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October 26, 2016

SupErb Construction Ltd.
2345 Delinea Place
Nanaimo, BC
V9T 5L9

Re: Noise Monitoring Report
Noise Study – Vancouver Island Motorsport Circuit
Reference No. 1603594

Email: chris@chriserb.ca

Dear Chris Erb,

RWDI AIR was retained by SupErb Construction Ltd. (Vancouver Island Motorsport Circuit) to conduct a noise study of the Vancouver Island Motorsport Circuit and its potential impact at neighboring residences. This letter report provides the results of the noise monitoring conducted on August 28, 2016 and September 16, 2016 and compares the track-related noise levels at the neighboring residences to the limits contained in Section 6.1.3 of the Cowichan Noise Bylaw No. 3723 as well as to noise levels created by other sources in the community. The noise bylaw, and noise monitoring methodology, results and discussion are presented below.

Cowichan Noise Bylaw No. 3723

Although the motorsport circuit is in the District of North Cowichan, the North Cowichan Noise Bylaw No. 2857 is a "nuisance-based" bylaw[1] and does not provide any noise level limits. As an alternative, the noise measurement results will be compared to the noise level limits presented in the Cowichan Noise Bylaw No. 3723. Section 6.1.3 of this noise bylaw provides sound level limits for continuous[2] and non-continuous[3] sounds at the point of reception. These limits are presented in Table 1 below.

Table 1: Cowichan Noise Bylaw No. 3723 Noise Level Limits (Section 6.1.3)

Time	Continuous Noise Level Limit, dBA	Non-Continuous Noise Level Limit, dBA
7:00 am – 9:00 pm	60	80
9:00 pm – 7:00 am	50	65

[1] Bylaw No. 2857 prohibits noise that may disturb any individual in the neighborhood but does not provide any noise level limits.
[2] Continuous Sound is defined by the by-law as any noises or sounds other than construction noise, continuing for a period, or periods, totaling 3 minutes or more in any 15-minute period.
[3] Non-continuous sound is defined by the by-law as any noises or sounds other than continuous sound and construction noise

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In some noise bylaws, such as those of the Victoria and Vancouver, the noise level limits are based on the zoning of both the noise source and receiver. According to North Cowichan's Zoning map, the Vancouver Island Motorsport Circuit is situated in a mix of Commercial Rural Recreation Zone (e.g., racetrack) and Industrial Heavy Zone. The North Cowichan Zoning Bylaw 1997 (Bylaw No. 2950) permits land use that could have possibly created higher (e.g., a helicopter landing pad) or more continuous noise levels (e.g., an industrial site operating 24/7 such as a sawmill). Unfortunately, Bylaw No. 2950 does not provide noise limits for the permitted uses of the various zones, so the Cowichan Noise Bylaw No. 3723 will be referred to for noise limit guidance.

Noise Measurement Methodology

Instrumentation

The noise monitoring was conducted using three kinds of Type 1 sound level meters (SLM): Larson Davis LxT, Larson Davis 812 and Bruel & Kjaer 2250. These digital instruments comply with ANSI S1.4 (1983) standards for Type 1 SLM and are capable of sampling the ambient sound level many times per second and storing the resulting sound level data for subsequent analysis and display. The SLM were calibrated before and after each measurement period using a Larson Davis CAL200 Calibrator. The SLMs and calibrator are regularly checked by a certified laboratory/Type 1 SLMs are accurate to within approximately ±1.0 dBA. The Bruel & Kjaer 2250 is capable of audio recording for noise analysis purposes.

SLM Setup

SLM microphones were mounted on tripods at a height of approximately 1.7 m above ground level. The SLM were configured to collect a complete statistical description of the noise environment every 5 minutes. The SLM was set to fast response for measuring the sound levels. The measured noise metrics included:

1. Equivalent A-weighted sound level (L_{eq})[4]
2. Maximum A-weighted sound level (L_{max})[5]

The measurement data were analyzed to determine the noise levels at the neighboring residences. The L_{eq} and L_{max} data obtained on the two monitoring days were then compared to determine the difference in noise levels during a track day and non-track day. To identify and analyze noise sources, audio recording was conducted at one of the residential sites (site 4).

Monitoring Times

Continuous noise monitoring was conducted on two occasions: a track day (August 28, 2016) and a non-track day (September 16, 2016). Measurements were conducted at four[6] locations on the track day and three locations on the non-track day. The monitoring times were as follows:

[4] The L_{eq} is the steady A-weighted sound level which, over a given time period, would result in the same overall sound energy exposure as would the actual fluctuating level.
[5] The L_{max} is the maximum A-weighted sound level measured during a given time period.

