Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

Associated Engineering (B.C.) Ltd.
Suite 300 - 4940 Canada Way
Burnaby, British Columbia Canada V5G 4M5
TEL 604.293.1411
FAX 604.291.6163
www.ae.ca

June 12, 2009
File: 20072035.00.A.07.00

Mr. Brian Chow
Chief Engineer
Ministry of Forests and Range
PO Box 9510
Stn. Prov. Gov.
Victoria, BC
V8W 9C2

Re: REVIEW OF THE DEVELOPMENT AND IMPLEMENTATION OF THE NEW DESIGN VEHICLES FOR THE DESIGN OF BRIDGES - REVISION 1

Dear Mr. Chow:

1 INTRODUCTION

The Ministry of Forests and Range retained Associated Engineering to review of the development of the two proposed design vehicles, the adoption of the BCL-625 design vehicle and provide recommendations to facilitate the adoption of these design vehicles within the framework of the Forest Service Bridge Design and Construction Manual and the 2006 Canadian Highway Bridge Design Code (S6-06).

This report presents a historical overview of the development and summary of the proposed design vehicles. Further, following our review we recommend that prior to adopting these new design vehicles, the Ministry address the following:

- Provide guidance on which design vehicle Owners should adopt for the design of new structures and evaluation of existing bridge inventory.
- Develop screening tools to allow Owners to identify which bridges in their inventory are suitable for use with the new design vehicle and those that require evaluation that is more detailed.
- Provide guidance on how to complete detailed evaluations on existing inventory using the new design vehicles.
- Provide guidance on posting load restrictions.
- Develop new bridge design criteria incorporating S6-06 (or a modified version).
- Develop new standard bridge drawings that account for the new design vehicles.

The remainder of the report briefly addresses these items.

2 HISTORICAL OVERVIEW

The following presents a brief chronological overview of how the Ministry developed the proposed new design vehicles including some of the recommendations and conclusions made at each stage of the process:

- In 2003, the Ministry retained Buckland & Taylor to evaluate whether the existing design vehicle configurations produce force effect envelopes that are reasonably representative for logging vehicles currently in use in British Columbia and whether it is appropriate to use the existing design configurations with the load factors included in S6-00.

- Subsequently, the Ministry retained FERIC to complete a survey of logging truck weights and axle configurations to provide sufficient data to produce reliable statistical data to facilitate the evaluation of the design vehicles.

- The data collected during the initial study by FERIC included both G.V.W., individual axle weights, axle configurations, wheel spacing, truck type and the annual number of loaded trucks using the bridge.

- Although the FERIC study targeted off-highway trucks in coastal areas (L150-L165), highway legal logging trucks in coastal areas, off-highway trucks in the interior (L75) and highway legal logging trucks in the interior, they were only able to collect sufficient data to evaluate the L75 and highway legal categories. This study did not target the L100 type logging trucks or loads associated with the movement of heavy logging equipment.

- Upon completion of the first study (Phase I), the following was noted:

  .a The average axle and gross vehicle weights of highway legal logging trucks slightly exceeds the legal limits as defined by the B.C. Commercial Transport Act.

  .b The L75 design configuration is only partially effective in producing force effects similar to those resulting from actual logging trucks.

    .i Buckland & Taylor developed revised live load factors consistent with S6-00 for use with the L75 design vehicle.

    .ii Given the higher variability of axle loads versus G.V.W., if the current L75 truck configuration is not altered, different load factors would be required for short span (<15 m) and long span (>15 m) bridges to ensure a consistent level of safety. In other words, the vehicle configuration would have to be altered to allow the use of a single load factor.

.iii To avoid the use of multiple load factors for short and long span bridges, Buckland & Taylor modified the L75 design vehicle configuration to allow it to be used in conjunction with S6-00 (i.e., live load factor = 1.7). Only the axle loads were altered and the axle configuration, wheel imbalance and truck eccentricity remained unchanged when compared to the original L75 design vehicle.

.c Buckland & Taylor evaluated the possibility of using a CL-W design vehicle model to represent the L75 design vehicle, however, upon further investigation; it became apparent that they would require significant modification to be suitable for application to forestry bridges. Therefore, the use of the CL-W truck configuration offered no advantages over the proposed modifications to the current design vehicle configurations.

- Since Buckland & Taylor identified a lack of data as one on the problems from the Phase I study, the Ministry again retained FERIC to collect additional survey data on the G.V.W. of logging trucks. They targeted operations in both the Interior and Coastal regions of BC in an effort to get a representative sample to determine the design capacities required by the industry. For this survey, FERIC collected only G.V.W. weights based on scale information from 29 operations throughout BC.

