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Proposed Change 1976

Code Reference(s):	NBC20 Div.B 1.1.3.1. (first printing) NBC20 Div.B Appendix C (first printing)
Subject:	Earthquake Load and Effects — Seismicity
Title:	Update of Seismic Hazard in Northwestern Canada
Description:	This proposed change addresses a known issue in the NBC 2020 seismic hazard values for parts of northwestern Canada and updates Note A-1.1.3.1.(4) and Appendix C to reference the 2025 National Building Code of Canada Seismic Hazard Tool.

This change could potentially affect the following topic areas:

- | | |
|--|---|
| <input type="checkbox"/> Division A | <input checked="" type="checkbox"/> Division B |
| <input type="checkbox"/> Division C | <input type="checkbox"/> Design and Construction |
| <input type="checkbox"/> Building operations | <input checked="" type="checkbox"/> Housing |
| <input checked="" type="checkbox"/> Small Buildings | <input checked="" type="checkbox"/> Large Buildings |
| <input type="checkbox"/> Fire Protection | <input type="checkbox"/> Occupant safety in use |
| <input type="checkbox"/> Accessibility | <input checked="" type="checkbox"/> Structural Requirements |
| <input type="checkbox"/> Building Envelope | <input type="checkbox"/> Energy Efficiency |
| <input type="checkbox"/> Heating, Ventilating and Air Conditioning | <input type="checkbox"/> Plumbing |
| | <input type="checkbox"/> Construction and Demolition Sites |

Problem

There is a known issue with the values of seismic hazard in parts of northwestern Canada for use with the NBC 2020. These seismic hazard values are larger than intended, and their use may unintentionally result in higher costs of construction. Seismic hazard disaggregations also produce unrealistic earthquake scenarios in the impacted regions.

Seismic hazard disaggregations are typically used in time history analysis for buildings (see the Appendix to Commentary J in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)"), geotechnical analysis, and some other infrastructure projects. Anomalies in the disaggregations in the impacted regions may lead to difficulties for engineers.

Justification

The proposed change addresses the issue of overly high seismic hazard values in parts of northwestern Canada. The adoption of updated values, which are lower than the current ones, may reduce the construction costs in these localities.

The proposed change also addresses the issue of inappropriate seismic hazard disaggregations for parts of northwestern Canada. Natural Resources Canada corrected this issue after the publication of the NBC 2020 and released an updated seismic hazard model referred to as CanadaSHM6.1. It is important to implement the updated CanadaSHM6.1 model in the NBC 2025 for consistency so that the seismic hazard model referenced in the Code is the most current model and the only model applicable in the country.

The proposed change implements this update. It also updates Note A-1.1.3.1.(4) and Appendix C to reference the 2025 National Building Code of Canada Seismic Hazard Tool.

