REPORT

VANCOUVER ISLAND MOTORSPORT CIRCUIT

DUNCAN, BC

RESPONSE TO NAVCON "NOISE STUDY PEER REVIEW"
RWDI # 1803556
September 16, 2019

SUBMITTED TO

Lorenzo G. Oss-Cech
c/o Vancouver Island Motorsport Circuit
4063 Cowichan Valley Highway
Duncan, BC V9L 6K4
lgo@hom-law.com

SUBMITTED BY

Andrew Williamson
Acoustical Specialist
andrew.williamson@rwdi.com

RWDI AIR Inc.
Consulting Engineers & Scientists
301-2250 Oak Bay Avenue,
Victoria, BC V8R 1G5
T: 250.370.9302

TABLE OF CONTENTS

VERSION HISTORY

Index	Date	Pages	Author
1	2019/09/16	All	Andrew Williamson, P.Eng.

REPORT SIGNATURES

Andrew Williamson, P.Eng.

1 INTRODUCTION

As requested, this report provides RWDI's responses to the comments submitted by NAVCON Engineering Network (Navcon) in their May 7, 2018 document "Navcon project no. 173729b [Rev B], Municipality of North Cowichan Vancouver Island Motorsport Circuit (VIMC) Noise Studies Peer Review". Responses are provided only for the section of the document which relates to the RWDI/Wakefield (RWDI) report. Before replying to the Navcon report on a response-by-response basis, two of the primary issues that Navcon raised several times in their report are addressed.

2 PRIMARY ISSUES

2.1 Level of Activity at the VIMC

Several of Navcon's comments relate to their concern that on the day of RWDI/Wakefield Acoustics' measurements, the VIMC was not operating in a manner consistent with a "Busy Member Day". This is not our understanding. Chris Erb, the contractor who built the track and who was present on the measurement day, provided the following information regarding the operational conditions:

- It was a day that was double as busy as any member day now or in the past 18 months. We rarely have 12 cars at the same time on the circuit and went to the maximum.
- The 12 vehicles included the following:
    - 2 Alfa Romeo 4C
    - 3 Porsche Cayman
    - 1 AMG GTS
    - 1 AMG C63
    - 1 BMW M3
    - 1 BMW 240i
    - 3 Subaru WRX

As such, it is our understanding that the noise measurements were carried out while the VIMC was operating under conditions that would be expected to produce noise levels equal or greater to those produced during a typical event day.

2.2 Use of the 5-minute Equivalent Sound Level (L_{eq})

The Cowichan Valley Regional District (CVRD) Noise Bylaw does not have a timeframe associated with the sound level limits. RWDI used professional judgement in selecting the 5-min time-period over which the L_{eq} were assessed. The City of Victoria Noise Bylaw recommends using a 5-min L_{eq} for sounds such those emitted by the VIMC that "fluctuate in level or character in a repeatable fashion over periods of from three seconds to one minute…". The timeframe was also chosen such that it would include more than one vehicle lap while still being of short enough duration to show variations in VIMC noise output. While the Navcon report criticizes the 5-min RWDI timeframes, it does not provide any valid rationale for this criticism nor does it suggest an alternative timeframe.

While the CVRD bylaw does not have a timeframe associated with the sound level limits although it defines continuous sound as follows:

> "**Continuous Sound**" means any noise or noises, other than Construction Noise, continuing for a period, or periods, totalling 3 minutes or more in any 15 minute period;

Our opinion is that this definition would suggest using a 15-minute L_{eq} for comparison with the bylaw limit. A more conservative interpretation would be to employ a 3-min L_{eq} as shorter averaging times tend to result in higher L_{eq} when measuring quasi-continuous noise such as that produced by VIMC events. Using either of these averaging times, however, would have resulted in the same conclusions regarding the relative lack of influence of VIMC noise on average community noise levels. The data was re-analyzed using both 3-minute and 15-minute L_{eq}. Table 1 and Table 2 present the results of this analysis.