- The Ministry retained Buckland & Taylor to evaluate the additional data collected by FERIC. Since FERIC only collected G.V.W. data, Buckland and Taylor adopted the statistical information from Phase 1 pertaining to the variability of individual axle loads and the effect that this variability has on the design of short span bridges.

- Upon completion of the second study (Phase II), the following was noted:

  .a Buckland & Taylor developed revised live load factors consistent with S6-00 for use with the L100, L150 and L165 design vehicles.

  .b As with Phase I, if the current truck configurations are not altered, different load factors would be required for short span (<15 m) and long span bridges (>15 m) to ensure a consistent level of safety.

  .c The L165 design vehicle is conservative for all spans.

.d To avoid the use of multiple load factors for short and long span bridges, Buckland & Taylor modified the L100, L150 and L165 design vehicle configurations to allow them to be used in conjunction with S6-00. Only the axle loads were altered and the axle configuration, wheel imbalance and truck eccentricity remained unchanged when compared to the original L100, L150 and L165 design vehicles.]

.e Buckland & Taylor evaluated the possibility of using a CL-W design vehicle model to represent the L100, L150 and L165 design vehicles, however, upon further investigation; it became apparent that we would have to significantly modify the CL-W truck configuration to be suitable for application to forestry bridges. Therefore, the use of the CL-W truck configuration offered no advantages over the proposed modifications to the current design vehicle configurations.

.f Buckland & Taylor reviewed various lowbed configurations and weights developed by FERIC and concluded that the methodology for evaluating existing bridges prescribed in section 14 of S6-00 is suitable for evaluating these specific events.

- Following completion of Phase II, the Ministry retained Buckland & Taylor to complete a third study, Phase III. This study resulted in the development of three design vehicles that best represent typical logging trucks in BC and that the Ministry can use in conjunction with S6-00. In summary the results regarding the design vehicles included:

  .a Proposed an off-highway interior logging truck configuration that has the same axle spacing, wheel imbalance and specified truck eccentricity as the L100 design vehicle.

  .b Proposed an off-highway light coastal logging truck configuration that has the same axle spacing, wheel imbalance and specified truck eccentricity as the L100 design vehicle. This design vehicle is identical to the off-highway interior design vehicle.

  .c Proposed an off-highway heavy coastal logging truck configuration that has the same axle spacing, wheel imbalance and specified eccentricity as the L165 design vehicle.

  .d In addition, Buckland & Taylor also developed design lane loads for use with the proposed off-highway design vehicle configurations. The intent was to provide a more rational approach to the design of bridges for multiple trucks than that currently used by the Ministry.

- Following the completion of Phase III, Buckland & Taylor provided a method for evaluating the suitability of an existing truck population with respect to the proposed design vehicles (i.e., based on existing scale information, which design vehicle the Ministry/Owner should adopt to best represent the actual truck population).

- Subsequent to the completion of Phase III the Ministry decided to proceed with moving forward with the implementation of two off-highway design vehicles, the Light Off-Highway and Heavy Off-Highway vehicles as defined by the off-highway interior/ off-highway light coastal and heavy coastal logging trucks respectively. Further, based on discussions of the ad hoc bridge committee, the Ministry adopted the CL-625 design vehicle for the design of bridges carrying highway legal logging trucks. One of the primary rationales for adoption of the CL-625 was to ensure consistency with the BC Ministry of Transportation design approach. Using the same design vehicle as BC Ministry of Transportation would facilitate transfer of structures between agencies.

- The Ministry requested that Buckland and Taylor develop Live load factors for use with Section 14 of S6-00. These Live Load Factors are identical to those specified for the CL-625 design vehicle in Table 14.12.3.1 (a) of Section 14 in S6-06.

- CSA releases the 2006 Canadian Highway Bridge Design Code that supersedes the 2000 version.

- Following the adoption of the BCL-625 design vehicle by the BC Ministry of Transportation for the design of all bridges required to support highway legal loads, the Ministry of Forests and Range adopted the BCL-625 design vehicle for use on forestry bridges to ensure consistency with the Ministry of Transportation. The Ministry of Transportation adopted the BCL-625 design vehicle to ensure that bridges designed in accordance with S6-06 have adequate load capacity for 85 tonne Class Permit Vehicles and 6 Axle Mobile Cranes with boom in cradle to travel with other traffic given that CL-625 loading is inadequate in short spans for cranes and medium length continuous spans in moment for 85 tonne Class Permit Vehicles.

