

**REPORT OF THE
BUILDING SAFETY TECHNICAL
ADVISORY PANEL**

JANUARY 27, 2016

TABLE OF CONTENTS

Letter to the Minister of Municipal Affairs and Housing	3
Executive Summary	4
Introduction	8
Establishing the Building Safety Technical Advisory Panel (BSTAP).....	10
Approach: Evaluating Buildings Based on Identifiable Risk Factors.....	11
Determining Risk Factors	13
Key Risk Factors	13
Risk Factor Descriptions	14
The Risk Screening Evaluation Tool.....	17
Testing the Risk Screening Evaluation Tool.....	18
Recommended Schedule for Structural Adequacy Assessments based on Risk Screening Evaluations	21
BSTAP Recommendations.....	26
Recommendations on the Risk Screening Evaluation Tool.....	26
Recommendations for Structural Adequacy Assessment Cycles.....	27
Recommendations for a Risk Screening Evaluation and Structural Adequacy Assessments in Practice	28
Recommendations for New Definitions and Technical Requirements.....	28
Recommendation to Address Façades/Building Envelopes.....	29
Conclusion	30
Appendix A: Background and Rationale for Risk Factors	31
Appendix B: Sample Buildings used to test the Risk Screening Evaluation Tool.....	38
Appendix C: Recommended Structural Adequacy Assessment Cycles and Processes 	39
Appendix D: Sources and References	41
Appendix E: Biographies of BSTAP Members	44
Appendix F: Building Safety Technical Advisory Panel Terms of Reference	49

Letter to the Minister of Municipal Affairs and Housing

January 27, 2016

The Honourable Ted McMeekin
Minister of Municipal Affairs of Housing
777 Bay Street, 17th Floor
Toronto, ON
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minister.mah@ontario.ca

Dear Minister McMeekin,

I am pleased to transmit the final report of the Building Safety Technical Advisory Panel (BSTAP).

As noted in our mandate, BSTAP considered specific criteria in evaluating its recommendations, including impacts to public safety, technical feasibility and innovation, and the purposes of Ontario's Building Code.

In eight meetings and with numerous hours of research and fact finding, the panel's expert members have fulfilled their mandate by conducting an evaluation of which classes of buildings should be reviewed; which should be given priority for initial periodic inspection; the time within which each class of buildings should have an initial periodic inspection; and the appropriate period within which each class of buildings should be inspected on a periodic basis.

With the support of your Ministry's staff, the members of the panel have dedicated considerable time and effort to this process, and I thank them for their efforts.

Yours very truly,



Tony Crimi
Chair

Executive Summary

On June 23, 2012, a portion of the rooftop parking deck of the Algo Centre Mall in the City of Elliot Lake collapsed onto the two floors below. Two people were killed, and 19 others were injured. The Government of Ontario appointed the Honourable Justice Paul R. Bélanger to lead an independent public inquiry into the collapse, and the subsequent emergency response. Commissioner Bélanger released his final report on October 15, 2014.

On the same day, the Government of Ontario committed to act on one of the inquiry's recommendations to establish an advisory panel to provide both expert and technical advice for the inspection of existing buildings. The Building Safety Technical Advisory Panel (BSTAP) was established by Ontario's Ministry of Municipal Affairs and Housing. The panel's expert members held eight full-day meetings between April and December 2015. With support from Ministry staff, the members conducted research and analysed matters within the panel's mandate. As a result of this work the panel has developed a comprehensive set of recommendations, summarized below.

BSTAP Recommendations

The following recommendations are the product of extensive research, discussion and consideration by the experts who comprise BSTAP. There are four sets of recommendations, covering use of a Risk Screening Evaluation Tool, timelines for Structural Adequacy Assessments, qualifications for those carrying out Risk Screening Evaluations and Structural Adequacy Assessments, and new definitions and technical requirements.

Recommendations on the Risk Screening Evaluation Tool

BSTAP developed a Risk Screening Evaluation Tool that catalogued generally acknowledged building elements that, if not properly maintained, could present a risk to public safety. The tool is intended to be used to determine if, and when, a professional engineer is needed to conduct a Structural Adequacy Assessment. It could also establish the building's compliance with the Minimum Structural Maintenance Standard recommended by the Commission.

1. BSTAP recommends that:

- 1.1. The Ontario government amend the Building Code Act, 1992 and the Building Code to require that owners of prescribed buildings have their buildings evaluated by a qualified individual, using the Risk Screening Evaluation Tool.
- 1.2. Based on the Risk Screening Evaluation, buildings with a score of less than 100 points be defined as low risk, buildings with a score between 100-130 points be defined as medium risk, and buildings with a score greater than 130 points be defined as high risk.

- 1.3. Buildings of Group C, residential occupancy that fall under the application of Division B, Part 9 in Ontario's Building Code be exempt from undergoing a Risk Screening Evaluation and from completing the Structural Adequacy Assessment program.
- 1.4. Within six (6) years after implementation of the requirement to complete the Risk Screening Evaluation Tool, the Ministry of Municipal Affairs and Housing engage an independent party to review the score values within the tool. This would serve to further validate the tool, assess the possibility of exempting further buildings, or modify the inspection schedules set out within this report. This review should also consider any improvements to the Structural Adequacy Assessment methodology being used in Ontario at the time.
- 1.5. The Ontario government amend the Building Code Act, 1992 and amend the Building Code to require that building owners post the completed Risk Screening Evaluation Tool and Structural Adequacy Assessment Report on a public registry, should one be established.

Recommendations for Structural Adequacy Assessment Cycles

BSTAP discussed when the initial structural assessment of a building identified as medium or high risk should occur, and how the subsequent structural assessment cycle should be determined.

2. BSTAP recommends that:

- 2.1. The Ontario government amend the Building Code Act, 1992 and the Building Code to require Structural Adequacy Assessments for new and existing buildings, as per the schedules set out in [Appendix C: Recommended Structural Adequacy Assessment Cycles](#).
- 2.2. The Ontario government amend the Building Code Act, 1992 and the Building Code to require that building permit applications for a new building include verification that a Risk Screening Evaluation has been completed by a qualified individual.
- 2.3. Risk Screening Evaluations be conducted on buildings outside of these set timelines, when a building owner applies for a building permit for an addition, change of use or extensive renovation.

Recommendations for a Risk Screening Evaluation and Structural Adequacy Assessments in Practice

BSTAP discussed the importance of ensuring that the practitioners and professionals using the Risk Screening Evaluation Tool and those professionals conducting Structural Adequacy Assessments be both qualified and accountable. The panel agreed that all practitioners and professionals who are conducting evaluations and assessments should have the requisite qualifications and regulatory permissions to design the building they are evaluating and assessing.

3. BSTAP recommends that:

- 3.1. The Ontario government require that only qualified individuals conduct Risk Screening Evaluations and Structural Adequacy Assessments.
- 3.2. The Ontario government require that all Structural Adequacy Assessments related to completing a Structural Adequacy Report be completed by a qualified professional engineer.
- 3.2. The Ministry of Municipal Affairs and Housing (the Ministry) enhance the Building Code's qualification and registration program for Building Code Identification Number (BCIN) holders with enforcement/oversight processes, to help ensure that BCIN holders are held accountable for their work and actions.
- 3.3. The Ministry incorporate a continuing education component into the Building Code's qualification and registration program to help ensure practitioners have up-to-date knowledge of Ontario's Building Code.

Recommendations for New Definitions and Technical Requirements

Part of the panel's mandate was to develop recommended definitions and technical requirements for structurally sound and safe buildings. BSTAP recommends the following definitions for "structural sufficiency" and "unsafe".

4. BSTAP recommends that:

- 4.1. The definition of "structural sufficiency" be defined by Professional Engineers Ontario.
- 4.2. For the purposes of this report to government and for the purposes of any regulations, that "unsafe" be defined based on the current definition that is included in the Building Code Act, 1992.

- 4.3. The Building Code be amended to include the following technical requirement to help achieve watertight, structurally sound buildings:

Buildings must be maintained in a manner such that moisture is prevented from causing deterioration, degradation or any other adverse impact on the integrity of the building's structural components, connectors or any other elements that are essential to the structural integrity of the building, or that are necessary to maintain the stability of non-structural components, the failure of which could adversely impact public safety.

Recommendation to Address Façades/Building Envelopes

BSTAP discussed the role of façades as a component of moisture management. With exposure to moisture identified as a principal cause of deterioration, the panel agreed that how façades resist moisture penetration is an important consideration for any proposed structural assessment program.

5. BSTAP recommends that:

- 5.1. The Ministry of Municipal Affairs and Housing address matters related to the maintenance and inspection of façades separately, with advice from the appropriate experts.

Conclusion

Fulfilling its mandate to develop a recommended approach to help safeguard public safety through the inspection of buildings, the panel has proposed a three-part strategy that:

- Creates an effective Risk Screening Evaluation Tool to prioritize new and existing buildings for inspections.
- Identifies qualifications for those conducting Risk Screening Evaluations and Structural Adequacy Assessments.
- Establishes Structural Adequacy Assessment timelines.

Adoption of these recommendations by the Province of Ontario would provide a robust and progressive standard for the mandatory periodic assessments of existing buildings, based upon their likelihood of posing a risk to public safety.

Introduction

On June 23, 2012, a portion of the rooftop parking deck of the Algo Centre Mall in the City of Elliot Lake collapsed onto the two floors below. Two people were killed, and 19 others were injured. On July 9, 2012, the Government of Ontario appointed the Honourable Justice Paul R. Bélanger to lead an independent public inquiry into the collapse, and the subsequent emergency response.

Commissioner Bélanger concluded that the Algo Centre Mall structural collapse occurred:

“After more than 30 years of unabated exposure to constant wetting and drying conditions in the presence of chlorides, a weld rusted to the point where it gave out. It had become so depleted from corrosion that, at the time of the collapse, it had only 13 percent of its original capacity. A car seen in video footage driving over the area in the seconds before the collapse was the proverbial ‘straw that broke the camel’s back.’”¹

The corrosion of the weld occurred as a result of a waterproofing system, which was, as the Commissioner noted, an “untested variant” of systems used elsewhere, and never used again.² Although the mall’s designs were found by the Commissioner to have complied with the 1975 Building Code, “the waterproofing system installed was never able to provide a watertight roof”.³

Released on October 15, 2014, the Report of the Elliot Lake Commission of Inquiry makes 71 recommendations to government. Part One of the report contains factual findings related to the collapse of the Algo Centre Mall, and includes 33 recommendations related to building safety. Part Two of the report contains factual findings related to the rescue and recovery, with 38 recommendations related to the emergency response to the collapse and the Government of Ontario’s inquiry processes.