Table 1: 15-min. L_{eq} at Residential Sites

Assessment Site	Location	Range of L_{eq}(15-min.) (dBA)		Average L_{eq}(15-min.) (dBA)	
		Aug. 2016 (Track Day)	Sept. 2016 (non-Track Day)	Aug. 2016 (Track Day)	Sept. 2016 (non-Track Tay)
3	Mina Dr.	48-50	47-52	49	49
4	Sahtlam Rd.	38-49	41-51	43	44

Table 2: 3-min. L_{eq} at Residential Sites

Assessment Site	Location	Range of L_{eq}(3-min.) (dBA)		Average L_{eq}(3-min.) (dBA)	
		Aug. 2016 (Track Day)	Sept. 2016 (non-Track Day)	Aug. 2016 (Track Day)	Sept. 2016 (non-Track Tay)
3	Mina Dr.	46-53	44-55	49	49
4	Sahtlam Rd.	34-53	34-55	42	43

Tables 1 and **2** shows that an analysis using 3-minute and 15-minute L_{eq} arrived at the same results as an analysis using 3-min L_{eq}. Namely, that VIMC noise had little to no influence on the L_{eq} at the two residential monitoring sites.

3 NAVCON COMMENTS AND RWDI RESPONSES

3.1 Navcon Comment #1

► Only one Wakefield engineer was present during each noise survey which can be problematic in regard to documenting and understanding what was going on at the track and the residential noise monitoring locations. Wakefield provided Navcon with their field notes from the 28-Aug-2016 Track Day survey but the notes were for the most part illegible. Navcon discussed the field notes with the Wakefield engineer who created the notes and he was also unable to read them. Wakefield was not able to provide their field notes from the Non-Track Day survey and said that the project folder had been lost or misplaced.

RWDI Response:

- The focus of the assessment was the noise levels that were being experienced at the residences during a typical VIMC event. Consequently, what was specifically occurring at the track during the measurements was of secondary importance provided that VIMC Operation was typical of a "Busy Member Day. By having a sound level meter (SLM) setup trackside, and a SLM gathering noise and audio data at one of the residences, a single engineer was able to conduct the field work and gather sufficient data for the noise assessment.

3.2 Navcon Comment #2

► Wakefield did not document the vehicle makes (e.g., Porsche, Audi, BMW, etc.), the vehicle models (e.g., GT3, Boxster, R8, M4, etc.), the number of cars on the track during each driving session, the start and stop time for each driving session or the type of track operation (e.g., Circuit Taxi Experience, Driving Experience, Member Track Day or Busy Member Track Day). However, the Wakefield engineer who conducted the noise surveys said that to the best of his recollection, Porsche was conducting a "sales event" with potential customers during the Track Day survey. He also added that there was an autocross course setup in the VIMC parking lot and that the customers were switching between the VIMC track and autocross track throughout the Track Day survey. We do not know whether it is common practice for VIMC to run autocrosses in their parking lot during Track Day events.

RWDI Response:

- Documenting the information referenced above was considered unnecessary as operating conditions at the VIMC were understood to be consistent with those during a "Busy Member Day". Additionally, noise levels were averaged over longer time-period than required for a vehicle to complete a single lap so that exact start and stop times of individual vehicles were irrelevant. Furthermore, vehicle types and numbers have now been provided.

3.3 Navcon Comment #3

► To better understand the type of track operation which was going on during the Track Day survey, we created a graph using the 1-second L_{eq} levels recorded by the Wakefield track side noise monitor between 11:00 am and 11:30 am (refer to ***Navcon Figure 1***). The Wakefield monitor was positioned 15m (~50') south of the shoulder of the track between the start/finish line and Turn 1. With an open track ahead, the cars should be at full throttle / full load when passing the microphone. Wakefield used the data recorded during this time period (i.e., 11:00 am to 11:30 am) to assess the VIMC track noise impact at Sahtlam Rd. (Site 4) as presented in ***Table 3*** of their report [***ref. 1***]. As shown in ***Navcon Figure 1*** the maximum track side pass-by noise level during the 30-minute period was 92 dBA while most of the peaks ranged between 70 dBA and 85 dBA. Navcon has a database of pass-by noise levels for various street legal and race cars. Following are the pass-by noise levels for three street legal Porsche models under full engine load and measured at 15m (~50'). The VIMC Track Day pass-by noise levels were several decibels below these levels