- Track day
  - Site 1 (Track), 10:30 am to 3:30 pm
  - Site 2 (Cowichan Valley Highway), 10:30 am to 2:00 pm
  - Site 3 (Mina Drive), 10:30 am to 12:40 pm[7]
  - Site 4 (Sahtlam Road), 10:30 am to 3:10 pm
- Non-track day
  - Site 2, 10:30 am to 12:30 pm
  - Site 3, 10:30 am to 12:30 pm
  - Site 4, 10:40 am to 12:30 pm

Noise Measurement Locations

The four measurement locations were chosen to collect noise data at the track (during the track day only), near the Cowichan Valley Highway, and near two concerned residents' properties. Figure 1 below shows the locations of the four measurement sites.

Site 1 was situated approximately 15 m south of the shoulder of the track. This SLM was specifically placed at the south end of the track to capture the noise levels which the vehicles emitted in the direction of the concerned residents' properties.

Site 2 was located near Cowichan Valley Highway. The microphone was setback approximately 5 m from the shoulder of the highway. There were two locations for site 2[8]: location 1 and location 2, which were respectively situated approximately 240 m east and 200 m west of the intersection of Cowichan Valley Highway and Mina Drive. The purpose of this monitoring site was to obtain highway noise histories for the two measurement days. This SLM data has been used to better understand the noise environment created by highway traffic.

Site 3 was situated approximately 10 m south from the cul-de-sac of Mina Drive and approximately 530 m from Cowichan Valley Highway. The site was chosen to capture the noise levels received at 6259 Mina Drive[9].

Site 4 was situated approximately 10 m west of the west end of Sahtlam Road. The site was chosen to capture the noise levels received at 4245 Sahtlam Road[10]. The SLM with audio recording capabilities was employed at site 4 for noise analysis purposes.

[6] RWDI setup one additional sound level meter near the track during the track day for analysis purposes.
[7] SLM ran out of memory but contained enough data to compare the track day and non-track day noise levels.
[8] The site was relocated to location 2 during the non-track day in order to avoid a non-highway related noise source near location 1.
[9] This measurement site was chosen by the client. RWDI was not authorized to setup the SLM on the concerned resident's property (6259 Mina Drive).
[10] This measurement site was chosen by the client. RWDI was not authorized to setup the SLM on the concerned resident's property (4245 Sahtlam Road).

Figure 1: Noise Monitoring Locations

Noise Measurement Results

Track Day Results (August 28, 2016)

A summary of the results of the noise measurements taken during the track day at the track site, highway site and the two residential sites is provided in Table 2 below.

Table 2: Track Day Noise Monitoring Results

Site #	L_{eq} (5 min), dBA		Overall L_{eq}, dBA*	Highest L_{max}, dBA
	Minimum	Maximum		
1**	61.0	77.4	70.3	97.7
2	68.8	72.8	70.7	92.1
3	46.2	51.4	48.0	66.4
4	37.9	52.0	49.2	65.4

* The Overall L_{eq} is the equivalent sound level over the entire noise monitoring period.
** Noise levels when the track was in use.

During the track day noise monitoring session, the overall noise environments (as indicated by the L_{eq}) at site 3 and 4 were dominated by non-track noises. The noise environment at site 3 was dominated by highway traffic noise while that at site 4 was dominated by aircraft noise.

Noise sources were identified from the audio recording at site 4. Notable noise sources and noise levels are presented in Table 3.

Table 3: Track Day Noise Sources and Noise Levels at Site 4

Noise Source	L_{eq} (5 min), dBA	Range of L_{max}, dBA	Average L_{max}, dBA
Track	40.1 to 50.2	38.4 to 59.9*	48.1*
Aircraft	46.1 to 52.0	51.0 to 65.4**	56.9**

* Noise levels determined from the recording between 11:00 am and 11:30 am. This time period was chosen because the highest track-related L_{max} occurred during this period.
** Noise levels determined from the recording between 11:30 am and 12:00 pm. This time period was chosen because the highest aircraft-related L_{max} occurred during this period.

Track noise was audible on the audio recording made at site 4. There were 53 track-related noise events during the 11:00 am to 11:30 am track run and each event lasted roughly 10 seconds. However, aircraft noise events had overall higher noise levels and longer durations, lasting roughly 1 to 3 minutes per occurrence. Within the 11:30 am to 12:00 pm logging period, 6 aircraft fly-by noise events occurred.

Non-track Day Results (September 16, 2016)

A summary of the noise measurements taken at the four sites during the non-track day is provided in Table 4.

Table 4: Non-track Day Noise Monitoring Results

Site #	L_{eq} (5 min), dBA		Overall L_{eq}, dBA*	Highest L_{max}, dBA
	Minimum	Maximum		
2	68.1	74.9	72.1	94
3	46.0	53.7	49.1	66.7
4	36.5	55.9	49.9	66.5

* The Overall L_{eq} is the equivalent sound level over the entire noise monitoring period.