On October 15, 2014, the Government of Ontario committed to act on one of the inquiry’s recommendations to establish an advisory panel to provide both expert and technical advice for the inspection of existing buildings:

Elliot Lake Commission of Inquiry Recommendation 1.16

“An advisory panel should be established as soon as possible to determine the appropriate classes of buildings, grouped by risk and the consequences of their failure, and to make recommendations no later than 12 months from the release of this Report, on the following:

1. which classes of buildings should be given priority for the initial periodic inspection;

¹ Report of the Elliot Lake Commission of Inquiry, “Executive Summary”, page 6, October 15, 2014.

² Ibid.

³ Ibid.

2. the time within which each class of buildings should have had an initial periodic inspection; and
3. the appropriate period within which each class of building should be inspected on a periodic basis.”⁴

Commissioner Bélanger specified that the panel be composed of only technical experts:

“Let me be clear. I am proposing that technical experts be asked to consider these technical questions, develop solutions, and make recommendations. I am not proposing that this panel be composed of “stakeholders” in the normal sense taken from those who will be affected by the proposed inspection program, such as owners. The questions to be answered are technical...”⁵

The Commissioner intended that the panel, as a response to recommendation 1.16, determine *which* types of buildings should be inspected. The Commissioner recommended that Professional Engineers Ontario determine *how* those structural inspections were to be carried out:

Elliot Lake Commission of Inquiry Recommendation 1.4

“For buildings to which these Recommendations apply, the Professional Engineers of Ontario should enunciate a Performance Standard for the prescribed structural inspection.”⁶

In 2013, Professional Engineers Ontario’s Professional Standards Committee formed a subcommittee of engineers experienced in performing structural condition assessments in anticipation of a recommendation such as recommendation 1.4 written above. This subcommittee was tasked to develop best practices for professional engineers undertaking this work, and to prepare a best practices guideline.⁷

A representative from Professional Engineers Ontario’s subcommittee was invited to attend BSTAP meetings as an observer to help ensure both committees’ recommendations would result in seamless implementation of any proposed inspection program across Ontario’s building regulatory system.

4 Report on the Elliot Lake Commission of Inquiry “Part One: The Events Leading to the Collapse of the Algo Centre Mall”, Chapter 14, page 651, October 15, 2014.

5 Report on the Elliot Lake Commission of Inquiry “Part One: The Events Leading to the Collapse of the Algo Centre Mall”, Chapter 14, page 636, October 15, 2014.

6 Report on the Elliot Lake Commission of Inquiry “Part One: The Events Leading to the Collapse of the Algo Centre Mall”, Chapter 14, page 652, October 15, 2014.

7 Professional Engineers Ontario Subcommittee, “Draft – Structural Condition Assessments of Existing Buildings and Designated Structures”, page 5, August 15, 2015.

Establishing the Building Safety Technical Advisory Panel (BSTAP)

Ontario's Ministry of Municipal Affairs and Housing (MMAH) asked the following organizations to review BSTAP's Terms of Reference, and nominate up to two candidates for potential appointment:

- Large Municipalities Chief Building Officials
- Ontario Building Officials Association
- Professional Engineers Ontario
- Ontario Association of Architects
- Consulting Engineers of Ontario
- Ontario Society of Professional Engineers

Individuals with technical expertise were also invited to apply for appointment to the panel, based on their skill-set and experience with respect to BSTAP's mandate.

After an evaluation of skills and experience by MMAH, the following people were selected as members of the panel:

Chair

- Tony Crimi, Professional Engineer, A.C. Consulting Solutions Inc.

Appointed Members

- Brian Aitken, Architect, Ontario Association of Architects
- Grant Brouwer, Ontario Building Officials Association, Chief Building Official for the Town of St. Marys
- Brad Green, Architect, Ontario Association of Architects
- R. Douglas Hooton, Professional Engineer, Individual appointee
- William Johnston, Professional Engineer, Deputy Chief Building Official for the City of Toronto
- George Kotsifas, Professional Engineer, Large Municipalities Chief Building Officials, Chief Building Official for the City of London
- Alison Orr, Professional Engineer, Individual appointee
- Bruna Pace, Professional Engineer, Ontario Society of Professional Engineers, Senior Plans Examiner for the City of Vaughan
- Chris Roney, Professional Engineer, Professional Engineers Ontario
- Daniel Templeton, Professional Engineer, Consulting Engineers Ontario
- Will Teron, Professional Engineer, Individual appointee

Approach: Evaluating Buildings Based on Identifiable Risk Factors

In spring 2015, BSTAP members began their work to meet the panel's mandate, by:

- Reviewing and analyzing relevant inter-jurisdictional and international information, literature, and existing requirements, standards and guidelines available on existing building inspection regimes that are in place
- Collecting and reviewing other relevant information on international practices and procedures
- Evaluating impacts on public safety
- Applying expert technical knowledge on how structural integrity of large buildings can be compromised over time, based on such factors as design, structural systems/components, repairs, renovations, patterns of usage, weathering and effectiveness of codes/standards under which they were constructed
- Considering an inspection regime that would effectively help protect public safety
- Presenting a report to the Minister of Municipal Affairs and Housing, with recommendations that can be implemented through legislation/regulation.

BSTAP held eight full-day meetings between April and December 2015. The panel began its discussions by considering building collapses in Ontario and comparable jurisdictions, and identifying any incidents of buildings' structural deterioration that members have seen in their professional careers.

Information on actual collapses was difficult to obtain, since most jurisdictions do not track and report them publicly. Media sources tend to only report collapses at a local level, and where the collapse leads to injury. Drawing from members' experience, the panel used examples to gauge how often buildings fail or are at risk of failing, and to identify which types of buildings are most prone to failure. Based on their professional experience, members agreed that structural deterioration was commonly a result of poor or inadequate building maintenance.

Members identified several common trends in some structural collapses which have occurred since the 1950s. The majority of deteriorating buildings or collapses started with external water infiltration. Many of those water-related failures resulted in envelope/façade failures (i.e., the exterior wall peeling off the building). A few collapses were the result of design errors, such as incorrect load calculations to adequately support the building. Others were related to material failures, often when new products did not perform as intended.

Based on the identified incidents of collapses and information from panel members' professional experience in dealing with deterioration of buildings, the panel concluded that risk of actual or potential failure could not be linked to a single building use or occupancy (e.g., a hockey arena versus an apartment building). As a result, the panel sought to develop an approach that would assess buildings based on identifiable risk factors.

BSTAP identified Commentary L from the "User's Guide – NBC 2010 Structural Commentaries" published by the National Research Council of Canada, as a resource that could be used to guide and inform their discussions and deliberations. Commentary L "concerns the structural evaluation and upgrading of existing buildings to achieve a level of performance that is appropriate, based on the intent of the current National Building Code requirements."⁸ The commentary establishes the concept of the evaluation of a building's structural adequacy, based on a set of risk and reliability factors. This general approach was the model that BSTAP used to begin its discussions on risk factors for existing buildings.

BSTAP began its discussions with the identification of risk factors for buildings. While Commentary L ties risk to specific occupancy types for the purposes of estimating the number of people exposed to risk, BSTAP had already concluded from its review that building occupancy type was not necessarily directly linked to risk. As a result, BSTAP began working to adapt some of the approaches used in Commentary L in order to develop their own risk assessment model.

⁸ National Building Code of Canada 2010, "Application of NBC Part 4 of Division B for the Structural Evaluation and Upgrading of Existing Buildings" page L-1, September 30, 2015.

Determining Risk Factors

Limiting the exposure of structural elements to moisture and corrosive compounds is a crucial factor in preventing the premature deterioration of a building's structural elements. Therefore, it is critical to ensure that a building's moisture management system is performing effectively over time.

The panel discussed the role of building envelopes as a component of moisture management. With exposure to moisture identified as a principal cause of deterioration, the panel agreed that the means by which façades resist moisture penetration is an important consideration. Although façades are a critical element for moisture management, they are typically not structural elements. The panel concluded that the particular issue of addressing the maintenance and inspection of façades fell outside the scope of their mandate. As such, the panel decided instead of making recommendations on how to deal with the maintenance of façades that they would recommend that the Ontario government undertake a further review with other experts.

However, the panel agreed that *elements* of façades, such as balconies, protruding elements and cladding systems, should be considered as risk factors, since these types of elements often penetrate the building envelope, and potentially allow water to get in. These types of failures were identified as having resulted in impacts to public safety.

Key Risk Factors

After detailed discussion and consideration, BSTAP determined that the following are the principal characteristics and elements of buildings that, where not properly maintained, may pose a higher risk to public safety:

1. Occupant load (as defined by Ontario's Building Code)
2. Building area (as defined by Ontario's Building Code)
3. Building height (as defined by Ontario's Building Code)
4. Vulnerable building materials and systems
5. Concealed structural elements
6. Environmental exposure of structural elements
7. Vulnerable elements
8. Roofs and roof elements
9. Building importance category (as defined by Ontario's Building Code)
10. Multiple storeys below grade
11. Structures with vehicle traffic/parking

Risk Factor Descriptions

[Appendix A](#) of this report provides background, definitions and rationale for the inclusion of each of the individual risk factors identified above. A summary of these descriptions is provided below. Each of these descriptions is bookmarked to the corresponding explanatory section in Appendix A.

1. Occupant Load (as defined by Ontario's Building Code)

As per BSTAP's mandate, the consequences of a structural failure in relation to the potential number of people at risk were considered. The panel used the 2012 Building Code (Ontario Regulation 332/12) requirements for occupant loads (the number of people for which a building or part of a building is designed) as a guide for measuring incremental risk to the public from a building collapse. For specific data, see the Building Code.

2. Building Area (as defined by Ontario's Building Code)

The Building Code generally uses the footprint area of a building to define whether a building is small or large. Generally, the Building Code treats buildings with a footprint area exceeding 600 square metres as large buildings.

3. Building Height (as defined by Ontario's Building Code)

Building height is defined by the Building Code, where building height means the number of storeys contained between the roof and the floor of the first storey. For its purposes, the panel designated low-rise buildings as three storeys and less, mid-rise buildings as four to six storeys, and tall buildings as seven or more storeys.

4. Vulnerable Building Materials and Structural Systems

This category identifies specific structural and material elements of a building that are considered to be vulnerable to premature deterioration if they are not properly maintained. Examples of these materials and systems that the panel determined would merit additional review are the following:

- a. Autoclaved aerated concrete roof panels
- b. Cold form steel joists with closed top chord
- c. Phenolic foam roof insulation
- d. Post-tensioned concrete
- e. Stay-in-place form work
- f. Other vulnerable materials (to be identified by the practitioner or professional conducting the evaluation)

5. Concealed Structural Elements

The panel considered that finishes which conceal the ability to assess a building's structural elements are an important factor in determining if deterioration is occurring at an accelerated rate. When structural elements are concealed, deterioration could be taking place unseen.

