REAL PROPERTY SERVICES POLICY

Seismic Resistance of PWGSC Buildings

EFFECTIVE DATE:	March 28, 2001
REVIEW DATE:	The policy will be reviewed by the end of 2005 or earlier as developments require.
CANCELLATION(S):	• Draft RPS Policy, Seismic Safety of PWGSC Buildings, September 3, 1998 • A&ES Procedure, Seismic Safety of Existing PWGSC Buildings, September, 1998

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Policy Objective

The objective of this policy to provide a consistent risk management approach with respect to the seismic resistance of buildings.

Policy Statement

RPS will implement and maintain a seismic safety program as it relates to the seismic resistance of buildings against the effects of expected ground shaking during an earthquake. External seismic hazards such as potential failure of service lifelines, ground failures outside the building, and business resumption after an earthquake are not addressed in this policy.

Background

There is a growing global momentum to address the seismic (earthquake) resistance of older existing buildings that may not meet the stricter requirements of current building codes for seismic loading and design of new buildings. While the National Building Code of Canada does not apply retroactively to older buildings, there is a clear need for a duly diligent approach. It was with this in mind that the 1998 draft of this policy was created, along with accompanying procedure and position papers, which together were issued by RPSMC in October, 1998, as a Guideline. This policy combines all of the previous documents into one, maintaining the same intent, namely to specify that seismic considerations be included in major renovations of PWGSC crown-owned buildings in moderate to high seismic zones — and has added into the body of the document:

- requirements for collecting basic seismic information about a building through seismic screenings;
- requirements for an annual seismic status report; and
- a more complete list of communities where the policy would apply.

Policy Scope

This policy applies to crown-owned buildings currently in or to be added to the custody of PWGSC.

Policy Requirements

New Buildings

New buildings shall be designed and constructed in accordance with the seismic requirements of the National Building Code of Canada (NBCC), provincial/territorial building codes and local bylaws. Planned additions to existing buildings should also be considered under the category of new buildings.

Existing Buildings

I. Seismic screenings; Seismic screenings shall be conducted on all buildings in *zones of moderate to high seismicity.* ***Zones of moderate to high seismicity*** are defined as zones where the effective seismic zone, Ze, (see Appendix A for definition) is greater than or equal to 2 (range 0 to 6). Communities where there are PWGSC administered Crown owned buildings are listed in Appendix A, with the Effective Seismic Zone rating for that community. Generic Terms of Reference for seismic screenings are included in Appendix B. For buildings in PWGSC's custody, screening results are to be included in each building's Asset Management Plan. Results are to be used in the investment analysis planning process on a building-specific and portfolio-wide basis. For buildings that have not been subject to an earlier seismic screening, such a screening will be completed as part of the input to the completion of the next Asset Management Plan for the building. These screenings are part of the operation and maintenance activity and are to be funded out of the building's existing annual budget using the Building Condition Report and Building Management Plan process.

Seismic screening of buildings in zones of moderate to high seismicity that are not yet within the custody of PWGSC shall be completed prior to a final agreement to acquire the facility.

II. When a seismic screening results in a Structural Priority Index (SPI - see Appendix B) greater than 30 for a building in PWGSC's custody, the results are to be submitted immediately to the AES COE for quality assurance review and verification of the index.

III. A. For a building with a confirmed SPI greater than 30, a detailed seismic assessment is mandatory and must be completed within a reasonable period and not later than the subsequent fiscal year after confirmation of the SPI by the AES NCOE. Generic Terms of Reference for detailed seismic assessments are included in Appendix C.

B. When significant projects are being planned for buildings located in *zones of moderate to high seismicity*, a detailed seismic assessment is mandatory and must be conducted in the project planning phase.

A project is considered to be significant when any of the conditions noted below exist:

- the work includes, without consideration of seismic improvements, the stripping of many finishes and the exposure of structural elements in the entire facility or substantial portions of it, such as complete wings or full floors.
- the work changes the use or intended use of the facility as indicated by a change in Occupancy classification as per the NBCC, such as from warehouse to office or vice versa.
- the work provides for adding significant weight to the existing building such as the addition of one or more storeys;
- the work includes removal or modification of key seismic resistance elements of the existing building such as the planned removal of walls, braces or sections of the building, etc.
- the project costs are at or above 50% of replacement costs for the building.