- Porsche GT3: 99 dBA with the factory exhaust in Sports Mode
- Porsche Cayman: 96 dBA with the factory exhaust in Sports Mode
- Porsche Turbo S: 91 dBA with the factory exhaust (no Sports Mode)

The average lap time for the car with the highest pass-by noise levels was 115 seconds. The track calculated speed for a Porsche GT3RS is 83.2 seconds and during a discussion with a VIMC driving instructor we learned that the average Porsche Cayman S lap times are in the range 86 to 87 seconds. We also checked lap times on the web site, MYLAPS.com and confirmed that 86 to 90 seconds are common lap times during VIMC Track Day events. The cars which were on track during the Track Day survey were running extremely slow lap times which explains why the Wakefield track side and the community L_{max} and L_{eq} noise levels were so low.

Based upon the track side pass-by noise levels and the vehicle speeds (refer ***Navcon Figure 1***) it is Navcon's opinion that the Track Day operation was similar to a Circuit Taxi Experience which represents the lowest level of Track Day Operation.

The noise data recorded by Wakefield can be considered a "data point", however it is not representative of the noise impact experienced by the community during a Member Track Day or a Busy Member Track Day. Wakefield should have conducted the Track Day survey during a Busy Member Track Day or similar track event when the track noise impact would be at its highest level, not its lowest level.

RWDI Response:

- Navcon's use of the 1-second L_{eq} to document vehicle pass-by noise levels is inappropriate. The maximum noise level (L_{max}) is the preferred noise metric for assessing the maximum noise levels created by transient noise events such as vehicle pass-bys. By using the 1-second Leq, Navcon underestimated the trackside noise levels produced by the vehicles. During the entire event, the highest L_{max} recorded trackside was 98 dBA and, during the 11:00 to 11:30 a.m. track-day monitoring period, several vehicle pass-bys exceeded L_{max} 90 dBA. The highest L_{max} recorded trackside (98 dBA) is similar to the upper end of the range of pass-by levels referenced by Navcon (99 dBA for a Porche GT3 with factory exhaust in Sports Mode). Therefore, the values measured by RWDI/Wakefield would are similar to the values that Navcon suggest are typical of loud vehicle types. Furthermore, the highest L_{max} measured at sites #3 and #4 (residences) ranged from 65 to 66 dBA which are well below the CVRD Noise Bylaw limit of 80 dBA for non-continuous noise.

- The Navcon report also did not specify the conditions under which their reported L_{max} values were taken, such as ground type. Typically, vehicle noise emission measurements are conducted over hard surfaces such as pavement (i.e., both vehicle and sound level meter on the track). The RWDI measurements at the VIMC would include a mixture of both hard and soft surfaces, as the meter was located 15 m south of the shoulder of the track. This would have tended to reduce the L_{max} due to vehicle pass-bys relative to an entirely "hard ground" scenario. The other aspect not accounted for by Navcon is that the setback distance reported by RWDI was relative to the south of the shoulder of the track, not to the vehicles on the track. This extra distance would also tend to reduce the L_{max} that were measured by RWDI/Wakefield relative to those presented by Navcon.

3.4 Navcon Comment #4

► ***Table 2*** of the Wakefield report [***ref. 1***] summarizes the levels recorded during the entire Track Day survey. They considered three noise metrics:

- L_{eq} (5 min) which is the equivalent continuous sound level calculated for consecutive 5-minute periods for the entire Track Day
- Overall L_{eq} which is the equivalent continuous sound level for the entire Track Day
- Highest L_{max} which is the highest noise level measured during the Track Day

In regard to the noise impact assessment, ***Table 2*** does not provide any useful information for the following reasons:

- As previously stated, the Track Day event was essentially a Circuit Taxi Experience and the track noise was at a minimum.
- Without a detailed log of the track activities (e.g., the types and number of cars on the track, the session start/end times, etc.) as well as a description of the sounds at the community locations, it is not possible to relate the track noise with the community noise impact.
- The Leq (5 min) is not a measure called out in CVRD Bylaw No. 3723 and it is not a good indicator of community noise annoyance.
- The Overall L_{eq} is not a measure called out in CVRD Bylaw No. 3723 and it is not a good indicator of community noise annoyance.
- Highest L_{max} levels at noise monitoring Sites 1 - 4 were recorded at different times and there is no description of the corresponding track and community noise events.

