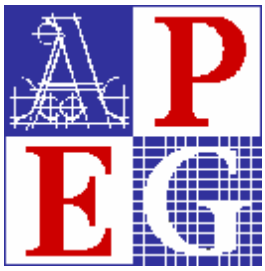
BRIDGING GUIDELINES FOR THE PERFORMANCE-BASED SEISMIC RETROFIT OF BRITISH COLUMBIA LOW-RISE SCHOOL BUILDINGS

OFFICE VISIT REPORTS

MARCH, 2006



1.0 INTRODUCTION

John Wallace, P.Eng., StructEng. (APEGBC Peer Review Committee member) and Dr. Graham Taylor, P.Eng. (UBC research team) visited the office of Herold Engineering Ltd. on February 27, 2007 to solicit critique of the Bridging Guidelines Second Edition.

The critique recorded in this document was provided by the following professional engineering staff of Herold Engineering Ltd.:

- Lee Rowley, P.Eng.,M.I.Struct.E.
- Mark Bowen, P.Eng.,M.I.Struct.E.
- Sean Herold, P.Eng.

2.0 GENERAL INTRODUCTORY COMMENTS - PRC/UBC

The PRC/UBC representatives at the meeting made the following introductory comments to start the meeting:

(1) Ministry Feedback

Consultants' critique of the Bridging Guidelines Second Edition was being actively sought by the Ministry of Education.

(2) Collaboration

The development of the guidelines and its critique yield the best end product through a collaborative approach.

(3) Technical Review Board

In the next proposed phase of the research program, UBC is proposing a Technical Review Board (TRB) as a collaborative, problem solving technical resource for the successful implementation of the guidelines.

(4) Innovative Retrofit Testing

In the next proposed phase of the research program, UBC is proposing an Innovative Retrofit Testing Program where consultants' approved cost-effective innovative retrofit concepts can be tested full-scale.

(5) Site Class D Sites

UBC is requesting consultants to submit soil column information for any Site Class D school site that has softer soil depths of 30-60 metres overlying a till-like material (Vs>760 m/s).

3.0 GENERAL COMMENTS - HEROLD ENGINEERING

Herold Engineering offered the following general comments on the Bridging Guidelines Second Edition:

(1) Overall Comment

Strongly support an industry-led collaborative approach with further development of the guidelines, especially in the design development and implementation stages of this program. As practical issues arise, it will be useful to have a resource such as the TRB to assist in any challenges faced.

(2) Methodology

The general methodology of using inelastic drift estimation (performance-based approach) is a good development in advancing seismic engineering.

(3) User Friendly

In general, the Bridging Guidelines are easy to use.

(4) Collaboration

Collaboration with design consultants is a good approach to improving the Bridging Guidelines (informal meetings with consultants, workshops) and to assisting consultants/school districts/Ministry with difficult or unusual technical issues.

(5) Demonstration Projects

Demonstration projects are a good resource for consultants, especially if all consultants have an opportunity to contribute.

(6) Non-school Application

Consultants would be most interested in any developments in adapting the Bridging Guidelines for non-school buildings (e.g. post-disaster buildings).

4.0 ERRATA

None of Herold Engineering's review comments require additional errata that is to be published and released by APEGBC by March 31, 2007.

5.0 FUTURE UPGRADES

Herold Engineering offered the following suggestions for enhancements to the next edition of the Bridging Guidelines:

(1) Feasibility Guidelines

The feasibility guidelines are not very explicit on "soft" management issues such as minimum qualifications for a prime consultant (some structural engineering firms may be uncomfortable or unqualified to be prime). School districts would also appreciate some guidance.

Phasing (scheduling, swing space) is a huge construction management issue where the consultant and the district would benefit from more explicit guidance.

(2) Stack Bond

Some guidelines are needed for stack bond concrete masonry (some provisions were in first edition). Out-of-plane behaviour of stack bond is an important issue. A demonstration project with stack bond would be very helpful.

(3) FRP

Fibre-reinforced polymer (FRP) seems to be used by other consultants. We need some guidelines on how and when FRP can be used.

(4) Diaphragms

We would like number of diaphragm types expanded.

