

10 Duke Steet West
Kitchener, Ontario

**Existing Façade Retention
Heritage Risk Assessment Report**



Project No. 24012

Draft report issued March 27th, 2024

Final report issued April 4th, 2024

Report Prepared by:

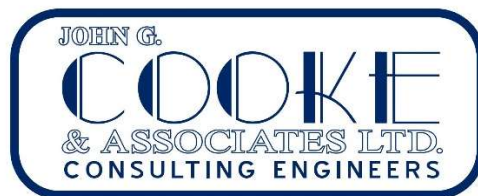


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1. INTRODUCTION

John G. Cooke & Associates Ltd. (JCAL) was retained by VanMar Developments Inc. (VanMar) to provide consulting structural engineering services as it relates to the retention of portions of the primary façades of the existing building at 10 Duke Street West, in Kitchener, Ontario, for incorporation of these facades with a planned redevelopment on the site. The redevelopment will include the construction of a new tower that occupies much of the footprint of the existing building presently on the site.

VanMar received conditional approval of their Site Plan Application - SP22/104/D/AP, the draft version of which, dated June 23, 2023 and available to JCAL, requires “That the Owner submits a Risk Management Plan, including a Vibration Monitoring Plan, commenting on the means and methods that shall be used to minimize vibration to 10 Duke Street West during grading, construction, [etc.]”.

This report is intended to satisfy the requirement for a Risk Management Plan for the heritage façade elements that are to be retained during the redevelopment project. JCAL has already produced a Vibration Monitoring Plan, dated December 15, 2023, and revised for March 27th, 2024, which provided parameters for vibration limits and monitoring to mitigate the effects of vibration on the existing facades. That Vibration Monitoring Plan is attached here to as Appendix A.

2. TERMS OF REFERENCE

The scope of work for John G. Cooke & Associates Ltd. is based on JCAL’s proposal P23208, dated September 18, 2023, and Additional Service Agreement No. 1 (ASA-01), dated March 22, 2024.

The general scope of this report is intended to satisfy the outline provided by Jessica Vieira, Heritage Planning, City of Kitchener, in her e-mail dated March 20, 2024, as follows:

- **Risk Identification** - Construction activities, vibration, weather, fire etc.
- **Risk Response** - How will the risks be mitigated, what will the response be if damage does occur, what standards/guidelines are applied.
- **Implementation** - Roles and responsibilities, monitoring, and reporting.

3. OBJECTIVES

This Risk Management Plan is only intended to identify and address physical risks to the heritage fabric to be retained (the historic facades) over the course of the proposed construction period. This plan is not intended to identify any other risks that might be associated with construction such as health and safety aspects, labour shortages, cost, and schedule overruns, etc.

In this report, potential risks to the heritage fabric are identified. For each such risk, mitigation measures are presented, followed by descriptions of how each risk can be mitigated and managed throughout the project and the responsibilities of the parties involved.

4. IDENTIFICATION OF RISKS

During the retention and partial demolition of the existing heritage building, as well as the construction of the new building, the possible risks to the historic facade that may be encountered are categorized as follows:

- **Construction Activities** - risks associated with construction and demolition activities.
- **Vibration** – risks to the heritage fabric due to vibrations from the proposed construction.
- **Weather** – risks posed by the elements that are increased by the proposed construction.
- **Other** – risks that do not fall into the above categories.

A detailed breakdown of each risk and the impacts that it could have on the historic facade, along with the recommended response for each identified risk, are presented in the Risk Assessment Table in Section 6 below.