RWDI Response:

Table 2 of the October 2016 RWDI report provides useful noise level data for the assessment because:

- As stated in the introduction to this report, the VIMC was operating under conditions consistent with a "Busy Member day".
- It shows that VIMC vehicle L_{max} approximately corresponded to the upper range of Navcon's suggested noise level range for "loud" vehicles.
- Types and numbers of cars on the track have been provided. However, in assessing the impact in the community, the focus was not on the noise levels created by specific VIMC vehicles, but rather on the influence of VIMC noise emissions on overall community noise levels. In other words, did VIMC noise cause an increase in the L_{eq} and L_{max} measured at residences relative to ambient conditions? Answering this question is an industry standard approach to assessing community noise impacts. The L_{eq} is one of the most widely used noise metrics for assessing community noise impacts. The following federal, provincial, and municipal organizations use the L_{eq} for this purpose:
    - Municipal Nose Bylaws such as those of the City of Vancouver and the City of Victoria
    - B.C. Oil and Gas Commission document "British Columbia Noise Control Best Practices Guidelines
    - Canadian Mortgage and Housing Corporation Document "Road and Rail Noise: Effects on Housing"
    - B.C. Ministry of Transportation and Infrastructure Highway Noise Policy

- The highest L_{max} levels measured at the at Sites #3 and #4 during the measurement period were well below the CVRD Noise Bylaw 80 dBA limit for non-continuous noise. As such, while it would have been interesting to have correlated VIMC noise events with the resulting noise levels at the residences, it was not necessary to draw conclusions regarding the community noise impact. Rather, a conservative approach was used where it was assumed that the highest L_{max} were caused by VIMC noise.

3.5 Navcon Comment #5

> ► ***Table 3*** of the Wakefield report [***ref. 1***] summarizes the noise measurements recorded at Sahtlam Rd. (Wakefield Measurement Location Site 4) during the Track Day survey. Of most interest is the fact that the Wakefield engineer who conducted the noise survey identified 53 track related noise events between 11:00 am and 11:30 am by listening to their audio recording. The Wakefield engineer indicated that each of the 53 events lasted roughly 10 seconds for a total time of 8 minutes, 50 seconds of the 30-minute measurement period. In other words, the track was clearly audible approximately 30% of the time between 11:00 am and 11:30 am. Referring to ***Navcon Figure 1***, the peaks show that 31 cars or groups of cars passed the track side microphone between 11:00 am and 11:30 am. This means that the Sahtlam Rd. location was also impacted by 22 car related events from other locations on the track. This makes sense considering that there are seven locations on the track where the cars are likely to be at full throttle and since Sahtlam Rd. is elevated, the forest has less effect on the sound propagation. The community is not just impacted by the cars traveling down the front straight (i.e., from Turn 19 to Turn 1 to Turn 2), the community is also impacted from cars at other locations on the track.
>
> We created a graph using the Wakefield statistical noise data recorded at the Sahtlam Rd. location during their Non-Track Day survey and superimposed the range of track related L_{max} levels (i.e., 38.4 dBA to 59.9 dBA) they recorded during their Track Day survey (refer to ***Navcon Figure 2***). The L_{max}, L_{50}, L_{90} and L_{min} are levels averaged over 5-minute periods. They are defined as follows:
>
> - L_{max} is the maximum noise level measured during the 5-minute period.
> - L_{50} is that noise level which was exceeded 50% of the time during the 5-minute period.
> - L_{90} is that level which was exceeded 90% of the time during the 5-minute period. L_{90} is also that level which is considered to be the "ambient" noise level. Noise impacts are often assessed by comparing noise event levels with L_{90} levels. It is a good metric for predicting annoyance and how communities may react to noise.
> - L_{min} is lowest noise level measured during the 5-minute period.
>
> The graph clearly shows that the range of track related L_{max} levels is 20 dBA to 30 dBA higher than the L_{90} Levels (i.e., the community ambient noise level) which is why the Wakefield engineer could easily identify (i.e., hear) the 53 events in the audio recordings. As previously discussed, the Track Day survey was conducted during a low noise event (i.e., Circuit Taxi Experience). We anticipate the track related noise events (i.e., the L_{max} levels) are even more noticeable during a Member Track Day or Busy Member Track day.