6. Environmental Exposure of Structural Elements

The panel considered whether the exposure of building elements to certain environmental conditions would contribute more significantly to a building's risk of premature deterioration. In particular, the exposure of structural building elements to moisture increases the potential for premature deterioration (e.g., corrosion). In addition, certain corrosive elements (e.g., salt, chlorides, etc.) have the capacity to significantly accelerate deterioration of structural elements.

7. Vulnerable Elements

There are other elements on the envelope/façade of a building that are understood to be vulnerable to deterioration if they are not properly maintained. The panel intended that the "vulnerable elements" category be distinct from the "vulnerable building materials and structural systems" category. Generally, vulnerable elements do not include structural elements, but their presence on a building increases the risk of deterioration of the structural components and the envelope/façade element itself. These vulnerable elements include:

- a. Balconies
- b. Cantilevered or projecting elements
- c. Vulnerable cladding systems
- d. Slender vertical elements

8. Roofs and Roof Elements

Roofs perform a primary function in managing and controlling water from entering a building and therefore are included as a risk factor. BSTAP identified the following types of roofs and roof elements that may increase risk if they are not properly maintained:

- a. Flat roof with parapets and no scuppers
- b. Occupied roofs (including green roofs, building podiums)
- c. Other installed elements (including billboards, communication antennae, solar panels)

9. Building Importance Category (as defined by Ontario's Building Code)

BSTAP determined that there are buildings designated as essential to the provision of services in the event of a disaster (high importance buildings) as defined by the Building Code. In addition, these buildings are those that would likely be used as post-disaster shelters and therefore, are important and should be prioritized as important to assess for risk. These buildings include:

- a. Post-Disaster (as defined by Ontario's Building Code)
- b. High Importance (as defined by Ontario's Building Code)

10. Multiple Storeys Below Grade

The failure of a large building has the potential to have a greater adverse impact on the public than the failure of a small building. This factor accounts for the additional risk due to below grade portions of a building. It applies to cases where there are multiple storeys of a building located below grade, with “storeys” as defined by the Building Code. It applies only where there is more than one level below grade.

11. Structures with Vehicle Traffic/Parking

The deterioration of parking garages and structures exposed to vehicle access has been identified as a significant risk, due primarily to the severe corrosion of steel elements (including steel embedded within concrete) that occurs in the presence of common de-icing chemicals combined with moisture and oxygen. In the case of interior portions of such structures, these de-icing chemicals are carried into the building or onto the structure by vehicles.

The Risk Screening Evaluation Tool

The Elliot Lake Commission of the Inquiry recommended that the Ontario government establish mandatory inspection requirements for existing buildings. This report recommends that such inspection requirements consist of two components: a Risk Screening Evaluation, and a Structural Adequacy Assessment.

To consolidate its deliberations in a simple, implementable tool, BSTAP sought to establish a recommended methodology to evaluate and determine the degree of risk that each of the factors placed on a building. To achieve this, the panel created the Risk Screening Evaluation Tool (below). Each of the identified risk factors is listed in the screening tool, and assigned a weighted value.

The assigned values proportionally identify the factors in buildings that, when not maintained properly, could lead to potential structural failure and risk to public safety. The panel determined that the cumulative scores would provide a realistic sense of proportionality. As a result, BSTAP determined that it is possible to identify the overall relative risk (i.e., low, medium and high) of each building evaluated. The Risk Screening Evaluation Tool is a key component in fulfilling BSTAP's mandate to determine which buildings should be prioritized for structural assessment.

BSTAP developed the following Risk Screening Evaluation Tool, based on factors identified with their value:

RISK SCREENING EVALUATION TOOL	
Factor	Value
Occupant Load⁹	
<10	0
11-50	10
51-150	20
151-500	40
>500	70
Building Area (sq. m)¹⁰	
600m ² and less	0
>600m ²	25
Building Height (number of storeys)¹¹	
1-3	0
4-6	10
7 and greater	25

⁹ Occupant load is determined based on the 2012 Building Code.

¹⁰ Building Area is determined based on the 2012 Building Code.

¹¹ Building Height is determined based on the 2012 Building Code.

RISK SCREENING EVALUATION TOOL	
Factor	Value
Vulnerable Building Materials and Structural Systems	
Autoclaved aerated concrete roof panels	5
Cold form steel joist with closed top chord	5
Phenolic foam roof insulation	5
Post-tensioned concrete	5
Stay-in-place form work	5
Other vulnerable materials	5
Concealed Structural Elements	
Open to visible inspection	0
Concealed by finishes	10
Environmental Exposure of Structural Elements	
Moisture	20
Corrosive elements (to structure)	20
Vulnerable Elements	
Balconies	10
Cantilevered or projecting elements	10
Vulnerable cladding systems	10
Slender vertical elements	20
Roofs and Roof Elements	
Flat roof with parapets and no scuppers	10
Occupied roof	20
Other installed elements	10
Building Importance Category	
Post-disaster	40
High importance	20
Multiple Storeys Below Grade	
	5
Structures with Vehicle Traffic/Parking	
	40

Testing the Risk Screening Evaluation Tool

Having developed the Risk Screening Evaluation Tool, the panel identified that it was necessary to validate it (and the scores produced from it) by reviewing a reasonable number of existing buildings. To accomplish this, members conducted sample reviews of structures with which they were familiar.

BSTAP tested the Risk Screening Evaluation Tool against a sample of 103 buildings of various types, in various large and small communities in Ontario. This data was used to determine whether the tool's calibrated scores generally reflect the panel's perceived risk of various building types. The data was also used to determine if the tool scored similar buildings across the province consistently, so that those buildings seen to be potentially "at-risk" in members' professional experiences were identified consistently. A summary of the 103 examples is shown in [Appendix B: Sample Buildings Used to Test the Risk Screening Evaluation Tool](#).

Based on this testing, BSTAP considered that the Risk Screening Evaluation Tool was useful as a means to categorize buildings into low, medium or high risk categories. As a result, BSTAP recommends that the Risk Screening Evaluation Tool be used by a qualified individual to determine the frequency of the Structural Adequacy Assessments. The Structural Adequacy Assessments would be conducted by a qualified professional engineer. BSTAP expects that qualifications for professional engineers will be further defined by Professional Engineers Ontario.

Low Risk Buildings

- Based on the results of the testing of the Risk Screening Evaluation Tool, BSTAP found that buildings with a score of fewer than 100 points present a low level of risk, and therefore recommends that such buildings would not require a Structural Adequacy Assessment.

Medium Risk Buildings

- BSTAP considers that buildings with a score between 100 and 130 points pose a medium risk. Therefore, these buildings should be placed on a schedule of Structural Adequacy Assessments that responds to the threat to public safety, based on the risk categories identified in the Risk Screening Evaluation Tool.

High Risk Buildings

- BSTAP considers that a score greater than 130 points demonstrates a building at high-risk. Therefore, these buildings should be placed on a schedule of Structural Adequacy Assessments where they are reviewed sooner, and more frequently, since the risk factors identified demonstrate an increased potential to adversely affect structural elements.

BSTAP recognized that adjustments to the Risk Screening Evaluation may be necessary over time, as evaluations and assessments are implemented across the province. Consequently, the Ministry of Municipal Affairs and Housing should consider recalibrating the Risk Screening Evaluation Tool at a future date, as a larger body of data is developed. Such a review of the tool should also take into consideration the Structural Adequacy Assessment methodology that is developed.

The panel recommends that the Risk Screening Evaluation Tool be used by a practitioner qualified to have designed the building under Ontario's Building Code, the Professional Engineers Act, 1990, or the Architects Act, 1990. These qualified persons could, in some cases, be practitioners with a Building Code Identification Number (BCIN) who are qualified to design the building under the Building Code, and in other cases, professional engineers or architects.

Members agreed that buildings of Group C, residential occupancy, falling under the application of the Building Code Division B, Part 9, should be exempt from completing a Risk Assessment Evaluation (unless those buildings change their use, e.g., a house that is converted into a restaurant, as a house converted to a commercial occupancy would result in the potential for increased risk to more individuals).

BSTAP emphasizes the clear distinction between the Risk Screening Evaluation Tool and the Structural Adequacy Assessment. The Risk Screening Evaluation would be performed solely for the purposes of determining *if, when* and *how frequently* a Structural Adequacy Assessment must be carried out.

Recommended Schedule for Structural Adequacy Assessments based on Risk Screening Evaluations

Risk Screening Evaluations for New Buildings

For new buildings, the panel recommends that a Risk Screening Evaluation be completed before an application for a building permit is submitted.

New buildings would be scored as low, medium, or high risk. Buildings that score under 100 in the risk evaluation would not require a Structural Adequacy Assessment. Buildings that scored between 100 and 130 points would pose a medium risk, and buildings with a score greater than 130 points would pose a high risk.

The panel recommends that the risk screening be completed by the appropriate qualified individual before submitting a building permit application. Afterward, the building permit applicant would verify whether or not they have completed the evaluation to help ensure they, along with the enforcement jurisdiction, are aware of the Structural Adequacy Assessment cycle.

Structural Adequacy Assessments for New Buildings

After developing a risk assessment methodology, BSTAP's next step was to consider an appropriate schedule for Structural Adequacy Assessments. BSTAP reviewed requirements for existing buildings in comparable jurisdictions. These jurisdictions and website links to their requirements are listed in Appendix D.

Jurisdictions with mandatory inspection requirements for existing buildings usually phase-in the first inspection over two to 10 years, with periodic re-inspections that range from three to 10 years. These jurisdictions generally regulate the mandatory inspection of 600 to 20,000 existing buildings.

The panel members considered their own professional experience, along with timelines for other assessments, such as reserve studies for condominiums. Assessment cycles were ultimately chosen based on milestones in both design and construction. Panel members also recognized that there must be a distinction made between the implementation periods for new and existing buildings, due to the heightened risk factors associated with building age.

The following table summarizes the timelines for Structural Adequacy Assessments, based on the score determined in the Risk Screening Evaluation, for new buildings:

Table 1:

Structural Adequacy Assessment Cycles: <i>New Buildings</i>			
Risk Screening Evaluation Score (at time of building permit application)	Low <100 points	Medium 100-130 points	High >130 points
First Structural Adequacy Assessment (from time of initial occupancy)	N/A	18 years	12 years
Frequency of Subsequent Structural Adequacy Assessments	N/A	12 years	6 years

Phasing-in Risk Screening Evaluations for Existing Buildings

Ontario has approximately 200,000 existing buildings¹², excluding houses. With this large number, the challenge is to implement a practical yet efficient evaluation, and subsequent structural assessment schedule.