5. ROLES & RESPONSIBILITIES

The parties involved in the proposed project are categorized within this report into several roles, as follows:

- **Subtrades** – All Subcontractors and trades retained by the General Contractor for carrying out specific aspects of the new construction including the selective demolition and temporary bracing of the Heritage Building, as well as the construction, of the new building. They are responsible for their specific scope of work and any direct impacts that may occur to heritage fabric during their construction activities. All communications by the Subtrades are assumed to be made directly to the Contractor.
- **Contractor** – VanMar and/or any parties representing them, acting as “Constructor” or General Contractor, and responsible for the overall construction activity on the site. They are responsible for the management of the project as a whole and to communicate relevant information between the Subtrades and the Heritage Consultant.
- **Heritage Consultant** – The member of the project team responsible for consulting on the heritage elements that were or may be affected by the construction of the new building (whether architectural or structural). They are responsible for advising on the specific methodologies that are required for the retention, repair, and preservation of the heritage elements in question.
- **Heritage Subcontractor** – A Subcontractor retained for their specific and demonstrated experience working with heritage materials and on heritage buildings. They are responsible for completing any repairs specific to the existing heritage fabric, as specified by the Heritage Consultant.

Each of the above noted parties has a role to play in the implementation of the risk management for the historic facades. The roles of each party with respect to the identified risks are presented in the Risk Assessment Table in Section 6.

6. RISK ASSESSMENT TABLE

RISK IDENTIFICATION	RISK RESPONSE	IMPLEMENTATION
Construction Activities		
<p>Impact damage to heritage fabric to be retained.</p> <p>(Ex. Crane lift collides with the heritage masonry to be retained.)</p>	<p>Minimize lifts adjacent to heritage masonry. Use tag lines on crane lifts with a likelihood of swinging or damaging masonry. Assess any impacts for damage and make good in accordance with preservation best practices and the Standards and Guidelines.</p>	<p>Subtrades: Report any impacts to the Contractor. Follow procedures to minimize risk of materials impacting the masonry.</p> <p>Contractor: Report any impacts to the Heritage Consultant. Provide temporary protection where work posing an increased risk of damage must happen adjacent to heritage fabric.</p> <p>Heritage Consultant: Assess for any damage, determine repair methodology and review completed repair.</p> <p>Heritage Subcontractor: Repair damage in accordance with the specified repair methodology.</p>
<p>Spills on heritage masonry to be retained.</p> <p>(Ex. Concrete spillage during bucket lifts)</p>	<p>Minimize lifts adjacent to heritage masonry. Remove any spilled products promptly by washing, before they have set, and not with any abrasive or acidic products/methods. Review for any staining/damage after removal.</p>	<p>Subtrades: Notify Contractor of any spills.</p> <p>Contractor: Clean spill promptly following cleaning methodology. Notify Heritage Consultant if any remaining damage or staining is present.</p> <p>Heritage Consultant: Assess for any damage and staining. Determine a cleaning methodology and repair methodology, and review completed repair.</p> <p>Heritage Subcontractor: Clean and repair damage in accordance with specified repair and cleaning methodologies.</p>
<p>Demolition not in accordance with the Structural Assessment and Retention Plan.</p>	<p>Develop Selective Demolition & Retention tender and contract documents, to be developed by the Heritage Consultant(s)</p>	<p>Subtrades: Bid and construct in accordance with the tender and contract documents.</p> <p>Contractor: Bid and construct in accordance with the tender and contract documents.</p> <p>Heritage Consultant: Prepare Selective Demolition & Retention tender and contract documents.</p> <p>Heritage Subcontractor: N/A</p>