RWDI Response:

- When discussing the exceedance of the L_{90} by track vehicle noise, Navcon should have also mentioned that the exceedances due to non-track sources were similar if not greater (see Figure 2 of the Navcon report). In excluding this analysis, Navcon failed to provide useful context for assessing the acceptability of track-noise levels in the community.
- As previously stated, the measurements were conducted while the VIMC operated under conditions consistent with "Busy Member Track Day"

3.6 Navcon Comment #6

> ► ***Tables 4 & 5*** of the Wakefield report [***ref.1***] summarize the Non-Track Day measurement data recorded over the entire survey period. The noise metrics include the Minimum and Maximum L_{eq} (5 min), the Overall L_{eq} and the Highest L_{max} level. The data, as presented does not provide any additional useful information in regard to the VIMC noise impact assessment.

RWDI Response:

- Rather than not providing "any additional useful information", in assessing the impact of a new activity on a community, it is critical to document the existing sources of noise in the community and the noise levels these sources create. Knowing the L_{max} levels created by the various non-track sources of noise (e.g., logging trucks, aircraft) is helpful in predicting a community's potential reaction to a new noise source. In general, *a community that has experienced lower noise levels, and less intrusive noise events, will react more strongly to the introduction of a new noise source*.

3.7 Navcon Comment #7

- ***Table 6*** of the Wakefield report [***ref.1***] compares track related noise, aircraft noise and wood working tools noise with the noise limits specified in CVRD Bylaw No. 3723. Wakefield then concluded, "*As shown in Table 6, track-related noise levels do not approach or exceed the noise limits in the Cowichan Noise Bylaw No. 3723.*"
  - As previously pointed out, Wakefield conducted their noise survey on a day when the VIMC activities were similar to a Circuit Taxi Experience; the track related noise was low due to the engine loads, vehicle speeds and slow lap times. The data they presented is merely a data point for this type of Track Day Operation. Wakefield should have conducted the survey on a "Busy Member Day" when the track related noise is higher.
  - The comparison of aircraft noise and wood working tools noise with the noise limits really has no bearing on the VIMC noise impact assessment and should not be included in ***Table 6***.
  - The Wakefield engineer who setup their sound level meters and was onsite to acquire the test data indicated that they approached the project as though it were a traffic noise characterization study. He said that for traffic noise they typically record L_{eq} (10 min) levels but because of the short track sessions he decided to record the Leq (5 min) levels. We believe that this was a mistake and that Wakefield should have aligned their noise measurements with the track sessions and that they should have kept a detailed log of the number of cars on the track, the vehicle types, vehicle speeds, etc.

RWDI Response:

- As previously discussed, it is our understanding that the noise measurements were conducted on a day that was typical of a "Busy Member Day" at the VIMC. While the data presented is acknowledged to be for just one day, there is no reason to expect that VIMC noise levels would be significantly higher on other days.
- The noise environment experienced at the residences include many sources of noise, not just a single source such as the VIMC. Therefore, when evaluating the impact of track vehicle noise on the community, consideration must be given to the other sources of noise in the region and the noise levels they produce.
- For reasons previously discussed, the 5-min L_{eq} is considered an appropriate and conservative noise metric for this assessment (in addition to the L_{max} that was also used) and for comparison with the CVRD bylaw limits.

