of growth between 2019 and 2020 and the traffic turning on and off PTH 101 at Wenzel Street, the estimated 2020 weekday daily volume for PTH 101 east of the interchange seems reasonably consistent with the permanent count station data from Station 86.

In November 2019, the weekday daily volume on PTH 101 at Station 20 was 14,700 vehicles westbound and 17,740 vehicles eastbound. The estimated 2020 weekday non-pandemic daily volumes on PTH 101 west of the interchange is 14,245 vehicles westbound and 16,360 eastbound (**Figure 2.4**). While it is difficult to make a conclusion from this because Station 20 is about 5 kilometres from the PTH 101 and PTH 59N interchange with two major routes intersecting PTH 101 in between (PTH 9 and PR 204), the estimated 2020 weekday daily volume for PTH 101 west of the interchange do appear to be generally consistent with the permanent count station data from Station 20.

Data for Station 86 (PTH 101, 1.0 km east of Wenzel Road) was also obtained for November 2020 (during the pandemic) in order to compare to the November 2020 estimated 24-hour daily traffic volumes (during pandemic restrictions) (**Figure 2.1**). In November 2020, the weekday daily volumes on PTH 101 at Station 86 were 6,213 vehicles westbound and 6,360 vehicles eastbound. As shown on **Figure 2.1**, the estimated 2020 weekday daily volumes (during the pandemic) on PTH 101 east of the interchange is 5,850 vehicles westbound and 6,950 eastbound. Considering traffic turning on and off PTH 101 at Wenzel Street in between Station 86 and the interchange, the estimated 2020 weekday daily volume for PTH 101 east of the interchange during the pandemic seems reasonably consistent with the permanent count station data from November 2020 at Station 86 (during the pandemic).

As noted above, the 2020 traffic volumes estimated for non-pandemic conditions using the October and November 2020 Miovision counts is relatively consistent with the 2019 permanent count station data and the 2020 traffic volumes estimated for pandemic conditions using the 2020 counts is relatively consistent with the 2020 permanent count station data. This suggests that traffic volumes have gone down from the previous 2014 counts.

POSSIBLE REASONS FOR LOWER TRAFFIC VOLUMES

Area traffic patterns can change when a new transportation facility is constructed. While a new facility may result in increased traffic volumes if the new facility improves traffic flow and reduces travel times compared to alternate routes, a lengthy construction period of several years may result in new patterns being established, routing some traffic to adjacent routes and resulting in lower traffic volumes. The construction of the PTH 101 and PTH 59N interchange spanned approximately three and a half years. During this time there were significant delays to traffic travelling through the intersection and some motorists may have established new routes such as PR 204/Henderson Highway to PTH 101. Some of these motorists may not have resumed their original routes after the construction was complete.

Current traffic volumes through the interchange may be affected by a long-term lane closure on the PTH 59 Floodway Bridge. This bridge is located approximately four kilometers north of the PTH 101 and PTH 59N interchange. The northbound direction on the bridge has been restricted to one lane and speeds have been reduced since July 12, 2018 when the bridge was impacted by an over-height vehicle. Reconstruction of the bridge is currently underway and expected to be complete by November 2023. This lane closure results in northbound queuing and delays, particularly in the afternoon peak period. Some motorists may be diverting to other routes to avoid this area.

Another consideration may be the day the 2014 counts were completed. The 2014 weekday counts were conducted on the Thursday before the Victoria Day May long weekend. With the long weekend, volumes on the Thursday may have been higher than typical due to recreational traffic destined to Manitoba cottage country areas located north of Winnipeg. As well, the 2014 counts did not capture the southbound to westbound right-turn movement. In the absence of a count of this movement and in order to estimate total approaching volumes, it was assumed that the southbound to westbound movement was the same as the eastbound to northbound movement captured by the camera study of the eastbound to northbound fly-over. If this assumption overestimates the southbound to westbound movement, that may account for at least some of the apparent reduction between the 2014 and 2020 volumes.

All of the above possible reasons may contribute to the apparent reduction in volumes though it is not possible to assess to what level each may be contributing on its own.

2.3.2 PREVIOUSLY FORECASTED VOLUMES

The 2035 traffic forecasts developed using the estimated 2020 non-pandemic traffic volumes (**Figures 2.7**, **2.8** and **2.9**) were compared to the 2035 traffic forecasts developed for the most recent previous noise study for the interchange. The new 2035 traffic projections are slightly lower than the previously projected 2035 forecasts but within ten percent. The a.m. and p.m. peak hour volumes used in the previous noise study were based on annual daily traffic estimates, so the 2020 non-pandemic traffic volumes were converted to annual daily traffic peak hour volumes based on the 0.95 factor described in **Section 2.3.1**. See **Table 2.2**.

Table 2.2: Comparison of Previous and Current Study's Estimated 2035 Peak Hour Traffic

	PREVIOUS NOISE STUDY'S 2035 ESTIMATED VOLUMES		CURRENT NOISE STUDY'S 2035 ESTIMATED NOVEMBER VOLUMES		CURRENT NOISE STUDY'S 2035 ESTIMATED AVERAGE DAILY VOLUMES	
DIRECTION	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
Southbound Entering	2,540	1,510	2,220	1,280	2,335	1,345
Northbound Entering	1,400	2,245	1,055	1,795	1,110	1,890
Eastbound Entering	1,465	3,105	1,450	2,765	1,525	2,910
Westbound Entering	1,150	960	945	1,045	995	1,100
TOTAL ENTERING	6,555	7,820	5,670	6,885	5,965	7,250

The previous study's forecasts used growth rates of 1.7% per year on PTH 59N and 2.6% per year on PTH 101. Using more recent data from area permanent count stations, the growth rates used in the current study were 1.5% per year on PTH 59N and 2.0% per year on PTH 101. The lower 2035 forecasts are a result of both the slightly lower growth rates used, and the different base year traffic volumes used for the forecasts. When different base year volumes are used to produce future projections, the differences will be compounded. In producing future traffic forecasts, the best data available at the time of the forecast is used and this will result in differences between forecasts produced in different years.

It is unknown at this time how the current pandemic will affect commuting patterns and future development in the long term. Many employers have experienced a significant shift to work-from-home/remote work arrangements. It is unknown to what extent work-from-home/remote work will continue post-pandemic but as employers and employees have successfully transitioned to this work model during the pandemic, it is likely to continue for some of the province's workforce on a part-time or full-time basis, which may permanently affect traffic volumes on all commuter routes. While this makes it difficult to predict long-term future traffic growth, it suggests that a more conservative approach to developing growth rates may be reasonable.

2.3.3 HISTORIC COUNTS AND PREVIOUS FORECASTS CONCLUDING COMMENTS

Although the 2020 traffic counts were completed during pandemic conditions which have affected overall traffic volumes on commuter routes across the province, based on the review of the permanent count station data from 2019, the 2020 estimates (during pandemic restrictions) are considered representative of existing conditions at the time of the noise monitoring and the 2020 estimates (without pandemic restrictions) are considered representative of what traffic volumes would have been without the pandemic.

New counts should be conducted at the interchange in the future when the pandemic is over and following completion of the PTH 59 Floodway Bridge construction. As noted above, the transition to remote work models during the pandemic may affect commuting patterns and peak hour traffic volumes in the long-term, resulting in changes to traffic patterns and volumes that are difficult to predict at this time.

3 NOISE POLICIES AND GUIDELINES

Traffic noise is defined as the sounds generated by vehicles operating on a highway and include engine, exhaust and tire-road contact sounds. Traffic noise may be affected by roadway surface condition, higher truck volumes, higher traffic speeds and steep grades that cause strain on vehicle engines.

Most highways under MI's jurisdiction are in rural areas where vehicle noise generally is not an issue. However, MI also have highways that are adjacent to or within municipal boundaries and oftentimes residential development has occurred along the highways. MI, as with most jurisdictions, considers noise mitigation measures for new or upgraded facilities that may increase existing noise levels, but not for current, baseline noise levels. MI recognizes the need to consider vehicle noise when an existing highway is being upgraded, or a new highway is being built, near existing residential development and has applied the City of Winnipeg's (the City's) "Motor Vehicle Noise Policies and Guidelines" dated October 11, 1984 to several projects, including: construction of the northeast portion of PTH 101; the CentrePort Canada Way project; the South Perimeter Highway Design Study; and the PTH 101 / PTH 59N project.

3.1 CITY OF WINNIPEG NOISE POLICY AND GUIDELINES

The City's "Motor Vehicle Noise Policy and Guidelines"[2], dated October 11, 1984, (the Guidelines) provides policy and guidelines to minimize the impact of motor vehicle noise on residential areas.

The City uses a threshold of 65 dBA Day-Night Level (L_{DN}) when considering mitigation of traffic noise. L_{DN} is a 24-hour A-weighted equivalent sound level with a 10-decibel penalty to sound levels during nighttime hours (11:00 p.m. to 7:00 a.m.) to recognize that nighttime noise is more intrusive than daytime noise levels. L_{DN} describes the cumulative noise exposure over a full 24 hours.

The Guidelines note that the intruding traffic noise must exceed the existing sound level by 5 dBA if noise attenuation measures are to be considered. This is based on the technical feasibility to attenuate the noise. The Guidelines note that if the intruding noise is less than 5 dBA louder than the background noise level, then it is not possible to attenuate to achieve a perceptible reduction in sound level.

The Guidelines further note that it is difficult to attenuate sounds that are of approximately equal sound level. As such, if an area had a relatively high level of background noise (for example, 63 dBA) due to existing roadways, adjacent industrial areas, train traffic or air traffic, then the intruding roadway noise needs to be at least 5 dBA louder for attenuation to be effective. The Guidelines provide an example of the residential neighbourhood on the west side of Lagimodiere Boulevard between Marion Street and Dugald Road which is surrounded by industrial land uses and notes that because the noise from Lagimodiere Boulevard is approximately 2 to 3 dBA higher than the surrounding background noise, a noise wall or berm along Lagimodiere Boulevard would be ineffective.

When determining noise impacts on residential properties, the Guidelines consider the sound levels at the limit of the outdoor recreational area (rear yard) for the residential properties.

[2] The City of Winnipeg's Motor Vehicle Noise Policies and Guidelines can be viewed at the following web address: https://winnipeg.ca/publicworks/trafficControl/pdf/MotorVehicleNoisePolicy.pdf

Key policies and guidelines from the City's Guidelines which pertain to provision of noise attenuation for transportation facilities adjacent to existing residential areas are provided in **Table 3.1**.

Where new residential development is proposed adjacent to an existing or proposed regional transportation facility, the City's Guidelines provide that the developer shall be responsible for noise attenuation if required to attenuate the design noise level to the threshold 65 dBA L_{DN} based on projected traffic volumes for the design year.

Table 3.1: City of Winnipeg Motor Vehicle Noise Policies and Guidelines - Policies and Guidelines Related to Noise Attenuation for Transportation Facilities Adjacent to Existing Residential Development

CATEGORY	POLICIES	GUIDELINES
Sound Level Limits	a) The City recognizes that the magnitude and effect of excessive sound levels cause noise impacts which vary from person to person. b) The City has an obligation to establish a balance between the cost of noise attenuation and the benefits which can be achieved.	a) The outdoor sound level limit for residential areas adjacent to a regional transportation facility is a Design Noise Level of 65 dBA L_{DN}. b) The intruding noise must exceed the existing L_{DN} sound level by 5 dBA if noise attenuation measures are to be considered. c) Noise attenuation measures shall, where technically and economically feasible, be designed to attenuate to the design noise level predicted based on the design year traffic volume. d) The point of reception for determining noise impacts on a property shall be at the limit of the outdoor recreational area closest to the regional transportation facility under consideration. Readings shall be taken at a height of 1.2 metres above ground.
Areas of Application	a) The noise policy shall apply to all regional transportation facilities where the adjacent land use within 100 metres of the existing or proposed nearest travelled lanes is residential with an outdoor recreation area.	a) It must be technically and economically feasible to provide noise attenuation measures.

CATEGORY	POLICIES	GUIDELINES
Modifying Existing Regional Streets	a) The City recognizes that some residential development adjacent to existing Regional Streets is currently experiencing noise impacts, but because of the layout of the lots and the available right-of-way, in most cases it is not cost effective to attenuate the noise.	a) The City recognizes that where dwelling units back on a Regional Street where there is a frontage road between the dwelling units and the Regional Street, it may be possible to construct noise attenuation devices. Where dwelling units flank a Regional Street, or front directly on a Regional Street, it is usually not feasible to construct noise attenuation devices. b) The City recognizes that noise attenuation devices may have negative effects such as poor aesthetics, increased maintenance cost, reduced driver visibility, and reduced access. c) The City recognizes that noise levels are higher at intersections due to the increased number of vehicles and the need for vehicles to accelerate and decelerate. The City therefore supports the optimization of the spacing and traffic control at intersections.
Noise Attenuation Measure: New Regional Transportation Facilities/Existing Residential Development	a) The City recognizes the responsibility for noise attenuation based on the principle that noise impacts on existing residential development adjacent to new regional transportation facilities should be minimized where practical.	a) Where the predicted noise level for the design year exceeds the design noise level, attenuation measures will be considered. b) Noise attenuation devices where required should be installed as part o the Capital Works Program for construction of a regional transportation facility. c) Any noise attenuation devices should be acceptable to a majority of the residents within 100 metres of the nearest travelled lane where the attenuation measures are to be applied.

CATEGORY	POLICIES	GUIDELINES
Noise Attenuation Measure: Existing Regional Transportation Facilities/Existing Residential Development	a) The City recognizes a desire to achieve noise attenuation of existing residential areas adjacent to existing regional streets exposed to excessive noise levels.	a) The City recognizes that in most cases it is not feasible to construct noise attenuation devices adjacent to the existing regional streets due to the lack of right-of-way, the need for aesthetics, and the need for vehicle and pedestrian access to the regional street. b) If a noise attenuation device is to be effective, it should be continuous and close to either the roadway or the dwelling units. c) Residential areas adjacent to existing regional streets must have an existing noise level which exceeds the design noise level before consideration will be given to the installation of noise attenuation devices. d) Any noise attenuation devices should be acceptable to a majority of the residents within 100 metres of the nearest travelled lane where the attenuation measures are to be applied.

3.2 JURISDICTIONAL REVIEW

Noise guidelines vary by jurisdiction. Some jurisdictions consider base noise on outdoor levels, some on indoor levels, some on 24-hour weighted average (including Winnipeg), some on daytime (16 hr Leq) and nighttime (8 hr Leq). There is no uniform standard in Canada for traffic noise guidelines. Alberta Transportation and the City of Saskatoon use the same noise level limit as Winnipeg and MI.

3.2.1 CITY OF WINNIPEG

When the City of Winnipeg was developing their guidelines, they reviewed other jurisdictions as summarized in **Table 3.2** below. The range of L_{DN} noise levels for jurisdictions reviewed ranges from 55 to 80 dBA, depending on jurisdiction and type of project.

Table 3.2: Comparison of Noise Standards for Residential Land Use, in Various Countries (Source: Reproduced from the City of Winnipeg *Motor Vehicle Noise Policies and Guidelines*, 1984)

COUNTRY	ORGANIZATION	PURPOSE	TYPE OF STANDARD	NOISE STANDARD DESIGN NOISE LEVEL	CORRESPONDING L_{DN}	COMMENTS
Canada	Central Mortgage and Housing Corporation	Restrict mortgages for new construction unless building insulation improved and outdoor areas shielded.	Absolute	55 dBA $L_{eq}(24)$	55-60 dBA L_{DN}	Difficult to achieve on Regional Streets. Funds available to insulate and shield in environments up to 75 dBA $L_{eq}(24)$, to reduce exposure to the Design Noise Level.
USA	Federal Highway Administration	Require new (and improved) roadways to incorporate noise abatement in their facility design.	Absolute	67 dBA L_{eq} for 30th worst hour of the roadway's design year	65-70 dBA L_{DN}	Funds available to attempt to achieve the Design Noise Level.
			Relative	Not quantified	***	Existing noise should be used as a measure of the noise impact.
USA	Department of Housing and Urban Development	Restrict Federal participation for residential construction unless building insulation improved and outdoor areas shielded.	Absolute	Exceeds 65 dBA 8 hours per day, or loud repetitive sounds	60-70 dBA L_{DN}	Funds available to attempt to achieve the Design Noise Level.

COUNTRY	ORGANIZATION	PURPOSE	TYPE OF STANDARD	NOISE STANDARD DESIGN NOISE LEVEL	CORRESPONDING L_{DN}	COMMENTS
Sweden	Traffic Noise Committee	Limit the disturbance caused by traffic noise consistent with technical and economic feasibility.	Absolute	65 (55) dBA $L_{eq}(24)$ 60 dBA $L_{eq}(24)$ 65 dBA $L_{eq}(24)$ 70 (55) dBA $L_{eq}(24)$	65-70 (55-60) dBA L_{DN} 60-65 dBA L_{DN} 65-70 dBA L_{DN} 70-75 (55-65) dBA L_{DN}	New area near major routes. New route in existing area. Upgrading of existing route. Redevelopment of existing area.
Great Britain	Noise Advisory Council	Prevent subjection of existing residential development, as an act of public conscience, to noise above the standards.	Absolute	70 dBA L10 (arithmetic average over the 18 hours from 6:00 a.m. to midnight)	75-80 dBA L_{DN}	Planners, wherever possible, should design to lower levels.