We would like some guidance on a cost-effective way to upgrade an unblocked wood diaphragm to a higher strength blocked diaphragm that has minimal impact to roof coverings.

We need some resistance data for an upgraded Type B metal deck diaphragm (falls short of Type A but better than Type B). This may require some further research (Tremblay).

(5) Rocking

Section 8 (rocking LDRSs) needs more clarification.

6.0 QUESTIONS AND ANSWERS

Herold Engineering asked for UBC/PRC response to the following questions on the second edition of the Bridging Guidelines:

(1) Rocking

Question: Can we not just use basic engineering principles to allow for rocking? We don't find the rocking section easy to use.

Answer: We will expand the rocking section in Commentary Part A to help clarify the rocking issues. It is important to use the Bridging Guidelines approach to rocking. Rocking resistance is strongly influenced by the type of material, the aspect ratio and the Governing drift Limit. It is not simply the maximum lateral force resisting overturning.

END OF REVIEW COMMENTS

1.0 INTRODUCTION

John Sherstobitoff, P.Eng., (APEGBC Peer Review Committee member) and Rob Hall, P.Eng. (in lieu of Clint Low of the APEGBC Peer Review Committee) visited the office of Omega & Associates Engineering Ltd. (Omega) on March 02, 2007 to solicit critique of the Bridging Guidelines Second Edition.

The critique recorded in this document was provided by the following professional engineering staff of Omega:

- ??, P.Eng.,
- ??, P.Eng.

2.0 GENERAL INTRODUCTORY COMMENTS - PRC/UBC

The PRC/UBC representatives at the meeting made the following introductory comments to start the meeting. Omega staff had feedback on the comments as noted.

(1) Ministry Feedback

Consultants' critique of the Bridging Guidelines Second Edition was being actively sought by the Ministry of Education. Omega fully supports consultants being able to provide feedback.

(2) Collaboration

The development of the guidelines and its critique yield the best end product through a collaborative approach. Omega fully supports a collaborative effort, incorporating consultant input, to develop the final product.

(3) Technical Review Board

In the next proposed phase of the research program, UBC is proposing a Technical Review Board (TRB) as a collaborative, problem solving technical resource for the successful implementation of the guidelines. Omega fully supports such an initiative. Furthermore, Omega would like to see a means to have feedback on constructability from completed projects, available to all consultants.

(4) Innovative Retrofit Testing

In the next proposed phase of the research program, UBC is proposing an Innovative Retrofit Testing Program where consultants' approved cost-effective innovative retrofit concepts can be tested full-scale. Omega fully supports further

testing. Discussion was held regarding the need for bi-directional seismic loading in future testing to more realistically represent actual earthquake demands.

(5) Site Class D Sites

UBC is requesting consultants to submit soil column information for any Site Class D school site that has softer soil depths of 30-60 metres overlying a till-like material (Vs>760 m/s). Omega would review current projects to see if they had any such data.

3.0 GENERAL Discussion - Omega

The following items were noted in the discussion between Omega and the PRC/UBC representatives regarding the Bridging Guidelines Second Edition:

(1) There was some misunderstanding regarding use of guidelines for retrofit, as compared to just using them for evaluation purposes. Guidelines could perhaps further emphasize the expectation that consultants use guidelines for retrofit design; only defer to NBC 2005 I=1 if guidelines not applicable.

Question: If using NBC 2005 I=1 results in retrofit within escalated 2004 budget, should that be used? To provide a higher resistance level for the school? Should all consultants compare costs of NBC 2005 I=1 upgrade vs. cost of guideline upgrade? That is, do parallel design for all upgrades?

(2) User Friendly

In general, the Bridging Guidelines are easy to use. Understanding of LDRS generally OK.

(3) Collaboration

Collaboration with design consultants is a very good approach to improving the Bridging Guidelines (informal meetings with consultants, workshops) and to assisting consultants/school districts/Ministry with difficult or unusual technical issues. A regularly updated website or such to provide answers to Frequently Asked Questions (FAQ) is very important to have.

(4) Demonstration Projects/ completed projects

Demonstration projects are a good resource for consultants. Furthermore, a library of upgrade details from completed projects (or the complete set of drawings) should be available to all consultants for their use in future projects. Also a library of approx costs of such upgrades and details.