3.8 Navcon Comment #8

> ► In the Conclusion Section of their report [***ref. 1***], Wakefield stated, "*Track noise was audible at the two residential monitoring sites and may cause annoyance to some individuals.*" Navcon listened to the Wakefield audio files and agrees with them that the track noise is clearly audible and likely to cause annoyance. The Wakefield recordings are similar to the YouTube videos posted by members of the Sahtlam Neighborhood Association and other residents affected by VIMC who are clearly annoyed with the track related noise.

RWDI Response:

- Just because a given noise source is clearly audible does not mean that it is "likely to cause annoyance"; just that it may cause annoyance to certain people. Because annoyance due to noise is so subjective and personalized, many noise bylaws (such as the CVRD's) include quantitative limits.

3.9 Navcon Comment #9

► Wakefield summarized their report [***ref. 1***] in a letter dated 23-Mar-2017 [***ref. 2***]. They stated, "*Noise levels created by motorsport circuit operations on the track day never approached the limits contained in the Cowichan Noise Bylaw of 60 dBA for continuous noise and 80 dBA for non-continuous noise.*" We agree that the levels did not exceed the Bylaw limits but again, the Track Day was similar to a Circuit Taxi Experience which represents the lowest level of Track Day Operation and noise. Wakefield then talked about noise exposure:

- "*The noise created by motorsport activities on the "track day" did not significantly influence the overall **noise exposures** experienced at the two residential sites.*"
- "*Attended noise monitoring at the Mina Drive site revealed that **overall noise exposures** were dominated by Highway 18 traffic and that maximum noise levels, or Lmax, created by highway traffic (particularly logging trucks) substantially exceeded those created by motorsport circuit activities.*"
- "*In conclusion it may be stated that, while noise from motorsport circuit activities was, at times, clearly audible in the community (particularly at the Sahtlam Road site), and the audibility and intrusiveness of these noises are enhanced by their character (tonality and variability), they do not dominate, not even significantly contribute to, the overall **noise exposures** of residents in the community.*"

Navcon does not agree with Wakefield's use of the term, noise exposure. Noise exposure is typically used in occupational settings when addressing high levels of noise which can result in temporary, long term or permanent hearing damage (e.g., tinnitus, hyperacousis, etc.) or other health related problems. This is not a noise exposure situation, this is a case of community noise annoyance.

In their conclusion Wakefield acknowledged that the track related noise is clearly *audible* in the community and in their own words, they stated that the noise is *intrusive*. They also wrote that the frequency content and temporal variations (i.e., fluctuations) of the sound enhances the *intrusiveness*. They countered this by stating that the track related noise does not "dominate" or even "significantly contribute" to the overall noise exposure of the residents. This is exactly why CVRD Bylaw No. 3723 has statutory nuisance provisions. Section 5 of the Bylaw, states that a person can be in compliance with the noise limits but may still be found in violation of the General Regulations.

We believe that Wakefield missed the point. They conducted their Track Day survey on a day when the VIMC was operating at a low level (i.e., Circuit Taxi Experience) and, using their own words, the noise was audible and intrusive in the community. The real question is whether or not the track related noise represents a legitimate nuisance to the community. Noise nuisance provisions provide an additional level of protection for communities. Section 5, states that a person can be in compliance with the noise limits but may still be found in violation of the General Regulations.

RWDI Response:

- We do not agree that the measurements were conducted on a day "which represents the lowest level of Track Day Operation and noise". As previously stated, it is our understanding that the measurements were conducted while conditions at the track were consistent with a "Busy Member Day".

- While the use of the term "noise exposure" is often associated with occupation health assessments it is also a valid term for describing a community's exposure to acoustic energy. The use of this term is considered to have no bearing on the overall findings and therefore to be irrelevant.
- As human annoyance to noise is a highly subjective and personalized experience, the Cowichan Noise Bylaw provides quantitative limits. While Section 5 states that a person or party may still be found in violation despite compliance with the noise level limits, we would suggest that in interpreting Section 5, strong consideration should be given to the fact that track noise levels were well below the bylaw limits and at comparable levels to other sources of community noise. In interpreting the City of Victoria and City of Vancouver Noise Bylaws, which include both annoyance clauses and noise level limits, it has been our experience that greater importance is placed on the limits.