

CANADIAN CONSULTING ENGINEERING AWARDS 2018

CITY OF VANCOUVER POST EARTHQUAKE INSPECTION GUIDE

CATEGORY B: TRANSPORTATION



COWI North America Limited
138 13th Street East
North Vancouver, BC
V7L 0E5

COWI



B. PROJECT OUTLINE

PROJECT SUMMARY

The Post Earthquake Inspection Guide is a practical and efficient tool, covering forty-one bridges with a wide range of structural systems within the CoV's inventory, and developed for use by non-technical staff to facilitate the Level 1 Evaluations. This Guide also provides a link between the initial assessment and subsequent more detailed inspections by professional engineers.

The City of Vancouver's (CoV) bridges provide vital links to the local transportation system. Following a major disaster, such as an earthquake, the ability to restore that network for emergency services and associated support is paramount. A key component of the CoV's Earthquake Response Plan is rapid visual inspection (Level 1 Evaluation) of the CoV's bridges to identify potential significant structural safety issues immediately following a major seismic event. The information from this initial assessment will be used to determine if a bridge is considered safe for public use or if it warrants immediate closure.

The primary focus of the Guide is to provide appropriate information to assist first response evaluators perform the initial bridge assessments. It provides key bridge specific information in a quickly and easily digestible format to ensure critical structural components are assessed appropriately and efficiently.

A secondary focus of the Guide is to provide general structural information to assist with the follow-up detailed inspections performed by qualified professional engineers, as well as outline expected types of bridge damage and guidelines to help inspectors determine if a bridge can remain open, be closed, or stay open for emergency vehicles only.



1. INNOVATION

The City of Vancouver's (CoV) bridges provide vital links to the local transportation system. Following a major disaster, such as an earthquake, the ability to restore that network for emergency services and associated support is paramount. A key component of the CoV's Earthquake Response Plan is rapid visual inspection (Level 1 Evaluation) of the CoV's bridges to identify potential significant structural safety issues immediately following a major seismic event. The information from this initial assessment will be used to determine if a bridge is considered safe for public use or if it warrants immediate closure.

New or Advanced Approach: Existing bridge inspection manuals are typically designed for use by qualified and trained engineers and technicians. In this case, important technical information had to be distilled into a very clear and succinct presentation that would be accessible to any staff with minimal technical background and some training. At the same time, the process has to be robust enough to ensure safety for both the inspectors and the public.

Unique Combination of Materials and/or Equipment: The manual uses a format that allows for ease of use and rapid dissemination of the evaluation materials. It is formatted so that it can be used by experts and lay people alike. Pull out sheets for each bridge contain all structural, site and inspection information. These can be laminated and potentially uploaded into an electronic form both for the inspection itself and for information sharing after the event.

Internal Resources, Experience and Expertise: The staff involved in this assignment collectively have extensive experience in bridge inspections, earthquake science and design, bridge condition assessments and are intimately familiar with all of the City's bridge inventory. These staff were brought together to workshop the actual inspection process so that all nuances of each type of expertise could be captured and distilled to a process and format that could ultimately be used by both technical and non-technical inspectors. In particular, extensive experience with seismic vulnerability allowed the customization of the inspection approach for each bridge, focusing and prioritizing inspection on those components of each structure that would most likely be susceptible to damage.



2. COMPLEXITY

The complexity of this project was rooted in the need to develop an inspection approach for a situation for which there was no precedent and which had to be accessible to a wide range of potential inspectors while preserving the integrity of the screening to ensure safety to the public. The job was to create a straight forward guide and approach to the inspections - from a formerly undefined process implemented by highly technical staff from the CoV. The ultimate goal is to provide safe travel within the City after a disaster event.

- Simplify the inspection process so that it can be easily used by non-technical City staff;
- Create a tool that is general enough to be applicable to all types of structural systems; and
- Distill a complex body of structural information into a succinct two sheet package for each structure;
- Introduce a consistent approach for all structures, which can also be expanded to more structures in the future; and
- Provide confidence to users that the structures are safe.



3. SOCIAL AND/OR ECONOMIC BENEFITS

The City has a practical and versatile tool that can be used by their non-technical staff to assess potential earthquake damage to key city structures and provide key information for decision-making in terms of which bridges and structures to close/open. With inspections being performed quickly and efficiently, the City can ensure public safety and at the same time avoid unnecessary bridge closures. This approach maximizes mobility options for the public while maximizing the value of the asset inventory.



4. ENVIRONMENTAL AND SUSTAINABILITY

Using this Guide, it can be determined if a bridge can safely remain open to traffic, avoiding an unnecessary closure. By keeping a bridge open, long detours and unnecessary delays are prevented, reducing congestion and reducing air pollution from idling vehicles. Allowing as many bridges as possible to remain open also provides the maximum mobility possible to first responders and residents as they try to make their way around the City following an earthquake. In turn, these benefits also mitigate the overall cost impact of the event, as fewer bridge closures will be needed.



5. MEETING CLIENT NEEDS

The Guide assesses potential structural damage on a variety of structure types, in a format that is accessible to a range of users. This allows the City to deploy a wider range of staff to site following an earthquake event, allowing a quicker response that maximizes the number of bridges which can remain open to users without compromising safety. The Guide fits into the City's overall Earthquake Response Plan yet also stands alone as a tool for assessment of the bridges which can be updated and expanded as needed over time.

This project also required close collaboration with the client as it is a customized tool designed for use in a way that works within the City's overall emergency response plan and with a broad range of staff. Communication and frequent review with the client was essential for the production of a successful product.



Task assignment at muster station



Review tearout sheet



Drive to bridge site



Review structure



Fill out form



Inspectors reporting findings of evaluation.



Close bridge (if necessary)