(5) Non-school Application

Consultants would be most interested in any developments in adapting the Bridging Guidelines for non-school buildings.

(6) Feasibility Studies

General agreement that structural engineering firms should be prime consultants for majority of small to medium projects. For very large projects or heritage/historical projects an architect may have more experience or more specific expertise than certain structural firms, and should be considered for the prime role.

Phasing (scheduling, swing space) is a huge construction issue where the consultant and the district would benefit from more explicit guidance. Consultants could also use guidance regarding options that trade off cost vs. noise and disruption; e.g. reinforcing masonry by sawcutting face, installing rebar, grouting versus FRP application. Is the Ministry willing to accept a cost premium if noise and disruption is reduced that results in a better teaching environment during construction?

(7) Stack Bond

Some guidelines are needed for stack bond concrete masonry (some provisions were in first edition). Out-of-plane behaviour of stack bond is an important issue. A demonstration project with stack bond would be very helpful.

(8) FRP

Need some guidelines on how and when FRP can be used. Also, suggested that FRP retrofit concepts should be part of proposed bi-directional testing.

(9) Testing

Suggest testing of other upgrade materials/schemes such as:

- Sureboard on metal studs (or over timber studs)
- metal deck over masonry

(10) Thin URM walls

Suggest more guidance for 100mm URM walls, especially in areas very difficult and costly to upgrade, such as washrooms. Should low occupancy areas such as washrooms, storage areas, be deleted from upgrading? If not, can cost effective alternatives be provided.

(11) Connections

Really need more detail and clarity on what to do.

Clarify connection from diaphragm to LDRS; which value to use: LDRS required resistance, LDRS actual capacity, diaphragm required resistance, diaphragm actual capacity, ? other ?

(12) Overstrength

With inherent factors of safety in timber design, should overstrength be approached differently from concrete, masonry and steel?

(13) Sliding Resistance

Clarify required sliding resistance of foundations.

(14) Building Envelope

Comment on issues of thermal conductivity of reinforced masonry in external walls (ie where rebar and grout replace insulation in cavities). Who is responsible for envelope issues, if one follows recommended guideline upgrades?

(15) Masonry Sliding

Could use clarification on where sliding is assumed to occur (sketch?).

(16) Diaphragms

Clarify preferences for upgrading of metal decks:

- combine capacity of new pins and existing welds? Or only capacity of new pins?
- Laps: combine capacity of button punch and new screws? Or only capacity of new screws?
- Retrofit from underside OK?
- Retrofit laps from underside, then defer upgrade of connections from above until roofing scheduled for replacement
- Delete reference to welded washers?
- Offer guidance on Hilti tabulated values vs Hilti software; and what factor to use on allowable (vs ultimate) tabulated values

Definition of shear at one edge of diaphragm as Rmd * Wd very misleading; expecting “normal” definition such as ½ Rmd * Wd; perhaps revise for future editions; emphasize definition this edition.

(17) Rocking

Section 8 (rocking LDRSs) needs more clarification.

END OF REVIEW COMMENTS

1.0 INTRODUCTION

John Wallace, P.Eng., StructEng. (APEGBC Peer Review Committee member) and Dr. Graham Taylor, P.Eng. (UBC research team) visited the office of Peterson Galloway Ltd. on March 13, 2007 to solicit critique of the Bridging Guidelines second edition.

The critique recorded in this document was provided by the following professional engineering staff of Peterson Galloway Ltd.:

- Chris Peterson, P.Eng.
- Greg Beaveridge, P.Eng.

2.0 GENERAL INTRODUCTORY COMMENTS - PRC/UBC

The PRC/UBC representatives at the meeting made the following introductory comments to start the meeting:

(1) Ministry Feedback

Consultants' critique of the Bridging Guidelines second edition was being actively sought by the Ministry of Education.

(2) Collaboration

The development of the guidelines and its critique yield the best end product through a collaborative approach.

(3) Technical Review Board

In the next proposed phase of the research program, UBC is proposing a Technical Review Board (TRB) as a collaborative, problem solving technical resource for the successful implementation of the guidelines.

(4) Innovative Retrofit Testing

In the next proposed phase of the research program, UBC is proposing an Innovative Retrofit Testing Program where consultants' approved cost-effective innovative retrofit concepts can be tested full-scale.

