

Oakville North Park Community Center RF Mitigation Plan

Due to the presence of the nearby CJYE & CJMR
AM Transmission Site

OCR-523 v1.2

by



For the client:

**diamond
schmitt**

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DOCUMENT REVISIONS

| Rev # | Date | Section | Description |
|-------|---------------|-------------------|--|
| 1.0 | April 7, 2022 | all | Document's creation |
| 1.1 | May 6, 2022 | Executive Summary | Adding clarifications regarding the impact on Safety Code 6 matters, electric shocks, Medical electronic equipment and Consumer electronics. |
| 1.2 | May 11, 2022 | Executive Summary | Adding clarifications regarding the effect of building heights. |
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SIGNATURES

This Engineering Report has been entirely prepared by the undersigned, who is a professional engineer, member in good standing of PEO, OIQ and of the CABC, and whose qualifications are known to the department of Innovation, Sciences and Economic Development of Canada and recognized by the Province of Ontario and the Province of Québec.

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EXECUTIVE SUMMARY

The Diamond Schmitt Architects bureau has requested the services of Octave Communications to produce a mitigation plan for the construction of the new Oakville North Park Community Center (hereafter "the development") located in the high field region of the AM transmission site of CJYE & CJMR radio stations in the town of Oakville (ON). This report consists of the mitigation plan that identifies the RF hazards that construction workers can experience while working near the transmitter facility. The risks are evaluated based on the following criteria:

1. Public health and safety matters (during construction & post-construction):
 - A) Non-Ionizing Radiation on a Human Body (Safety Code 6)
 - B) Electrical Shock Hazard due to Contact Current in Metallic Structures
2. Radio interference with construction equipment and consumer electronics

RECOMMENDATIONS AND MITIGATION

Based on our evaluation, the following mitigation measures should be considered and implemented:

GENERAL RECOMMENDATIONS:

- All workers should have access to a copy of this report upon request.
- Workers responsible for safety/security on the site should receive a basic training in RF safety with a certified RF engineer.
- The map at Appendix A should be printed and clearly in view at common worker sites, indicating which zone should be considered with more attention.

1. Health Issues (Safety Code 6):

All simulations and measurements have demonstrated that the Safety Code 6 zone will end at 19m around each of the AM tower. Therefore, the site is 100% safe in terms of SC6, during construction and during long-term occupancy.

RECOMMENDATION: No actions are required.

2. Health Issues (Electrical Shock Hazards):

RECOMMENDATION During Constructions: Always ground construction crane and use a non-conductive sling between the hook and main crane cable. Workers attaching the hook to charges must avoid touching the crane's main cable at all times. The operator must be careful when embarking / disembarking from the crane as static shocks can occur (ensuring the usage of protective gloves and booths). Measurements inside the cabin have demonstrated a very low RF radiation level since the cabin act as a Faraday cage and protect the operator.

RECOMMENDATION Long-term occupancy: During occupation, the main problems might arise from long cable, such as elevator cable, grounding cables from potential lightning rods, etc. The building's maintenance crews should be made aware of these possibilities and ensure that they take the proper mitigation (where insulated gloves,

discharge any standing current from the cables, etc). There is no recommendation for this issue (electric shock hazards) for the users and public when at the site.

3. Public Health (Usage of Medical Electronic Equipment):

RECOMMENDATION During Constructions: The red contour (3 V/m on the map at Appendix A) will reach half of the site, workers and future users of the site using medical aid devices having to enter this 3 V/m zone should make sure that their non life-supporting medical device (like hearing aids) is operating properly before undertaking his/her work. We are recommending that a first walk through the zone while using the equipment is done prior to start any kind of work to ensure good operation.

RECOMMENDATION Long-term occupancy: The indoor usage of the site generally reduces the RF level by 6 dB to 10 dB (even more for concrete and metallic constructions) which will make all indoor locations lower than the 3 V/m contour. Usage of non life-supporting medical devices in outdoor situations might be subject to malfunction in some rare occasions. There is no limit in occupancy for the usage of life-supporting medical devices (pacemakers, defibrillators, etc) indoor or outdoor.