3.2.2 ALBERTA TRANSPORTATION

Alberta Transportation adopted noise guidelines in 2009 ("Noise Attenuation Guidelines for Provincial Highways under Provincial Jurisdiction within Cities and Urban Areas"). The Guidelines define noise as "the sounds generated by vehicles operating on the highway… (and) includes but is not limited to engine/exhaust sounds and road contact sounds". The corresponding guideline notes that:

- For construction of or improvements to highways through cities and other urban areas, Alberta Transportation will adopt a noise level of 65 dBA $L_{eq}24$ (L_{DN}) measured 1.2 meters above ground level and 2 metres inside the property line (outside the highway right-of-way). The measurements are adjusted to the 10-year planning horizon value, as a threshold to consider noise mitigation measures.
- The decision to implement noise attenuation devices such as noise walls and / or berms must consider if the mitigation is cost-effective, technically practical, broadly supported by affected residents and fits into overall provincial priorities.

3.2.3 MINISTRY OF TRANSPORTATION OF ONTARIO

Ontario has a number of guidelines and documents related to assessing road traffic noise impacts. The Ministry of Environment and Energy (MOEE) and Ministry of Transportation (MTO) Joint Protocol, "A Protocol for Dealing with Noise Concerns during the Preparation, Review and Evaluation of Provincial Highway's Environmental Assessments" (MTO & MOECC, 1986) is most applicable to municipal roadway projects. The MTO "Environmental Noise Guideline" (MTO, 2006) supersedes the Joint Protocol and previous MTO Quality and Standards Directive QST-A1 for Provincial highways and freeways (MTO 1992).

The Environmental Noise Guideline sets out an Outdoor Objective sound level of 55 dBA L_{eq} (approximately 50 – 60 dBA L_{DN}), or the existing ambient. In the case where sound levels exceed 65 dBA L_{eq} (approximately 65 – 70 dBA L_{DN}), the Guide is more stringent.

Noise mitigation is warranted when increases in sound level over the "no-build" ambient are greater than 5 dBA. Mitigation measures can include changes in vertical profiles and horizontal alignments, noise barriers, and noise reducing asphalts. Noise mitigation, where applied, must be administratively, economically, and technically feasible, and must provide at least 5 dBA of reduction averaged over the first row of noise-sensitive receivers. Mitigation measures are restricted to within the roadway right-of-way. Off right-of-way noise mitigation, such as window upgrades and air conditioning, is not considered. Noise mitigation requirements are summarized in **Table 3.3**.

Table 3.3: Summary of Mitigation Efforts Under Ontario Road Traffic Noise Guidelines (Source: Reproduced from Ontario Road Traffic Noise Guidelines)

FUTURE SOUND LEVELS*	CHANGE IN NOISE LEVEL ABOVE FUTURE "NO BUILD" AMBIENT (DBA)	MITIGATION EFFORT REQURIED
< 55 dBA	0 to 5	None
	> 5	None
> 55 dBA	0 to 5	None
	> 5	• Investigate noise control measures within right-of-way • Noise control measures where used must provide a minimum of 5 dBA of attenuation, averaged over the first row of receivers • Mitigated to as close to ambient as possible, where technically, economically and administratively feasible

*Values are L_{eq} (16-hour) levels for municipal roads and provincial highways, and L_{eq} (24-hour) for freeways.

3.2.4 CITY OF SASKATOON

Traffic noise sound attenuation is considered in the construction of all new residential areas. Land developers build these measures and pay all costs for their construction where needed. Traffic noise sound attenuation is also considered and provided for as needed for all new transportation infrastructure projects and is included in those project costs. As an example, sound attenuation was provided along all residential neighbourhoods adjacent to the Circle Drive South project.

The City uses a guideline of 65 dBA L_{DN} before considering attenuation. The City adopted its Traffic Noise Sound Attenuation (TNSA) Program to help maintain the quality of the outdoor amenity space in residential areas located adjacent to high speed roadways. The TNSA policy framework and a TNSA monitoring program with a monitoring list of potential future sound wall projects was approved by City Council in November 2016. Locations adjacent to arterial roads or freeways/expressways with average daily traffic levels greater than 20,000 vehicles per day are included. Potential locations are added to the monitoring list when traffic volumes over 20,000 vehicles per day are measured. Noise measurements are to be completed every three years beginning in 2020.

The City's policy identifies a number of common noise decibels for comparison purposes, as shown in **Table 3.4**.

Table 3.4: Common Noise Decibels (Source: Reproduced from City of Saskatoon web page: https://www.saskatoon.ca/moving-around/driving-roadways/managing-traffic/traffic-noise)

	IN THE HOME	**AT WORK**	**GENERAL**
Sample Noise Levels (decibel)	50-75 washing machine 55-70 dishwasher 60-85 vacuum cleaner 60-95 hair dryer 80 doorbell 80 ringing telephone 110 baby crying	65-95 power lawn mower 90 tractor 105 snow blower 110 leaf blower 120 ambulance siren 140 airplane taking off	70 freeway traffic 85 noisy restaurant 90 truck, shouted conversation 95-110 motorcycle 100 snowmobile 110 car horn 125 auto stereo (factory installed) 130 stock car races 157 balloon pop 170 shotgun

3.2.5 CITY OF EDMONTON

The City of Edmonton developed the following noise policy statement: Mitigating the impact of traffic noise in the urban environment is governed by the following: The City of Edmonton will seek to ensure that no new residential development less than three storeys will be allowed adjacent to transportation facilities (arterial roadways, light rail transit) unless the developer proves to the satisfaction of the City that the projected noise level in the private back yards of residences abutting the transportation facility will not exceed 65 d_{BA} L_{eq24} (approximately 65 – 70 dBA L_{DN}). Construction of any noise attenuation measures necessary to achieve this threshold will be funded and undertaken by the developer of the adjacent property, unless specific site characteristics, such as topography or existing land uses, necessitate the consideration of relief from the requirement.

3.2.6 JURISDICTIONAL REVIEW SUMMARY

There is no set guideline used by Canadian road jurisdictions. However, the threshold level of 65 dBA L_{DN} to consider mitigation adopted by the City of Winnipeg, and MI, is the same, or similar, to other Canadian jurisdictions. The City of Winnipeg's and MI's guidelines share other common features with other Canadian jurisdictions including the requirement for considering attenuation only if levels exceed the guideline by 5 dBA, if attenuation would achieve noise level reductions of at least 5 dBA, and if attenuation measures are cost effective and technically feasible. Another common attribute is examining mitigation only along low-density residential development (e.g., single family homes, duplexes).

4 ENVIRONMENTAL NOISE STUDY

Industrial Technology Centre (ITC) provided noise monitoring and sound modeling services for this study. ITC's trained sound engineering professionals are qualified technical experts in noise monitoring and complex sound analysis using sophisticated equipment and modeling software. ITC has significant experience conducting noise monitoring studies, developing sound models and noise forecasts and developing mitigation recommendations for transportation facilities. This includes the previous noise studies conducted for PTH 101 and PTH 59N in 2010 and 2015.

Professional Class A Sound Level Meters with level of accuracy of less than +/- 0.1 dBA were used in the collection of sound levels for this study. These Sound Level Meters are calibrated for use and must comply with acoustical and electrical tests to meet national and international standards. **Table 4.1** identifies the instrumentation used for this study.

Table 4.1: Instrumentation

ITC ID NUMBER	DESCRIPTION	CALIBRATION DATE	CERTIFICATION NO.
ITC 10004	B&K 2250 Sound Level Meter	2020-10-15	Navair 163470
ITC 10004	B&K 4231 Field Calibrator	2020-10-15	Navair 163471

4.1 2020 FIELD NOISE MEASUREMENTS AND SOUND MODELING

Field noise monitoring was conducted from November 25, 2020 to December 11, 2020 at locations in the four quadrants of the PTH 101 and PTH 59N interchange. As per traffic sound monitoring guidelines, the Sound Level Meters were set up between the highway and the residential properties. A typical equipment set up is shown in **Figure 4.1**.

Figure 4.1: Sound Level Meter Including Environmental Enclosure

Figure 4.2 shows the ground level elevations and four locations of the Sound Level Meters used in the study.

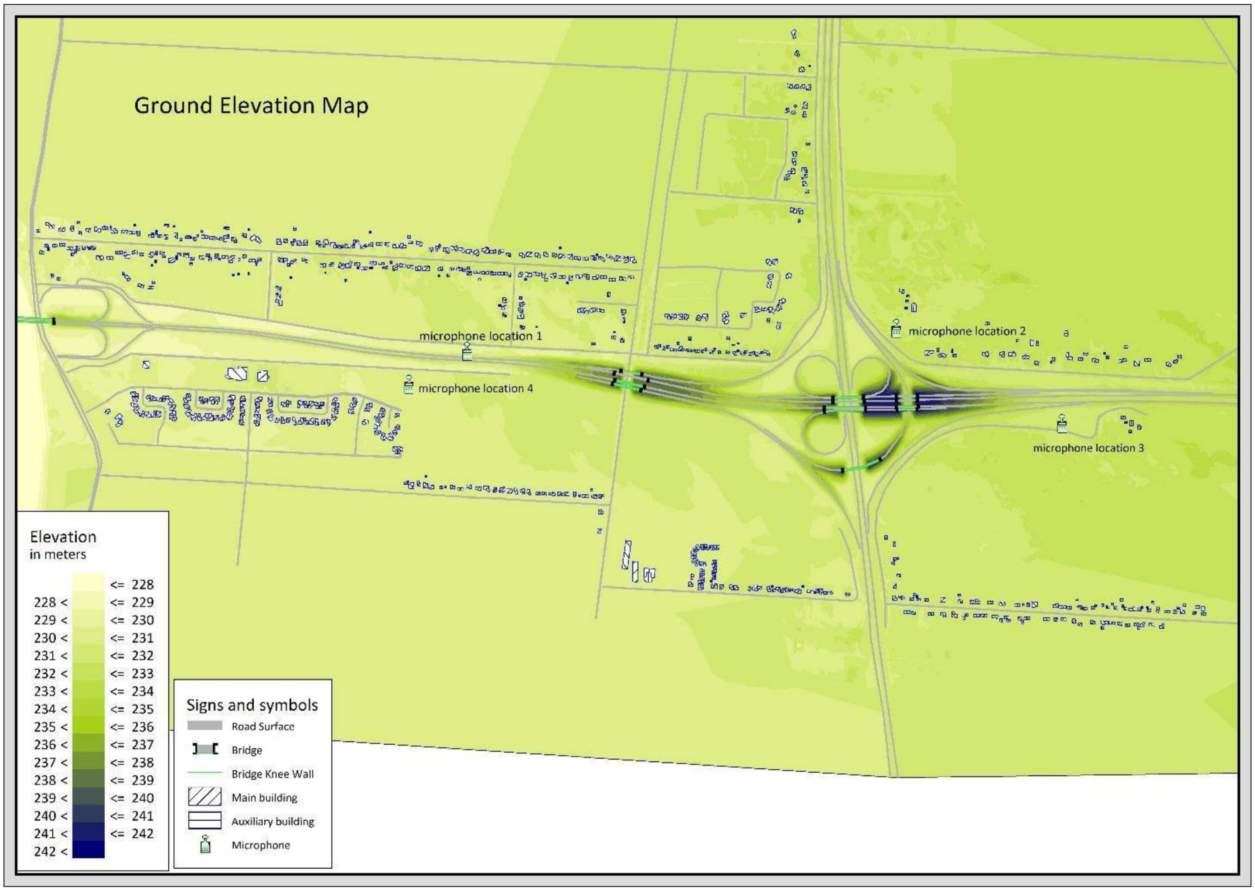


Figure 4.2: Ground Elevation Map

The sound levels obtained through the field monitoring were converted to hourly sound exposures. The traffic sound model developed for previous noise studies conducted in 2010 and 2015 was updated with current roadway geometry, ground elevations, house locations/sizes, and traffic volumes.

Figures 4.3, **4.4**, **4.5** and **4.6** show the measured and predicted Leq at the microphone locations in the northwest, northeast, southeast and southwest quadrants, respectively. As shown, there is good correlation between the measured sound levels and the simulation model predicted levels.

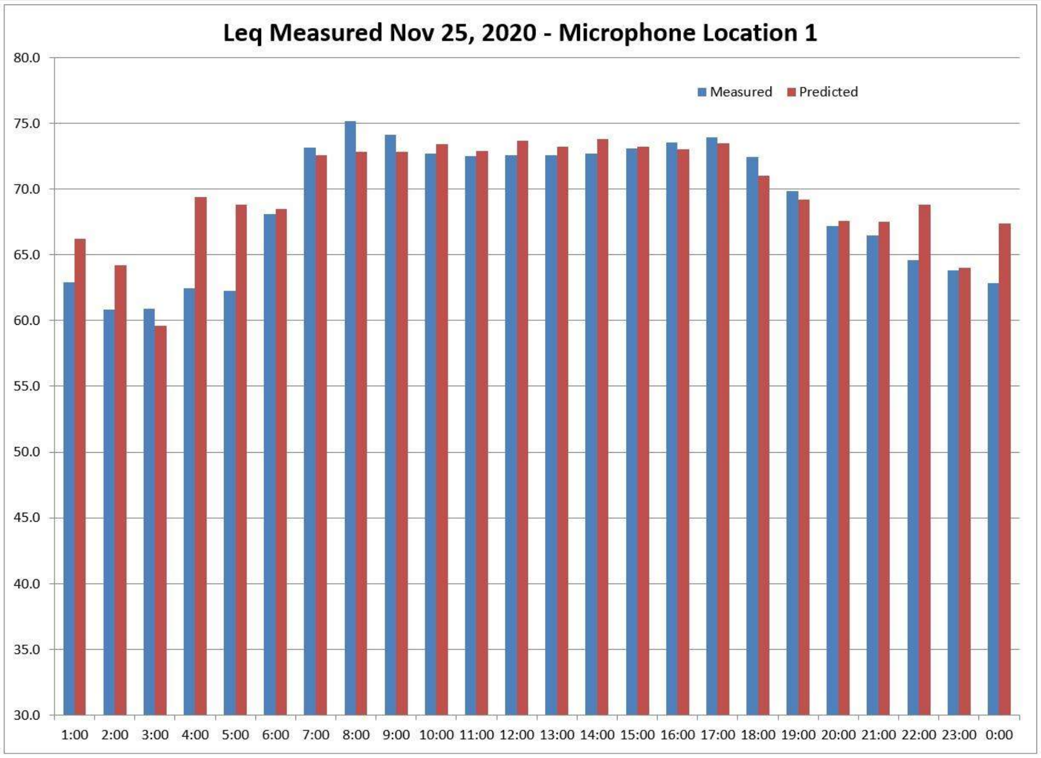


Figure 4.3: Measured and Predicted Leq Sound Levels (dBA) at Location 1 (Northwest Quadrant)

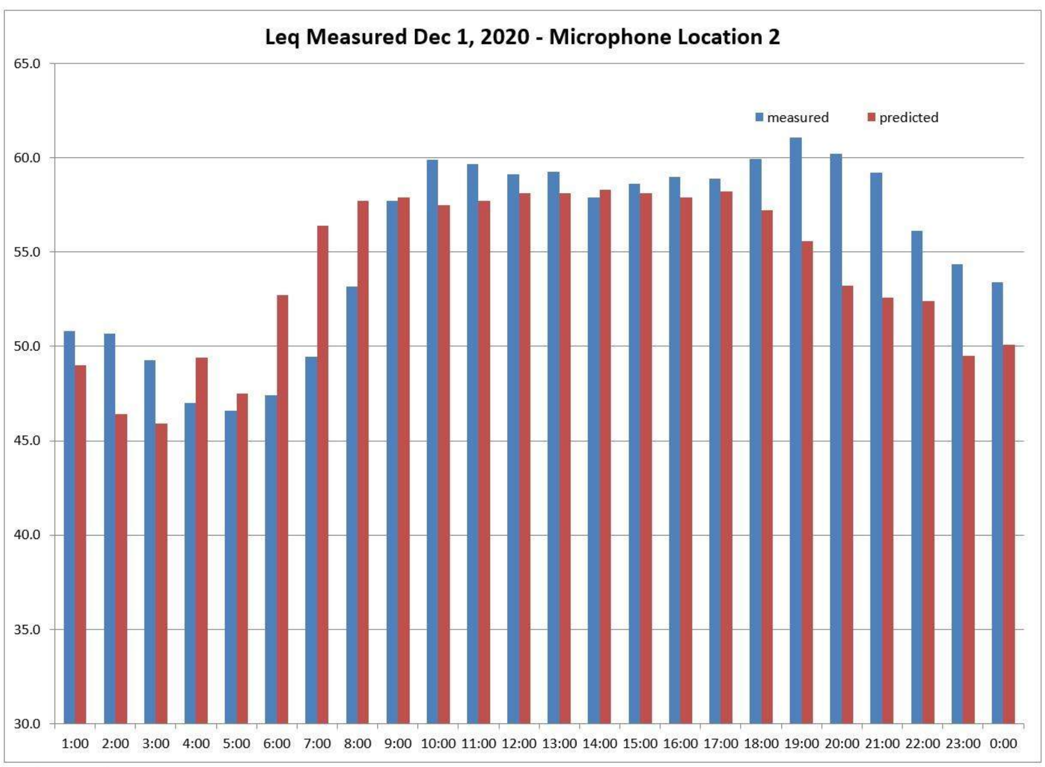


Figure 4.4: Measured and Predicted Leq Sound Levels (dBA) at Location 2 (Northeast Quadrant)