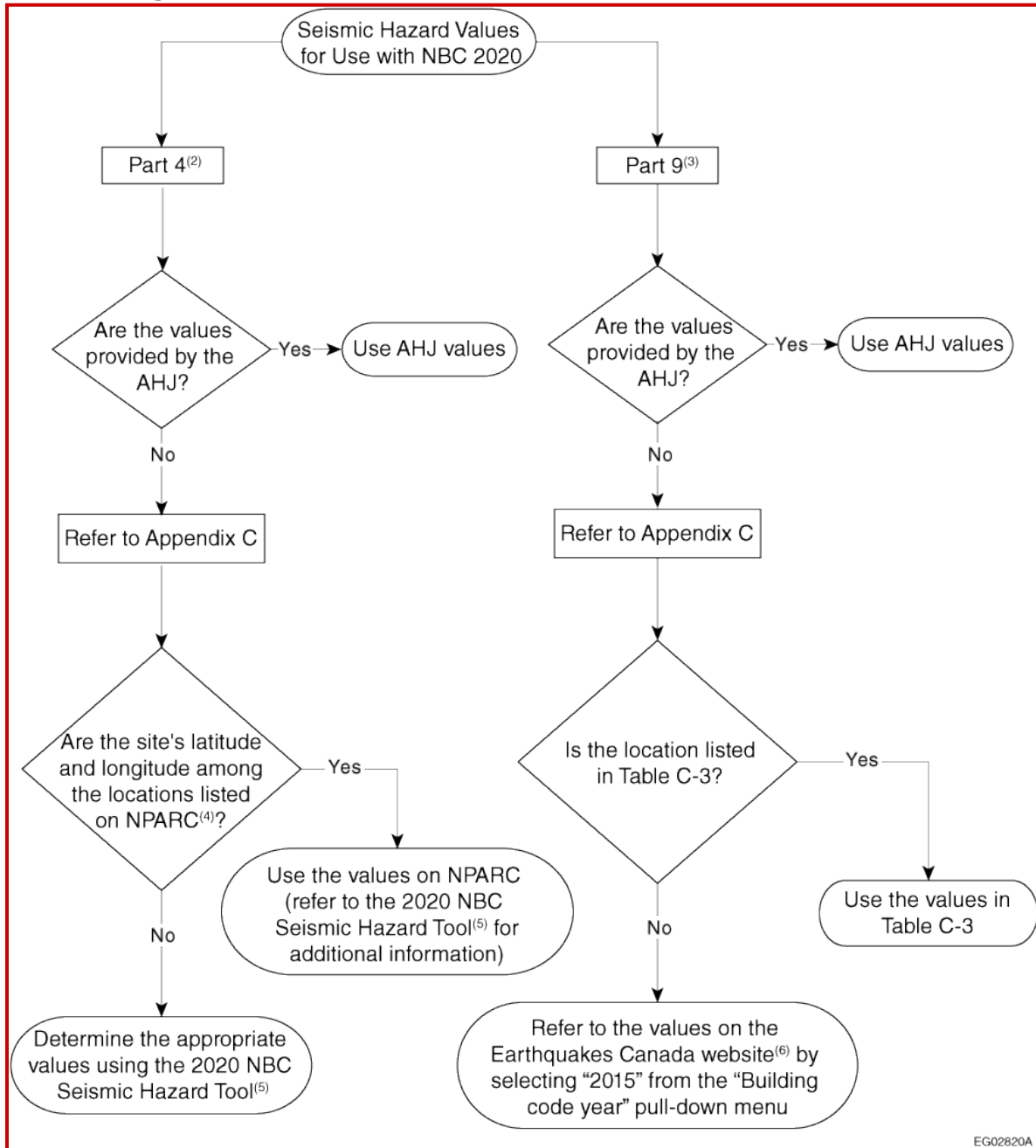
PROPOSED CHANGE

[1.1.3.1.] 1.1.3.1. Climatic and Seismic Values

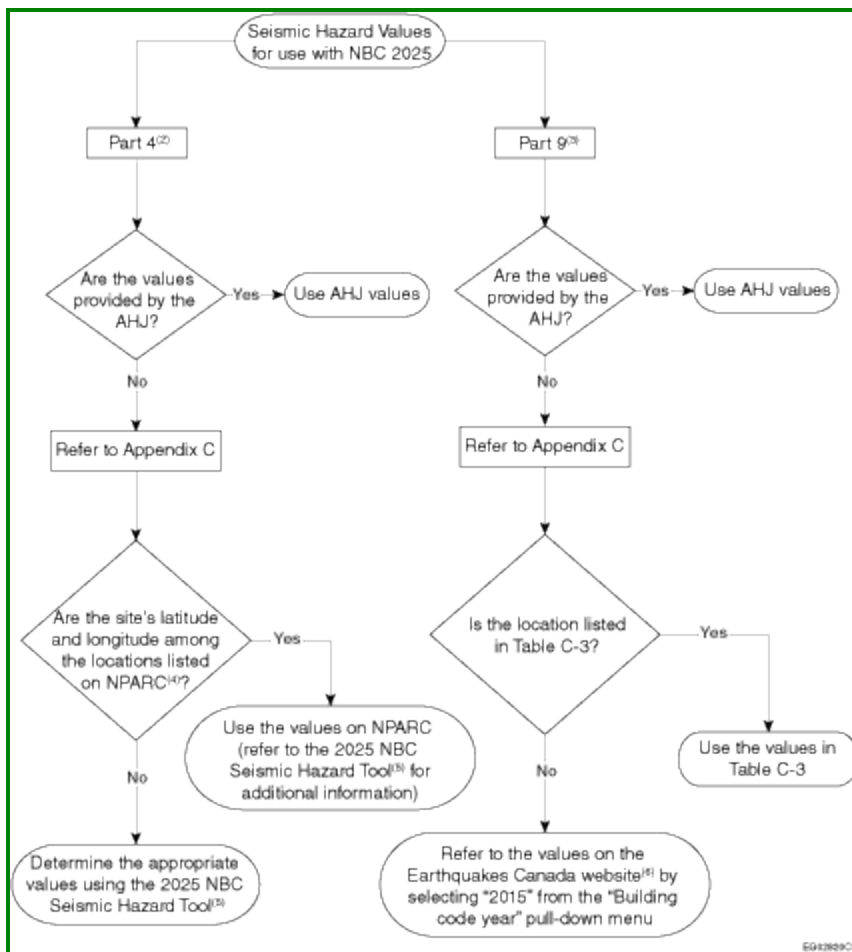
Note A-1.1.3.1.(4) Seismic Values.

Figure A-1.1.3.1.(4) illustrates how to determine the seismic hazard values to be used in the application of the Part 4 and Part 9 seismic provisions.

Figure [A-1.1.3.1.(4)] A-1.1.3.1.(4)
Determining seismic hazard values for use in Part 4 and Part 9



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Notes to Figure A-1.1.3.1.(4):

- (1) The abbreviations used in the figure have the following meanings:
 AHJ = authority having jurisdiction
 NPARC = NRC Publications Archive
- (2) See also the section entitled "Seismic Hazard for Part 4" in Appendix C.
- (3) See also the section entitled "Seismic Hazard-3 for Part 9" in Appendix C.
- (4) The seismic hazard values available on NPARC at <https://doi.org/DOI-110.4224/nqzr-dz38> (digital object identifier (DOI) to be added when available) were generated from the 2020/2025 National Building Code of Canada Seismic Hazard Tool. This subset of values on NPARC is provided as a static, archival record for Code users.
- (5) The 2020/2025 National Building Code of Canada Seismic Hazard Tool is available at <https://doi.org/DOI-210.23687/b1bd3cf0-0672-47f4-8bfa-290ac75fde9b> (DOI to be added when available).
- (6) Refer to the "2015 – 2005 National Building Code of Canada seismic hazard values" page on NRCan's Earthquakes Canada website.

Appendix C Climatic and Seismic Information for Building Design in Canada

Footnote: This information is included for explanatory purposes only and does not form part of the requirements.

Seismic Hazard for Part 4

The seismic hazard values to be used for the design of buildings under Part 4 can be obtained from the ~~2020~~2025 National Building Code of Canada Seismic Hazard Tool (<https://doi.org/DOI-210.23687/b1bd3cf0-0672-47f4-8bfa-290ae75fde9b>), which provides seismic hazard values for any site in Canada defined by latitude, longitude and site designation. The seismic hazard values used for the design of buildings under Part 4 must correspond to the applicable probability of exceedance stated in Subsection 4.1.8. The tool also provides seismic hazard values at additional probabilities and periods.