(5) Site Class D Sites

UBC is undertaking preliminary site response non-linear dynamic analyses of a number of Site Class D and Site Class E school sites as the first step in obtaining a better understanding of the site response issue. Victoria High School (Site Class C/D) is one of the schools to be analysed. The results for Victoria High School will be passed onto Peterson Galloway who have completed the feasibilities studies for this school.

3.0 GENERAL COMMENTS - PETERSON GALLOWAY

Peterson Galloway offered the following general comments on the Bridging Guidelines second edition:

(1) Overall Comment

We are supportive of a collaborative process that provides all engineers with the opportunity to provide constructive criticism to improve the Bridging Guidelines, especially given the substantial change advocated in seismic engineering practice.

We like the ability to be able to combine contributions from different materials in a deformation compatible manner.

The second edition is a vastly improved document compared with the first edition. The first edition was more like a "black box". We are looking forward to using the second edition for assessing George Jay Elementary that has a large clay brick masonry building.

(2) Steel Buildings

The Bridging Guidelines seem to penalize steel buildings, especially older steel buildings. Connections in older steel buildings are problematic. We understand the rationale for "AgFy". The options for upgrading older steel buildings are challenging.

(3) Steel Deck Diaphragm

We noted the substantial difference in ductility between Type A and Type B steel deck diaphragms. We look forward to the review comments from the External Peer Reviewers (EPR) on diaphragms and steel deck diaphragms in particular (EPR of diaphragms in late 2007).

4.0 ERRATA

None of Peterson Galloway's review comments require additional errata that is to be published and released by APEGBC by March 31, 2007.

5.0 FUTURE UPGRADES

Peterson Galloway offered the following suggestions for enhancements to the next edition of the Bridging Guidelines:

(1) Subduction Ground Motions

A suite of subduction ground motions needs to be included in the Bridging Guidelines to enable engineers to check Vancouver Island buildings for long duration shaking.

6.0 QUESTIONS AND ANSWERS

Peterson Galloway asked for UBC/PRC response to the following questions on the second edition of the Bridging Guidelines:

(1) 60% Minimum Resistance

Question: What is the basis for introducing the minimum resistance threshold of 60% of the corresponding code value?

Answer: The 60% of code value was determined by consensus around the peer review table as the minimum level of resistance that should be permitted for upgrading school buildings.

END OF REVIEW COMMENTS

1.0 INTRODUCTION

John Wallace, P.Eng., StructEng. (APEGBC Peer Review Committee member) and Dr. Graham Taylor, P.Eng. (UBC research team) visited the office of Stantec Consulting Ltd. on March 13, 2007 to solicit critique of the Bridging Guidelines second edition.

The critique recorded in this document was provided by the following professional engineering staff of Stantec Consulting Ltd.:

- Bruce Slight, P.Eng.

2.0 GENERAL INTRODUCTORY COMMENTS - PRC/UBC

The PRC/UBC representatives at the meeting made the following introductory comments to start the meeting:

(1) Ministry Feedback

Consultants' critique of the Bridging Guidelines second edition was being actively sought by the Ministry of Education.

(2) Collaboration

The development of the guidelines and its critique yield the best end product through a collaborative approach.

(3) Technical Review Board

In the next proposed phase of the research program, UBC is proposing a Technical Review Board (TRB) as a collaborative, problem solving technical resource for the successful implementation of the guidelines.

(4) Innovative Retrofit Testing

In the next proposed phase of the research program, UBC is proposing an Innovative Retrofit Testing Program where consultants' approved cost-effective innovative retrofit concepts can be tested full-scale.

(5) Site Class D Sites

UBC is undertaking preliminary site response non-linear dynamic analyses of a number of Site Class D and Site Class E school sites as the first step in obtaining a better understanding of the site response issue. Victoria High School (Site Class C/D) is one of the schools to be analysed. The results for Victoria High School will be passed onto Peterson Galloway who have completed the feasibilities studies for this school.

3.0 GENERAL COMMENTS - STANTEC

Stantec offered the following general comments on the Bridging Guidelines second edition:

(1) Overall Comments

We are comfortable with the Bridging Guidelines methodology for their application to the retrofit of school buildings in the province.