It must be understood that the classification of planned work in a building as being a significant project will, in many cases, require subjective judgment. This is particularly true when assessing the multi-year plans that are included in Asset Management Plans. The intent of this policy is to provide, over time, a minimum level of seismic resistance in buildings located in zones of moderate to high seismicity. Where there is a question as to whether a particular activity or series of activities constitute a significant project, the long range plans for the building must be reviewed. This is to be done in order to determine the most appropriate time to trigger a detailed seismic assessment and complete any necessary seismic upgrades. If work that might be considered significant is being carried out, the detailed seismic assessment, and any seismic improvements that were identified in the detailed seismic assessment, are to be included unless a more appropriate future time has been identified.

IV. Seismic requirements are to be in full compliance with current local by-laws and provincial/territorial building codes, where such requirements exist.

V. **Seismic upgrading in zones of moderate to high seismicity:**

A. Except where required under IV above, seismic upgrading of the building structure is not mandatory if the building structure's seismic resistance meets or exceeds 60% of the seismic load requirement for new building construction as specified by the current NBCC.

B. If the main building structure's seismic resistance does not meet 60% of the NBCC requirements, seismic upgrading of the main structure is required. The upgraded structure must have a seismic resistance of at least 60% of the NBCC requirements or meet the requirements of IV above, whichever is higher. Consideration shall be given to upgrade the building to NBCC requirements or higher. The optimal level of upgrade shall be selected based on financial, functional, operational, security and client requirements as usually documented in an Investment Analysis Report. Appendix D provides a list of some of the elements to be considered.

C. Seismic improvements for the main structure and non-structural components shall be considered within the context and scope of the plans for the building as detailed in the Asset Management Plan for the facility and in specific Investment Analysis Reports that deal with the renovation or rehabilitation of the facility.

D. Innovative and cost effective technologies and approaches to seismic improvements are to be explored.

E. For heritage-designated buildings, the heritage character and value are to be respected and protected.

VI. A seismic database for the PWGSC building inventory is to be maintained and a *national seismic status report* submitted to RPSMC on an annual basis. The ***national seismic status report*** will list all PWGSC non-residential Crown-owned buildings and identify, for each building;

- base building information;
- the effective seismic zone (Ze) the building is located in;
- seismic screening results;
- identification of a completed detailed seismic assessment where it has been carried out;
- scope and cost of seismic improvements where such improvements have been included as part of a renovation;
- mission-criticality information of building usage.

Roll-up summaries of the information are to be included in the report.

VII. Justifications for exemption from this policy shall be documented and submitted to the Director General of AES for approval. The Director General of AES will consult with the Director General OARES prior to approving an exemption.

Roles and Responsibilities

The regional project manager, AES is responsible to:

- implement requirements as prescribed in this policy for applicable projects,
- manage project implementation of the policy requirements,
- notify and coordinate technical quality assurance reviews with the regional AES discipline manager,
- ensure that project drawing plans contain the seismic assessment report name, author, date and details of seismic improvements,
- submit copies of the final seismic assessment report and a description of the scope and cost of implemented seismic improvements to the regional AFMS asset manager and the regional AES discipline manager for record purposes.

The regional asset manager AFMS is responsible to:

- ensure seismic screening as prescribed in this policy are undertaken and the results incorporated in buildings' AMPs,
- submit seismic screening results to the AES discipline manager for quality assurance reviews,
- identify applicable projects as prescribed in this policy and coordinate the requirements with the project manager, AES,

- ensure requirements as prescribed by this policy are included in applicable projects,
- submit seismic screening results, detailed seismic assessments and scope/cost of seismic upgrades to the NCOE, AFMS for collection of information nationally.

The regional CASA and project leader are responsible to:

- identify applicable projects as prescribed in this policy and coordinate the requirements with the project manager, AES,
- ensure requirements as prescribed by this policy are included in applicable projects.

The regional discipline manager, AES is responsible to:

- coordinate and ensure the provision of technical advice, guidance and quality assurance services,
- provide strategic advice and contextual analysis in support of the application of this policy.

The regional structural engineer, AES is responsible to:

- provide technical advice, guidance and quality assurance services in support of the application of this policy,

The NCOE AFMS is responsible to:

- collect, maintain and submit national seismic status reports to RPS senior management on an annual basis.