<p>Demolition and Retention Tender and Construction Documents</p>	<p>Require a Demolition Plan that is to be reviewed by the Project Consultants for conformance with contract documents.</p>	<p>Subtrades: Submit a Demolition Plan in accordance with project specifications. Contractor: Review demolition plan from Subtrade. Heritage Consultant: Review the Demolition Plan and conduct on-site reviews. Heritage Subcontractor: N/A</p>
<p>Fire damage. (Ex. Fire caused by welding)</p>	<p>Mandate approvals before any hot work can be conducted. Maintain a Firewatch during any periods where hot work is being performed.</p>	<p>Subtrades: Complete hot work only when authorized. Contractor: Review and authorize requests for hot work. Maintain a Firewatch during hot work activities. Heritage Consultant: N/A Heritage Subcontractor: N/A</p>
<p>Damage due to service connections. (Ex. gas, electrical, water)</p>	<p>All services are to be identified and disconnected prior to any construction activity.</p>	<p>Subtrades: Do not proceed with demolition or any other works until services are disconnected. Contractor: Disconnect services before starting any construction activities. Heritage Consultant: N/A Heritage Subcontractor: N/A</p>
<p>Discovery of as-found site conditions (masonry condition, existing structural framing, etc.) that differ from findings or assumptions made in the Structural Assessment & Retention Plan or Demolition and Retention Tender and Construction Documents.</p>	<p>Conditions are to be reported, for the Consultant to review and determine what additional measures may be required.</p>	<p>Subtrades: Report to the Contractor any as-found conditions discovered that are not typical, or damage not noted prior. Modify procedures as directed by the Heritage Consultant. Contractor: Report as-found conditions to the Heritage Consultant. Heritage Consultant: Review discovered conditions and provide additional drawings & details. Specify extent of additional repairs required, or any modifications as required, to suit as-found conditions. Heritage Subcontractor: Complete additional repairs in accordance with specified repair methodology, as directed by the Heritage Consultant.</p>

Damage to the heritage elements to be retained due to new construction by the subtrades.	The heritage fabric is to be clearly identified during project orientation so that all parties are aware and understand which critical heritage elements are being retained. Conduct site meetings with subtrades.	Subtrades: Review all documents and attend all meetings pertaining to the heritage scope to ensure awareness and understanding. Contractor: Incorporate a representative from all subtrades in any communications pertaining to the heritage scope. Clearly identify heritage fabric in on-site orientations for subtrade staff. Heritage Consultant: Assess for any damage, determine repair methodology and review completed repair. Heritage Subcontractor: Repair damage in accordance with the specified repair methodology.
Damage to the heritage elements to be retained during attempted repairs to heritage fabric.	Work on heritage fabric to be completed only by contractors with appropriate heritage experience.	Subtrades: Do not attempt repairs to heritage fabric without clear direction from the Heritage Consultant. Contractor: Report any damage to Heritage Consultant. Heritage Consultant: Assess the damage and determine the repair methodology. Review the completed repair. Heritage Subcontractor: Report any damage to the Contractor and repair -in accordance with specified repair methodology.
Vibration		
Excessive vibrations that may destabilize the masonry or structure.	Set vibration limits and monitor vibrations continually during active construction.	Subtrades: Follow Vibration Monitoring Plan. Communicate to the Contractor the construction method and any potential sources of vibration prior to construction, for review by The Heritage Consultant. Contractor: Follow Vibration Monitoring Plan. Report to the Heritage Consultant any activities that may exceed vibration limits. Install vibration monitors during construction and report any exceedances to the Heritage Consultant. Report any damage to the Heritage Consultant. Heritage Consultant: Develop a Vibration Monitoring Plan. Review any construction method and activities causing exceedances to vibration limits. Assess for any damage, determine the repair methodology and review completed repair.