4. Radio Interference to Construction Equipment and Consumer Electronics:

RECOMMENDATION During Constructions:

- a. Construction Equipment and Consumer Electronics (including two-way radios, cell phone, drones, remotely operated devices and other communication devices): Electronic equipment that will be used inside the EMCAB-2 Zone (Orange Contour at Appendix A) must be properly tested before usage (by a walk through or other types of tests depending on the device).
- b. Remote Control of Construction Explosives: the usage of remote-controlled construction explosives should be certified by the manufacturer of that equipment prior to any usage in the EMCAB-2 zone. The operator must be well aware of the potential shock hazards risk when using long cables which can results in unwanted detonation of the device. Usage in another nearby zone should be done carefully.

RECOMMENDATION Long-Term occupancy: The usage of consumer electronics (remote controlled drones, portable radios, etc) is subject to malfunction in the EMCAB-2 Zone. Cautious usage is recommended and especially the usage of flying devices (drones) should be restricted at the site (a signage is recommended).

Stability of the AM Signal in Relation with Height

Previous measurements have demonstrated a trend that the measured AM signal level rises by up to 6 dB for the first 10m. This level trend to return to its original ground level value (or lower) as we go higher in altitude (from 15m to 30m).

Consequently, when considering that our measurements have typically an accuracy of 3 dB, the highest peak reached at 10m represents twice the level of the signal received. This behaviour has generally no impact on the Safety Code 6 zone as it is the responsibility of the broadcaster to

demonstrate that all public uncontrolled zones are protected at all time (even those in altitude like building rooftop).

But this behavior might nevertheless impact the operation of electronic devices (i.e. the 3 V/m zone will be potentially be at 6 V/m). Since ground measurements are usually demonstrating levels that are slightly lower than the simulated ones (in fact, measuring a higher level might compromise the station's coordination), we consider that the simulated contours displayed in this report (Figures 2 and 3) correspond to final coordination zone.

1. INTRODUCTION

The Diamond Schmitt Architects bureau has requested the services of Octave Communications to produce a mitigation plan for the construction of the new North Park Community Center located near the AM transmission site of CJYE & CJMR radio stations in the town of Oakville (ON). This report consists of the mitigation plan that identifies the risks for construction workers and future users will experience while working near the transmitter facility. The risks are evaluated based on the following criteria:

This report will evaluate the impact and proposed a mitigation plan based on the following criteria:

- Public health and safety matters (during construction & post-construction);
 - In terms of non-ionizing radiation (Safety Code 6)
 - In terms of risk of electrical shock hazards
- Radio interference with construction equipment and consumer electronics;

This plan is based on the requested by Diamond Schmitt from the document “211030 NPCC AM Radio LOI EXECUTED.pdf”, which the principal work request is reproduced below:

Mitigation Plan shall consist of the following:

- *Ensure Code 6 Safety Compliance*
- *Identification of Electrical Shock Hazards derived from contact currents*
- *Identification of radio interference derived from construction equipment and other medical devices from the surrounding area*
- *Identification of alternate paths to mitigate radio frequency during the construction of the Project.*

The actual site description map considered in this report as been reproduced at Appendix B.

2. SOURCE OF DOCUMENTS

The following documents are considered as the primary source of information for this report:

- i. 211030 NPCC AM Radio LOI Executed.pdf – from Diamond Schmitt
- ii. A010 – NPCC Site Plan.pdf – from Diamond Schmitt.

Additionally, the following rules and regulations have been considered:

- iii. Health Canada, “Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz (Safety Code 6 (2015))”, June 2015.
- iv. ISED, Broadcasting Procedures and Rules, Part 1: General Rules (BPR-1), Issue 7, February 2016
- v. ISED, Broadcasting Procedures and Rules, Part 2: Application Procedures and Rules for AM Broadcasting Undertakings, Issue 3, February 2016
- vi. ISED, CPC-3-14-01 – Determinations of Harmful Interference with Respect to Radio-Sensitive Equipment, Issue 2, October 2008.
- vii. ISED, EMCAB-2 – Criteria for Resolution of Immunity Complaints Involving Fundamental Emissions of Radiocommunications Transmitters, Issue 1, June 1994
- viii. Ontario D6 Land Use Compatibility Guidelines, <https://www.ontario.ca/page/d-6-compatibility-between-industrial-facilities>
- ix. Halton Region – Regional Official Plan Guidelines, [https://www.halton.ca/The-Region/Regional-Planning/Regional-Official-Plan-\(ROP\)/About-Regional-Official-Plan-\(ROP\)/Regional-Official-Plan-Guidelines](https://www.halton.ca/The-Region/Regional-Planning/Regional-Official-Plan-(ROP)/About-Regional-Official-Plan-(ROP)/Regional-Official-Plan-Guidelines)