Based on the non-track day noise monitoring results, the noise environment at site 3 was dominated by highway traffic noise, while at site 4, it was dominated by woodworking noise originating at a nearby residence.

Noise sources were identified from the audio recording made at site 4. Notable noise sources and noise levels are shown Table 5.

Table 5: Non-track Day Noise Sources and Noise Levels at Site 4

Noise Source	L_{eq} (5 min), dBA	Range of L_{max}, dBA	Average L_{max}, dBA
Woodworking Tools	50.1 to 55.9	51.1 to 64.2**	57.8**
Aircraft	NA*	47.8 to 63.4***	53.6***
Highway Traffic	NA*	42.2 to 50.0***	NA**

* Not applicable: L_{eq}(5 min) contaminated by other noise sources (e.g., birds, dogs, woodworking noise).
** Noise levels determined from the recording between 11:45 am and 12:00 pm. This time period was chosen because the highest woodworking-related L_{max} occurred during this period.
*** Noise levels determined from field notes. There may have been more occurrences that were not documented.

From the audio recording at site 4, the L_{eq}(5 min) on the non-track day were dominated by woodworking noise from a nearby residence. Also notable on the audio recording were noises from aircraft and highway traffic (i.e., logging trucks). However, the measured L_{eq}(5 min) containing the aircraft noise and highway traffic noise were contaminated by the woodworking noise.

Discussion

Monitoring Site on Mina Drive (Site 3)

During the track day noise monitoring session at site 3, track noise was audible only when the traffic on Cowichan Valley Highway was minimal. The noise environment at site 3 was dominated by traffic noise from Cowichan Valley Highway during both the track day and non-track day monitoring periods.

From the measurements at site 3, both the range of L_{eq}(5 min) and the overall L_{eq} were higher on the non-track day. The highest L_{max} for the track day and non-track day were very similar (66.4 dBA and 66.7 dBA respectively). The L_{max} for both days were likely caused by non-track noise sources (i.e., logging trucks on Cowichan Valley Highway). The L_{eq} measured for both track day and non-track day are below the bylaw's

continuous daytime noise level limit of 60 dBA. In addition, the L_{max} on both days were found to be below the non-continuous noise level limit of 80 dBA. From the measurements, track noise has little or no effect to the overall L_{eq} and L_{max} at Site 3.

Monitoring Site on Sahtlam Road (Site 4)

During the track day noise monitoring session at site 4, track noise was audible and may cause annoyance to some individuals. This is often the case when a new noise source (i.e., the track) is introduced to the area. Table 6 below compares the track day's L_{eq} and L_{max} to the daytime noise limits set by the Cowichan Noise Bylaw.

Table 6: Comparison between Noise Levels Measured at Site 4 and the Noise Bylaw Daytime Limits

Noise Source	Continuous Noise		Non-continuous Noise		Violates Bylaw
	Measured L_{eq} (5 min), dBA	Noise Level Limit, dBA	Measured Highest L_{max}, dBA	Noise Level Limit, dBA	
Track	40.1 to 50.2	60	59.9	80	No
Aircraft	46.1 to 52.0		65.4		No
Woodworking Tools	50.1 to 55.9		64.2		No

* The L_{eq} were compared with the continuous noise level limit because the L_{eq} represent the overall noise level during the 5 minute measurements.
** The highest L_{max} were compared with the non-continuous noise level limit because the highest L_{max} only occurred for a brief period of time.

As shown in Table 6, track-related noise levels do not approach or exceed the noise level limits in the Cowichan Noise Bylaw No.3723.

In addition, although track noise was audible at site 4, higher noise levels were measured from other noise sources. During the track day, aircraft noise dominated the noise environment with a maximum noise level of 65.4 dBA, while the maximum track-related noise level measured was 59.9 dBA. Track-related noise events occurred more often than aircraft noise events but had much shorter durations (roughly 10 seconds per track-related noise event versus 1 to 3 minutes per aircraft-related noise event). During the non-track day, the dominating noise sources were woodworking tools with a maximum noise level of 64.2 dBA. Aircraft noise was also present during the non-track day but was not as frequent as on the track day.

Conclusion

Based on our measurements, the overall L_{eq} for sites 3 and 4 (Mina Drive and Sahtlam Road) were below the noise level limits in the Cowichan Noise Bylaw No. 3723. Track noise was audible at the two residential monitoring sites and may cause annoyance to some individuals. However, the noise environments (L_{eq}) at both residential sites were dominated by other noise sources. The noise environment at the Mina Drive site was dominated by traffic noise from Cowichan Valley Highway, while that at the Sahtlam Road site was dominated by aircraft noise during the track day and woodworking noise during the non-track day. From the recordings at site 4, the track-related L_{max} were found to be below the L_{max} from other noise sources (i.e., aircraft, woodworking).

Sincerely,

RWDI AIR Inc.

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