<p>Vibrations caused by excavation adjacent to the heritage building.</p>	<p>Excavation is expected to be minimal as no blasting or hoe-ramming is required.</p>	<p>Heritage Subcontractor: Complete additional repairs in accordance with specified repair methodology.</p> <p>Subtrades: Follow Vibration Monitoring Plan. Communicate to the Contractor the construction method and any potential sources of vibration prior to construction, for review by The Heritage Consultant.</p> <p>Contractor: Follow Vibration Monitoring Plan. Report to the Heritage Consultant any activities that may exceed vibration limits. Install vibration monitors during construction and report any exceedances to the Heritage Consultant. Report any damage to the Heritage Consultant.</p> <p>Heritage Consultant: Review the construction method and activities. Assess for any damage, determine the repair methodology and review completed repair.</p> <p>Heritage Subcontractor: Complete additional repairs in accordance with specified repair methodology.</p>
<p>Vibrations induced by the infill of the basement mechanical room.</p>	<p>Infill with lean-mix concrete, eliminating the need for heavy compaction equipment.</p>	<p>Subtrades: N/A</p> <p>Contractor: Review with the Heritage Consultant any plan to deviate from the intent of in-filling the basement with lean-mix concrete.</p> <p>Heritage Consultant: Review any proposed changes to the construction method and activities.</p> <p>Heritage Subcontractor: N/A</p>
<p>Vibrations caused by machinery operation. (Ex. Use of cement trucks and cranes.)</p>	<p>Trucks and other heavy equipment required for construction are to be identified prior to beginning any construction activities and reviewed for conformation with the contract documents.</p>	<p>Subtrades: Follow Vibration Monitoring Plan. Communicate to the Contractor the construction method and any potential sources of vibration prior to construction, for review by The Heritage Consultant.</p> <p>Contractor: Follow Vibration Monitoring Plan. Report to the Heritage Consultant any activities that may exceed vibration limits. Install vibration monitors during construction and report any exceedances to the Heritage Consultant. Report any damage to the Heritage Consultant.</p>

		<p>Heritage Consultant: Review the construction method and activities. Assess for any damage, determine the repair methodology and review completed repair.</p> <p>Heritage Subcontractor: Complete additional repairs in accordance with specified repair methodology.</p>
Weather		
<p>Increased moisture levels within the retained heritage masonry once the building is no longer heated.</p>	<p>Provide heat within the heritage building until construction is set to commence. Complete construction in a timely fashion to limit exposure length.</p>	<p>Subtrades: N/A</p> <p>Contractor: Maintain heat in the building until construction activities are ready to commence.</p> <p>Heritage Consultant: N/A</p> <p>Heritage Subcontractor: N/A</p>
<p>Ponding/water retention on slabs infiltrating the heritage masonry to be retained.</p>	<p>Clear standing water on structural slabs and surfaces during construction.</p>	<p>Subtrades: Store materials in dry locations and maintain a tidy working area. Report any standing water to the Contractor.</p> <p>Contractor: Keep surfaces clear of debris and materials that may retain moisture. Routinely clear any standing water as it forms.</p> <p>Heritage Consultant: Review discovered conditions and provide additional drawings & details. Specify extent of additional repairs required.</p> <p>Heritage Subcontractor: Complete additional repairs in accordance with specified repair methodology.</p>
Other		
<p>Vandalism (Ex. Heritage masonry defaced with graffiti.)</p>	<p>Site fencing, hoarding to be installed. Security services to be retained as required.</p>	<p>Subtrades: Report any observed instances of vandalism to the Contractor.</p> <p>Contractor: Provide site fencing & hoarding around construction area and retain security services. Report any observed instances of vandalism to the Heritage Consultant.</p> <p>Heritage Consultant: Assess for any damage. Determine a cleaning methodology and repair methodology, and review completed repair.</p>

Heritage Subcontractor: Clean and repair damage in accordance with specified repair and cleaning methodologies.		
Extensive schedule delay, project abandonment	All parties are to coordinate and submit construction plans prior to commencing any work. Should the project be abandoned, additional protection measures will be required.	Subtrades: Provide up-to-date work schedules to the Contractor. Contractor: Retain site supervisors and project managers to coordinate Subtrades and communicate project progression. Coordinate temporary protective measures, if required to suspend the project. Heritage Consultant: To advise on protective measures with the Contractor, if required. Heritage Subcontractor: N/A

7. DISCLAIMER & LIMITATIONS

This report is based on and limited to information supplied to John G. Cooke & Associates Ltd. by VanMar Developments Inc. personnel and representatives, and by observations made during walk-through inspections of the subject property. Only those items that are capable of being observed and are reasonably obvious to John G. Cooke & Associates Ltd. or have been otherwise identified by other parties and detailed during this investigation can be reported.