During the development of the off-highway design vehicles there was a significant amount of discussion regarding whether to maintain the truck eccentricity and off-balance wheel loading as both these effects are not included in the CL-W design vehicle model. The Ministry decided to adopt the S6-06 guidelines relating to truck eccentricity (i.e., place the wheel 600 mm from the edge of the curb). However, the Ministry decided to maintain the wheel imbalance as this better reflects reality. To provide consistency for the off-highway vehicles, the Ministry adopted a 60/40 split for both the interior and coastal off-highway vehicles.

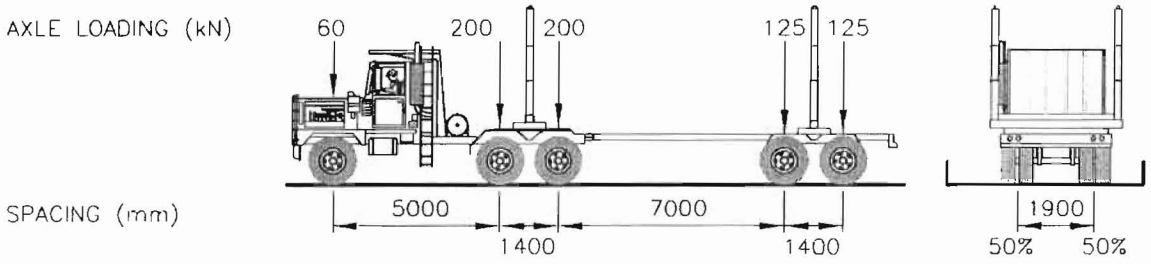
June 12, 2009
Mr. Brian Chow
Ministry of Forests and Range
- 6 -

3 PROPOSED DESIGN VEHICLES

In the report "Design Vehicle Configuration Analysis and CSA S6-00 Implication Evaluation Phase III", Buckland & Taylor proposed the two off-highway design vehicles based on the analysis of truck configuration and scale information collected throughout British Columbia. In addition, they advised that the CL-625 design vehicle, as specified in S6-00, would be suitable for the design of forestry bridges subject to highway legal logging trucks. The Ministry adopted the CL-625 and then the BCL-625 design vehicle for the design of bridges subject to highway legal loading as discussed in Section 2.

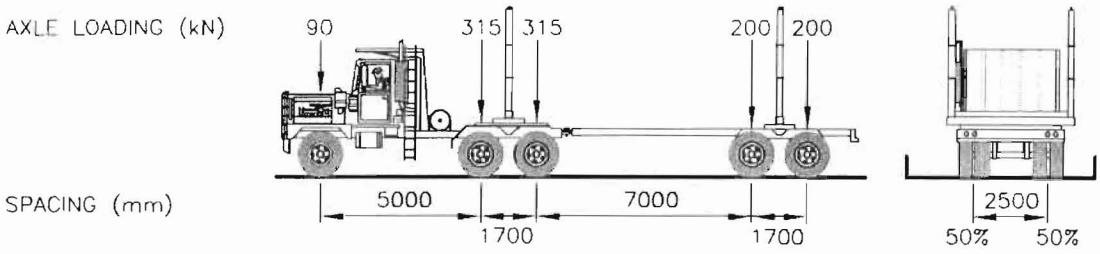
The proposed design vehicles are calibrated for use with the Live Load factors and Dynamic Load Allowance specified in CSA S6-06 and are intended for use when designing girders and stringers. Although the proposed design vehicles were developed for the design of longitudinal girders, preliminary review suggests that they can be used for deck design. Figures 1 and 2 illustrate the two proposed off-highway design vehicles.

Figure 1
Light Off-Highway Design Vehicle
GVW: 72,375 kg



June 12, 2009
Mr. Brian Chow
Ministry of Forests and Range
- 7 -

Figure 2
Heavy Off-Highway Design Vehicle
GVW: 114,200 kg



4 GUIDANCE ON ADOPTION OF THE MOST APPROPRIATE DESIGN VEHICLE

The adoption of new design vehicles may present a challenge to Owners since it is difficult to relate the proposed design vehicles to actual truck configurations or the current design vehicles. Typically, Owners define design loads based on:

- Maximum loads allowed at mill scales.
- Historical precedence i.e., "L75 bridges are what we have always designed".
- Target G.V.W. assuming a set volume of wood and assumed net weight of the logging truck i.e., 20 ton logging truck carrying 80 m3 (80 ton) of timber results in 100 ton G.V.W. and therefore a L100 design load.
- The heaviest load that the bridge might expect e.g. the transportation of a grapple yarder (120 ton) on an off-highway low bed (40 ton) results in a 160 ton G.V.W. and therefore a L160 design load.
- The assumption that L75 represented highway loads while L100 represented overloaded highway logging trucks.