Those engineers initially reluctant to embrace the Bridging Guidelines are simply reacting to a major change in practice. We understand on-going professional development is a healthy aspect of our profession.

The second edition is a more credible document compared with the first edition.

Application of the guidelines to actual buildings makes the familiarization process easier.

4.0 ERRATA

None of Stantec's review comments require additional errata that are to be published and released by APEGBC by March 31, 2007.

5.0 FUTURE UPGRADES

Stantec offered the following suggestions for enhancements to the next edition of the Bridging Guidelines:

(1) Building Prototypes

The guidelines would benefit from an expanded number of building prototypes, especially for steel buildings.

6.0 QUESTIONS AND ANSWERS

Stantec had no significant questions requiring clarification.

END OF REVIEW COMMENTS

1.0 INTRODUCTION

Ron DeVall, P.Eng., (APEGBC Peer Review Committee member) and Dr. Timothy White, P.Eng. (UBC research team) visited the office of Jones Kwong Kishi Consulting Engineers (JKK) on March 14, 2007 to solicit critique of the Bridging Guidelines Second Edition.

The critique recorded in this document was provided by the following professional engineering staff of JKK:

- Fadi Ghorayeb, P.Eng., Struct. Eng.

2.0 COMMENTS - PRC/UBC

The PRC/UBC representatives at the meeting made the following introductory comments to start the meeting:

(1) Feedback

Consultants' comments/questions of the Bridging Guidelines Second Edition were being actively sought by UBC and the PRC. Comments and/or questions would be included in either a Frequently Asked Questions (FAQ) document, errata to the 2nd Edition Bridging Guidelines or deferred to the next edition.

(2) Demonstration Projects

Demonstration projects for the 2nd Edition Bridging Guidelines would soon be available.

(3) Future Tests at UBC

In the next proposed phase of the research program, UBC is proposing an experimental testing on more prototypes, such as concrete masonry.

3.0 COMMENTS - JKK

JKK offered the following general comments on the Bridging Guidelines Second Edition:

(1) Infill Masonry

1st Edition require that 75mm gaps be left on both sides, 2nd Edition only requires top corner blocks to be removed. Uncomfortable with 2nd Edition solution as compression struts can still form. Suggests this be verified experimentally.

(2) Masonry Prototypes

Suggest providing a method to account for strength of URM infill and masonry walls with vertical reinforcement only. Currently the Guidelines send the engineer to the Masonry Code for the capacity of reinforced masonry. It does not allow for vertical bars only.

(3) Clay Tile Partitions

There could be a cost savings in allowing for exterior clay tile to be protected on the interior and to have a protected fall zone on the exterior.

(4) Rigid Diaphragms

Rigid Diaphragms should be included.

Some older concrete diaphragms have high stiffness but a low strength. A section on rigid diaphragms is needed to

(5) Concrete Walls

The procedure for dealing with concrete walls is confusing. We need an example to show how the governing mode of failure is determined (i.e. rocking, shear or flexure).

It is confusing that both shear and flexural behaviour share the same resistance table.

It is odd that a wall 30’ long and a wall 10’ long have the same strength to stiffness ratio. More tables should be provided to account for different strength to stiffness ratios for concrete walls.

4.0 QUESTIONS AND ANSWERS

JKK asked for UBC/PRC response to the following questions on the second edition of the Bridging Guidelines:

(1) Rigid Diaphragms

Question: How do we determine the forces in a rigid diaphragm?

Answer: Suggest using the force distribution in Equation (1-2), but use the overstrength of the walls (i.e. $R_e R_o$). Concrete School Demonstration Project will provide an example.

(2) Determining Equivalent Shear for Flexural Resistance of Concrete Walls.

Question: How do we determine the corresponding base shear for the flexural resistance?

Answer: Suggest back calculating the force distribution in Equation (1-2). Equation (1-1) gives conservatively high moments, intended to boost the resistance for foundations and holdowns. If used for the flexural "base shear" it would underestimate it.

(3) Brittle Systems

Question: How are new and old systems combined together with a rigid diaphragm?

Answer: Regardless of the performance of a system, all LDRSs can be combined provided they have a common governing drift limit (GDL). Only a few combinations of systems are not possible (e.g. unreinforced clay brick masonry and steel moment frames).