The work reflects the Consultant's best judgment in light of the information reviewed by them at the time of preparation. There is no warranty expressed or implied by John G. Cooke & Associates Ltd. that this investigation will uncover all potential deficiencies and risks of liabilities associated with the subject property. John G. Cooke & Associates Ltd. believes, however, that the level of detail carried out in this investigation is appropriate to meet the objectives as outlined in the request. We cannot guarantee the completeness or accuracy of information supplied by any third party.

John G. Cooke & Associates Ltd. is not investigating or providing advice about pollutants, contaminants, or hazardous materials.

This report has been produced for the sole use of VanMar Developments Inc. and cannot be reproduced or otherwise used by any third party unless approval is obtained from John G. Cooke & Associates Ltd. No portion of this report may be used as a separate entity; it is written to be read in its entirety.

We trust this report covers the scope of work as outlined in our Terms of Reference. Should there be any questions regarding this report, or if we can be of any further assistance to you, please contact us.

JOHN G. COOKE & ASSOCIATES LTD.



Jonathan Dee, P. Eng., ing., CAHP
Principal

JD/jd
24012/10 Duke - Structural Assessment & Retention Plan

APPENDIX A

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Vibration Monitoring Plan

10 Duke Steet West
Kitchener, Ontario

**Existing Façade Retention
Vibration Monitoring Plan**



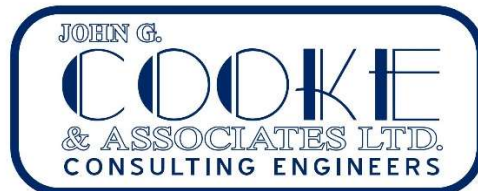
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Revised report issued March 27th, 2024

Report Prepared by:



1. INTRODUCTION

John G. Cooke & Associates Ltd. (JCAL) was retained by VanMar Developments Inc. (VanMar) to provide consulting structural engineering services as it relates to the retention of portions of the primary façades of the existing building at 10 Duke Street West, in Kitchener, Ontario, for incorporation of these facades with a planned redevelopment on the site. The redevelopment will include the construction of a new tower that occupies much of the footprint of the existing building presently on the site.

VanMar received conditional approval of their Site Plan Application - SP22/104/D/AP. The draft version of this approval, dated June 23, 2023 and provided to JCAL, included Heritage Planning Conditions which require

[t]hat the Owner submits a Risk Management Plan, including a Vibration Monitoring Plan commenting on the means and methods that shall be used to minimize vibration to 10 Duke Street West during grading, construction, servicing or other site development works to the satisfaction of the Manager of Development Review and the City's Heritage Planner.

This report is intended to satisfy the requirement for a Vibration Monitoring Plan.

Further to other conditions in the Site Plan Application approval, JCAL has already completed an investigation of the subject site, including destructive exploratory openings, and prepared a Structural Assessment Report, dated December 4th, 2023.

Design progress drawings for the new tower have been completed and reviewed by JCAL, to 75% progress at the time of this writing. A geotechnical report (File no. G21270, Chung & Vander Doelen Engineering Ltd.) has been prepared and also reviewed by JCAL.

2. TERMS OF REFERENCE

The scope of work for John G. Cooke & Associates Ltd. is based on JCAL proposal P23208, dated September 18, 2023.

3. EXISTING CONDITIONS

JCAL completed an investigation of existing conditions at the subject site. Observations made during that investigation are more comprehensively described in our Structural Assessment Report. A summary of the relevant facts are included in the discussion below.

The existing building is constructed predominantly of one-way concrete slabs, supported by steel beams, which are supported by interior steel columns and, at the building perimeter, load-bearing multi-wythe brick masonry exterior walls. The existing building is a 3-storey building plus a full-height basement level.

The existing exterior walls are in good condition where visible on the exterior, and where exposed during investigatory openings made at the interior. The walls consist of an exterior wythe of clay brick with two backup wythes of concrete brick at the interior. These are bonded together with regular header bricks. Mortar joints remain generally intact, except for localized areas. and openings at the interior revealed a well-constructed wall assembly with solid mortar present in the head and collar joints. Stone masonry is included at details such as bands, sills, and surrounding the main entrance.