Finally, the following documents have been considered as additional information related to calculation of the impact of AM sites on development nearby:

- x. V. Javor, “Electromagnetic Interference between Cranes and Broadcasting Antennas”, Hindawi Publishing Corporation, 22 July 2015

3. EVALUATION OF THE SIGNAL LEVELS AT THE DEVELOPMENT SITE

3.1 Site Location and RF Level Evaluation

The following map represents the proposed North Park Community Center:

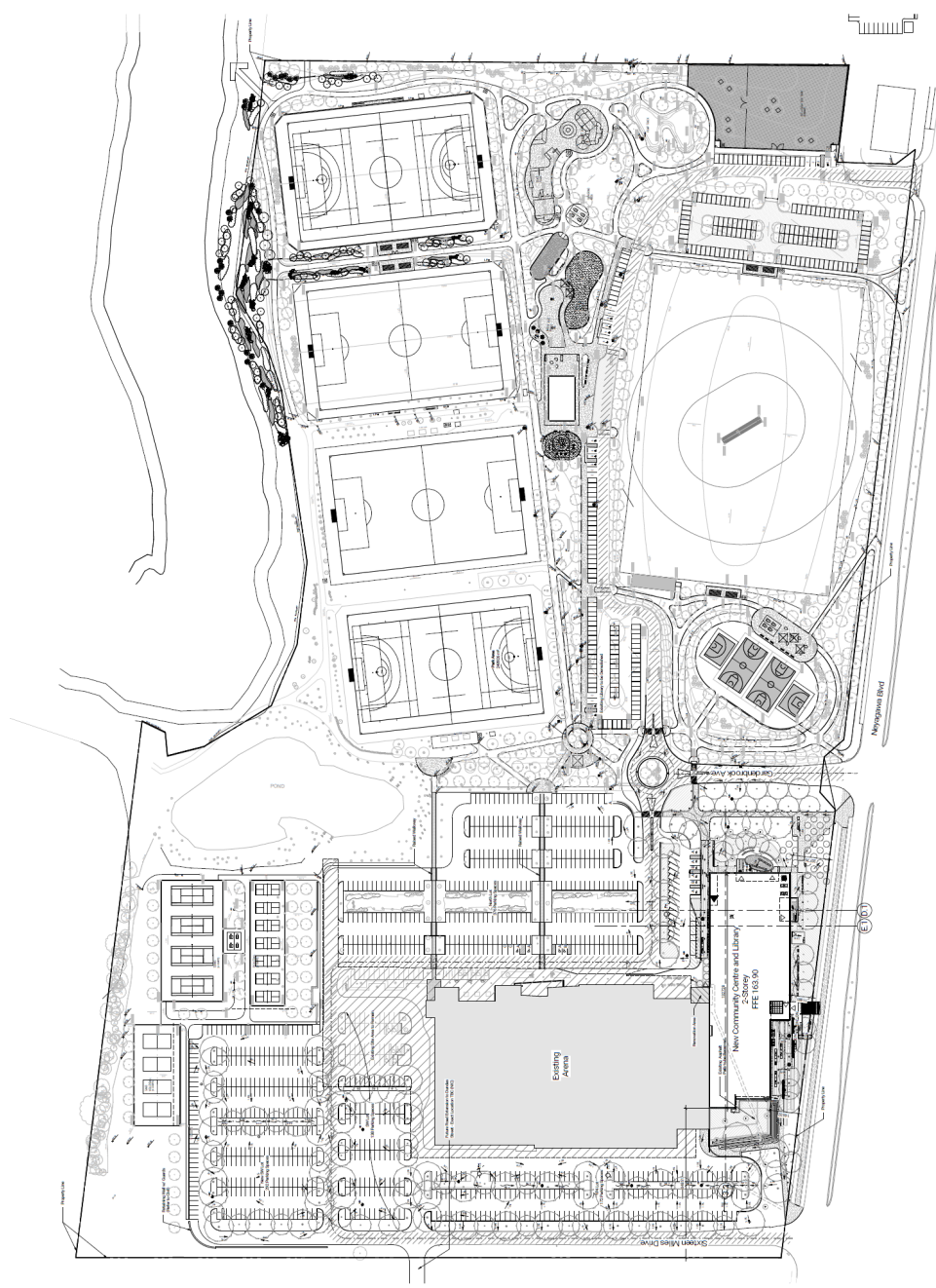


Figure 1: Oakville – North Park Community Center

We have projected this map into our RF simulation software to evaluate the different contour levels present at the site. Following represents the resulting simulation map:



Figure 2: Impact on North Park Community Center Development



Figure 3: Impact on North Park Community Center Development (zoomed view)

On the previous figures 2 and 3, the documents that establish the limit zones for the protection of electronic equipment from high RF radiation are the CPC 3-14-01¹, EMCAB-2², IEC 66601 and the BPR-2³. The following list highlights the different limits:

- 0.25 V/m: this contour (brown) is for the calculation for the protection of AM receivers against intermodulation and cross-modulation as per BPR-2.
- 1.0 V/m: this contour (green) is used as a basis in the BPR-2 to evaluate the potential immunity region of other electronic devices.
- 1.83 V/m: (blue) this is the broadcast and associated equipment immunity contour (EMCAB-2).
- 3.0 V/m: this contour (red) is the protected contour for non-life supporting medical devices (IEC 66601).
- 3.16 V/m: this contour (orange) is the radio-sensitive equipment immunity contour (EMCAB-2).
- 10.0 V/m: this contour (pink) is the protected contour for life supporting medical devices.

The contours on the previous maps have been calculated using the groundwave calculation methodology defined in the BPR-2 (doc v). The contours are a combination of the total power transmitted from each station (CJYE and CJMR).

The EMCAB-2 Level is the blue contour line. The site will be entirely located inside this contour. The detailed analysis of this type of interference can be found at section 3.4 while the proposed mitigation is described at section 4 of this document.

3.2 Safety Code 6 (SC6) Issues:

When in presence of a strong radiofrequency field, the human body usually absorbs the incoming energy in the form of heat and nerve stimulation, within the 3 kHz to 300 GHz frequency bands. The Health Canada Safety Code 6 document (doc iii) describes the different phenomena and sets the limits to ensure public safety and compatibility from RF emitting devices.

Additionally, ISED is responsible for the application of the Safety Code 6 in uncontrolled environment (which is all of the public spaces where people can live, walk, work, etc). ISED has also produced several documents that allow for simulations, calculations, or direct measurement of the Safety Code 6 limits. One of the base documents is the BPR-1 (document iv). The annex B of BPR-1 document proposes a method to evaluate compliance with the SC6 limits for AM broadcasting services.

¹ **Industry Canada**, CPC 3-14-01 – Determinations of Harmful Interference with Respect to Radio-Sensitive Equipment, <https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf01383.html>, verified on April 7, 2022.

² **Industry Canada**, EMCAB-2 – Criteria for Resolution of Immunity Complaints Involving Fundamental Emissions of Radiocommunications Transmitter, <https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf01005.html>, verified on April 7, 2022.

³ **Industry Canada**, BPR-2 – Application Procedures and Rules for AM Broadcasting Undertakings, <https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf01152.html>, verified on April 7, 2022.

The main limitation of the methodology of BPR-1 is that the lookup tables provide only specify calculations for single frequency AM site. Additionally, we usually calculate the minimum distance for each tower by measuring the power transmitted when doing a proof of performance evaluation. This generally minimizes the exclusion zones in terms of SC6.

In our case, if we consider the worst-case situation (using 20 kW of transmitted power as the combination of the 2 stations (10 kW each) and using the parameters that lead to the longest protection distance, which is using frequency 1320 kHz for 95° of electrical height), we find that the safe distance required to achieve a maximum Safety Code 6 level of 50% is 19 metres. This means that non-RF workers should never be closer than 19m distance from one of the Whiteoaks AM site towers. One must note that detailed measurements will usually lead to a shorter distance.

Consequently, as long as the requirement of 19m minimum distance from any tower is respected, any land utilization outside of this distance will be considered as safe, in terms of Safety Code 6 impact on humans. This is also valid for the people already living near the site and they must meet this regulation at all time.