The Regional Manager Owner/Investor is responsible to:

- assess whether the building assessment and project planning process in place in the Region incorporates consideration of this policy's requirements,
- when reviewing or considering individual proposals, assess the proposals to verify adherence to this policy's requirements.

The NCOE OARES is responsible to:

- review the national seismic status reports and assess progress in fulfilling the intention of this policy and status on a portfolio wide basis.

The Technology Directorate, AES is responsible to:

- provide technical advice and guidance on the use of innovative and cost effective technologies and approaches to seismic improvements.

The Director, Civil Engineering, AES is responsible to:

- ensure and coordinate regular policy updates

Authority

This policy is issued under the authority of the Assistant Deputy Minister, RPS.

References

Note that references provided here are a base only, and that regional experts are to be consulted for up-to-date technical requirements on a given project and location.

- AES Position Paper - Seismic Safety of Existing PWGSC Buildings
- NRC Guidelines for the Seismic Evaluation of Existing Buildings
- NRC Manual for Screening of Buildings for Seismic Investigation
- NRC Guideline for Seismic Upgrading Techniques of Building Structures
- PWGSC Guideline on Seismic Evaluation and Upgrading of Non-Structural Building Components
- DRAFT CSA-S832-2000 Guideline for Seismic Risk Reduction of Operational and Functional Components

Enquiries

Director, Civil Engineering, AES for Policy and implementation (956-4028)
Director, Technology, AES for seismic technologies (956-3423)
Director, Owner/Investor, OARES for investment management (956-7426)

APPENDIX A

Effective Seismic Zone (Ze) Values for Canadian Communities

In the National Building Code, Canadian cities are assigned an acceleration zone (Za) and a velocity zone (Zv). NRC defines the effective seismic zone, Ze as being equal to Zv unless Za is greater than Zv, in which case Ze = Zv + 1.

Zones of moderate to high seismicity are defined as zones where the effective seismic zone, Ze, is greater than or equal to 2 (range 0 to 6).

Community with corresponding Ze zone value;

British Columbia

Community	Ze	Zone of moderate to high seismicity		Community	Ze	Zone of moderate to high seismicity
Campbell River	6	Yes		Port Alberni	5	Yes
Clearwater	1	No		Prince George	2	Yes
Dawson Creek	1	No		Prince Rupert	5	Yes
Delta	4	Yes		Queen Charlotte City	6	Yes
Esquimalt	6	Yes		Revelstoke	1	No
Fort Nelson	1	No		Richmond	4	Yes
Kamloops	1	No		Smithers	3	Yes
Kelowna	1	No		Surrey	4	Yes
Kitimat	4	Yes		Tofino	5	Yes
Lillooet	2	Yes		Vancouver	4	Yes
Nanaimo	4	Yes		Vanderhoof	2	Yes
Nelson	1	No		Vernon	1	No
New Westminster	4	Yes		Victoria	6	Yes
Penticton	1	No				

Alberta, Saskatchewan, Manitoba

Community	Ze	Zone of moderate to high seismicity		Community	Ze	Zone of moderate to high seismicity
Banff (AB)	1	No		Fort Qu'Appelle (SK)	0	No
Calgary (AB)	1	No		La Ronge (SK)	0	No
Edmonton (AB)	1	No		Prince Albert (SK)	0	No
Lethbridge (AB)	0	No		Regina (SK)	0	No
Penhold (AB)	1	No		Saskatoon (SK)	0	No
Red Deer (AB)	1	No		Brandon (MB)	0	No
				Winnipeg (MB)	0	No