Localized repointing and other conservation work will be required as part of the preservation and retention of the relevant portions of the existing façades, including at stone details and throughout the masonry. No bulging, significantly displaced stones, or excessively deteriorated or unstable

masonry was noted that would cause us to consider this building to be especially vulnerable to vibrations. Masonry conservation work is not expected to be required in advance of construction.

One caveat is at the parapet which extends above the roof level. The interior face of the parapet is fully covered with metal flashing. While it was not possible to assess the masonry at arms-length from the exterior, and mortar joints here do appear to be generally intact, there is some efflorescence at the exterior of the parapet. This is an indication of high moisture content and migration, suggesting a higher likelihood of deterioration of masonry within the core of the wall. There is nothing to suggest a deviation from the course of action proposed herein, but the condition of this parapet will be monitored and assessed further, as work is ongoing on this project.

4. PLANNED CONSTRUCTION

As noted in the Introduction section, above, the project includes the planned retention in full for the existing south and east facades, and partial retention of the existing west façade, for the building at 10 Duke St. W., for integration with a new tower to be constructed on the site. The project's intent is to retain the existing facades by primarily making use of the steel frame of the existing load-bearing masonry and steel-framed building, supplemented by temporary bracing and supports as necessary, until the façade may be secured to the new permanent structure (designed by other consultants), floor by floor, as construction progresses.

The interior finishes in the building are typically applied to a terra cotta tile backup placed with an approximately 25 mm gap to the interior wythe of backup brick. As part of the work to stabilize the façade and to integrate it with new wall assemblies, it is proposed to remove this terra cotta tile and all finishes. As such, impact to plaster or other finishes are not a consideration in determining the vibration susceptibility of the building.

The new tower will be constructed with a raft foundation, the base of which will be set close to the basement level of the current building. The raft will occupy much of the height of the current lower level of the building, and, aside from elevator pits, the occupiable space of the building will generally extend from approximately grade level and above. The geotechnical report indicates that native soil on the site consists generally of fine granular deposits and silty clay till. It is clear that rock will not be encountered for the proposed depth of excavation.

As a result of the foundation and soil conditions, excavation is anticipated to be relatively minimal. It is further understood, as communicated by VanMar, that the limited excavation that will be required will proceed using sloped excavations. Certainly, no blasting or hoe ramming of rock is anticipated to be required.

Currently, there is a basement mechanical/boiler room within the existing building that extends further below grade than typical conditions, approximately an additional floor level below grade. This room is located against the North (rear) wall of the building and extends for approximately 10m in each direction (about 1½ structural bays). The brick chimney which extends up beyond the roof is quite visible and is located at the northeast of this room. It will be necessary to fill and level the subgrade prior to construction of the raft slab, and the geotechnical report provides two potential options for infilling at this room, to bring it flush with the remaining basement. The first is to place lean mix concrete for the height required, and the second is to place heavily compacted granular fill. VanMar have indicated that they will place lean mix concrete to fill this void, which would not result in significant vibrations being induced, as the costs are quite comparable between the options.

Overall, vibration from excavation is expected to be relatively minimal. General vibration from other construction is expected to stem from miscellaneous construction equipment and activities, such truck traffic adjacent to the facades retained in-situ, and no special circumstances are anticipated to apply.

Localized vibration may be induced from demolition and construction activity near the masonry to be retained. The bracing and construction sequencing and the design of temporary lateral support for the existing masonry facades to remain in-situ are also being prepared by JCAL. Provisions for saw or torch cutting of masonry, concrete, and steel elements connecting to the masonry to be retained will be included. Specifically,

- saw cuts will be introduced in masonry walls at the interface with masonry to be retained before demolition is to occur on portions that are not to be retained,
- saw cuts will be introduced in the concrete slabs along the masonry walls to be retained, before those slabs are removed,
- steel beams that are connected with elements to remain will be torch cut prior to removal, and
- the use of chippers on elements that remain connected to the masonry to be retained will be limited to 12 lb. electric models, unless a mock-up demonstrates that alternatives do not risk damaging masonry.