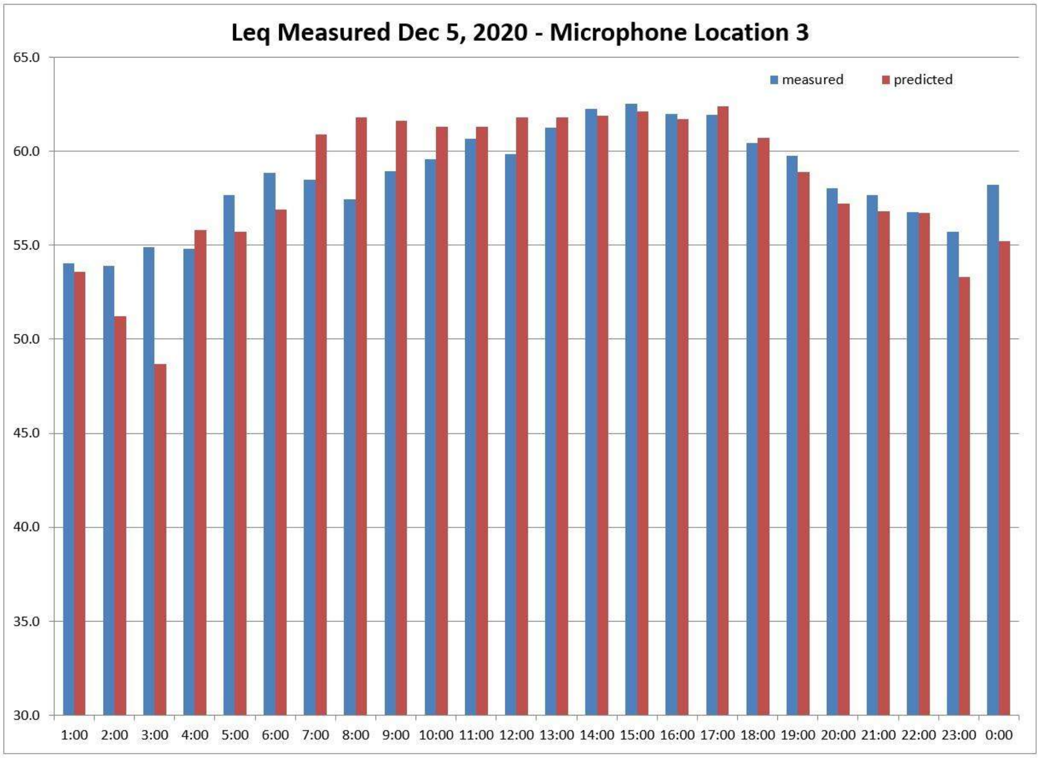


Figure 4.5: Measured and Predicted Leq Sound Levels (dBA) at Location 3 (Southeast Quadrant)

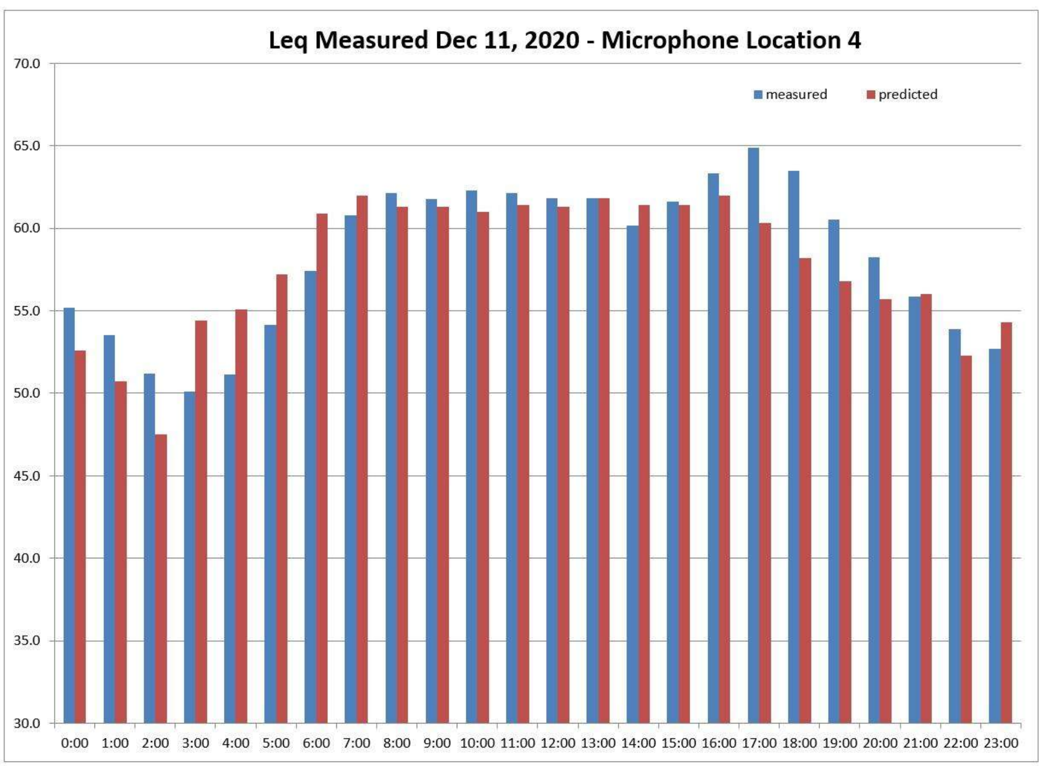


Figure 4.6: Measured and Predicted Leq Sound Levels (dBA) at Location 3 (Southwest Quadrant)

Figure 4.7 shows the noise model results for the existing 2020 Day-Night Noise Level, L_{DN}, sound contours. These represent the L_{DN} sound contours from traffic related noise for existing conditions at the time of the 2020 noise monitoring field studies which, as discussed in **Section 2.1**, were conducted during the COVID-19 pandemic. As shown, the 65 dBA line is currently close to the road in all four quadrants of the interchange. This was confirmed by reviewing the measured noise levels at each location.

Based on the City's Guidelines and as noted in **Section 3.1**, where the L_{DN} in the outdoor recreational area adjacent to a residential property exceeds 65 dBA, sound mitigation will be investigated. Since there are no residential properties meeting this criterion, investigation of sound mitigation is not warranted.

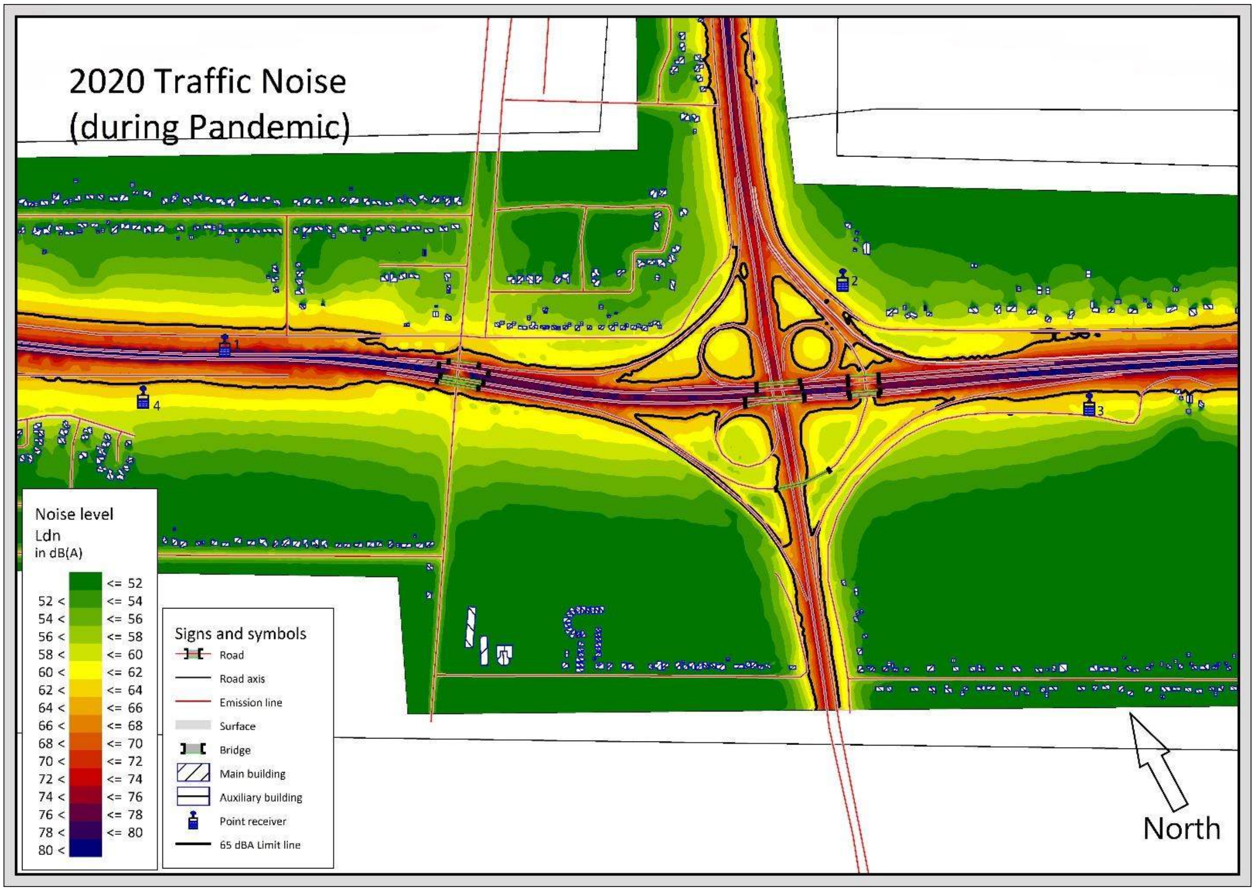


Figure 4.7: 2020 Existing L_{DN} Traffic Noise Contour Map

4.2 2035 PROJECTED FUTURE SOUND MODELING

Figure 4.8 shows the predicted sound levels from traffic related noise in 2035 during non-pandemic traffic patterns. The 65 dBA line is farther from the road than it was in the 2020 existing noise level contour map and touches residential properties on Sperring Avenue between Benham Way and Pritchard Farm Road on the west side of PTH 59N. This is consistent with the findings of the previous sound studies conducted.

Figure 4.9 provides a close-up view of the area along Sperring Avenue near Pritchard Farm Road. The 65 dBA line touches the front yards of residential properties but does not extend to the outdoor recreation areas at the rear of these properties.

Since the 65 dBA line does not encroach on the outdoor recreational area of any residential properties, the criteria required for investigation of sound mitigation measures is not met.

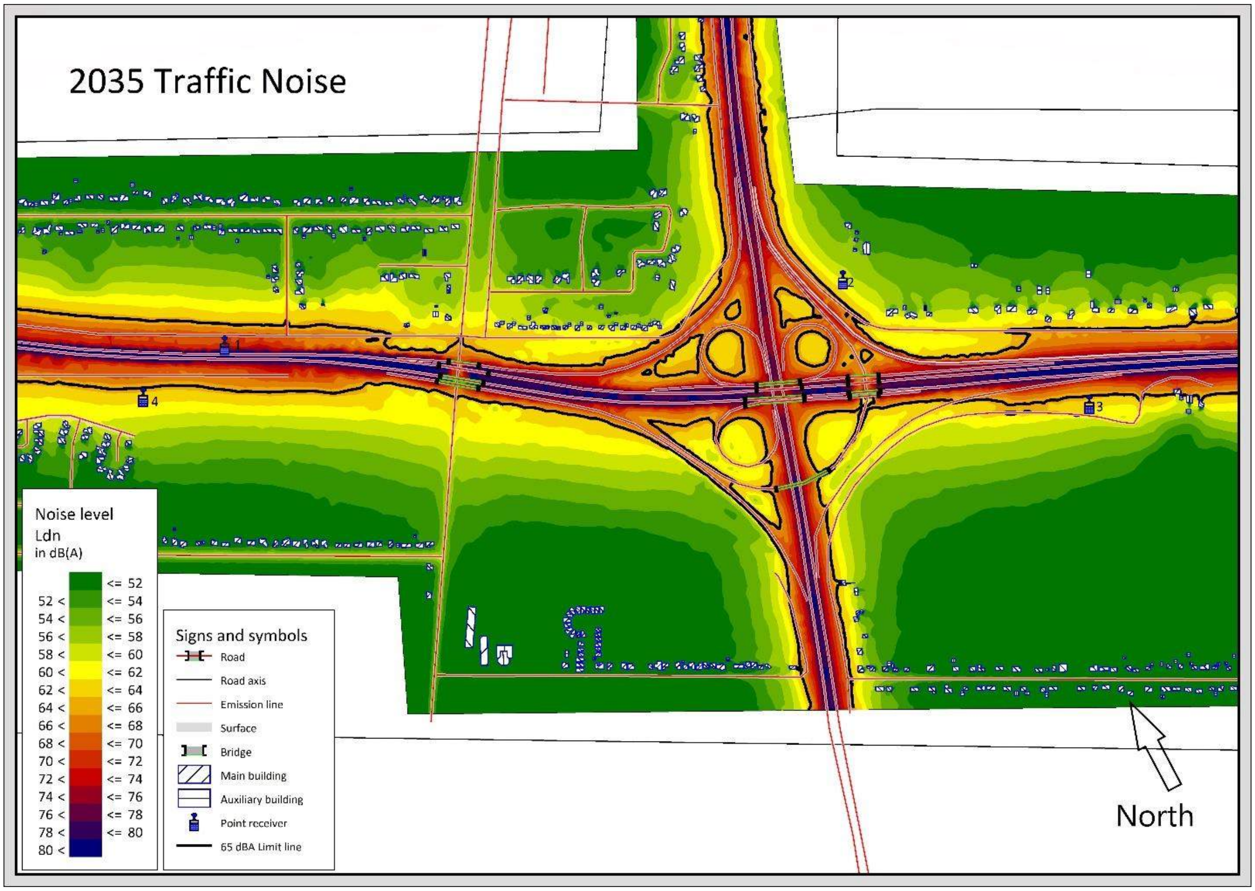


Figure 4.8: 2035 Predicted L_{DN} Traffic Noise Contour Map

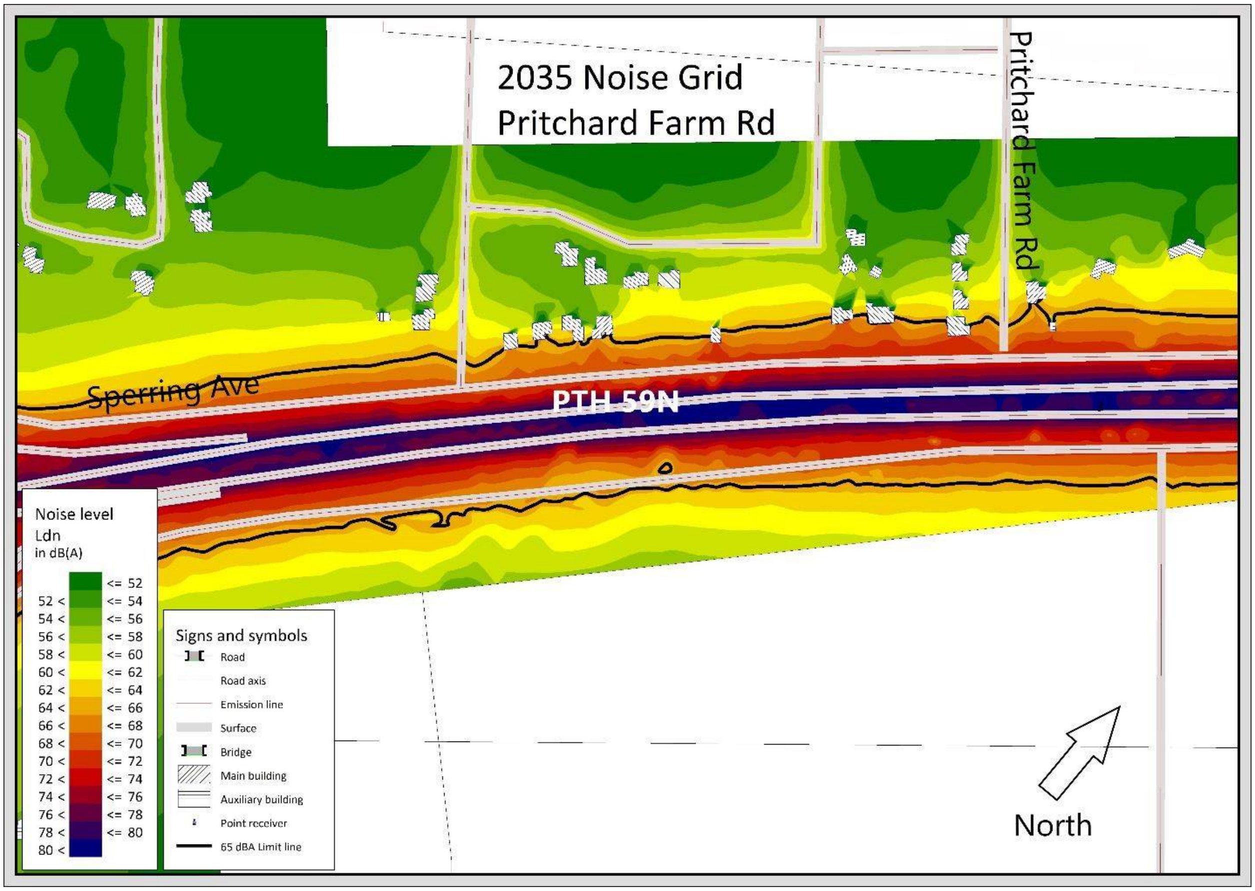


Figure 4.9: 2035 Predicted Traffic Sound Contours Along Sperring Avenue Near Pritchard Farm Road