3.3 Electrical Shock Hazards:

As noted in different reports, the proximity of metallic construction near an AM site can induce current which can then provoke an electrical shock when touched. Although we could not find any cases of death by electrocution, many have reported some painful electrical shocks that also caused skin burns.

To understand what can cause these standing voltages, you need to have the following conditions:

- Proximity to the site: some electrical shocks have been recorded up to 8 km from AM sites.
- Long metallic structures acting as an antenna: the worst structures to accumulate standing voltages are construction cranes, other nearby towers (cell phone towers, home TV antenna, etc) and long metallic wire structures (electrical cables, long metallic wire supporting structures, etc). The reason is these structures act as a receiving antenna for the AM RF wave.

The document *Electromagnetic Interference between Cranes and Broadcasting Antennas* (doc x) proposes ways to calculate the potential induced voltage. Additionally, there are ways to mitigate these effects by properly grounding those structures. Workers should also be aware of these conditions and take the appropriate precautions.

After construction is completed, some shock hazards could still exist from nearby metallic objects, but they will be of a much lesser magnitude (much like a static electrical shock). Nevertheless, they could be annoying, and people living or working near an AM site should be aware of the situation.

Some example of post-constructions problems might be experience with elevator system using long steel cable for the cabin. It has been known that elevator controllers are failing more often due to electrical discharges from the elevator cables.

3.4 Radio Interference with Construction Equipment and Consumer Electronics

The main principle that applies is when a broadcaster wishes to implement a new AM radio station, they need to ensure that they will meet all regulations in terms of radio interference (CPC 3-14-01 and EMCAB-2) regarding radio sensitive equipment. Required calculation contours must be clearly indicated, as per BPR-2. Generally speaking, ISED recognizes that problems can arise in the 1 V/m contours and, because of that, when an application is submitted, the population located in the 1 V/m contours should not exceed 0.02% of the population in the 5 mV/m contour (main zone of coverage).

Also, it should be recognized that the 1 V/m limit is more stringent than the EMCAB-2 regulations which recommends the following values:

| Type of Equipment | Field Strength (dBµV/m) | Field Strength (V/m) |
|---------------------------|-------------------------|----------------------|
| Broadcasting Receivers | 125 | 1.83 |
| Associated Equipment | 125 | 1.83 |
| Radio-Sensitive Equipment | 130 | 3.16 |

As specified in EMCAB-2:

“If the level of the transmitted signal exceeds the applicable field strength value on the premises of the affected equipment, it will be deemed that the transmission is the cause of the problem. If the field strength is less than the applicable value, the affected equipment's lack of immunity will be judged the cause.”

Therefore, for this site, the 3.16 V/m limit (orange contour) should be considered as the “cautious” zone in terms of EMCAB-2 levels.

3.4.1 Impact on Construction Equipment

As indicated previously, the impact on construction equipment will be experienced where equipment which has a long metallic height, such as a boom or cable, where they can act as an antenna for the AM frequency. When this situation occurs, the probability of experiencing a standing voltage, which can result in an electrical current discharge (electrical shock) increases with the proximity to the site and the length of the metallic construction equipment.

The worst type of equipment is construction cranes. As identified in section 3.3, electrical shocks can result when touching the crane. One should note that the operator himself, if located on the crane, will probably be in an electrically “floating” condition, which means he will not feel any impact of being in such a situation. But when embarking or disembarking from the crane, it is possible that he will then act as a ground drain for the crane and he can then experience an electrical shock. For this reason, proper precautions, such as equipment grounding, must be considered. Also, the operation of loading on to the cable hook could pose an electrical shock hazard as this will create an electrical circuit to ground.

One must note that, although some electrical shocks have been reported as causing minor burn injury, no loss of life due to this type of electrical shock has been reported nor found in our research.

Other types of equipment, such as vehicles, bulldozers, digging cranes, are not likely to experience

any problems, as long as they are not relying on radio sensitive equipment if they are used inside of the limit of EMCAB-2 (3.16 V/m – orange contour).

Finally, since the site will be located entirely in the EMCAB-2 zone, the usage of any equipment requiring the usage of radio sensitive device, telemetry or remote control (including remotely detonated explosives), should be safely assess before using them (see bullet list 8 in Section 4 for the mitigation measures associated).