None of these methods has a scientific basis but they appear to work. Therefore, the proposed change will force Owners to better define their truck population and corresponding design loads. In presenting this change to the Owners, the Ministry should identify why the change is required. Some of the reasons for the required change include:

- It will be a valuable exercise for Owners to complete as it could reduce the conservatism in the bridge design process i.e., bridges are designed for a load that best represents the actual truck population.
- Owners can ensure that their bridges have adequate capacity to safely carry existing and future traffic.
- The proposed design vehicles are more representative of the actual trucks used by the forestry industry.
- The design vehicles are calibrated for use with S6-06. Therefore, the more extensive design provisions and commentary provided can be applied in most cases.
- The new design vehicles should provide more balanced designs than previous design vehicles. Lighter loading for longer span bridges but heavier loading for shorter spans.

If the Ministry chooses to implement the new design vehicles, they will have to educate Owners on which design vehicle(s) they should adopt. If an Owner is hauling only highway legal loads, this choice is simplified and the design vehicle would be the BCL-625 design vehicle. However, if they are hauling off-highway loads further guidance will be required.

Buckland & Taylor provided a simplified method to determine which off-highway design vehicle Owners should adopt based on a statistical analysis of the G.V.W. scale information (excluding rare overloads resulting from equipment movement). However, this methodology assumes that the weigh scale information is available. If this information is not available, alternative guidelines are required.

We foresee the guideline containing some or all of the following:

- A simplified table recommending which design vehicle to adopt based on an Owner's current bridge inventory or design vehicle as shown in Table 1.
- Consideration of the capacities of existing structures.
- Guidance on target G.V.W. for each of the proposed design vehicles to allow Owners to evaluate their vehicles based on truck tare weights and assumed volumes of wood being hauled. This will also allow Owners to provide guidance to contractors who may be hauling on their infrastructure.
- A statistical methodology to determine which proposed design vehicle is appropriate for use based on weigh scale information.
- Guidance on what design vehicle to adopt if the statistical methodology suggests that the G.V.W. exceeds the Heavy Off-Highway Vehicle.
- A methodology to determine alternative design vehicles.
- Guidance on how to account for rare overloads when evaluating bridges.

Table 1
Illustrative Comparison of the Existing Design Vehicles Versus the Corresponding Proposed Design Vehicles

New Designated Design Load[1]	Previous Designated Design Load
BCL-625 (Highway Legal)	L45, L60, L75[2]
Light Off-Highway	L75[2], L100
Heavy Off-Highway	L110, L120, L150, L165

Note:
[1]This Table is shown for illustrative purposes only. Further investigation is required to verify the comparative assumptions made.
[2] Prior to the adoption of the BCL-625 design vehicle, the Ministry used the L75 design vehicle as the minimum design vehicle loading for bridges required to carry highway legal logging traffic. The L75 design vehicle replaced the L60 design vehicle which replaced the L45 design vehicle as truck configurations changed and weights increased.

5 SCREENING OF EXISTING BRIDGE INVENTORY

With the adoption of new design vehicles, Owners may question the adequacy of existing bridge and culvert inventories. To simplify the evaluation of existing inventory, we recommend that the Ministry develop a screening tool that will allow Owners to evaluate inventory designed to previously accepted design loads. Inventory deemed not suitable based on the screening tool could be further evaluated using additional guidelines developed by the Ministry.

Associated Engineering completed the initial stages of a study to evaluate the effect of the new design vehicles on bridges designed in accordance with S6-78 and S6-88 by comparing the force effects resulting from the proposed design vehicle against those from the L45, L60, L75, L100, L150 and L165 design loads. We completed the evaluation using live load factors specified by Buckland & Taylor and the methodology outlined in Section 14 of S6-00. Although this work was completed using CSA S6-00, it remains applicable to CSA S6-06. Table 2 briefly summarizes the results of this study for steel and concrete bridges.