4.3 PRE-CONSTRUCTION NOISE FORECASTS REVIEW

As noted, the results of the sound level modeling were consistent with the previous noise studies conducted. The previous studies and this study determined that the 65 dBA level was only met in future sound forecasts for the front of residential properties along Sperring Avenue in the area near Pritchard Farm Road but was not met in the outdoor recreational areas at the rear of these properties. **Figure 4.10** illustrates the future 2030 65 dBA limit line as determined in the 2010 study. The 65 dBA limit line along Sperring Avenue on the west side PTH 59N is very similar to the 2035 65 dBA limit line shown in **Figure 4.9**.

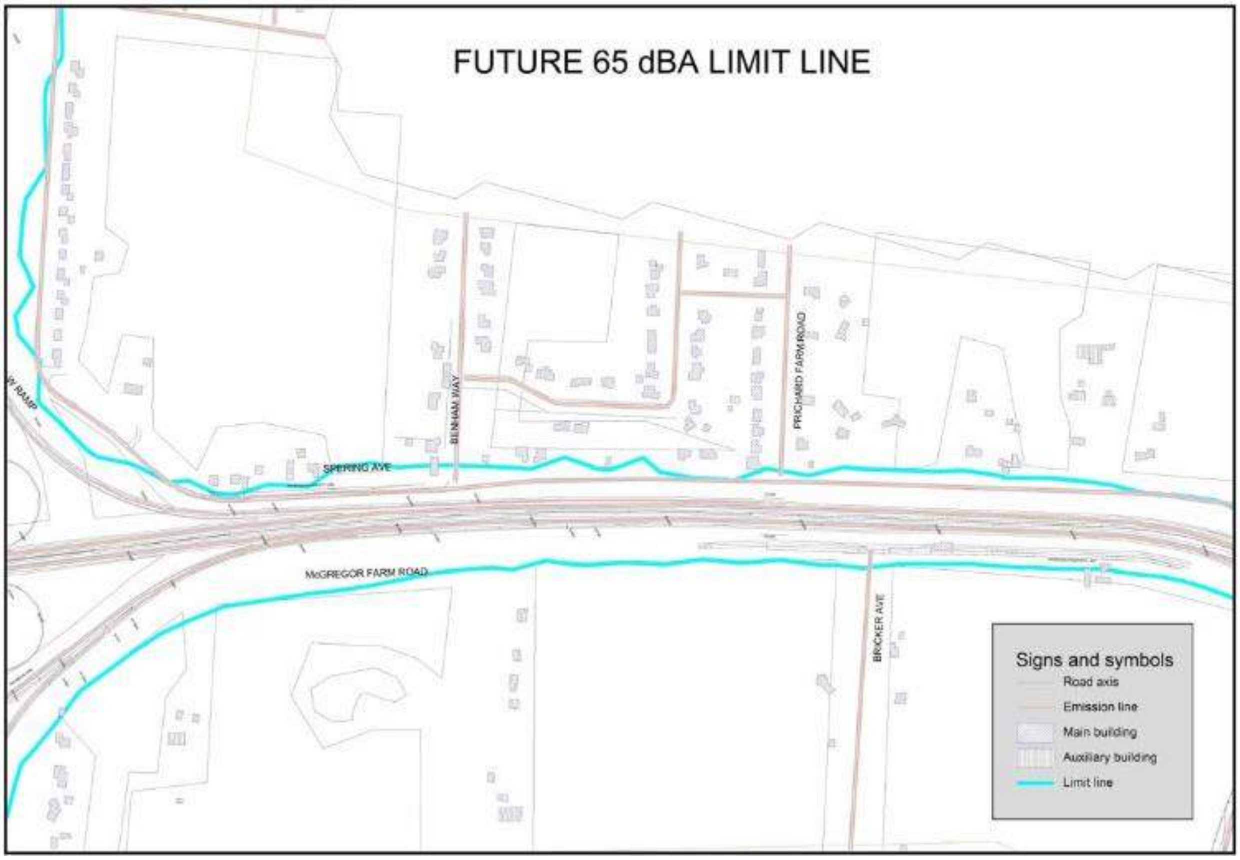


Figure 4.10: Future 2030 65 dBA Limit Line from 2010 Study

The results of this study were also consistent with the previous studies in that it showed future predicted sound levels for properties along PTH 101 at the fronts of houses along Sperring Avenue in the northwest quadrant of the interchange did not reach the 65 dBA level. These are shown on **Figure 4.8** and **4.10** for the existing and previous noise studies, respectively. **Figure 4.8** shows the 65 dBA limit line in this study slightly further away from the front yards of the properties along PTH 101 fronting Sperring Avenue as compared to the previous study (**Figure 4.10**).

4.4 DISCUSSION

4.4.1 SEASONAL AND WEATHER-RELATED CONSIDERATIONS

Temperature can affect how sounds travel through the air. At lower temperatures, sound travels further than at higher temperatures so noise from a particular source may be more noticeable or seem louder at lower temperatures than higher temperatures. However, because people are generally outside in their yards less in winter and windows are kept shut, sounds are often perceived as being louder or more intrusive in summer months. In summer, people are out in their yards more and may have their house windows open, so the sound level is generally more noticeable.

Strong wind affects sound propagation, particularly over long distances. Someone downwind of a noise source will hear louder noise levels than someone upwind of the same noise source at the same distance away from it. However, at shorter distances typical of studies done to assess noise levels in residential communities adjacent to transportation facilities, wind does not generally have a significant impact. However, wind may increase overall background sound levels due to leaves on trees rustling or other items being blown or moved by the wind.

Sound is reflected more by a ground surface with hard packed snow versus a softer ground surface which will absorb some sound. This will cause the sound to travel further. However, in developing noise models, as discussed in **Section 1.2.1**, ground absorption at the time of field monitoring is considered and the model is calibrated accordingly.

4.4.2 L_{DN} AND SPOT SOUND LEVELS

As noted in **Section 3.1**, L_{DN} represents the equivalent 24-hour sound level. It is an average noise level for a 24-hour period that considers the increased sensitivity to noise during night-time hours of 11:00 p.m. to 7:00 a.m. by adding 10 dBA to hourly sound levels between 11:00 p.m. to 7:00 a.m.

It is important to note that because L_{DN} is a 24-hour equivalent noise level, there may be low points during a 24-hour period with lower sound levels and high points with higher sound levels. It is also important to note that noise models for transportation facilities predict noise levels due to traffic and road noise from the highway and do not include background noise such as airplanes flying overhead, birds, wind, etc.

Because L_{DN} is a 24-hour equivalent sound level and because the model does not include background noise, as noted, it is possible that noise levels at a specific point and time may exceed or be less than the predicted L_{DN} for that location. As an example, if spot sound levels are recorded in the yard of a residential property in the study area, the sound level at that point in time may be higher or lower than the predicted L_{DN} at that location. However, the sound level will vary throughout the day and instantaneous sound levels recorded would include all background noise such as vehicles driving down the street, wind, nearby noise sources such as air conditioning units, etc. and not only the sound levels coming from the highway.

As well, if the spot noise measurements are taken using readily available smartphone apps, such as the National Institute for Occupational Safety and Health (NIOSH) app, it is important to note that at this time there are no smartphone apps for recording sound levels that meet applicable noise monitoring standards.

5 NOISE POLICY FACT SHEET

A noise policy fact sheet summarizing the guidelines followed by MI and the findings of the PTH 101 and PTH 59N noise monitoring study is included in **Appendix B**.

6 CONCLUSION AND RECOMMENDATIONS

Based on the Guidelines, noise mitigation in the form of a noise barrier or wall should only be considered if it is technically and economically feasible, desired by affected residents, and where noise levels in the outdoor recreation space, typically the rear yard of residential properties, have L_{DN} noise levels exceeding 65 dBA. The Guidelines further note that the intruding noise must exceed the existing L_{DN} sound level by 5 dBA.

The study found that for both the existing 2020 conditions (during the COVID-19 pandemic) and the predicted 2035 noise levels, the 65 dBA L_{DN} line does not touch the outdoor recreation area for any residential property in any of the four quadrants of the interchange. In the 2035 noise prediction, the 65 dBA L_{DN} contour line touches the front yards of residential properties on Sperring Avenue between Benham Way and Pritchard Farm Road on the west side of PTH 59N. This is consistent with the findings of the previous sound studies conducted.

In conclusion, noise mitigation measures are not warranted based on the measurements taken, forecast noise levels, and the application of the noise policy.

APPENDIX

A

PTH 101 & PTH 59N TRAFFIC COUNTS REVIEW

MEMO

TO: Warren Borgford, P. Eng., Acting Traffic Services Engineer

FROM: Abby Scaletta, E.I.T.,WSP and Diana Emerson, P. Eng., MCIP, RSP1, WSP

SUBJECT: **Traffic Counts at PTH 101 & PTH 59N for Noise Monitoring Study**

DATE: **December 22, 2020**

INTRODUCTION

The PTH 101 and PTH 59N interchange was constructed between summer 2015 to fall 2018 and was fully opened to traffic as of October 31, 2018. There are five traffic counts within the study area that were conducted pre- and post-construction, at the intersection and adjacent intersections. This memo includes the following sections that explain the process of data collection and analysis for the PTH 101 and PTH 59N Noise Study Traffic Count:

- May 2014 Traffic Count (pre-construction);
- November 2018 and September 2019 Traffic Counts (post-construction);
- October 2020 Traffic Count (post-construction and during Code Orange pandemic restrictions);
- November 2020 Traffic Count (post-construction and during Code Red pandemic restrictions during the time of the 2020 noise monitoring);
- Historical Growth Rates;
- Pandemic Adjustment Factors (for traffic impacts at different restriction levels for the months of October and November 2020); and
- Adjusted Traffic Counts (which apply growth rates and pandemic adjustment factors to determine pandemic adjusted 2020 and projected 2035 traffic volumes).

MAY 2014 TRAFFIC COUNT

MAY 2014 DATA COLLECTION

Traffic counts with the previous geometry were conducted by Manitoba Infrastructure on Thursday May 15, 2014. The count data was processed by Manitoba Highway Traffic Information System (MHTIS) and includes three 14-hour counts that were converted to 24-hour counts using a factor of 1.3. The three counts were conducted for the same 14-hour period at the south intersection, the north intersection and on the eastbound to northbound flyover. **Figure 1** shows the approach volumes for the entire interchange area from each of the three counts. The southbound right movement was not recorded in the traffic counts and for the purposes of this study, was estimated to be equal to the eastbound left volume.

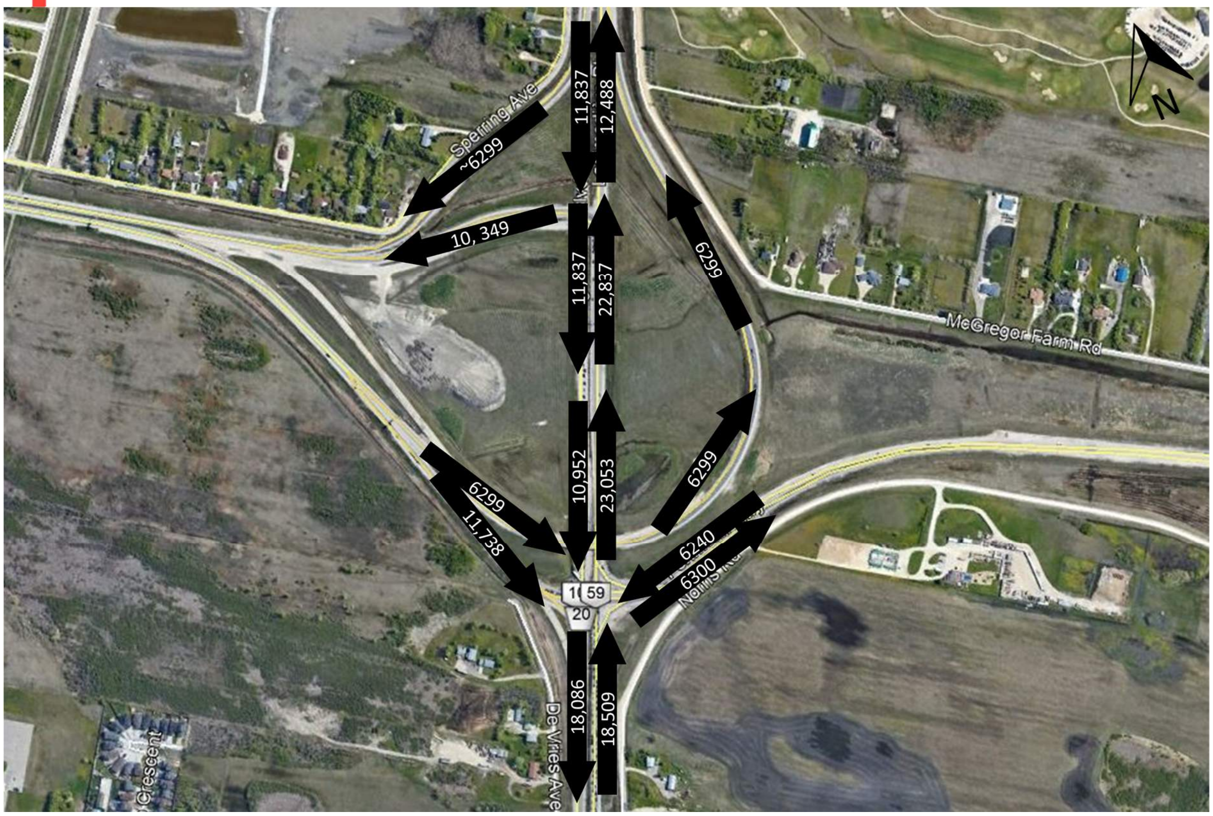


Figure 1: Raw 2014 Approach Traffic Volumes for the South Intersection, North Intersection, and the Flyover

MAY 2014 TRAFFIC COUNT ANALYSIS

The traffic count analysis for the interchange involves the combination of the three separate turning movement counts. The offset of the north and south intersections creates a challenge in determining the westbound through, westbound right, northbound through, and northbound left volumes as they cannot be tracked through the entirety of the intersection (as shown in **Figure 2**). The following formulas were created to reference the four movements with the volumes from the two intersection counts and labeled in **Figure 2**. The formulas are shown below in **Table 1**.