Ontario

Community	Ze	Zone of moderate to high seismicity		Community	Ze	Zone of moderate to high seismicity
Amherstburg	0	No		Nepean (ON)	3	Yes
Arnprior	3	Yes		Niagara Falls	1	No
Barrie	1	No		Orillia	1	No
Belleville	1	No		Oshawa	1	No
Borden	1	No		Ottawa	3	Yes
Bracebridge	1	No		Parry Sound	1	No
Brantford	1	No		Prescott	3	Yes
Chatham	0	No		Renfrew	3	Yes
Collingwood	1	No		Rockland	3	Yes
Cornwall	3	Yes		Sarnia	0	No
Cornwall Island	3	Yes		Sault Ste-Marie	0	No
Fort Frances	0	No		Sioux Lookout	0	No
Guelph	1	No		St. Catharines	1	No
Hamilton	1	No		Stratford	0	No
Kapuskasing	0	No		Sturgeon Falls	1	No
Kemptville	3	Yes		Sudbury	1	No
Kenora	0	No		Thunder Bay	0	No
Kingston	2	Yes		Timiskaming	2	Yes
Kitchener	1	No		Timmins	1	No
Lindsay	1	No		Tobermory	1	No
London	0	No		Toronto	1	No
Moose Factory	0	No		Windsor	0	No

Québec

Community	Ze	Zone of moderate to high seismicity		Community	Ze	Zone of moderate to high seismicity
Amos	2	Yes		Malartic	2	Yes
Angliers	2	Yes		Maniwaki	3	Yes
Aylmer	3	Yes		Matane	3	Yes
Buckingham	3	Yes		Montréal	3	Yes
Campbell's Bay	3	Yes		Port-Cartier	2	Yes
Cap-aux-Meules	1	No		Québec	4	Yes
Chandler	1	No		Rigaud	3	Yes
Chicoutimi	5	Yes		Rimouski	3	Yes
Cowansville	3	Yes		Rouyn-Noranda	2	Yes

Gaspé	1	No		Sainte-Agathe-des-Monts	3	Yes
Gatineau	3	Yes		Sainte-Foy	4	Yes
Grande-Rivière	1	No		Saint-Hyacinthe	3	Yes
Havre-Saint-Pierre	1	No		Saint-Laurent	3	Yes
Hull	3	Yes		Sept-Îles	2	Yes
Jonquière	4	Yes		Shawinigan	3	Yes
Lacolle	3	Yes		Shawinigan-Sud	3	Yes
La Tuque	3	Yes		Sherbrooke	2	Yes
Laval	3	Yes		Sorel	3	Yes
Longueuil	3	Yes		Trois-Rivières	3	Yes

New Brunswick

Community	**Ze**	**Zone of moderate to high seismicity**		**Community**	**Ze**	**Zone of moderate to high seismicity**
Bathurst	1	No		Richibucto	2	Yes
Blacks Harbour	2	Yes		Saint Andrews	2	Yes
Blackville	2	Yes		Saint John	2	Yes
Caraquet	1	No		Saint-Quentin	3	Yes
Clair	3	Yes		Shediac	2	Yes
Edmunston	3	Yes		Shippagan	1	No
Florenceville	2	Yes		St. Croix	2	Yes
Fredericton	2	Yes		St. George	2	Yes
Grand Falls	3	Yes		St. Leonard	3	Yes
Miramichi	2	Yes		St. Stephen	2	Yes
Moncton	2	Yes		Woodstock	2	Yes
North Head	2	Yes				

Nova Scotia

Community	**Ze**	**Zone of moderate to high seismicity**		**Community**	**Ze**	**Zone of moderate to high seismicity**
Amherst	1	No		Mahone Bay	1	No
Antigonish	1	No		New Glasgow	1	No
Arichat	1	No		Pictou	1	No
Bridgewater	1	No		Port Hawkesbury	1	No
Canso	1	No		Port Hood	1	No
Guysborough	1	No		Shelburne	1	No
Halifax	1	No		Sherbrooke	1	No
Kentville	1	No		Sydney	2	Yes
Liverpool	1	No		Westville	1	No

Lunenburg	1	No		Yarmouth	1	No

Prince Edward Island

Community	Ze	Zone of moderate to high seismicity
Alberton	1	No
Charlottetown	1	No
Kensington	1	No
Montague	1	No
Summerside	1	No
Tignish	1	No

Newfoundland

Community	Ze	Zone of moderate to high seismicity		Community	Ze	Zone of moderate to high seismicity
Bonavista	1	No		Marystown	2	Yes
Burgeo	1	No		Mount Pearl	1	No
Catalina	1	No		Pleasantville	1	No
Corner Brook	1	No		Rocky Harbour	1	No
Dildo	1	No		St. John's	1	No
Fogo	1	No		Trepassey	1	No
Grand Bank	2	Yes		Witless Bay	1	No

Territories

Community	Ze	Zone of moderate to high seismicity
Dawson (YT)	3	Yes
Whitehorse (YT)	3	Yes
Fort Simpson (NT)	1	No
Fort Smith (NT)	1	No
Hay River (NT)	1	No
Inuvik (NT)	2	Yes
Norman Wells (NT)	1	No
Yellowknife (NT)	1	No
Iqaluit (NV)	1	No

Ze zone values for communities not listed can be obtained from the regional or national AES COE.