The panel sought to consider a sense of priority and urgency, striking a balance between the number of buildings and the practitioners available in the sector to evaluate and subsequently assess them. Since these recommendations were developed with limited data, the panel recommends a higher threshold, until the results of the implementation can be measured and re-adjusted, if required. The phase-in cycle would prioritize assessments on the most critical buildings, and take into account additional factors such as costs, professional capacity, etc.

BSTAP determined that all existing buildings should be evaluated using the same Risk Screening Evaluation Tool used for new buildings. The same evaluation method would score existing buildings as low, medium, or high risk. Buildings that score under 100 in the risk evaluation would not require a Structural Adequacy Assessment. Buildings that score between 100 and 130 points would pose a medium risk, and buildings with a score greater than 130 points would pose a high risk. Aligning the assessment cycle with existing legislation (e.g., Ontario’s Condominium Act, 1998) would minimize undue assessments and disruption. The other two major factors that BSTAP considered regarding the phasing-in of the assessment of existing buildings are the building’s age and whether it has a parking structure.

¹² Estimate is based on property tax assessment data from the Municipal Property Assessment Corporation.

Building Age

BSTAP recommends that existing buildings built before 1976 (prior to Ontario's first Building Code coming into force) serve as a benchmark for phasing in the Risk Screening Evaluation and subsequent Structural Adequacy Assessments. Before 1976, some municipalities had their own building by-laws, while others referenced the model National Building Code of Canada. However, requirements were not consistent across the province. The panel agreed that buildings built pre-1976 should generally be evaluated before those built post-1976.

Parking Structures

BSTAP also considered another benchmark for buildings containing parking structures. Apart from the separate factor of building age, parking structures built before 1988 are the highest priority existing building type to conduct Risk Screening Evaluation and subsequent Structural Adequacy Assessments. These structures were identified because they were constructed prior to the Building Code's incorporation of the Canadian Standards Association (CSA) standard for "Parking Structures" (CAN/CSA-S413), which came into effect in 1988. This standard codified research and construction advancements over the course of the 1980s. The durability of parking structures has been significantly improved and further increased by subsequent CSA standard amendments. As a result, buildings with parking structures not built to the CSA standard should be subject to a phased-in implementation requirement sooner than buildings built before 1976.

Phasing-in Structural Adequacy Assessments of Existing Buildings

BSTAP considered the same factors for the phasing-in of Structural Adequacy Assessments as for the Risk Screening Evaluation. Table 2 below summarizes the recommended timeline for Structural Adequacy Assessments, for existing buildings:

Table 2:

Structural Adequacy Assessment Cycles: Existing Buildings									
Types of Existing Buildings	All Buildings with Parking Structures (Pre-1988)			All Other Buildings (Pre-1976)			All Other Buildings (Post-1976)		
Risk Screening Evaluation (from date requirement takes effect)	Within 3 years			Within 6 years			Within 10 years		
Risk Screening Evaluation Score	LOW <100 points	MED 100-130 points	HIGH >130 points	LOW <100 points	MED 100-130 points	HIGH >130 points	LOW <100 points	MED 100-130 points	HIGH >130 points
First Structural Adequacy Assessment (from date requirement takes effect)	N/A	Within 5 years		N/A	Within 8 years		N/A	Within 12 years	
Frequency of Subsequent Structural Adequacy Assessments	N/A	12 Years	6 years	N/A	12 years	6 years	N/A	12 years	6 years

Phasing-in Risk Screening Evaluations for Existing Buildings Undergoing an Addition, Change of Use and/or Extensive Renovation

The panel recommends that a new Risk Screening Evaluation be completed before an application for a building permit is submitted for an addition, change of use (e.g., a house converted to a commercial building) and/or extensive renovation for an existing building. For more information, see Part 10 and Part 11 of Ontario's Building Code (O. Reg. 332/12) that identifies the triggers for change of use and/or extensive renovations.

Structural Adequacy Assessments for Existing Buildings Undergoing an Addition, Change of Use and/or Extensive Renovation

For existing buildings undergoing an addition, change of use and/or extensive renovation, the panel recommends that these buildings be subject to the same Structural Adequacy Assessment cycle in Table 2 on page 24 based on their Risk Screening Evaluation score.

BSTAP Recommendations

The following recommendations are the product of extensive research, discussion and consideration by the experts who comprise BSTAP. There are four sets of recommendations, covering use of the Risk Screening Evaluation Tool, timelines for Structural Adequacy Assessments, qualifications for those carrying out Risk Screening Evaluations and Structural Adequacy Assessments, and new definitions and technical requirements. Each set of recommendations is presented with some background explaining their development.

Recommendations on the Risk Screening Evaluation Tool

The panel recognized that there were various elements of a building that could be considered high risk. Without regular and proper maintenance, these elements could contribute to the premature deterioration of structural elements of a building.

The identification and evaluation of what could be considered high risk components would help ensure that the buildings which are most at risk are identified for a further structural adequacy assessment.

To identify the buildings presenting the highest risk to public safety, BSTAP developed a Risk Screening Evaluation Tool that catalogued generally acknowledged problematic building elements. The tool would be used to determine if, and when, a professional engineer is needed to conduct a Structural Adequacy Assessment. For existing buildings, qualified practitioners would visit the building site and use their knowledge and experience to apply the Risk Screening Evaluation Tool to identify the building's relative risk. This relative risk would determine the frequency of the building's assessment under the Structural Adequacy Assessment program.

1. BSTAP recommends that:

- 1.1. The Ontario government amend the Building Code Act, 1992 and the Building Code to require that owners of prescribed buildings have their buildings evaluated by a qualified individual, using the Risk Screening Evaluation Tool.
- 1.2. Based on the Risk Screening Evaluation, buildings with a score of less than 100 points be defined as low risk, buildings with a score between 100-130 points be defined as medium risk, and buildings with a score greater than 130 points be defined as high risk.
- 1.3. Buildings of Group C, residential occupancy that fall under the application of Division B, Part 9 in Ontario's Building Code be exempt from undergoing a Risk Screening Evaluation and from completing the Structural Adequacy Assessment program.

- 1.4. Within six (6) years after implementation of the requirement to complete the Risk Screening Evaluation Tool, the Ministry of Municipal Affairs and Housing engage an independent party to review the score values within the tool. This would serve to further validate the tool, assess the possibility of exempting further buildings, or modify the inspection schedules set out within this report. This review should also consider any improvements to the Structural Adequacy Assessment methodology being used in Ontario at the time.
- 1.5. The Ontario government amend the Building Code Act, 1992 and amend the Building Code to require that building owners post the completed Risk Screening Evaluation Tool and Structural Adequacy Assessment Report on a public registry, should one be established.

Recommendations for Structural Adequacy Assessment Cycles

BSTAP discussed when the initial Structural Adequacy Assessment of a building identified as medium or high risk should occur, and how the subsequent structural assessment cycle should be determined.

For new buildings, verification that a Risk Screening Evaluation has been completed is recommended. This verification should be part of a building permit application, to help ensure that the appropriate enforcement jurisdiction knows which buildings are due for a Structural Adequacy Assessment.

For existing buildings, a separate phased-in cycle is proposed, along with a recommendation to conduct a Risk Screening Evaluation when a building owner applies for a building permit.

2. BSTAP recommends that:

- 2.1. The Ontario government amend the Building Code Act, 1992 and the Building Code to require Structural Adequacy Assessments for new and existing buildings, as per the schedules set out in [Appendix C: Recommended Structural Adequacy Assessment Cycles](#).
- 2.2. The Ontario government amend the Building Code Act, 1992 and the Building Code to require that building permit applications for a new building include verification that a Risk Screening Evaluation has been completed by a qualified individual.
- 2.3. Risk Screening Evaluations be conducted on buildings outside of these set timelines, when a building owner applies for a building permit for an addition, change of use or extensive renovation.

Recommendations for a Risk Screening Evaluation and Structural Adequacy Assessments in Practice

BSTAP discussed the importance of ensuring that the practitioners using the Risk Screening Evaluation Tool and those professionals conducting Structural Adequacy Assessments be both qualified and accountable. The panel agreed that all practitioners who are conducting evaluations and assessments should have the requisite qualifications and regulatory permissions to design the building they are evaluating and assessing. Persons conducting evaluations and assessments should have up-to-date qualifications that reflect knowledge of the most recent edition of Ontario's Building Code and be held accountable for their actions.

BSTAP notes that, in accordance with recommendation 1.5 in the Report of the Elliot Lake Commission of Inquiry (which was directed to Professional Engineers Ontario); any subsequent Structural Adequacy Assessments related to completing a Structural Adequacy Report should be required to be completed by a qualified professional engineer. This is distinct from the Risk Screening Evaluation.

3. BSTAP recommends that:

- 3.1. The Ontario government require that only qualified individuals conduct Risk Screening Evaluations and Structural Adequacy Assessments.
- 3.2. The Ontario government require that all Structural Adequacy Assessments related to completing a Structural Adequacy Report be completed by a qualified professional engineer.
- 3.2. The Ministry of Municipal Affairs and Housing (the Ministry) enhance the Building Code's qualification and registration program for Building Code Identification Number (BCIN) holders with enforcement/oversight processes, to help ensure that BCIN holders are held accountable for their work and actions.
- 3.3. The Ministry incorporate a continuing education component into the Building Code's qualification and registration program to help ensure practitioners have up-to-date knowledge of Ontario's Building Code.

Recommendations for New Definitions and Technical Requirements

Part of the panel's mandate was to create definitions and technical requirements for structurally sound and safe buildings. BSTAP recommends the following definitions for "structural sufficiency" and "unsafe".

4. BSTAP recommends that:

- 4.1. The definition of "structural sufficiency" be defined by Professional Engineers Ontario.

- 4.2. For the purposes of this report to government and for the purposes of any regulations, that “unsafe” be defined based on the current definition that is included in the Building Code Act, 1992.
- 4.3. The Building Code be amended to include the following technical requirement to help achieve watertight, structurally sound buildings:

Buildings must be maintained in a manner such that moisture is prevented from causing deterioration, degradation or any other adverse impact on the integrity of the building’s structural components, connectors or any other elements that are essential to the structural integrity of the building, or that are necessary to maintain the stability of non-structural components, the failure of which could adversely impact public safety.

Recommendation to Address Façades/Building Envelopes

BSTAP discussed the role of maintaining and inspecting façades as a component of moisture management. With exposure to moisture identified as a principal cause of deterioration, the panel agreed that how façades resist moisture penetration is an important consideration for any proposed structural assessment program.

In addition, the panel discussed how other jurisdictions addressed technical requirements and inspections for façades. It was agreed that a recommendation be made to the Minister of Municipal Affairs and Housing that maintenance standards and timeframes for inspections of envelope/façades be determined separately by the appropriate experts.