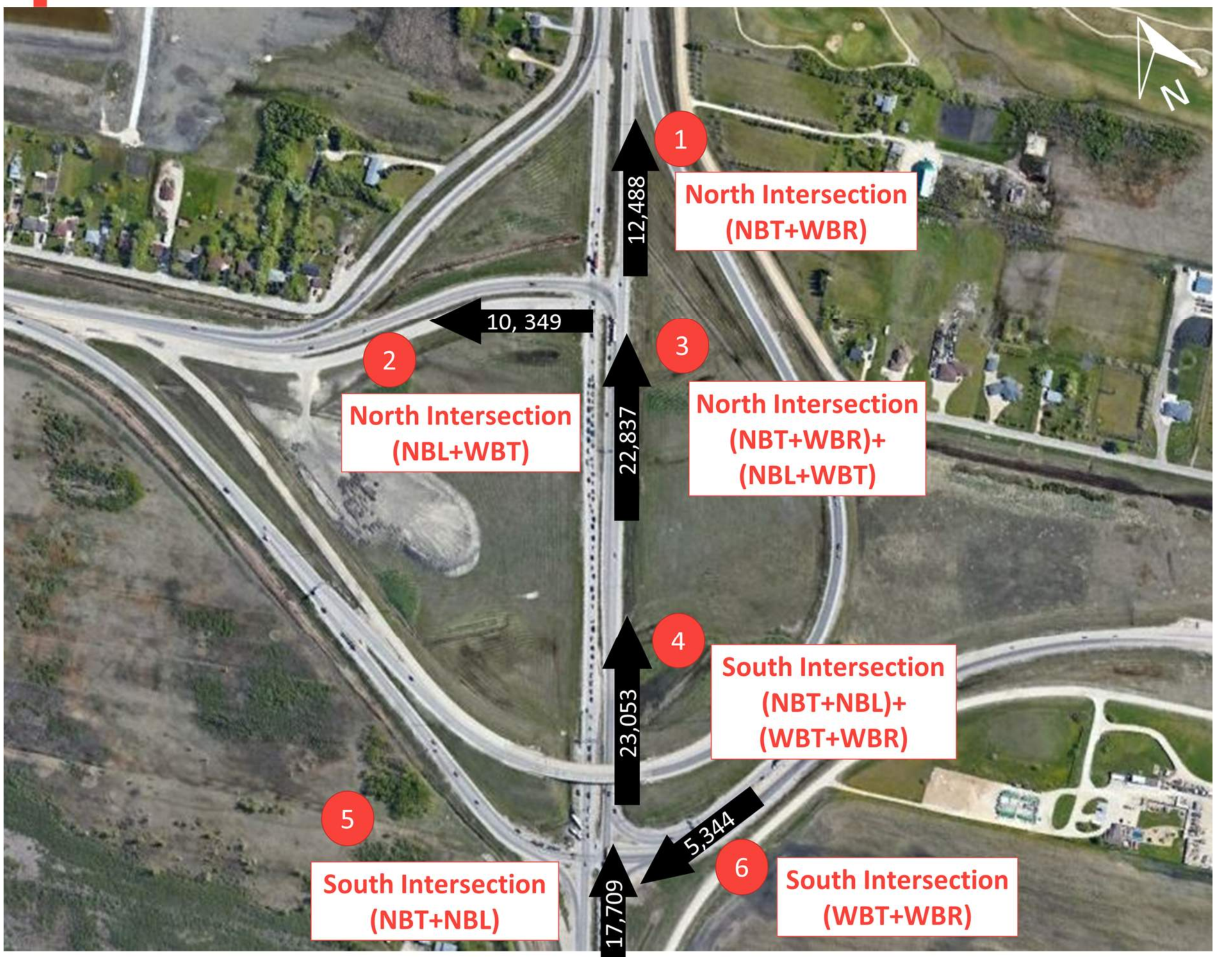


Figure 2: Unknown Proportions of Directional Traffic Volumes for Raw 2014 Traffic Counts

Table 1: Preliminary Equations for the Unknown Proportions for the Raw 2014 Traffic Count

ID	EQUATION	INTERSECTION LOCATION	TRAFFIC VOLUME (ADT)
1	NBT + WBR	NBT at North Intersection	12,488
2	NBL + WBT	NBL at North Intersection	10,349
3	NBT + NBL + WBT + WBR	NBT + NBL at North Intersection	22,837
4	NBT + NBL + WBT + WBR	NBT + WBR at South Intersection	23,053
5	NBT + NBL	NBT at South Intersection	17,709
6	WBT + WBR	WBR at South Intersection	5,344
	NBT + NBL + WBT + WBR	Average of North and South Intersections	22,945

Excel Solver was used to estimate the values of each of the four unknown variables (westbound through, westbound right, northbound through, and northbound left). This was done by equating the formulas to the traffic volumes and optimizing for a difference of zero. Since there are multiple solutions, contraints were set to contain the variables to reasonable values in comparison to their opposing movements. **Table 2** shows the contraints for each movement, the opposing movement volumes, and the output of Average Daily Traffic (ADT) for each variable.

Table 2: Development of Proportional Equations for Directional Traffic Counts in 2014

ID	EQUATION	EQUATION WITH VOLUMES	PROPORTIONAL
1	NBT@North = NBT + WBR	12,488 ≈ 10,828 + 1,660	NBT = 0.86711*NBT@N WBR = 0.13289*NBT@N
2	NBL@North = NBL + WBT	10,349 ≈ 6,773 +3,684	NBL = 0.65441*NBL@N WBT = 0.35602*NBL@N
3	NBT@South = NBT + NBL	17,709 ≈ 10,828 + 6,733	NBT = 0.61147*NBT@S NBL = 0.38243*NBT@S
4	WBR@South = WBT + WBR	5,344 ≈ 3,684 + 1,660	WBT = 0.68946*WBR@S WBR = 0.31054* WBR@S

Since there are two formulas to calculate each of the four variables, an average of the two is used to calculate the movements. **Table 3** shows the equation to use for each of the four variables than can be applied to each 15-min bin and/or vehicle type. **Figure 3** shows the combined 24-hour traffic volumes from the three 2014 traffic counts.

Table 3: Final Equations for the Unknown Directional Movements for the Raw 2014 Traffic Counts

VARIABLE	EQUATION
NBT	= AVERAGE(0.86711*NBT@N, 0.61147*NBT@S)
NBL	= AVERAGE(0.65441*NBL@N, 0.38243*NBT@S)
WBT	= AVERAGE(0.35602*NBL@N, 0.68946*WBR@S)
WBR	= AVERAGE(0.13289*NBT@N, 0.31054*NBT@S)

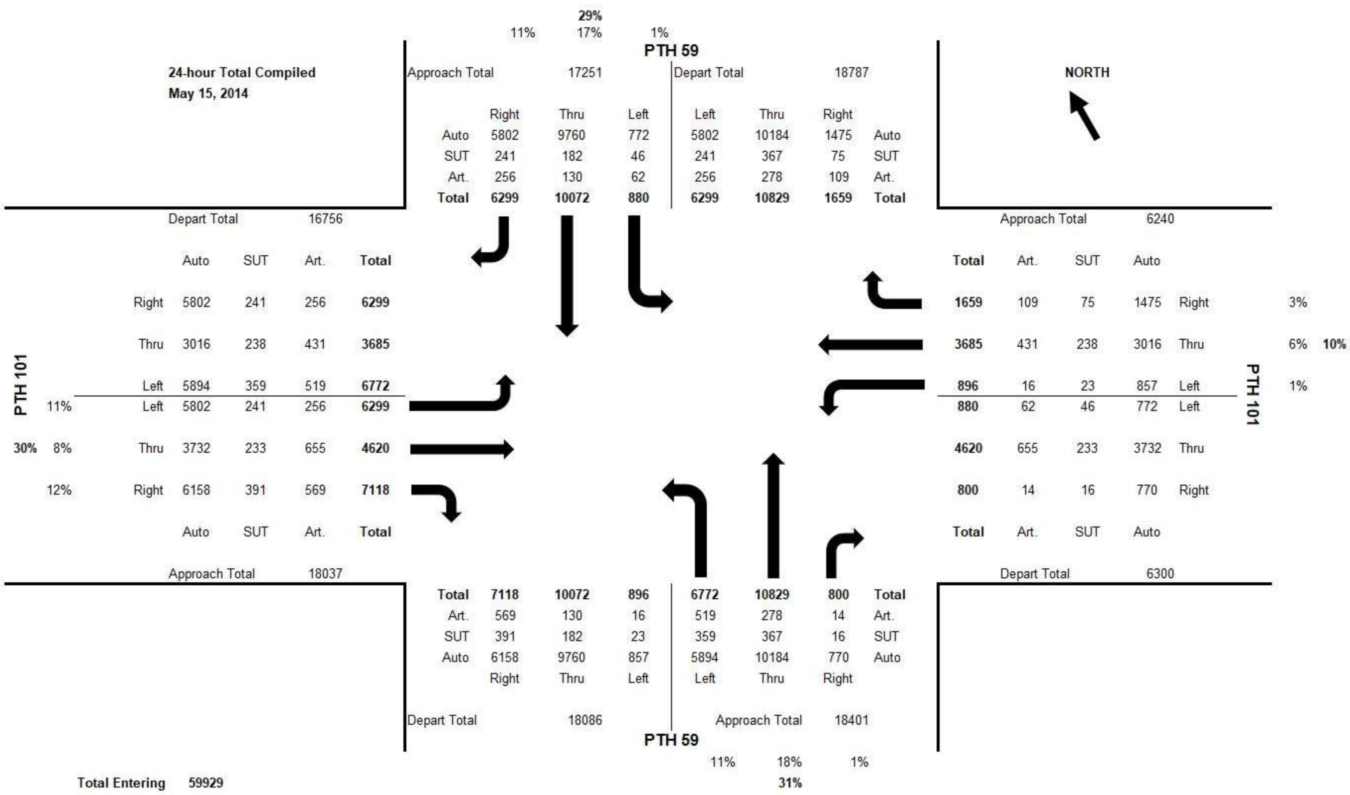


Figure 3: Combined May 2014 Traffic Count Diagram (24-hours)

NOVEMBER 2018 AND SEPTEMBER 2019 TRAFFIC COUNTS

There are two turning movement counts (TMCs) available at sites near PTH 101 and PTH 59N conducted in 2018 and 2019. The first is a 14-hour count at PTH 59N and PR 202 (north of the interchange) conducted on Thursday, November 29, 2018. The second is a 14-hour count at PTH 101 at Wenzel Road (east of interchange) conducted on Thursday, September 17, 2019. Both 14-hour counts were converted to 24-hour counts using a factor of 1.3. The November 2018 count at PTH 59N and PR 202 determined the 24-hour southbound departing volume to be 13,694 vehicles. This value is less than the May 2014 southbound volume and similar to the October 2020 southbound volume. The September 2019 count at PTH 101 and Wenzel Street determined the 24-hour westbound departing volume to be 10,001 vehicles. This volume is almost double the May 2014 and October 2020 westbound approach volumes. The September 2019 traffic count was excluded for this analysis as it is suspected that construction in the area at the time may have resulted in higher volumes through the intersection, including higher heavy truck volumes.

OCTOBER 2020 TRAFFIC COUNT

OCTOBER 2020 DATA COLLECTION

Figure 4 shows the position of seven cameras to collect all traffic movements for 24-hours each. Camera 5 was deployed starting on Tuesday, October 27 at 3:00 p.m.; Cameras 1, 2, 4, and 7 were deployed starting on Tuesday, October 27 at 4:00 p.m.; Camera 3 was deployed starting on Wednesday, October 28 at 5:00 p.m.; and Camera 6 was deployed from Wednesday, October 28 at 7:00 p.m.

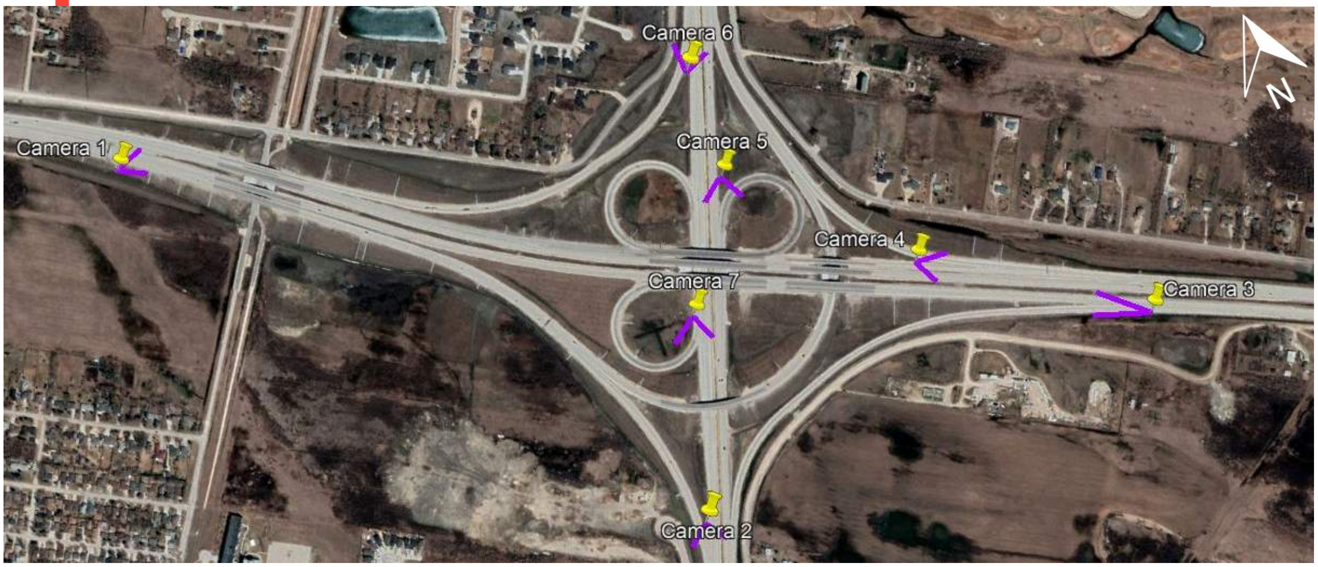


Figure 4: Miovision Camera Locations for the October 2020 Traffic Count

OCTOBER 2020 TRAFFIC COUNT ANALYSIS

Table 4 shows how each of the 12 movements is determined using the seven camera counts. **Figure 5** shows the total daily counts in October 2020. The red arrows indicate the raw values from the Miovision cameras and the black arrows indicate calculated volumes. There is a single discrepancy between the EBT movement calculated using counts from Camera 1 (EBT) and Camera 6 (SBL) and the raw value at Camera 3 (EBT+SBL). This is likely due to variance in day-to-day traffic as the two counts were conducted on different days. **Figure 6** shows the simplified traffic count diagram. The total entering vehicles is less in 2020 than it was in the 2014 study (47,406 vehicles in October 2020 compared to 59,929 in May 2014). This may be due to seasonal changes as well as a pandemic restricting business and travel within Manitoba.

Table 4: Calculations for Each Movement for the 2020 Traffic Count

	MOVEMENT		
	Right	**Thru**	**Left**
PTH 59 Southbound	Camera 6 SBR	Camera 6 SBTL minus Camera 7 SBL*	Camera 6 SBL**
PTH 101 Westbound	Camera 4 WBR	Camera 4 WBT	Camera 4 WBL
PTH 59 Northbound	Camera 3 NBR	Camera 5 NBT	Camera 5 NBL
PTH 101 Eastbound	Camera 2 EBR	Camera 3 (EBT+SBL) minus Camera 7 SBL***	Camera 1 EBLR minus Camera 2 EBR

* There seemed to be an error with the Camera 7 SBT movement (AADT 466) so a calculation using Camera 6 and Camera 7 volumes (AADT 8412) was used.
** The SBL volume was more conservative at Camera 6 (AADT 1179) than Camera 7 (AADT 1004)
*** The EBT volume was more conservative calculating Camera 3 and Camera 7 volumes (AADT 6260) than the Camera 1 volume (AADT 5564)