5.0 ERRATA

None of JKK's review comments require additional errata that is to be published and released by APEGBC by March 31, 2007.

END OF REVIEW COMMENTS

1.0 INTRODUCTION

Clint Low, P.Eng. Struct.Eng., (APEGBC Peer Review Committee member) and Dr. Timothy White, P.Eng. (UBC research team) visited the office of C Y Loh Associates Ltd. on March 22, 2007 to solicit critique of the Bridging Guidelines Second Edition.

The critique recorded in this document was provided by the following professional engineering staff of CY Loh Associates:

- Paul Henry, P.Eng.
- Kosta Marcakis, P.Eng.,Struct.,Eng.

2.0 COMMENTS - PRC/UBC

The PRC/UBC representatives at the meeting made the following comments during the meeting:

(1) Feedback

Consultants' comments/questions of the Bridging Guidelines Second Edition were being actively sought by UBC and the PRC. Comments and/or questions would be included in either a Critique document, Errata to the 2nd Edition Bridging Guidelines or deferred to the next edition.

(2) New Releases

Demonstration projects, Critique document, Errata and Commentaries for the 2nd Edition Bridging Guidelines would soon be available. The Errata will include values for more existing wood-frame materials.

(3) Future Tests at UBC

In the next proposed phase of the research program, UBC is proposing an experimental testing on more prototypes, such as concrete masonry.

(4) Alternative Retrofit Solutions

When the Governing Drift Limit (GDL) of a building is controlled by the non-LDRS concrete columns, supplementary steel posts can be added beside the existing columns. These columns will take the gravity loads of the existing column if it fails. This allows for the concrete columns to be ignored when determining the GDL, and allows for a broader choice of retrofit solutions.

3.0 COMMENTS – C Y Loh Associates

C Y Loh Associates offered the following general comments on the Bridging Guidelines Second Edition:

(1) Foundations and Rocking

In some situations we have encountered, there was a long wall that had both a high capacity and a high overturning resistance. Both were well above the "demands" from the resistance tables. It would be onerous to design the foundation and connections to the capacity of the element. Guidance should be given what to do this situation (i.e. such as some sort of bail-out).

(2) Soil Anchors

How are soil anchors accounted for in the Bridging Guidelines? How is Vrr accounted for and what is the Ro for soil anchors? Is it possible to use soil anchors, but still have rocking the governing mode of failure? Which prototype should be used in this case? Is a new prototype required?

(3) Overturning Equation

The revised equation (1-2) for overturning moment makes some sense, but is more confusing than using something like a force distribution in equation (1-1).

(4) Diaphragms

Understand the chord force equation, and also understand the ramifications of the assumed shear distribution. It should be stated explicitly in the Bridging Guidelines that for weak wood diaphragms, the entire diaphragm must be upgraded, but for weak steel deck diaphragms, only a portion around the perimeter may need to be upgraded.

The prescriptive method of wood diaphragms is good for assessment, but not so helpful for retrofit. Need more existing wood-frame materials to help justify the final retrofit design (shiplap, 38mm T & G).

(5) Additional Prototypes

Suggest adding prototypes for tall single storey buildings such as gymnasiums. This could make the retrofit of these structures more efficient.

(6) Adjacency

Sentence 1.13(1)(b) is a bit vague. More guidance should be given.

(7) General Prescriptive Methods

The Bridging Guidelines have a couple of prescriptive sections (wood diaphragms and out-of-plane concrete masonry). These methods are fine and more would be helpful, provided they do not eliminate retrofit options..

4.0 QUESTIONS AND ANSWERS

C Y Loh asked for UBC/PRC response to the following questions on the second edition of the Bridging Guidelines:

(1) Sentence 10.8(2) – Shiplap Roofs

Question: Does this limitation only apply to roofs?

Answer: Yes, floor diaphragms with horizontal shiplap will often have flooring nailed over it, which provides sufficient capacity.

(2) Diaphragm Connection force.

Question: The diaphragm connection force seems very high, and does not seem to include anything for the connection walls. Why is this?

Answer: The diaphragm connection force has been errata'd. See the Errata document for the new equations.