5. BSTAP recommends that:

- 5.1. The Ministry of Municipal Affairs and Housing address matters related to the maintenance and inspection of façades separately, with advice from the appropriate experts.

Conclusion

Fulfilling its mandate to develop a recommended approach to help safeguard public safety through the inspection of buildings, the panel has proposed a three-part strategy that:

- Creates an effective Risk Screening Evaluation Tool to prioritize new and existing buildings for inspections.
- Identifies qualifications for those conducting Risk Screening Evaluations and Structural Adequacy Assessments.
- Establishes Structural Adequacy Assessment timelines.

Adoption of these recommendations by the Province of Ontario would provide a robust and progressive standard for the mandatory periodic assessments of existing buildings, based upon their likelihood of posing a risk to public safety.

The panel is confident that a mandatory evaluation and assessment system would greatly reduce the likelihood and risk of structural failures in Ontario. However, BSTAP stresses that there is no system or set of rules that can eliminate the risk of structural failures completely. As noted in the recommendations, a six-year review of the Risk Assessment Evaluation Tool (with the advantage of longer term data) would enhance overall risk management in the future.

Appendix A: Background and Rationale for Risk Factors

1. Occupant load (as defined by Ontario's Building Code)

As per BSTAP's mandate, the consequences of a structural failure in relation to the potential number of people at risk were considered. The panel used the Building Code (O. Reg. 332/12) requirements for occupant loads (the number of people for which a building or part of a building is designed) as a guide for measuring incremental risk to the public from a building collapse. The utilization of the occupant load already included in the Building Code (Section 3.1.17. Division B) offers a pragmatic way of estimating the number of persons potentially at risk using a methodology already familiar to the building design industry.

2. Building area (as defined by Ontario's Building Code)

Building area was included as a risk factor for a number of reasons. Clearly, the failure of a large building has the potential to have a greater adverse impact on the public welfare than the failure of a small building. Furthermore, the Building Code already demands a higher degree of safety for a large building than it does for a small one. The Building Code generally defines the footprint of small and large building as having an area above or below 600 square metres, and the panel has, therefore, adopted this delineation. As per the Building Code, the building area is considered the greatest horizontal area of a building above grade.

3. Building height (as defined by Ontario's Building Code)

The height of a building, in terms of storeys above grade, was considered as a risk factor in much the same way, and for the same general reasons, as the building's area. Building area alone is insufficient to determine overall size since it is of the horizontal area only.

For the purposes of the panel's recommendations, building height is defined using the definition in the Building Code. That is, building height means the number of storeys contained between the roof and the floor of the first storey.

For the purposes of assessing risk factors, the panel has distinguished between low-rise buildings (three storeys and less), mid-rise buildings (four to six storeys), and tall buildings (seven or more storeys).

4. Vulnerable building materials and structural systems

This category identifies specific structural and material elements of a building that are known to be vulnerable to premature deterioration if they are not properly maintained.

a. Autoclaved aerated concrete roof panels

Autoclaved aerated concrete (AAC) was used as a building material in Ontario from 1955 to 1972, when it was manufactured domestically. It is lightweight, with favourable insulating and structural properties, and has a finish that could serve as an aesthetically pleasing exposed ceiling. It found widespread use in commercial, multi-unit residential, and assembly occupancies, including many schools. However, AAC has been found to suffer from structural degradation when exposed to moisture for an extended period of time and not maintained appropriately. This could lead to a number of structural issues where the material has been used as roof panels and where ongoing roof leaks have occurred. Consequently, the panel identified this material, if not properly maintained, as a potential risk.

b. Cold form steel joists with closed top chord

Open web steel joists are a structurally efficient (and very common) roof framing element. Though most are used as pairs of steel angles as their top chords, there have been some types of steel joists that used cold formed steel chords with a closed shape. These can allow water to collect, often undetected, in the channel formed in the top chord. Where water (most typically originating from a roof leak) becomes trapped within the top chord, corrosion can occur, reducing the structural capacity of the joists. This phenomenon has led to the collapse of the roof of some structures when not properly maintained and has been identified by the panel as a vulnerable structural element.

c. Phenolic foam roof insulation

Steel deck is widely used as a structural element to support roof assemblies and to resist the snow, rain, wind, and live loads imposed upon the roof of a building. Phenolic foam roof insulation was first produced in Canada in the mid-1970s, and production continued until 1991. It was widely used over steel deck.

Moist phenolic foam insulation within a roof assembly that includes steel deck has been found to cause accelerated corrosion of the steel deck if not properly maintained. The source of the moisture is most commonly linked to roof leakage or inadequate condensation control.

d. Post-tensioned concrete

Post-tensioned concrete has been used for many years in concrete frame structures. High-strength cable reinforcement is placed in ducts, which are cast within the concrete structure. The cables are placed under tension with hydraulic jacks, which are clamped in place with concrete-embedded anchors after the concrete is cast. Since the structural integrity of the post-tensioned structure depends, in large part, on the integrity of the anchorage of the steel cables, deterioration of the anchorages when not properly maintained can produce serious consequences. If these anchorages are exposed to moisture, corrosion can occur. Consequently, BSTAP identified that buildings using such systems could pose a higher risk should they experience a failure.

e. Stay-in-place form work

Concrete formwork that remains as part of the final structure cannot be inspected, either during or after placement. As a result, there is potentially a higher risk of undetected defects, some of which could lead to accelerated deterioration or structural failure if not properly maintained.

f. Other vulnerable materials

BSTAP recognizes that this is not an exhaustive list of vulnerable building materials and structural systems. There may be other systems and materials used in building construction today, or in the future, that can be equally susceptible to premature deterioration, under unfavourable conditions, or from improper maintenance. Accordingly, these other vulnerable materials should be identified as a risk and scored in the Risk Screening Evaluation Tool.

5. Concealed structural elements

The panel considered that finishes which conceal the ability to inspect a building's structural elements for signs of deterioration are an important factor. When structural elements are concealed, deterioration could be taking place unseen. Structural framing that is hidden behind ceiling or wall finishes, covered with a spray-on fireproofing, or embedded in masonry is more difficult to monitor and inspect for signs of deterioration or damage. Since such elements may go undetected until failure occurs, this represents an elevated risk.

This provision relates to framing that is located behind finishes or other constructs that would need to be cut away or dismantled to facilitate inspection. Elements concealed by easily removable and restorable finishes, such as a lay-in tile ceiling, should not be considered as concealed.

6. Environmental exposure of structural elements

The panel considered the exposure of building elements to certain environmental conditions as contributing more significantly to a building's risk of premature deterioration if not properly maintained. In particular, the exposure of structural and building elements to moisture increases the potential for premature deterioration (e.g., corrosion). In addition, certain corrosive elements (e.g., salt, chlorides, etc.) have the capacity to accelerate deterioration.

This category is intended for situations where the structural elements, or portions of them, are exposed to such environmental conditions as part of their normal service. This provision should not apply to suspended parking structures, as these are considered as a special case. However, it should be applied in cases where de-icing chemicals are used at suspended structures, other than those exposed to vehicular traffic.

7. Vulnerable elements

This risk factor identifies specific, envelope/façade elements of a building that are understood to be vulnerable to deterioration if they are not properly maintained. The panel intended that the "vulnerable elements" category be distinct from the "vulnerable building materials and systems" category. Generally, vulnerable elements do not include structural elements but their presence on a building increases the risk of deterioration of the structural components and the envelope/façade element itself if not properly maintained.

These components include:

a. Balconies

Balconies are typically located outside of the building envelope and exposed to the exterior environment. They tend to be exposed to the weather and subjected to the effects of freeze/thaw cycles. Typically, they also introduce discontinuities in the exterior cladding and weather-proofing system.

b. Cantilevered or projecting elements

Generally, these elements project from the building, and any failure of such elements or their connections to the building structure could put the public at risk. This category includes signs that project from the building face, canopies, exterior ornamentations, and appendages. This category is not intended to include roof overhangs that are extensions of the roof of the building, or balconies, which are dealt with separately. Elements projecting less than one metre may be excluded for the purposes of the risk screening evaluation.

c. Vulnerable cladding systems

When not properly maintained, certain types of cladding systems have been found to be more vulnerable to moisture penetration or retention, which may lead to adverse structural consequences. This includes cases where the cladding system allows (or facilitates) the deterioration of structural framing elements within or in the immediate vicinity of the cladding. It also includes deterioration of structural connections or the means of attachment of the cladding to the structure. Cladding attachment failure could endanger the public.

Examples of cladding systems that may be vulnerable if not properly maintained include face sealed cladding systems, composite brick/concrete block systems, brick veneer systems lacking sufficient movement joints, and older systems of masonry veneer backed by flexible backup walls.

d. Slender vertical elements

Structures with slender vertical elements were identified by the panel as a risk factor for a number of reasons. One example is bell and clock towers, which are often aged, highly exposed to the elements, and vulnerable due to inaccessibility.

The panel defines this category as vertical elements (or portions of a building) where the least lateral dimension (measured at its base) is less than one-fifth the height of the element. The height is defined as the measure from the uppermost level where lateral support to the tower is provided.

For example, in the case of a clock tower that extends beyond the roof of a building, the height would be measured from the elevation of the building roof to the eave of the tower, provided that the tower is structurally connected to the building roof. If not, or if its connection cannot be ascertained, its height would be measured from grade.

8. Roofs and roof elements

Considering the primary function that roofs perform in managing and controlling water from entering a building, it is clear that they must be included as a risk factor. BSTAP identified the following types of roofs and roof elements that may be vulnerable if not properly maintained:

a. Flat roof with parapets and no scuppers

Roofing systems with little or no slope that rely solely on roof drains are considered to be of higher risk. Roof drains commonly become blocked, leading to the potential for the buildup of water on the roof when not appropriately maintained. Water buildup increases the risk of moisture infiltration and may overload the building structure, or cause excessive deflections that could lead to premature deterioration of structural elements.

b. Occupied roofs (including green roofs, building podiums)

Roof areas that are landscaped or serve as occupied spaces or green roofs typically comprise either soil or a wearing surface over the waterproofing membrane. Experience has shown that such waterproofing systems are more difficult to inspect and more costly to repair, since access to them usually involves removal of the landscaping or surface finishes. This results in disruption to the use of the area in question, and significant additional costs.

In addition, some green roofs and landscaping systems retain water, instead of directing it away from the structure. As a result, the potential for water pooling could facilitate deterioration of the roof, when it is not properly maintained.

c. Other installed elements (including billboards, communication antennae, solar panels)

BSTAP recognizes that the list of roof elements outlined here is not an exhaustive list. Also, there may be systems on the roof that do not account for the intended load calculation, or which may have perforated the roof membrane during installation.