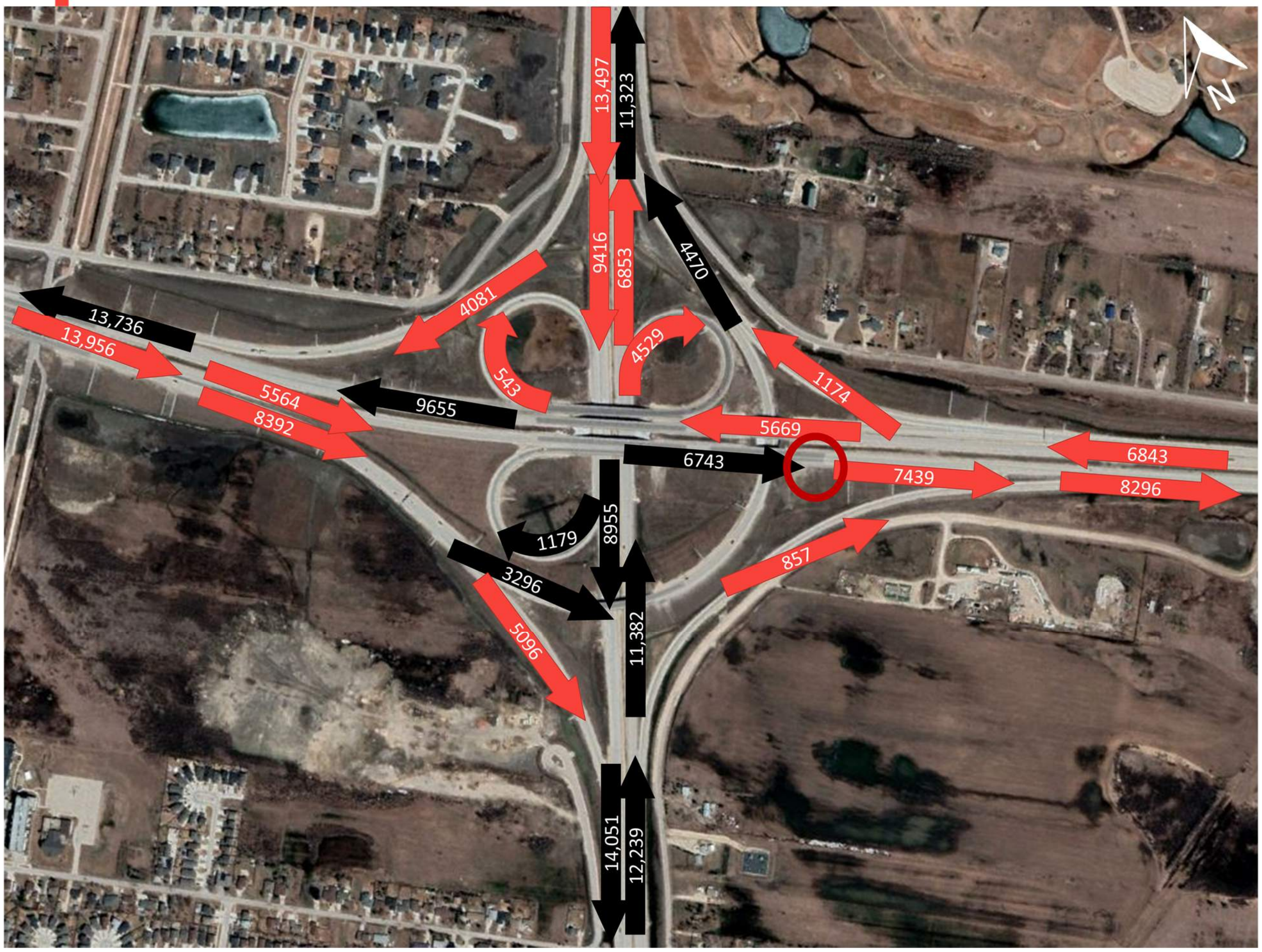


Figure 5: Raw and Calculated Ramp Volumes October 2020

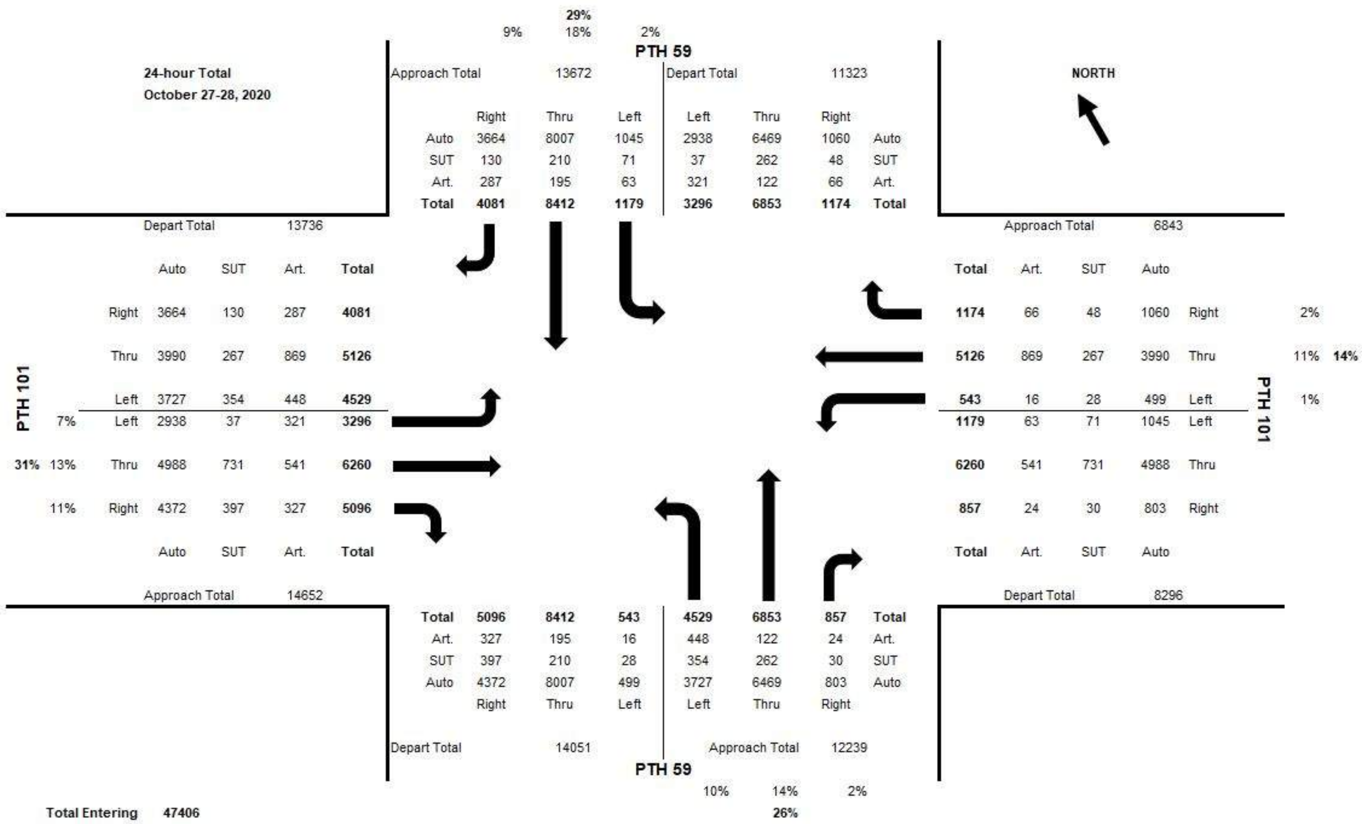


Figure 6: October 2020 Traffic Count Diagram

NOVEMBER 2020 TRAFFIC COUNT

NOVEMBER 2020 DATA COLLECTION

Between the October 2020 Traffic Count and the November 2020 Noise Study, additional pandemic response restrictions were put in place by the Province. The October restrictions allowed for some businesses to be open and limited social gatherings. The November restrictions increased such that only essential businesses could be open and social gatherings between households were prohibited. To account for the potential reduction in traffic between October 2020 to November 2020 when the field noise studies were being completed, a supplementary count was conducted using two cameras to develop a factor to apply to the October 2020 volumes to estimate volumes during the noise monitoring period. **Figure 7** shows the location of the two Miovision cameras to capture the approach/depart volumes for the south and west legs of the interchange.

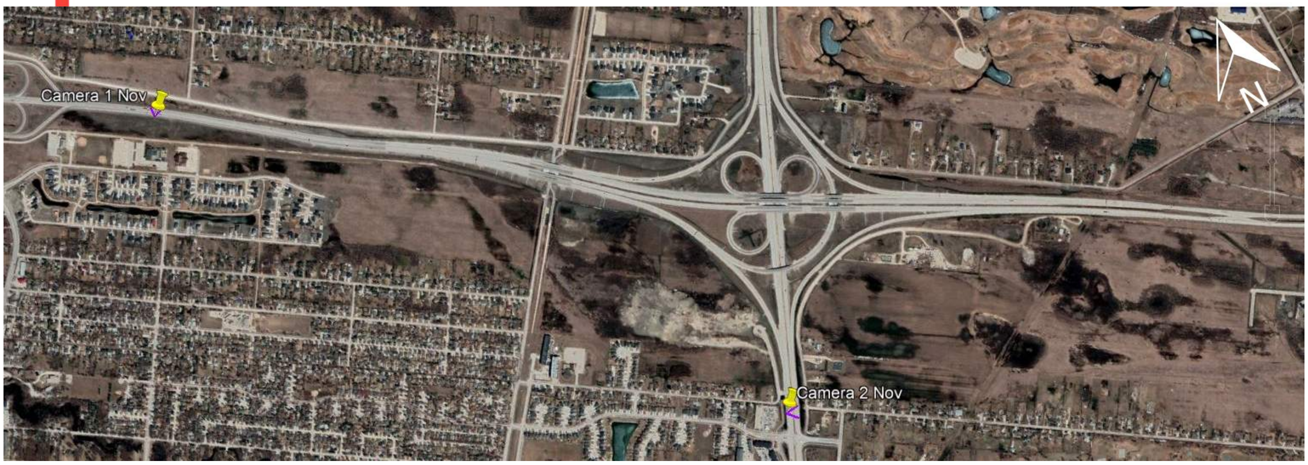


Figure 7: Miovision Camera Locations for the November 2020 Traffic Count

NOVEMBER 2020 TRAFFIC COUNT ANALYSIS

The November 2020 count provided the vehicle type for the total approach and total departing traffic on the west leg and on the south leg of the intersection. The raw 24-hour volumes for each approach and vehicle type are highlighted in blue. The through movements were calculated by using the directional proportions for each vehicle type volume from the October 2020 count. For example, the northbound automobile traffic from the October 2020 count was split 33.8% left turn, 58.8% through, and 7.3% right turn. Therefore, the November 2020 northbound automobile total of 11,131 was estimated to have 6,547 (58.8%) of those automobiles as through movements. Calculating the through movements from the 24-hour counts yielded a traffic count diagram of through movements at the interchange for November 2020 (**Figure 8**).

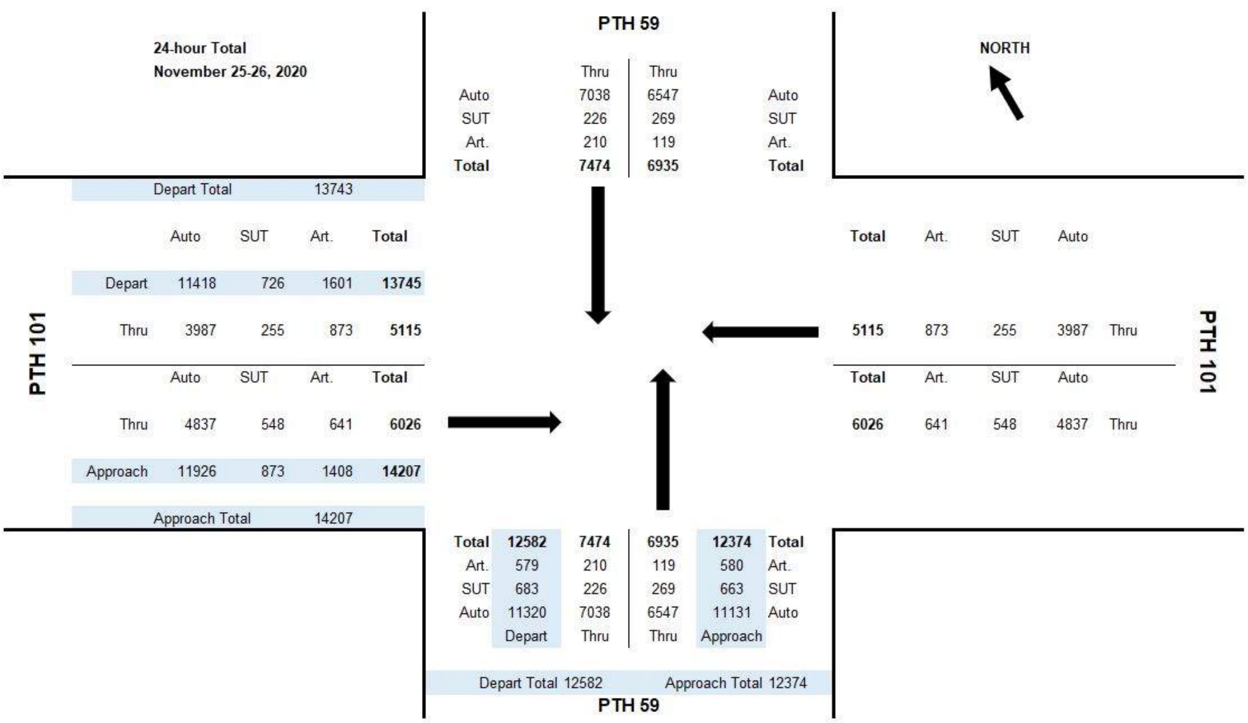


Figure 8: November 2020 Through Traffic at Interchange

HISTORICAL GROWTH RATES

Growth rates were developed for each leg of the intersection using the *Traffic Review of PTH 59N at PR 202* Report (WSP 2019), the City of Winnipeg's historic Traffic Flow Maps, and MHTIS traffic monitoring count stations. The annual growth rates for PTH 59N north leg and PTH 101 east leg were directly sourced from the 2019 report. The growth rate for PTH 59N (south leg) was developed using five years of historic traffic flow maps from the City of Winnipeg. The growth rate for PTH 101 west leg was developed from Permanent Count Station (PCS) No. 20. **Table 5** shows the annual growth rates for each leg of the intersection. All growth rates were discussed and approved by Manitoba Infrastructure. Details for how the PTH 59N south leg and PTH 101 west leg growth rates were determined are provided in this section.

Table 5: Annual Growth Rates for Each Leg of the PTH 59 and PTH 101 Intersection

ROADWAY	ANNUAL GROWTH RATE	SOURCE
PTH 59N North Leg	1.5%	Traffic Review of PTH 59N and PR 202 Report (WSP, 2019)
PTH 101 East Leg	2.0%	Traffic Review of PTH 59N and PR 202 Report (WSP, 2019)
PTH 59N South Leg	1.5%	City of Winnipeg Traffic Flow Maps of Lagimodiere Blvd
PTH 101 West Leg	2.0%	MHTIS Permanent Count Station 20

Table 6 shows the combined average daily traffic on Lagimodiere Boulevard (PTH 59N south leg) south of PTH 101 for the five years traffic flow maps are available. The per year compound annual average growth rate was calculated for each year of data to the most recent count (2018). Two years showed approximately 0% growth and the other two years showed approximately 1.5% growth. A conservative approach was taken to average the two years with growth for a PTH 59N south leg annual growth rate of 1.5%.

Table 6: PTH 59N South Leg City of Winnipeg Traffic Flow Map Volumes and Annual Growth Rate Calculations

YEAR	COMBINED DIRECTION AVERAGE DAILY TRAFFIC	ANNUAL PER YEAR GROWTH RATE 20XX TO 2018
2007	32500	0.46%
2009	30200	1.39%
2012	31100	1.60%
2015	34200	0.00%
2018	34200	
2007 to 2018 Average:	0.86%	
2009 to 2015 Average:	1.49%	
Rounded:	**1.50%**	

Figure 9 shows the Coverage Counts Stations (CCSs) and Permanent Count Stations (PCSs) within the study area. The CCSs were only conducted up to 2014 and have no data between 2014 to 2020 due to construction activities. Therefore, the PCS Station No. 20 was used to determine the annual growth rate for PTH 101 west leg. Station No. 20 is located west of PTH 9 and PR 204 so there may be errors associated with the location of the station with respect to the interchange.