5. VIBRATION LIMITS

Vibration limits are not stipulated in the City's conditions, nor is there a municipal bylaw in effect to limit vibrations. The nearby City of Toronto has placed limits on construction vibrations, in their bylaw No. 514-2008, and those limits are indicated in Figure 1, below.

Frequency of Vibration (hertz)	Vibration Peak Particle Velocity (mm/sec)
Less than 4	8
4 to 10	15
More than 10	25

Fig 1: City of Toronto construction vibration limits

The above-noted vibrations, while a good benchmark, are limits for any construction activity and are not necessarily applicable or appropriate to all projects. For historic buildings we typically recommend following the limits established in the DIN 4150-3 Standard, per line 3 of Table 1, included at Figure 2, below. The limits are

- **3 mm/s for vibrations less than 10 Hz,**
- **3 to 8 mm/s for vibrations between 10 to 50 Hz, to be interpolated linearly,**
- **8 to 10 mm/s for vibrations between 50 to 100 Hz, to be interpolated linearly, and**
- **10 mm/s for vibrations above 100 Hz.**

We recommend proceeding with the limits indicated above in this case.

These limits are quite low, and are intended to mitigate effects of vibration on historic buildings that might include deteriorated materials or sensitive finishes. The masonry facades to be retained on this building can be expected to be more resilient than many more delicate built historic structures.

Though we do not anticipate exceedances even of these values given the understood nature of the adjacent construction, these limits could be re-evaluated should these limits be found to have significant impact on construction.

Table 1: Guideline values for vibration velocity to be used when evaluating the effects of short-term vibration on structures

Line	Type of structure	Guideline values for velocity, v_1 , in mm/s			
		Vibration at the foundation at a frequency of			Vibration at horizontal plane of highest floor at all frequencies
		1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz*)	
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	3	3 to 8	8 to 10	8

*) At frequencies above 100 Hz, the values given in this column may be used as minimum values.

Fig 2: DIN 4150-3 guideline on vibration limits for various structure types

6. VIBRATION MONITORING AND MONITOR PLACEMENT

We recommend that vibration monitoring be implemented with the placement of two tri-directional digital seismographs to be securely affixed to the façade. See Figure 3.

- The first monitor is to be affixed to the interior face of the concrete foundation wall below the façade, just above the level of the raft slab, within the central third of the South (front) elevation wall. See red star in Fig 3.
- The second monitor is to be affixed to the interior face of the façade, immediately above the first monitor, within 600 mm of the underside of the roof level. See blue star in Fig 3.

Existing interior finishes and terra cotta tile are to be removed from the wall prior to installation, such that the monitors can be affixed to the underlying concrete or backup brick masonry.

The monitors and associated reporting are to continue through the course of construction on the project, or until such time as major vibration inducing construction activities have been completed, there are no regular vibration exceedances, any potential for damage from vibration is not anticipated, and the Consultant advises that they may be removed.

The vibration monitors are to be supplied and installed by a specialized firm that has experience providing such monitors for the duration of construction projects.