Roofs with other installed elements, whether or not there are roof penetrations, are considered to be at higher risk of damage or deterioration to the waterproofing system. This is due to a number of factors, including construction traffic on the membrane during installation, concentrated loads at supports, elevated local wind forces, dead loads or snow accumulations, disruption of roof drainage, etc. Furthermore, improper installation could perforate the roof membrane leaving it susceptible to water infiltration.

9. Building importance category (as defined by Ontario's Building Code)

BSTAP determined that there are buildings designated as essential to the provision of services in the event of a disaster (high importance buildings) as defined by the Building Code. In addition, these buildings are those that would likely be used as post-disaster shelters and therefore, are important and should be prioritized as important to assess for risk. These buildings include:

a. Post-Disaster

Post-disaster buildings are buildings essential to the provision of services in the event of a disaster, and include:

- hospitals, emergency treatment facilities and blood banks
- telephone exchanges
- power generating stations and electrical substations
- control centres for land transportation
- public water treatment and storage facilities
- water and sewage pumping stations

- emergency response facilities
- fire, rescue and police stations
- storage facilities for vehicles or boats used for fire, rescue and police purposes
- communications facilities, including radio and television stations

Due to their importance to public safety in the event of a disaster, BSTAP recommends that a factor be applied that would recognize the increased risk associated with a failure of these types of buildings.

b. High Importance

High importance buildings are those likely to be used as a post-disaster shelter. This category includes those buildings whose primary use is as an elementary, middle or secondary school or as a community centre. It also includes manufacturing and storage facilities containing toxic, explosive or other hazardous substances in sufficient quantities to be dangerous to the public if released. Consequently, BSTAP recommends that these buildings be included in a risk screening evaluation.

10. Multiple storeys below grade

The height of a building, in terms of storeys above grade, was considered as a risk factor in much the same way, and for the same general reasons, as the building's area. However, building height does not include the case where there are multiple storeys below grade. Clearly, the failure of a large building has the potential to have a greater adverse impact on the public welfare than the failure of a small building. This factor accounts for the additional risk due to below grade portions of the building. It would apply only where there is more than one level below grade.

11. Structures with vehicle traffic/parking

The deterioration of parking garages and structures exposed to vehicle access has been identified as a significant factor, due primarily to the severe corrosion of steel elements when they are not appropriately maintained. This includes steel embedded within concrete, in the presence of common de-icing chemicals combined with moisture and oxygen. These de-icing chemicals are typically carried into the garage or onto the structure by vehicles.

Corrosion of structures exposed to such conditions has led to numerous cases of severe deterioration of the structure and, ultimately, structural failure, when they are not maintained properly. Consequently, BSTAP identified this as a significant factor in the assessment. This does not apply to parking areas that derive their structural support solely from the ground on which they are constructed.

Appendix B: Sample Buildings used to test the Risk Screening Evaluation Tool

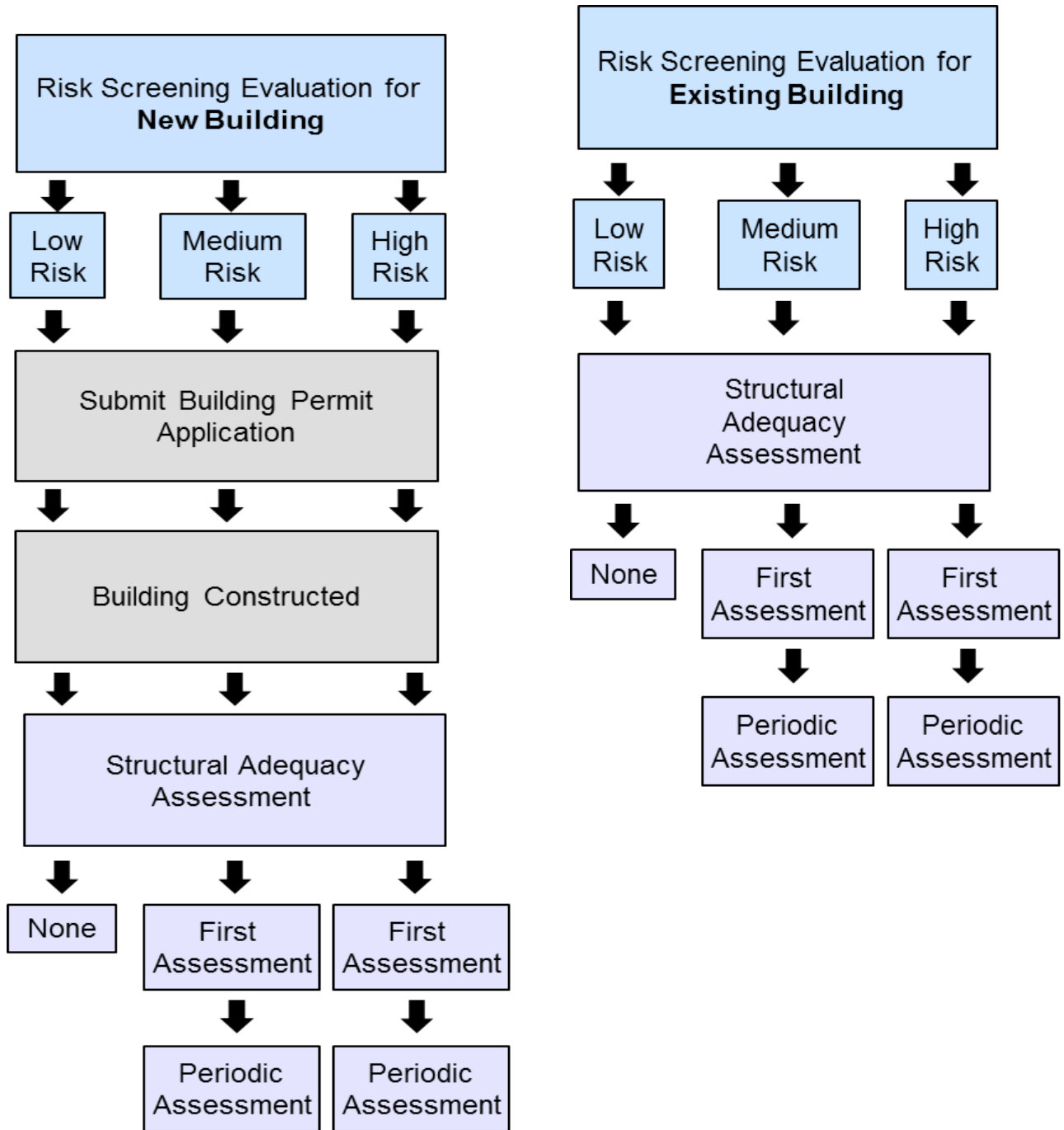
Building Type and Category Number	Number of Examples	With Parking Garages	Average Score	Average Score With Parking Garages	Low Range	High Range	Number of Low Risk <100	Number of Medium Risk 100-130	Number of High Risk >130
1. Residential Apartment Building Below 5 storeys	10	4	87	125	40	175	6	3	1
2. Residential Apartment Building, 5-18 storeys	17	9	142	159	70	210	5	4	8
3. Residential Apartment Building, greater than 18 storeys	4	2	139	173	105	175	-	2	2
4. Commercial/Office Buildings	13	2	82	108	30	135	9	4	-
5. Places of Worship	5	-	87	-	50	130	3	1	1
6. Educational Institution	7	-	108	-	50	155	1	5	1
7. Community Centre	8	-	117	-	65	150	1	7	-
8. Arena	3	-	82	-	65	95	3	-	-
9. Industrial	7	-	55	-	25	65	7	-	-
10. Post-disaster Buildings	3	1	72	85	60	85	3	-	-
11. Parking Structure	4	-	115	-	90	135	1	2	1
12. Main Street Residential/Commercial Mixed Use	4	-	45	-	30	80	4	-	-
13. Shopping Mall	9	-	82	-	35	115	8	1	-
14. Repair Garage	1	-	10	-	-	10	1	-	-
15. Aircraft Hangar	1	-	70	-	-	70	1	-	-
16. Nursing Home	1	-	155	-	-	155	-	-	1
17. Houses	3	-	40	-	20	60	3	-	-
18. Farm Buildings	3	-	47	-	20	75	3	-	-
TOTAL	103						59	29	15

Appendix C: Recommended Structural Adequacy Assessment Cycles and Processes

Structural Adequacy Assessment Cycles: <i>New Buildings</i>			
Risk Screening Evaluation Score (at time of building permit application)	Low <100 points	Medium 100-130 points	High >130 points
First Structural Adequacy Assessment (from time of initial occupancy)	N/A	18 years	12 years
Frequency of Subsequent Structural Adequacy Assessments	N/A	12 years	6 years

Structural Adequacy Assessment Cycles: <i>Existing Buildings</i>									
Types of Existing Buildings	All Buildings with Parking Structures (Pre-1988)			All Other Buildings (Pre-1976)			All Other Buildings (Post-1976)		
Risk Screening Evaluation (from date requirement takes effect)	Within 3 years			Within 6 years			Within 10 years		
Risk Screening Evaluation Score	LOW <100 points	MED 100-130 points	HIGH >130 points	LOW <100 points	MED 100-130 points	HIGH >130 points	LOW <100 points	MED 100-130 points	HIGH >130 points
First Structural Adequacy Assessment (from date requirement takes effect)	N/A	Within 5 years		N/A	Within 8 years		N/A	Within 12 years	
Frequency of Subsequent Structural Adequacy Assessments	N/A	12 years	6 years	N/A	12 years	6 years	N/A	12 years	6 years

Processes for Risk Screening Evaluations and Structural Adequacy Assessments



Appendix D: Sources and References

Report of the Elliot Lake Commission of Inquiry

Report on the Elliot Lake Commission of Inquiry. October 15, 2014.