3.4.2 Impact on Other Electronic Equipment (including medical equipment):

As a common rule, consumer electronics should normally follow the EMCAB-2 regulations. But in practice, consumer electronic equipment (two-way radios, radio-controlled drones, public announcement (PA) and intercom systems, etc.) can be susceptible to some form of annoyances and problems. This can be seen as reducing the operating distance for drones, receiving interference into two-way radios, rapid discharge of cell phone batteries, etc. For PA and intercom systems, using long wires running in walls of buildings can pick up the AM signal and get saturated rapidly, rendering the PA system unusable. This can also be seen on analog wired telephone system. So before selecting these systems for any critical operation, detailed specifications regarding the RF and EMC immunity will have to be confirmed by the equipment vendor.

Regarding medical equipment, the IEC60601-1-2 standard specifies that medical equipment should have the following immunity:

- Non-Life Supporting: 3 V/m (red contour on Figures 2 and 3)
- Life Supporting: 10 V/m (pink contour on Figures 2 and 3).

Therefore, anybody having a medical condition relying on an electronic medical device can potentially suffer dysfunction in the 10 V/m contour (see the pink contours from figures 2 and 3 at section 3.1). This means that defibrillators, pacemakers, etc will be operated above their tolerance limits and might malfunction. Note that it does not mean that they will certainly malfunction, but it means that the manufacturer of those equipment needs to certify that they will operate properly in an electromagnetic field of this magnitude or less. Fortunately, the 10 V/m contour does not reach the site.

Be since a good portion of the site will be inside the 3 V/m zone, other non-life supporting equipment sauce as hearing aids, wheelchairs, etc. might behave with a degraded condition (like a hissing present in hearing aids). Therefore, any workers requiring nonlife supporting medical devices (like hearing aids) should make sure that the device is operating properly before undertaking his/her work. We are recommending that a first walk through the zone while using the equipment is done prior to start any kind of work to ensure good operation.

As stated previously, this does not means that any electronic equipment (medical or not) will automatically fail in the 3 V/m contour (red line). It just means that the risk of failure is elevated and if such failure occurs, the equipment manufacturer cannot be held responsible for the malfunction as the equipment would have been used outside of its intended specifications. This also applies after the construction once regular users will be using this site.

4. PROPOSED MITIGATION MEASURES

Based on our previous evaluations, the following mitigation measures should be considered and implemented:

GENERAL RECOMMENDATIONS:

- All workers who request it should have access to a copy of this report.
- Workers responsible for safety/security on the site should receive a basic training with a certified RF engineer.
- The map at Appendix A (same as Figure 3) should be printed out and clearly in view at common worker sites, indicating which zone should be considered with more attention.

5. Health Issues (Safety Code 6): the rules are quite strict and must be met at all times. But as demonstrated, the protection zone should not extend further than about 19m from the base of the towers.

RECOMMENDATION: No additional actions are required.

6. Health Issues (Electrical Shock Hazards): Most of the electrical shocks during the construction can come from the usage of cranes. The main location where current might build up is indicated in the following graph (extracted from doc x):