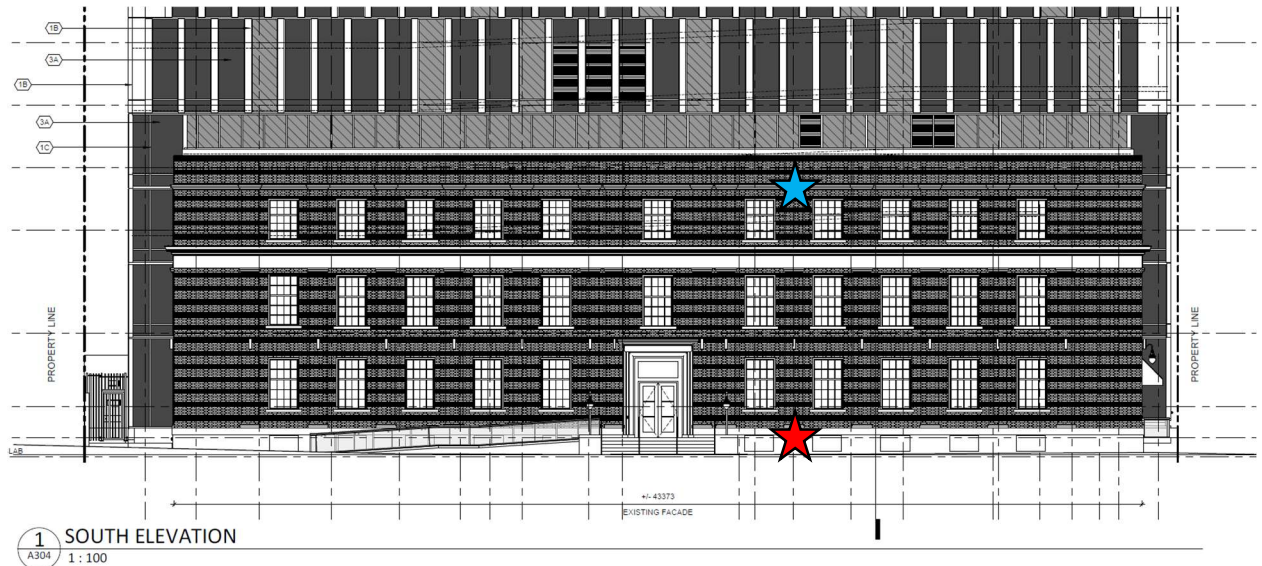


Fig 3: Part South Elevation, indicating proposed locations of vibration monitors.

7. NOTIFICATION AND EXCEEDENCE PROCEDURE

The vibration monitors must be connected for continual reporting of vibration events that result in exceedances of the vibration limits stipulated above. Exceedance events shall be reported by automated email to the Contractor, Owner, and appropriate Consultant(s).

In the event of an exceedance the Consultant is to be contacted. If the exceedance is not the result of disturbing the vibration monitoring equipment or very localized activity around it (both of which are common causes of exceedances), and the Consultant considers the exceedance to be significant, the Consultant shall review on site for any damage that may have resulted from the exceedance.

Future construction activity shall be modified to avoid further exceedances. In cases where this is not possible, and the exceedance was not observed to have had any impact to the structure, the Consultant may advise with respect to increased vibration limits. Note that this approach is intended to be generally consistent with the DIN 4150 standard, which states that "Exceeding the values in table 1 does not necessarily lead to damage; should they be significantly exceeded, however, further investigations are necessary." As noted above, it is our view that this building would likely tolerate vibration limits above those stipulated.

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The work reflects the Consultant's best judgment in light of the information reviewed by them at the time of preparation. There is no warranty expressed or implied by John G. Cooke & Associates Ltd. that this investigation will uncover all potential deficiencies and risks of liabilities associated with the subject property. John G. Cooke & Associates Ltd. believes, however, that the level of detail carried out in this investigation is appropriate to meet the objectives as outlined in the request. We cannot guarantee the completeness or accuracy of information supplied by any third party.

John G. Cooke & Associates Ltd. is not investigating or providing advice about pollutants, contaminants, or hazardous materials.

This report has been produced for the sole use of VanMar Developments Inc. and cannot be reproduced or otherwise used by any third party unless approval is obtained from John G. Cooke & Associates Ltd. No portion of this report may be used as a separate entity; it is written to be read in its entirety.

We trust this report covers the scope of work as outlined in our Terms of Reference. Should there be any questions regarding this report, or if we can be of any further assistance to you, please contact us.

JOHN G. COOKE & ASSOCIATES LTD.



Jonathan Dee, P. Eng., ing., CAHP
Principal

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24012/10 Duke – Vibration Monitoring Plan