<http://www.attorneygeneral.jus.gov.on.ca/inquiries/elliottlake/report/index.html>

Jurisdiction Research

City of Boston

<http://www.cityofboston.gov/ISD/>

City of Chicago

http://www.cityofchicago.org/city/en/depts/bldgs/provdrs/inspect/svcs/exterior_wall_program.html

City of Columbus

<https://www.columbus.gov/Templates/Detail.aspx?id=67006>

City of Milwaukee

<http://city.milwaukee.gov/Façade.htm>

City of Philadelphia

<http://www.phila.gov/li/Pages/default.aspx>

City of Pittsburgh

<http://pittsburghpa.gov/pli/building-codes>

City of St. Louis

<https://www.stlouis-mo.gov/government/departments/public-safety/building/building-codes.cfm>

Government of Hong Kong Administrative Region

http://www.bd.gov.hk/english/services/index_mbis.html

Government of Singapore

<https://www.bca.gov.sg/PSI/>

Florida – Broward County

<http://www.broward.org/CodeAppeals/AboutUs/Pages/SafetyInspectionProgram.aspx>

Florida – Miami-Dade County

http://www.miamidade.gov/pa/property_recertification.asp

New York City

http://www.nyc.gov/html/dob/html/safety/façade_inspections.shtml

Province of Quebec

<https://www.rbq.gouv.qc.ca/en/building/technical-information/building-chapter-from-the-safety-code/façades-maintenance-and-inspection.html>

<https://www.rbq.gouv.qc.ca/en/building/technical-information/building-chapter-from-the-safety-code/parking-garages-maintenance-and-inspection.html>

Legislation and Regulations

Building Code Act, 1992

<http://www.ontario.ca/laws/statute/92b23>

Building Code (O. Reg. 332/12)

<http://www.ontario.ca/laws/regulation/120332>

Condominium Act, 1998

<http://www.ontario.ca/laws/statute/98c19>

Books

Building Façade Maintenance, Repair, and Inspection, Editor: [Jeffrey L. Erdly](#)

Guides, Manuals and Standards

ASTM E2841 – 11 Standard Guide for Conducting Inspections of Building Façades for Unsafe Conditions

<http://www.astm.org/Standards/E2841.htm>

ASTM E2270 – 14 Standard Practice for Periodic Inspection of Building Façades for Unsafe Conditions

<http://www.astm.org/Standards/E2270.htm>

CAN/CSA-S413-94 (R2007) Parking Structures

<http://shop.csa.ca/en/restofworld/structures/s413-07-r2012/invvt/27005102007>

CAN/CSA-S448.1-10 (R2015) Repair of reinforced concrete in buildings and parking structures

<http://shop.csa.ca/en/canada/structures/s4481-10-r2015/invvt/27000572010>

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<http://shop.istructe.org/surveys-and-inspections-of-buildings.html>

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IStructE (2013) Manual for the systematic risk assessment of high-risk structures against disproportionate collapse. London: IStructE.

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National Building Code 2010, Structural Commentaries (Part 4 of Division B), User's Guide, Commentary L – Assessment of Existing Buildings

http://www.nrc-cnrc.gc.ca/eng/publications/codes_centre/2010_user_guide_nbc_part4.html

Professional Engineers Ontario Subcommittee, Draft – Structural Condition Assessments of Existing Buildings and Designated Structures,” August 15, 2015.

Appendix E: Biographies of BSTAP Members

Tony Crimi, Chair

Mr. Crimi is the founder of A.C. Consulting Solutions Inc. (ACCS), which specializes in building and fire related codes, standards, and product development activities in Canada, the U.S. and Europe, providing services to manufacturers and industry associations in achieving testing and product approval/recognition. Before he founded ACCS in 2001, he spent over 15 years in the area of codes, standards, testing, and conformity assessment with Underwriters' Laboratories of Canada (ULC), where he concurrently held the positions of Vice President & Chief Engineer.

At various stages of his tenure at ULC, he was responsible for Engineering and Laboratory Operations, Standards Development, Regulatory Affairs, Field Services and ISO 9000 series Quality System Registration.

Mr. Crimi continues to be a contributor to a wide range of Codes and Standards development activities in Canada, the U.S. and Europe. He is a member and immediate past-Chair of the NBCC Standing Committee on Fire Protection, and has been Chair of the Building Code Part 3 Technical Advisory Committee, and the Building Code Energy Efficiency Technical Advisory Committee. He is also currently Chair of the Building Code Conservation Advisory Council and formerly was Chair of MMAH's Expert Advisory Panel on Requirements for Outdoor Temporary Stages.

Brian Aitken

Brian Aitken is an Architect and currently a Practice Advisor for the Ontario Association of Architects (OAA). Brian's 35 years of experience include 20 years as a partner of Shore Tilbe Irwin & Partners Architects / Perkins+Will, Toronto, covering a multitude of project types. Over the years this focused onto large or complex projects, fast track, design-build, take-over and other non-traditional delivery methods. He has been active in contracts, practice and management issues of architecture for most of his career.

Brian is a member of the Canadian Construction Documents Committee (CCDC), member of the Executive Committee for the Institute for BIM in Canada (IBC) and Business Manager for buildingSMART Canada.

Current activities at the OAA and various committees bring his years of experience into collaborative development with younger members of the design and construction community, new best practices and new contracts for new delivery methods such as P3, BIM and IPD. Brian provides staff support to the OAA Practice Committee and Construction Contract Administration Committee and is a member of the Engineers Architects and Building Officials committee (EABO).

Brian received a Bachelor's degree from the School of Architecture and Planning, Howard University, Washington, D.C., is a member of the OAA, RAIC, and the American Institute of Architects.

Grant Brouwer

Grant Brouwer is a Director on the Board of the Ontario Building Officials Association (OBOA), and holds the designation of Certified Building Code Official. The OBOA is an industry association representing, training and certifying Ontario's municipal plans examiners and building inspectors. He is also co-Chair of the Education and Training Committee of the Board, developing Building Code and related training for a wide range of practitioners.

He has been the Chief Building Official for the Town of St. Marys for the past 12 years, and also holds the portfolio of Planning and Development. Until recently, he held the municipal facilities portfolio with over forty buildings under his care and control. Mr. Brouwer also owned and operated a small construction company.

Brad Green

Mr. Green is the President of H. Bradford Green Architect Inc., a Thunder Bay based architectural firm with 30+ years of experience. Mr. Green's formal education includes a Diploma in Architectural Technology from Ryerson University, a B.Sc. (Arch) and an M. Arch. from The Ohio State University.

Mr. Green is a Councillor of the Ontario Association of Architects, where he serves as the V.P. Practice and as a member of the OAA Discipline Committee. He also represents the OAA on the EABO Committee and the Pro-Demnity Insurance Co. Board. Over the span of his career, Mr. Green has designed buildings from all categories of the Building Code and in all geographic locales, from urban to remote fly-in sites.

R. Douglas Hooton

Dr. R. Doug Hooton is a professor and NSERC/Cement Association of Canada Senior Industrial Research Chair in *Concrete Durability and Sustainability* in the Department of Civil Engineering at the University of Toronto. In the 1980s, he was an engineer at Ontario Hydro's Research Division. His research over the last 40 years has focused on the durability performance of cementitious materials in concrete, as well as on performance specifications and performance tests. His durability research has encompassed all mechanisms of fluid ingress into concrete and all forms of concrete degradation including freezing and thawing as well as de-ice salt penetration and corrosion.

He has consulted on service life prediction of concrete structures in chloride exposures. He is a Fellow of the American Concrete Institute (ACI), ASTM, the American Ceramic Society, the Engineering Institute of Canada and the Canadian Academy of Engineering.

William Johnston

Mr. Johnston is a professional engineer with an undergraduate degree in Civil Engineering and a master's degree in Fire Protection Engineering from the University of British Columbia. He has over 20 years of building regulatory experience with the Cities of Toronto and Vancouver.

Mr. Johnston is currently a Director in Toronto Buildings and Deputy Chief Building Official, responsible for the design and construction of buildings through the permitting and inspection processes in the North District. In this role, he provides divisional leadership for all inspection activities across the City of Toronto, while establishing consistent policies and procedures for the delivery of these services.

George Kotsifas

Mr. Kotsifas graduated from Ryerson University with a Bachelor Degree in Civil Engineering and is a member of Professional Engineers Ontario. He began his career in consulting for various firms, including Trow, Planmac, and McCormick Rankin. He was involved in a wide range of projects and disciplines, some of which included transportation planning, geotechnical investigations, design, and project management for road and bridge construction.

George went to London, Ontario in 2008 as the Director of Building Controls and Chief Building Official. He has been actively involved in the building industry and is the past Chair of the Large Municipalities Chief Building Officials.

He is currently the Managing Director of Development and Compliance Services and Chief Building Official with the City of London, and is responsible for development approvals, buildings and by-law enforcement.

Alison Orr

Alison Orr is a Professional Engineer, designated Consulting Engineer, and Certified Building Code Official, with Orr Brown Consulting Engineers Ltd. She is also a member of the Building Code Commission, a tribunal that deals with disputes between permit applicants and municipal building departments.

Ms. Orr started her career as a building inspector and building engineer with the City of Hamilton. She then joined Southward Consultants Limited, where she became involved in the investigation of collapses, failures, and loss of serviceability of buildings, and the evaluation of buildings damaged by fire, impact, and weather events. Municipal liability claims are a particular area of specialty for Ms. Orr, primarily with respect to standard of care related to building inspections and plans examination.

Bruna Pace

Bruna Pace is a professional engineer and is currently a Senior Plans Examiner with the City of Vaughan. She formerly served as Building Plans Examiner with the City of Brampton and as Structural Engineer with MiTek Canada. Since 2005, Mrs. Pace has served on the Structural Advisory Committee of the Toronto Area Chief Building Officials Committee.

As a member of the Ontario Society of Professional Engineers (OSPE), she has represented OSPE at the Ministry of Municipal Affairs and Housing (MMAH) Building Code Technical Advisory Committee for Barrier-Free Design. She also served on the MMAH Expert Advisory Panel on Requirements for Outdoor Temporary Stages.

Mrs. Pace earned a Bachelor of Applied Science degree in Civil Engineering from Queen's University in 1995, and is a member of the Professional Engineers of Ontario (PEO) and the Ontario Building Officials Association (OBOA).

Chris Roney

Chris Roney holds an honours degree in Civil Engineering from Queen's University. A third-generation engineer, he heads Roney Engineering Limited, a Kingston, Ontario consulting firm offering a full range of structural engineering services. Mr. Roney has been a practicing structural engineer for over 21 years, and is accredited by Professional Engineers Ontario (PEO) as a Building Design Specialist and Consulting Engineer. He has a great deal of expertise and experience in the structural evaluation of existing buildings, including steel, concrete and masonry structures.

He serves as a member of the Ministry of Municipal Affairs and Housing's Building Advisory Council, the mandate of which is to provide strategic advice to the Minister on matters related to on-going policy, administrative and technical issues related to the Building Code Act, 1992 and the Building Code. Mr. Roney also served as Chair of the Part 4 (Structural) Technical Advisory Committee for the 2012 Building Code.

Mr. Roney has held a number of positions on the Council of Professional Engineers Ontario and has been extremely active on various committees and task forces for the past 17 years, including the Elliot Lake Advisory Committee. He participated in the drafting of PEO's recommendations and participated in the inquiry's roundtable sessions as an expert representing PEO.

Mr. Roney is the President-Elect of Engineers Canada, representing the 12 provincial and territorial associations that regulate engineering in Canada and license the country's more than 280,000 professional engineers.