5.0 ERRATA

None of C Y Loh Associates review comments require additional errata that is to be published and released by APEGBC by March 31, 2007.

END OF REVIEW COMMENTS

1.0 INTRODUCTION

Robert Hall, P.Eng. (Representing Clint Low, APEGBC Peer Review Committee member) and Dr. Timothy White, P.Eng. (UBC research team) visited the office of CWMM Consulting Engineers Ltd. on March 23, 2007 to solicit critique of the Bridging Guidelines Second Edition.

The critique recorded in this document was provided by the following professional engineering staff of CWMM:

- Patrick Lam, P.Eng., Struct.Eng.
- John Papadakis, P.Eng.

2.0 COMMENTS - PRC/UBC

The PRC/UBC representatives at the meeting made the following comments during the meeting:

(1) Feedback

Consultants' comments/questions of the Bridging Guidelines Second Edition were being actively sought by UBC and the PRC. Comments and/or questions would be included in either a Critique document, Errata to the 2nd Edition Bridging Guidelines or deferred to the next edition.

(2) New Releases

Demonstration projects, Critique document, Errata and Commentaries for the 2nd Edition Bridging Guidelines would soon be available. The Errata will include values for more existing wood-frame materials.

(3) Future Tests at UBC

In the next proposed phase of the research program, UBC is proposing an experimental testing on more prototypes, such as out-of-plane concrete masonry and hollow clay tile partition walls.

(4) Diaphragms

For diaphragms do not treat $R_{md}W_d$ as a force acting on the diaphragm, it is the required strength of the diaphragm. Also, note the diaphragm shear distribution on Figure A.10-3. This means that if a wood or horizontal steel braced diaphragm needs to be upgraded, the entire diaphragm needs to be upgraded.

3.0 COMMENTS – CWMM

CWMM offered the following general comments on the Bridging Guidelines Second Edition:

(1) 2nd Edition Guidelines

We have not used the 2nd Edition much as we currently only have one school. The retrofit design on this school has been delayed a long time because of the site response analysis.

(2) Connections

When a school is governed by a deficient load-path, there is no guidance in the Bridging Guidelines as to how to determine its risk. Most of the effort has been in developing tables that already assume an adequate load-path, but in reality many building have adequate lateral systems but poor connections.

Some sort of bail-out force is needed for connections on very strong LDRSs. While it may not follow a capacity design philosophy, the code allows it. In some cases it might be more cost effective to address these types of systems with the code and not use the Bridging Guidelines. If the purpose of the Bridging Guidelines is to be more efficient than the code, it needs to incorporate some bail-outs fore connection forces.

(3) Diaphragms

Very much like that diaphragms have been included in the 2nd Edition Bridging Guidelines. The minimum strength requirements for Type B (button punched and puddle welded) diaphragm seem very high.

What should be done about clay tile cast into concrete slabs?

(4) Seismic Zones

Suggest removing zones and have specific values for each municipality like the 2005 NBCC. Possibly do a range of spectral accelerations and then interpolate to get your site's values.

(5) Foundations

Little guidance is given on what to do with foundations. Would appreciate suggestions as to when footings need to be tied together.

(6) Other School Retrofit Projects

It would be nice to have access to other school projects that have been completed. Many schools built in the same era have very similar designs, and a lot of time could be saved (and money) by reusing the same details.

4.0 QUESTIONS AND ANSWERS

CWMM asked for UBC/PRC response to the following questions on the second edition of the Bridging Guidelines:

(1) Clay tile in ceiling

Question: What should be done about clay tiles cast into a concrete slab?

Answer: Currently they should be left in. This is a non-structural issue. The one exception to the non-structural rule is heavy partition walls, as they post a very serious life-safety threat.

(2) Clay tile partitions.

Question: Do Clay tile partition walls in bathrooms need to be removed? This can be very costly due to the removal and replacement of the bathroom finishes and plumbing.

Answer: Currently the clay tile walls in bathrooms need to be removed or restrained. Future research will investigate its hazard, and look into allowing it to remain in low occupancy areas.

5.0 ERRATA

None of CWMM review comments require additional errata that is to be published and released by APEGBC by March 31, 2007.

END OF REVIEW COMMENTS