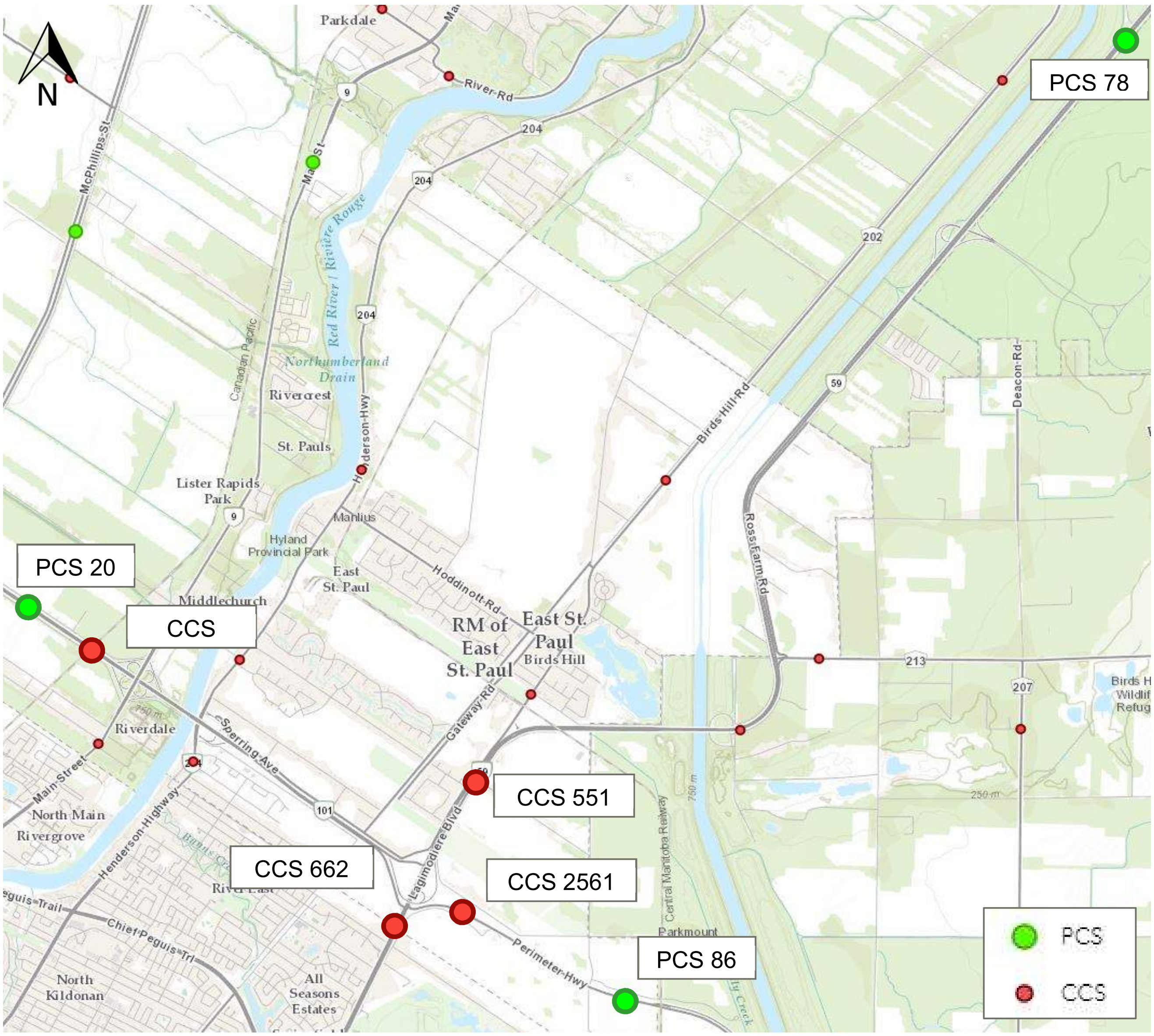


Figure 9: MHTIS Permanent and Coverage Count Station Locations

Table 7 shows the directional average daily traffic on PTH 101 west of the interchange for the past decade. The per year compound annual average growth rate was calculated for each year of data to the most recent count (2018/2019). A balanced approach was used for the eastbound volumes as the 2019 count seemed to be an anomaly as described above and the volumes may not be representative of the volumes at PTH 101 and PTH 59N as the count station is west of PTH 9 which likely has different traffic patterns. Manitoba Infrastructure was consulted, and it was agreed that 2.0% growth on PTH 101 west leg was reasonable given the long-term projection to 2035, the location of the Station, Station No. 20 volumes and the PTH 101 east leg growth rate.

Table 7: PTH 101 Permanent Count Station 20 Volumes and Annual Growth Rate Calculations

YEAR	EASTBOUND (EB) VOLUME	WESTBOUND (WB) VOLUME	EB COMPOUND ANNUAL PER YEAR GROWTH RATE 20XX TO 2019	EB COMPOUND ANNUAL PER YEAR GROWTH RATE 20XX TO 2017*	WB COMPOUND ANNUAL PER YEAR GROWTH RATE 20XX TO 2018
2010	No Data	No Data	No Data	No Data	No Data
2011	12270	11980	2.31%	1.59%	1.28%
2012	12230	11690	2.69%	1.98%	1.92%
2013	12360	11880	2.97%	2.21%	1.97%
2014	12800	12180	2.85%	1.77%	1.84%
2015	13410	No Data	2.37%	0.30%	No Data
2016	12800	12430	4.79%	5.39%	2.66%
2017	13490	12970	4.49%		1.00%
2018	13350	13100	10.34%		
2019	14730	No Data			
Average Growth Rates			4.10%	2.21%	1.78%
Rates Used in Calculation			**Eastbound: 2.0 %****		**Westbound: 2.0%**

*The 2019 eastbound count seemed to be unusually high and therefore created an unrealistic average growth rate. Instead, an average of annual growth for each year to the 2017 volume was used to achieve an average of 2.2%. The annual growth calculations did not use the 2018 count as the eastbound direction had less traffic than the previous year.
**A growth rate of 2.0% was selected as it was more reasonable for projected growth to 2035. This aligns with the westbound growth and the growth at PTH 101 East. The higher than expected growth at Station 20 may be due to its location being west of PTH 9.

PANDEMIC ADJUSTMENT FACTORS

PERMANENT COUNT STATION ADJUSTMENT FACTORS

Daily traffic volumes were obtained for PCS Stations No. 78, No. 86 and No. 20 to determine the effects of the pandemic restrictions throughout October and November 2020 and how that compared to the October and November 2019 counts. To achieve an average weekday traffic volume for each period, weekends, holidays, and weeks that included a mid-week holiday were excluded from the average. **Table 8** shows the average daily traffic for each direction at each station for October 2019 and November 2019 (pre-pandemic), the directional growth rates from the previous section, the projected October 2020 and November 2020 volumes using the growth rates, and the average daily traffic volumes for the four different pandemic response scenarios in 2020.

Table 8: Permanent Count Station Average Weekday Volumes During Different Pandemic Restriction Scenarios

COUNT DATES	PANDEMIC RESPONSE	STATION 78 (PTH 59 NORTH)		STATION 86 (PTH 101 EAST)		STATION 20 (PTH 101 WEST)	
		NB*	SB*	WB*	EB	WB	EB*
Weekday Oct 2019	Pre-pandemic	6,133	6,143	6,983	7,783	15,326	18,734
Weekday Nov 2019	Pre-pandemic	5,751	5,682	6,610	7,262	14,700	17,739
Pre-pandemic Growth Rates		1.50%	1.50%	2.00%	2.00%	2.00%	2.00%
Weekday Oct 2019 grown to Oct 2020	Pre-pandemic	6,225	6,235	7,123	7,939	15,633	19,203
Weekday Nov 2019 grown to Nov 2020	Pre-pandemic	5,838	5,768	6,743	7,408	14,995	18,183
Weekday Oct 2020	WMR Orange	5,576	5,531	6,587	6,843	15,436	16,211
Weekday Nov 2-11, 2020	WMR Red	5,722	5,578	6,828	7,166	15,485	16,304
Weekday Nov 12-19, 2020	MB Red	4,654	4,698	6,114	6,224	13,897	14,616
Weekday Nov 20-30, 2020	MB Red + Restrictions	5,153	4,401	5,626	5,666	12,871	13,521

* These directions are highlighted as they are the directions used to develop factors and traffic into the interchange. The Station 86 Eastbound and Station 20 Westbound volumes were analyzed to ensure consistency in the traffic fluctuations related to restrictions and time of year.
WMR – Winnipeg Metropolitan Region
MB - Manitoba

The volumes in **Table 8** were used to create directional factors in **Table 9**. There are four application factors developed related to seasonal and pandemic changes in traffic. The calculation and use for each factor are described below.

- The October 2019 to November 2019 Factor is calculated by dividing the November 2019 volumes by the October 2019 volumes. This factor represents the non-pandemic seasonal traffic changes from October to November in 2019;
- The October 2020 to November 2020 Factor is calculated by dividing the November 2020 volumes by the October 2020 volumes. This factor represents the pandemic and seasonal traffic changes from October to November in 2020;
- The October 2020 Pandemic (Code Orange) to October 2020 Non-Pandemic Factor is calculated by dividing the "October 2019 grown to October 2020" volume by the October 2020 volume during Code Orange restrictions. This factor represents the change from a projected or hypothetical, non-pandemic October 2020 to the pandemic Code Orange restrictions in October 2020.
- The November 2020 Pandemic (Code Red + Restrictions) to November 2020 Non-Pandemic Factor is calculated by dividing the "November 2019 grown to November 2020" volume by the November 2020 volume during Code Red plus additional restrictions between November 20-30, 2020. This factor represents the change from a projected or hypothetical, non-pandemic November 2020 to the pandemic Code Red plus additional restrictions from late November 2020.

Table 9: PCS Pandemic Traffic Adjustment Factors Near the PTH 101 and PTH 59N Interchange

DIRECTIONAL FACTORS	STATION 78 (PTH 59 NORTH)		STATION 86 (PTH 101 EAST)		STATION 20 (PTH 101 WEST)	
	NB*	SB*	WB*	EB	WB	EB*
October 2019 to November 2019 Factor	0.94	0.93	0.95	0.93	0.96	0.95
October 2020 to November 2020	0.92	0.80	0.85	0.83	0.83	0.83
October 2020 Pandemic (Code Orange) to October 2020 Non-Pandemic	1.12	1.13	1.08	1.16	1.01	1.18
November 2020 Pandemic (Code Red + Restrictions) to November 2020 Non-Pandemic	1.13	1.31	1.20	1.31	1.17	1.34
* These directions are highlighted as they are the directions used to develop factors and traffic into the interchange. The Station 86 Eastbound and Station 20 Westbound volumes were analyzed to ensure consistency in the traffic fluctuations related to restrictions and time of year.						

SUPPLEMENTARY MIOVISION ADJUSTMENTS

The November 2020 supplementary count can also be used to determine the effect of added pandemic restrictions on the through movements. **Table 10** shows the percent change from October 2020 to November 2020 for the approach/depart volumes at the south leg and west leg. The departing volume on the south leg shows a 10.5% decrease, however the other volumes show less than 4% change.

Table 10: Miovision Percent Change in Volume from October 2020 to November 2020 (Approach/Depart Volumes South and West Legs)

	SOUTH LEG DEPART	SOUTH LEG APPROACH	WEST LEG DEPART	WEST LEG APPROACH
Percent Change Oct to Nov 2020	-10.5%	+1.1%	-0.26%	-3.04%

Table 11 shows the percent change from the October 2020 to November 2020 through movements for each direction. The through movements were calculated using methods described in the November 2020 analysis section. The southbound through movement shows a 11.2% decrease, however the other volumes show less than 4% change.

Table 11: Miovision Percent Change in Volume from October 2020 to November 2020 (Through Movements)

	SOUTHBOUND THRU	WESTBOUND THRU	NORTHBOUND THRU	EASTBOUND THRU
Percent Change Oct to Nov 2020	-11.2%	-0.2%	+1.2%	-3.7%

SELECTED ADJUSTMENT FACTORS

The pandemic factors from the Permanent Count Station data in **Table 9** were used in further analysis as they provided a more conservative factor of the pandemic restriction effects. This dataset uses multiple days of data to determine the change in volumes and is therefore more temporally reliable. The results in **Table 10** and **Table 11** may be affected by the temporal variability of conducting single-day counts and the calculations to extrapolate the November 2020 counts to all directions and therefore, were not used in further analysis.

ADJUSTED TRAFFIC COUNTS

ADJUSTED NOVEMBER 2020 PANDEMIC TRAFFIC VOLUMES

To estimate traffic volumes in November 2020 during the noise study, the October 2020 count was adjusted for pandemic restriction impacts and seasonal traffic changes by using the October 2020 to November 2020 adjustment factors from **Table 9**. **Figure 10** shows the result for the estimation of November 2020 turning movement volumes (during pandemic).

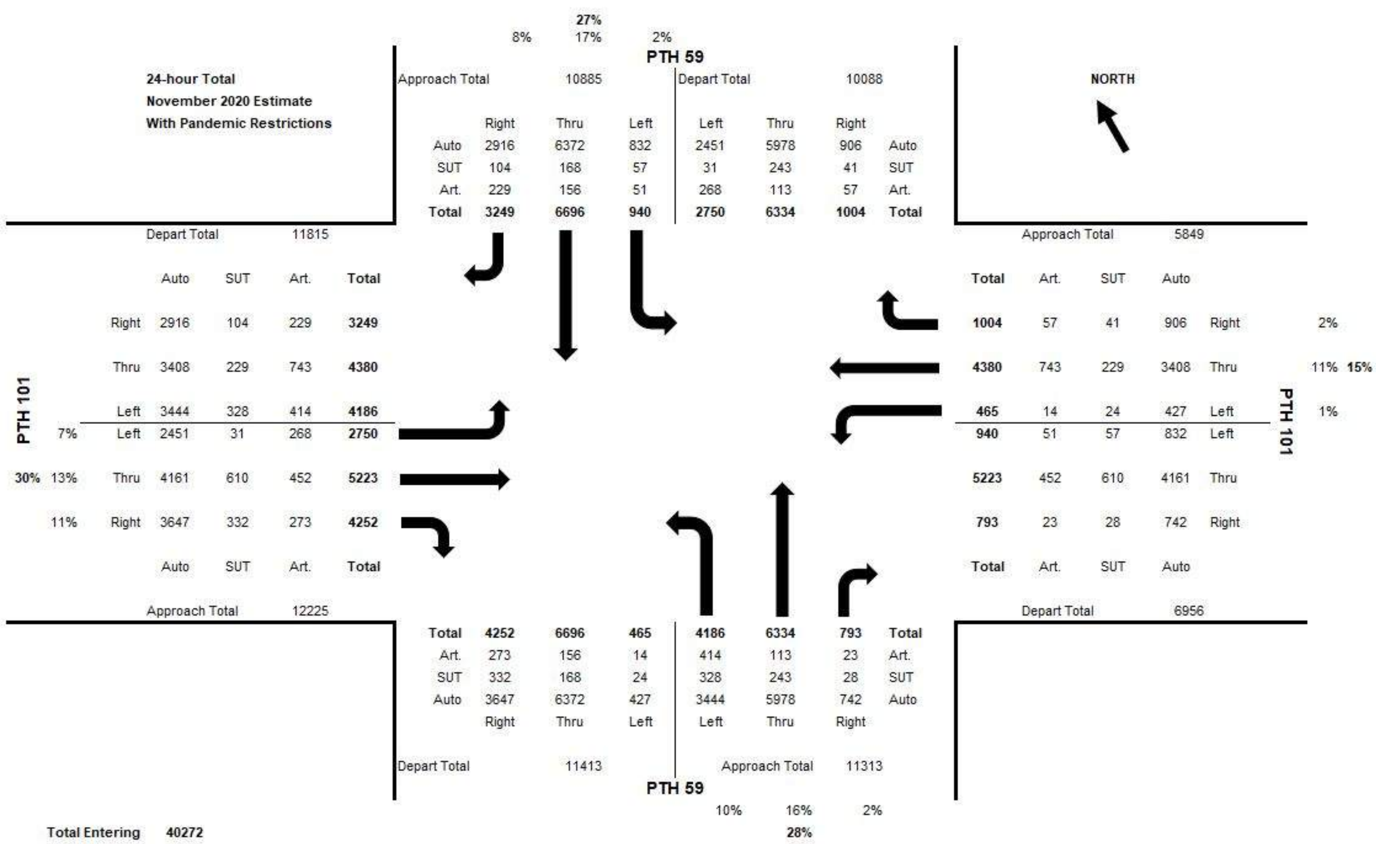


Figure 10: November 2020 Estimated Volumes (During Pandemic)

ADJUSTED NOVEMBER 2020 NO PANDEMIC TRAFFIC VOLUMES

Figure 11 shows the estimated November 2020 traffic volumes under no pandemic restrictions. This was estimated by adjusting the November 2020 pandemic traffic volumes with the November 2020 Pandemic (Code Red + Restrictions) to November 2020 Non-Pandemic factors from **Table 9**. This provides an estimate of November 2020 traffic volumes if there was no pandemic. This could be used if the noise study also adjusted for a decrease in traffic due to the pandemic restrictions and provides a reasonable baseline in comparison to the growth of the November 2035 projection below.