Daniel Templeton

Dan Templeton is a professional engineer, who obtained his Bachelor of Science, Civil Engineering degree at Queen's University. He joined a small general contracting firm after graduation, serving as project manager for industrial and commercial construction projects. He later joined a consulting firm in Barrie, Ontario, specializing in hydrogeology, and served as a project manager for numerous ground water studies and monitoring projects.

In 1996, he joined Halsall Associates, serving as a project manager in their Building Science Group. He is senior principal and technical lead for numerous areas of restoration including, cladding, roofing, structure repair, and Building Code compliance. During this time, Dan has been active in Property Condition Audits, Capital Planning and Reserve Fund Preparation, Tarion Warranty Resolution, Building Restoration Design and Project Management for all building systems.

Will Teron

Will Teron is a professional engineer and Designated Consulting Engineer, with special interest and experience in the assessment and analysis of existing buildings and structures. A particular focus is the structural engineering for the conservation of heritage and older buildings.

A graduate of University of Waterloo in Civil Engineering (Structural), he is currently Director – Investigation & Heritage and a Principal at Tacoma Engineers in Guelph, Ontario. Along with his commitment to the Building Safety Technical Advisory Panel, Mr. Teron sits on Professional Engineers Ontario's PSC sub-committee, addressing Structural Condition Assessments of Existing Buildings.

His building assessment experience serves him as an Expert Member of International Scientific Committee on the Analysis and Restoration of Structures of Architectural Heritage, an international technical committee of ICOMOS.

José Vera

José Vera, P.Eng., MEPP served as a guest observer on BSTAP. Mr. Vera is the Manager of Standards and Practice at Professional Engineers Ontario.

BSTAP would like to thank Mr. Vera for his support during the panel's deliberations. He provided valuable information, input to discussion, and support to members.

Appendix F: Building Safety Technical Advisory Panel Terms of Reference

Introduction

The Minister of Municipal Affairs and Housing (the Minister) established the Building Safety Technical Advisory Panel (BSTAP) to conduct a review and provide advice to the Minister on what kinds of existing buildings should be inspected, and when they should be inspected to help ensure public safety.

These Terms of Reference set out the mandate and scope of BSTAP's review.

Mandate

The Elliot Lake Commission of Inquiry recommended that at least some existing buildings should be inspected on a regular basis. BSTAP's review is not to determine whether such inspections are necessary.

BSTAP will develop a recommended approach that would help safeguard public safety through the inspection of existing buildings and would assist government in implementing the Commission's recommendation.

Specifically, BSTAP will identify:

- Priority categories of existing large buildings considered “high risk” in relation to their water tightness and structural sufficiency.
 - The categories of building will be grouped by risk (with the highest risk being assessed on the basis of the most people put at the most risk); and
 - For each category, the likelihood and consequences of failure will be assessed.
- An appropriate schedule for inspections to help safeguard public safety in relation to water tightness and structural sufficiency as these buildings age, including:
 - The timeframe within which each category of buildings should be subject to an initial post-occupancy inspection; and
 - The appropriate period within which each category of building should be inspected on a regular go-forward basis.
- Technical requirements to achieve watertight, structurally sound and safe large buildings.

BSTAP's recommended approach for Ontario will consider:

- Ontario's unique circumstances
- Capacity for effective implementation and enforcement
- Inspection regulations and practices in other jurisdictions and their relative effectiveness in preventing building failures
- Effectiveness of various approaches for all parties concerned

The approach recommended by BSTAP will need to be implementable through legislative and regulatory change (if necessary), including those changes that will be reflected in the inspection program.

BSTAP is established for a period of up to 12 months, starting with its first meeting.

Scope of the Review

In fulfilling its mandate, BSTAP will:

- Review and analyze relevant inter-jurisdictional and international information, literature, and existing requirements, standards and/or guidelines available on existing building inspection regimes that are in place
- Collect and review other relevant information on international practices and procedures
- Consult with experts as determined by the Ministry of Municipal Affairs and Housing (MMAH), as well as experts identified by BSTAP members
- Evaluate impacts on public safety
- Apply expert technical knowledge on how structural integrity of large buildings can be compromised over time, based on such factors as design, structural systems/components, repairs, renovations, patterns of usage, weathering and effectiveness of codes/standards under which they were constructed
- Consider an inspection regime that would effectively protect public safety
- Present a report, with recommendations that can be implemented through legislation/regulation

BSTAP may be directed by the Minister to undertake additional tasks.

Evaluation Criteria

The criteria BSTAP will consider in evaluating recommendations include:

- Impacts to public safety
- Technical feasibility and innovation
- The purposes of the Building Code, which are:
 - To establish standards for public health and safety, fire protection, structural sufficiency, conservation and environmental integrity and to establish barrier-free requirements, with respect to buildings
 - To establish processes for the enforcement of the standards and requirements

Membership

BSTAP members will be appointed at the discretion of the Minister of MMAH. The following organizations will be invited to nominate up to two individuals to represent their organization on BSTAP:

- Large Municipalities Chief Building Officials
- Ontario Building Officials Association
- Professional Engineers Ontario
- Ontario Association of Architects
- Consulting Engineers of Ontario
- Ontario Society of Professional Engineers

The Minister will appoint one representative from each organization to BSTAP. The Minister may appoint additional individuals to BSTAP.

Each member of the panel shall serve at the Minister's pleasure for up to 12 months, from BSTAP's first meeting.

Representatives of the following ministries will be invited to attend BSTAP meetings, but will not be voting members of the panel:

Ministry of Labour

Ministry of Community Safety and Correctional Services

Ministry of the Attorney General

Other ministries as deemed necessary by the Minister

Sub-committees

There may be a need for focused sub-committees. Among other tasks, sub-committees will provide research, analysis, and advice on specific topics related to inspections of existing buildings.

Establishment of sub-committees will be proposed by BSTAP and approved by the Director of MMAH's Building and Development Branch. Sub-committees will appoint a representative to report on findings, research or discussion topics to BSTAP.

Roles and Responsibilities of the Chair

The Chair of BSTAP will be hired under a contract by MMAH and will be a non-voting member. The Chair's responsibilities will include, but are not limited to:

- Acting as an impartial facilitator and mediator in discussions
- Providing leadership in seeking consensus
- Setting meeting times and frequency
- Approving meeting agendas
- Liaising effectively with leaders across government, the building, construction and municipal sectors and the private and not-for-profit sectors
- Collaborating and encouraging a balanced and strategic analysis of relevant issues
- Ensuring that linkages are made and that recommendations are harmonized with other ministry advisory bodies, as appropriate

- Assisting in the preparation of meeting agendas
- Ensuring scope of BSTAP remains consistent and aligns with government direction
- Recording in writing any declared conflicts of interest, and providing this document to the Minister
- Verifying that minutes of the meetings are accurately recorded
- Leading the development of a BSTAP work plan
- Determining the need for subcommittees
- Monitoring the work of the committee, and subcommittees if any, against the requirements of the Terms of Reference and as outlined in the work plan, with a view to keeping it on track to meet timelines
- Determining when to hold a vote on an item

If the Chair must be absent for a meeting, staff from MMAH will temporarily carry out the Chair's responsibilities. The Chair may invite experts who are not members of BSTAP to make presentations or submit information and reports for consideration by BSTAP.

Roles and Responsibilities of BSTAP Members

BSTAP members, including substitutes of members, are responsible for:

- Abiding by these Terms of Reference and any direction the Minister may issue as it relates to the panel's roles and responsibilities
- Carrying out work in a manner that preserves and enhances public trust in the integrity and skill of BSTAP to carry out its duties in the public interest and in a fair, effective and timely manner
- Completing all other duties as directed by the Minister

Conflict of Interest

A conflict of interest arises when a member's private or personal interests may take precedence over or compete with his or her responsibilities as a member of BSTAP. A conflict of interest may be actual, perceived, or potential, and may occur before, during and after membership on BSTAP.

Without limiting the generality of the forgoing, it shall be a conflict of interest for a member or a member's family to derive a personal gain or benefit arising from his or her membership on BSTAP. It shall also be a conflict of interest for a member to use or disclose confidential information, without prior written permission of MMAH at its sole discretion.

A member of BSTAP must, without delay, disclose to the Minister in writing any situation that may be reasonably interpreted as being an actual, perceived, or potential conflict of interest. The Chair of BSTAP must, without delay, disclose to the Minister in writing any situation that may be reasonably interpreted as being an actual, perceived, or potential conflict of interest.

Non-compliance with the above may result in the Minister revoking a member's or

Chair's membership on BSTAP. The Minister will determine if a situation constitutes a conflict of interest.

Support for BSTAP

Administrative and technical support for BSTAP will be provided by MMAH. The support provided will be subject to available MMAH resources.

Observers

At the discretion of the Chair, certain organizations may be permitted to send representatives to observe BSTAP proceedings. Observers are not members of BSTAP. Observers may contribute to BSTAP discussion at the determination of the Chair, but would not otherwise participate in the panel proceedings.

Decision-Making Process

BSTAP will endeavour to achieve a consensus on recommendations to be made to the Minister of MMAH. Where consensus is not achieved, the BSTAP's report to the Minister of MMAH will set out recommendations agreed to by two-thirds of the voting members of BSTAP, and will also summarize the positions of the other BSTAP members.

Voting

The Chair may determine to hold a vote on a given discussion topic/item. Where votes occur:

- In order to pass recommendations, agreement by at least two-thirds (66.6%) of members is required
- All votes will be recorded by the record keeper. BSTAP members will receive one vote per person
- If a member is to be absent during a vote, they can assign another member to be their proxy and vote on their behalf. BSTAP members can abstain from voting, which will also be recorded

Confidentiality

BSTAP members (including the Chair) will be required to sign confidentiality agreements. During the term of their appointment, and after their termination or expiration, they shall hold in confidence and treat as confidential all confidential information where "confidential information" is defined as all data and information in oral, written, graphic, photographic, recorded or other form acquired or prepared by or for them pursuant to this appointment, regardless of whether it is identified as confidential. Members will further undertake to:

- Use confidential information only as required for their participation as a member of BSTAP
- Maintain all confidential information separate and apart from all other records and databases in a physically secure location
- Not disclose, directly or indirectly, to any person or entity any Confidential Information without the prior written authorization of the Ministry at its sole discretion

- take all reasonable precautions to protect the Confidential Information from any unauthorized use, access and disclosure, and loss
- provide any confidential information in their possession or under their custody and control to the Minister on demand and at the termination or expiration of their appointment, with no copy or portion kept by them in any form or on any media

All confidential information shall be and remain the sole property of MMAH.

Timing

The first meeting will occur in spring 2015. Meetings will be called by the Chair, will occur approximately once a month, and will continue until the tasks are complete. The Chair may call for additional meetings after the finalization of recommendations, as he or she considers necessary.

Quorum

Majority (more than half) of BSTAP members present will constitute quorum.