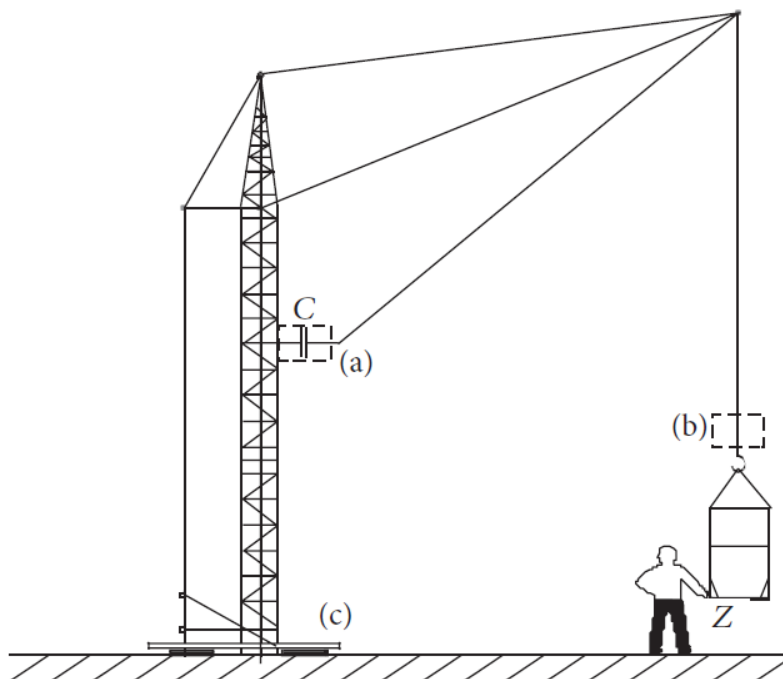


Figure 4: Places where contact current can build up

As we can see from Figure 4, the places where it is the most important to have an impedance matching circuit to have the contact current drained are listed as markers a, b

and c, where:

- a) This is where the main crane cable is attached to the structure;
- b) This is between the main cable and the hook;
- c) This is at the grounding of the crane.

Since the point “a” is not accessible by any workers, we can concentrate on points b and c. For point b, a suitable nonconductive (Kevlar or Polyester) sling should be used between the main cable and the hook. For point c, for a non-moving crane, a grounding rod can be added from the main frame (point c) and can be fixed into the ground. A conductive copper pipe with an appropriate copper wire can be used. For a moving crane, the following picture represent a possible implementation:



Figure 5: Proposed Grounding for Moving Cranes

RECOMMENDATION: Always ground the crane and use a non-conductive sling between the hook and main crane cable. Workers attaching the hook to charges must avoid touching the crane main cable at all times. The operator must be careful when embarking / disembarking from the crane as static shocks can occur (ensuring the usage of protective gloves and boots). Measurements inside the cabin have demonstrated a very low RF radiation level since the cabin act as a Faraday cage and protect the operator.

7. Public Health (Usage of Medical Electronic Equipment): As identified in section 3.4.2, some issues may arise from the usage of non-life-supporting medical devices.

RECOMMENDATION: Workers using medical aid devices having to enter inside the 3 V/m zone (a good portion of the construction site) should make sure that their medical device (like hearing aids) is operating properly before undertaking his/her work. We are

recommending that a first walk through the zone while using the equipment is done prior to start any kind of work to ensure good operation.

8. Radio Interference to Construction Equipment and Consumer Electronics: see section 3.4.1 and 3.4.2

RECOMMENDATION:

- a. Construction Equipment and Consumer Electronics (including two-way radios, cell phone, drones, remotely operated devices and other communication devices): Electronic equipment that will be used inside the EMCAB-2 Zone (Orange Contour at Appendix A) must be properly tested before usage (by a walk through or other types of tests depending on the device).
- b. Remote Control of Construction Explosives: the usage of remote-controlled construction explosives should be certified by the manufacturer of that equipment prior to any usage in the EMCAB-2 zone. The operator must be well aware of the potential shock hazards risk when using long cables which can results in unwanted detonation of the device. Usage in another nearby zone should be done carefully.

APPENDIX A – NORTH PARK COMMUNITY CENTER - HIGH FIELD CONTOURS



Where:

- Brown - 250 mV/m: this contour is for the calculation for the protection of AM receivers against intermodulation and cross-modulation as per BPR-2.
- Green - 1000 mV/m: this contour is used as a basis in the BPR-2 to evaluate the potential immunity region of other electronic devices.
- Blue - 1830 mV/m: this is the broadcast and associated equipment immunity contour (EMCAB-2).
- Red - 3000 mV/m: this is the protected contour for non-life supporting medical devices.
 - **Workers using medical electronic aids must enter this zone carefully and have a first walk through with their device to ensure a safe operation**
- Orange - 3160 mV/m: this is the radio-sensitive equipment immunity contour (EMCAB-2).
 - **Usage of remote-controlled devices (including EXPLOSIVES) and other radio sensitive equipment must be done carefully and thoroughly tested in a dry run before starting regular operation.**
- Pink - 10,000 mV/m: this is the protected contour for life supporting medical devices.
 - **This zone does not touch the premises**

For more information, consult the document: OCR-523 Diamond Schmitt North Park Community Center RF Mitigation Plan due to the presence of the nearby CJYE & CJMR AM Transmission.

APPENDIX B – DIAMOND SCHMITT – OAKVILLE NORTH PARK COMMUNITY CENTER