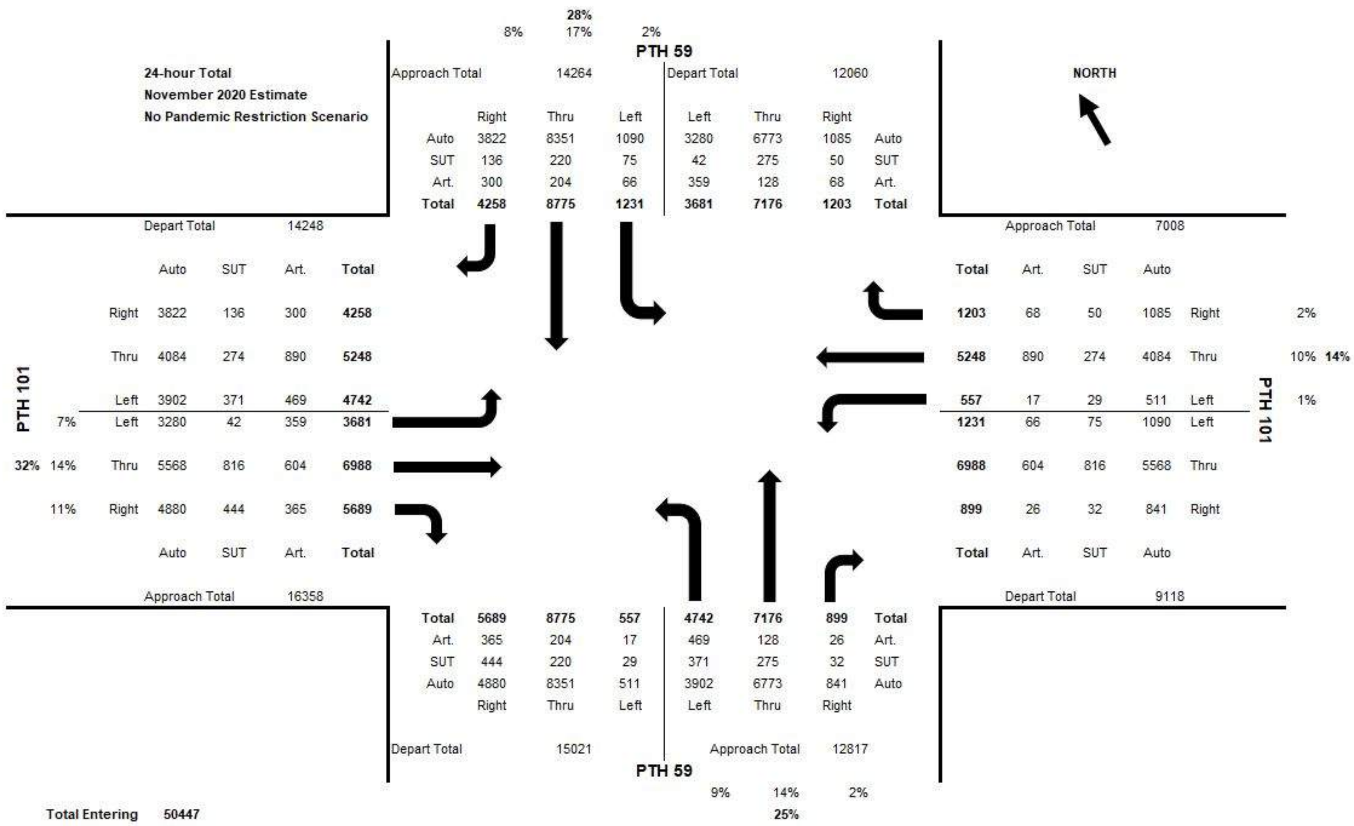


Figure 11: November 2020 Estimated Volumes for Non-Pandemic Conditions

NOVEMBER 2035 PROJECTED VOLUMES (POST-PANDEMIC)

The 2035 projection for no pandemic restrictions is shown in **Figure 12**. These volumes were calculated by applying the growth rates from **Table 5** to the November 2020 No Pandemic traffic volumes from **Figure 11**.

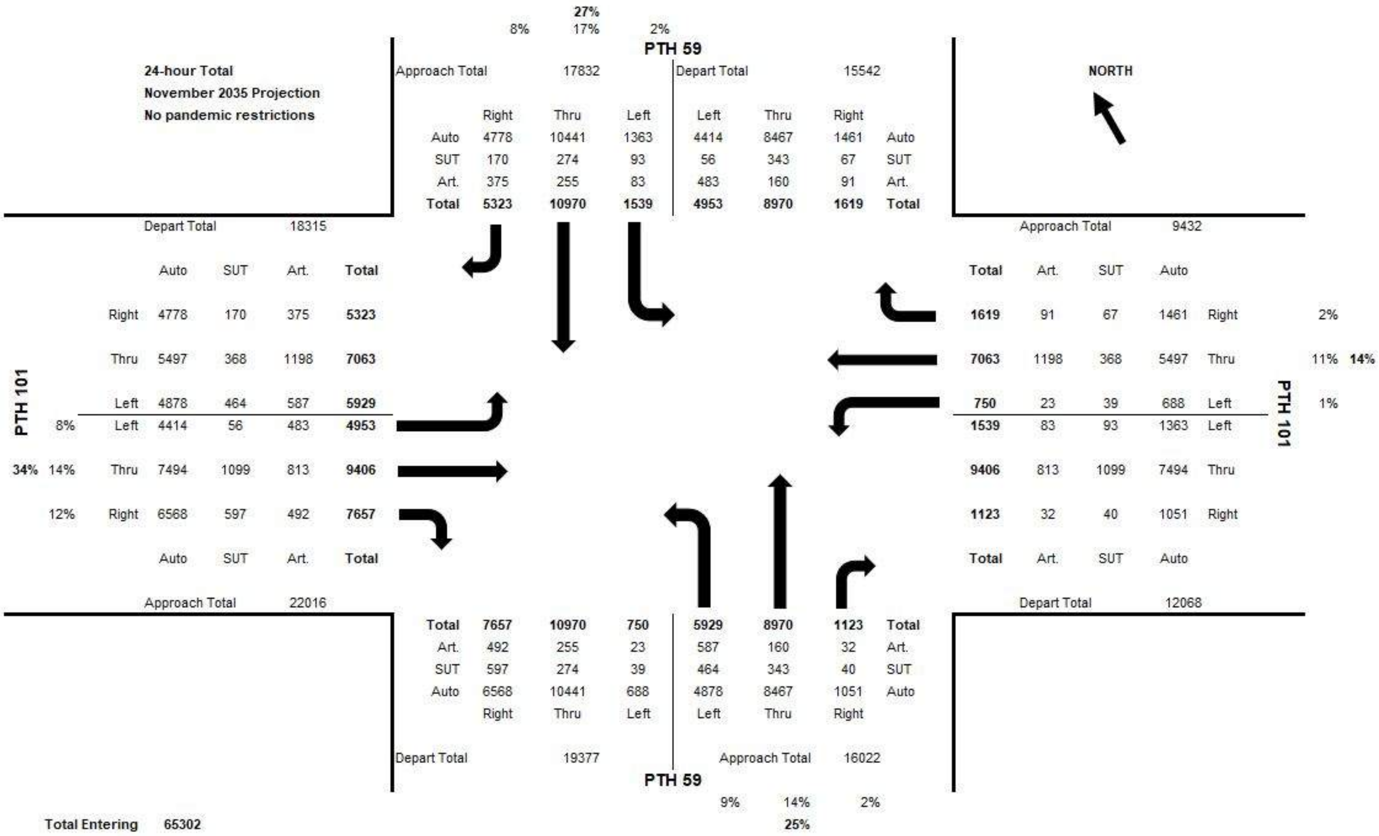


Figure 12: Traffic Count Diagram for Projected November 2035 Volumes Without Pandemic Restrictions

RECOMMENDATIONS AND SUMMARY

The sources of traffic count data include May 2014 pre-construction at PTH 101 and PTH 59N, November 2018 post-construction/pre-pandemic at PTH 59N & PR 202, September 2019 post-construction/pre-pandemic at PTH 101 and Wenzel Street, October 2020 post-construction/code orange pandemic at PTH 101 and PTH 59N, and November 2020 post-construction/code red pandemic at the south and west legs of PTH 101 and PTH 59N. None of the traffic counts allow for a direct comparison to another in terms of the stage of construction or the pandemic restrictions. Therefore, growth rates, pandemic restriction factors, and proportions from the complete turning movement count in October 2020 were used to estimate traffic volumes for various scenarios below. The growth rates were determined using past reports, permanent count station data and City of Winnipeg traffic flow maps. Pandemic restriction adjustment factors were developed using Permanent Count Station data in October 2019, November 2019, October 2020 and November 2020. Each of these scenarios and calculations has its own limitations and associated error in how volumes were estimated. The November 2018 and September 2019 counts were conducted at adjacent intersections and therefore only one direction approach volume could be estimated using the proportions from the October 2020 count. The three scenarios that are most of interest to the noise study include the November 2020 post-construction/code red pandemic restrictions, November 2020 post-construction/ no pandemic restrictions estimate and November 2035 post-construction/post-pandemic traffic projection. **Table 12** shows a summary of these scenarios, the analysis year and the total entering vehicles at PTH 101 and PTH 59N. The 24-hour turning movement diagrams with vehicle type for each of these scenarios are in **Figures 10, 11,** and **12** respectively. The hourly volumes by vehicle type and turning movement will also be provided for each scenario for the noise study.

Table 12: Total Entering Vehicles at PTH 101 and PTH 59N for Different Scenarios and Years

SCENARIO	YEAR	ENTERING VEHICLES
November 2020 Pandemic Adjusted from October 2020 Count	2020	40272
November 2020 No Pandemic Adjusted from October 2020	2020	50447
November 2035 Projection Post-Pandemic from October 2020	2035	65302

APPENDIX

B NOISE POLICY FACT SHEET

Manitoba Infrastructure Traffic Noise Policy and Guidelines

Manitoba Infrastructure (MI) has adopted the City of Winnipeg's "Motor Vehicle Noise Policies and Guidelines" when examining traffic noise adjacent to residential properties. The full document can be viewed here.

Purpose

1. To consider the need for attenuation of sound along Provincial highways when existing facilities are expanded or new facilities are proposed; and
2. To establish guidelines for assessing sound levels to determine when sound attenuation measures are warranted.

Application

- MI's noise policy is applied to highways where the land use within 100 metres of the roadway is residential with a ground level outdoor recreation area.
- The policy is applied to new highways and to modifications to existing highways that result in the travelled lanes moving closer to existing residential lands or there is a significant change in elevation (e.g., addition of an interchange).
- Where new residential development is built adjacent to an existing or proposed highway, the developer is responsible for noise attenuation, as required.

Guidelines

1. When considering mitigation of traffic noise from an adjacent highway, MI uses a threshold of 65 decibel (dBA) Ldn (Day-Night Level) to measure traffic related noise in the outdoor recreation area of residential properties (deemed to be the rear yard).
2. Intruding traffic-related noise must exceed the existing sound level by 5 dBA or more if noise attenuation measures are to be considered, and attenuation measures must reduce sound levels by at least 5 dBA.
3. Considerations for implementing noise attenuation include whether noise mitigation is technically and economically feasible and whether it is broadly supported by affected residents.

Quick Facts

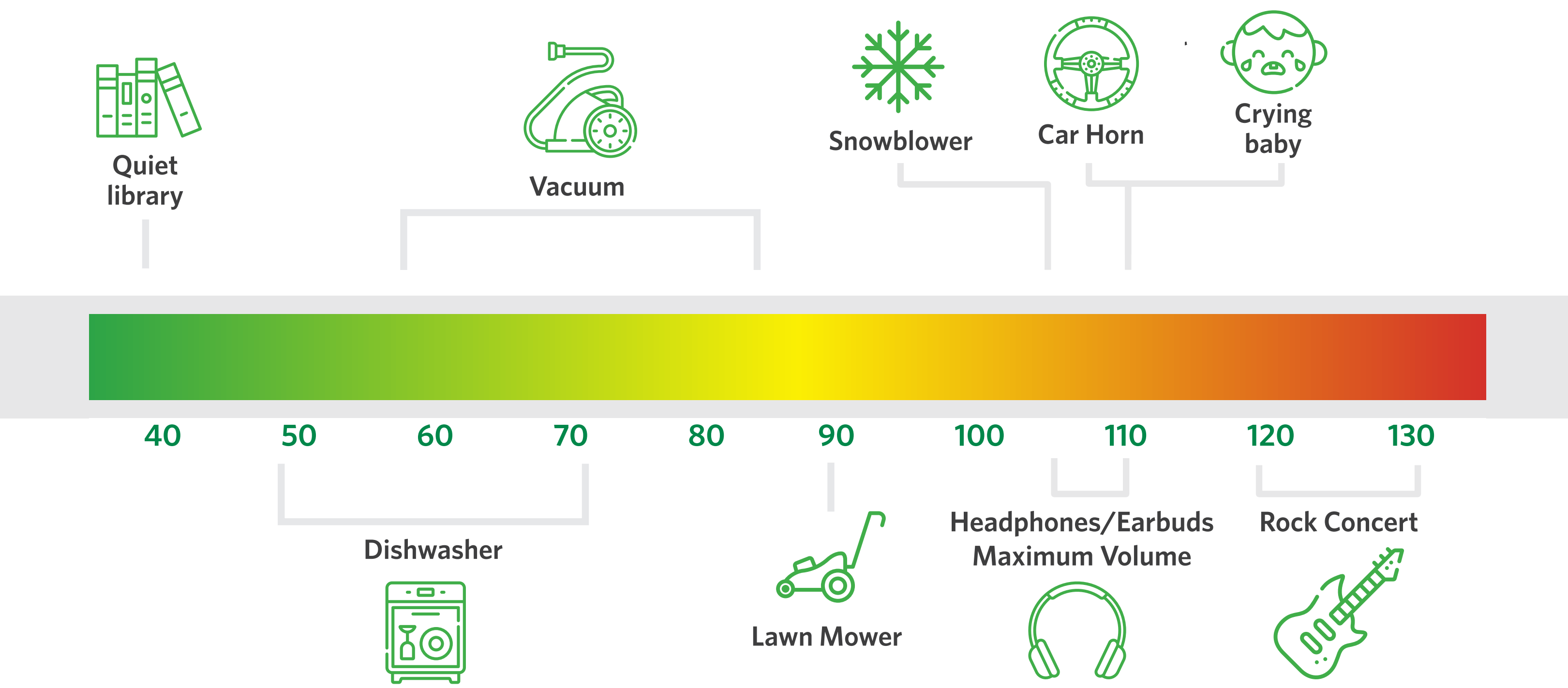
- **Ldn is a 24-hour equivalent sound level** with a 10 dBA penalty applied to sound levels during nighttime hours (11:00 p.m. to 7:00 a.m.) to recognize that nighttime noise is more intrusive than daytime noise levels.
- A change in sound level **less than 3 dBA is considered unnoticeable** by the human ear.
- If intruding noise is less than 5 dBA louder than the background noise, sound attenuation measures will be ineffective at achieving a perceptible reduction in sound level.
- 65 dBA Ldn of traffic noise is a common threshold level for considering noise mitigation in many North American jurisdictions.

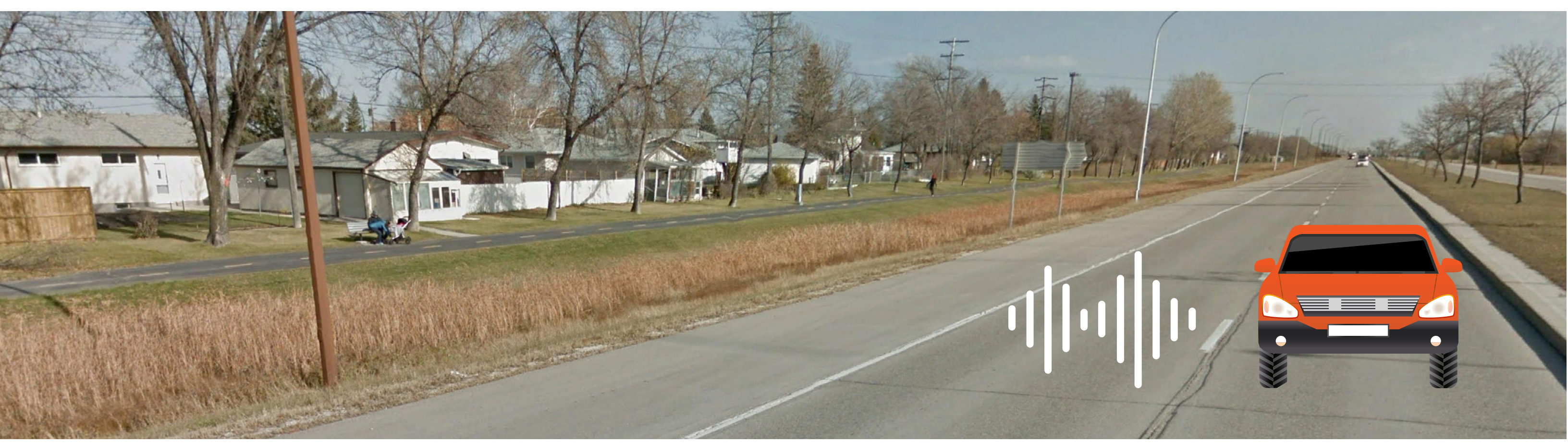
Manitoba

2020 Noise Study at PTH 101 and PTH 59N

- Noise monitoring and sophisticated noise models were developed by experienced noise monitoring professionals to review traffic noise from the PTH 101 and PTH 59N interchange for existing year 2020 and future year 2035
- Although noise monitoring was conducted in 2020 during the COVID-19 pandemic, pandemic adjustment factors were developed to adjust traffic volumes to account for non-pandemic conditions. The 2035 noise forecast modeling was based on non-pandemic conditions.
- Study findings included the following:
  - 65 dBA Ldn noise levels were found close to PTH 101 and PTH 59N roadways in 2020 and slightly farther from PTH 101 and PTH 59N roadways in the 2035 horizon year
  - No residential properties experience 65 dBA Ldn or higher in the outdoor recreation area in 2020 or 2035
  - Noise attenuation measures are not warranted based on the 2035 forecast traffic volumes

Some Common Sound Levels for Comparison





Manitoba