Seismic hazard values can be appreciably different for localities across a large locale. Therefore, applying the same seismic hazard value to a large geographic area could result in buildings being over-designed or under-designed. Given the large number of data points in Canada, listing every locality in a table is not practical. For archival purposes, the seismic hazard values for 679 specific latitudes and longitudes are reproduced from the ~~2020~~2025 National Building Code of Canada Seismic Hazard Tool on NPARC at <https://doi.org/DOI-110.4224/nqzr-dz38>. The digital properties of the NPARC website are more suited for a static, archival data set. As such, Figure A-1.1.3.1.(4) identifies the NPARC website as the primary data set for the specified latitude and longitudes.

The parameters used to represent seismic hazard for specific geographical locations are the 5%-damped horizontal spectral acceleration for periods of 0.2 s, 0.5 s, 1.0 s, 2.0 s, 5.0 s and 10.0 s, the horizontal peak ground acceleration (PGA) and the horizontal peak ground velocity (PGV) corresponding to a 2% probability of being exceeded in 50 years. The six spectral acceleration parameters are deemed sufficient to define spectra closely matching the shape of the uniform hazard spectra (UHS) for design purposes. Spectral acceleration values for additional periods are provided for use in the selection of ground motion time histories. Spectral acceleration values for additional probabilities of exceedance are also provided.

The seismic hazard values are mean values based on a statistical analysis of the earthquakes that have been experienced in Canada and adjacent regions.⁽¹¹⁾ ~~They were updated for the 2020 edition of the Code by slightly revising the seismic source zones, adding the Leech River and Devil's Mountain fault sources near Victoria, B.C.,⁽¹²⁾ increasing the rate of occurrence of great earthquakes on the Cascadia subduction zone to match new information, revising the ground motion models (GMMs),⁽¹³⁾ and using a probabilistic model to combine all inputs.~~ Further to the updates made to the seismic hazard model for the 2020 edition of the Code, seismic source zones in Alaska and the Beaufort Sea were revised for the 2025 edition to match the expected pattern of seismicity. This change generally resulted in a decrease in the estimated seismic hazard in northwestern Canada. The estimated seismic hazard is unchanged in all other parts of the country.

~~In addition, the method of determining seismic hazard values for different site designations has changed. For the NBC 2015, the seismic hazard values were calculated for reference Site Class C, and the values for other site designations were determined~~

~~by applying a site coefficient to the calculated values. For the NBC 2020, the seismic hazard values for each site designation were calculated directly.~~

~~For almost all locations, the revised GMMs are the most significant reason for changes in the seismic hazard values from the NBC 2015. In general, the estimated seismic hazard has increased across Canada.~~

Further details regarding the representation of seismic hazard can be found in the Commentary entitled Design for Seismic Effects in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B)".

Impact analysis

The supporting document shows a comparison of the proposed NBC 2025 seismic design data to the NBC 2020 data for affected localities, as an example. As shown, the seismic hazard values would decrease for parts of northwestern Canada as a result of the proposed change, leading to potential savings in construction costs for this region, but would not change for the rest of Canada.

The confusion resulting from anomalous disaggregation results would also be addressed by the proposed change. In addition, the editorial changes required to update the NBC to reference the 2025 National Building Code of Canada Seismic Hazard Tool would be implemented. In summary, the proposed change would have a positive impact.

Enforcement implications

The proposed change would have a positive impact on enforcement, as it updates the seismic hazard model used for the NBC to the most current seismic hazard model available in Canada, CanadaSHM6.1. The difficulties in interpreting disaggregation results for parts of northwestern Canada would also be addressed.

As a result of this proposed change, the seismic hazard values would not change for most of Canada, but would decrease for parts of northwestern Canada. These changes to the seismic hazard values would have a positive impact on enforcement.

Who is affected

Owners, designers, contractors and enforcement professionals dealing with the earthquake design of buildings and infrastructure projects, particularly those in northwestern Canada.

Supporting Document(s)

[Proposed NBC 2025 Seismic Design Data](#)

[\(proposed_nbc_2025_seismic_design_data.pdf\)](#)

OBJECTIVE-BASED ANALYSIS OF NEW OR CHANGED PROVISIONS

N/A

N/A