APPENDIX B

GENERIC TERMS OF REFERENCE
for Seismic Screenings

A seismic screening shall be carried out in accordance with NRCs "Manual for Screening of Buildings for Seismic Investigation". The screening shall include a site review, a review of available existing building drawings/reports and the submission of the completed NRC Seismic Screening Form. The form is to contain a photograph of the building, relevant sketch(es) and a completed comments section indicating notable observations and any qualifications used in determining the Structural Priority Index (SPI) score. The Seismic Screening Form is to be sealed by a provincially registered professional engineer.

Context of Screening Results

The SPI score indicates deviation by contributing seismic factors to current seismic construction practices. It is not a detailed assessment and does not identify the level of specific building vulnerabilities. NRC suggests SPI scores be used for evaluation and planning purposes on the following basis:

less than 10: low priority for further evaluation
between 10 and 20: medium priority for further evaluation
between 20 and 30: high priority for further evaluation
higher than 30: can be considered an exceptional risk

APPENDIX C

GENERIC TERMS OF REFERENCE
for Detailed Seismic Assessment

Detailed Seismic Assessment includes:

1. A review of the building's main structural resistance system and elements;
2. A detailed structural analysis taking into account the proposed alterations and building occupancy;
3. A gathering and review of existing plans and other documentation on the building;
4. Performing relevant on-site investigations and a condition survey of existing elements;
5. Involvement of a geotechnical engineer to address foundation requirements;
6. Review of functional components (i.e. non-structural elements) as it relates to operational and life safety requirements. These include, but are not limited to building components such as canopies over exit ways, partitions in corridors and stairwells, roof parapets, mechanical and electrical systems, ceilings, and cladding at access/egress locations. Submission of a seismic assessment report including an evaluation of the sufficiency of the main building structure expressed as a percentage of the NBC value. The report is also to include an assessment of the non-structural elements identified in 6.

The bulk of the seismic assessment will be done by a structural engineer, but other disciplines (e.g. geotechnical/electrical/mechanical/elevator/architecture) may be required to help coordinate with discipline-specific issues as required. Documents such as NRC's "Guidelines for the Seismic Evaluation of Existing Buildings" and PWGSC's "Guideline on Seismic Evaluation and Upgrading of Non-Structural Building Components" shall be considered as reference documents.

APPENDIX D

Options assessment for seismic upgrades

If the main building structure does not meet 60% of the NBCC requirements for new construction, upgrade options and approaches are to be investigated, so as to upgrade the seismic resistance of the main structure to the 60% or higher level. Incorporation of practical aspects of the building alteration are to be carefully considered. New and emerging technologies are also to be carefully considered. Upgrade options for non-structural items are also to be investigated. Options, cost estimates and recommended seismic upgrading approaches are to be documented.

Reference documents such as NRC's "Guideline for Seismic Upgrading Techniques of Building Structures" and the Draft CSA-S83-2000 "Guideline for Seismic Risk Reduction of Operational and Functional Components" are considered as reference documents.

Selection of an upgrade option (whether 60%, 100% or other value) will include consideration of the following, among others:

- Seismic performance level
- Design, project management and construction costs
- Constructability considerations
- Client requirements
- Operational requirements
- Displacement of building occupants
- Long-term flexibility requirements for the building
- Architectural aspects of improvements
- Heritage aspects

Consideration of options will be documented in part by ensuring:

Renovation plans contain the seismic assessment report name, author and date.

Where seismic upgrade work is not required, the existing level of seismic resistance expressed as a percentage of the current NBCC requirements is to be described on the renovation plans.

Where seismic upgrading work is included, details of the seismic improvements including the level of seismic upgrade in relation to the current NBCC requirements, seismic design loads and design philosophy are to be described on the renovation plans.

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