June 12, 2009
Mr. Brian Chow
Ministry of Forests and Range
- 10 -

Table 2
Summary of Evaluation of Existing Steel and Concrete Bridge Inventory for the Proposed CL625, Light Off-Highway and Heavy Off-Highway Design Loads

Evaluation Vehicle	Comments[1]
BCL-625	• L45 and L60 bridges typically do not have sufficient capacity to support highway legal vehicles. However, a more detailed evaluation may justify the suitability of some of these bridges. • L75, L100, L150 and L165 bridges are suitable for highway legal vehicles.
Light Off-Highway	• L45 and L60 bridges do not have sufficient capacity to support the Light Off-Highway vehicle. • L75 bridges typically do not have sufficient capacity to support the Light Off-Highway vehicle. However, further investigation may justify the suitability of bridges with span lengths exceeding 18 m. • L100, L150 and L165 bridges are suitable for the Light Off-Highway design vehicle.
Heavy Off-Highway	• L100 bridges typically do not have sufficient capacity to support the Heavy Off-Highway vehicle. • L150 bridges with span lengths exceeding 18 m typically have sufficient capacity to support the Heavy Off-Highway vehicle. However, further investigation will probably justify the suitability of bridges with span lengths less than 18 m. • L165 bridges are suitable for Heavy Off-Highway vehicle.

Note:
[1]Evaluation based on comparing the force effects resulting from the proposed design vehicle against those from the L45, L60, L75, L100, L150 and L165 design loads using live load factors specified by Buckland & Taylor and the methodology outlined in Section 14 of S6-00.

Based on this preliminary study, the Ministry could consider a screening tool for bridges such as that included in Appendix A.

Since we based the study on the comparison of total force effects i.e. it did not account for load distribution and actual section resistances, it conservatively estimated the Live Load Capacity Factors. Further work is required to develop the screening tool that applies to those bridges that probably do have sufficient capacity to support the new design vehicles as suggested in Appendix A. Therefore, as a continuation of this study, we recommend that the Ministry evaluate the following actual bridge designs:

- L45 bridges with spans ranging from 6-33 m and designed in accordance with S6-78 and S6-88 for the CL625 design vehicle.
- L60 bridges with spans ranging from 6-33 m and designed in accordance with S6-78 and S6-88 for the CL625 design vehicle.
- L75 bridges with spans ranging from 6-33 mm and designed in accordance with S6-78 and S6-88 for the Light Off-Highway design vehicle.
- L150 bridges with spans ranging from 6-15 m and designed in accordance with S6-78 and S6-88 for the Heavy Off-Highway design vehicle.

The above discussion has focused on the evaluation of bridges; a similar screening tool will also be required for culverts.

6 EVALUATION OF EXISTING BRIDGE INVENTORY

As discussed in Section 4, the adoption of new design vehicles and associated screening of existing bridges will result in Owners identifying potentially inadequate bridges. We recommend that the Ministry develop bridge evaluation and load posting guidelines to assist Owners in determining the adequacy of these bridges.

S6-06 Section 14 provides guidance for the evaluation and load rating of bridge structures. Further, work completed by Buckland & Taylor confirms that the Live Load Factors corresponding to various Target Reliability Indices (β) derived for the BCL-625 design vehicles are applicable to the Light and Heavy Off-Highway design vehicles. We therefore recommend that the Ministry consider the following evaluation guidelines:

- Evaluate bridges for the specified design load in accordance with S6-06 Section 14.
- The evaluation should include a review of the design drawings and available inspection reports.

When determining the Inspection Level we recommend:

- Where no inspection records are available, assume the inspection level = INSPI.
- Where the bridge inspection frequency meets or exceeds the frequency required by the Forest Road Engineering Guidebook, and the results of the routine inspections are available to the Engineer, Inspection Level = INSPII.
- Where the bridge has been inspected for the purpose of completing the evaluation and the results are available to the Engineer, Inspection Level = INSPIII.
- Assume the System and Element Behaviour Categories as summarized in Tables 3.
- Account for Resistance Adjustment Factors as specified in CSA S6-06 Table 14.15.

June 12, 2009
Mr. Brian Chow
Ministry of Forests and Range
- 12 -

Table 3
Recommended System and Element Behaviour Category Classification

Bridge Type	System Behaviour[1]	Element Behaviour[1]	
		Flexure	Shear
Twin steel I-girder bridges	S1	E3	E3
Twin pre-stressed I-girder bridges	S1	E3	E2
Multi-beam steel girder bridges	S2	E3	E3
Multi-beam concrete girder bridges	S2	E3	E2
Multi-beam shear-connected concrete slab bridges (incl. pre-stressed concrete boxes)	S2	E3	E2
Multi-beam non-shear connected slab bridges	S1	E3	E2
Twin glulam girder bridge	S1	E1	E3
Multi-beam glulam girder bridges	S2	E1	E3
Sawn timber stringer bridges	S2	E1	E3
Twin I-Compo-Girder bridges	S1	E3	E2
Compo-Girder Channel bridges	S1	E3	E2

Note:
[1]Classifications relate to S6-06 Clauses 14.12.2 and 14.12.3

In addition to evaluating the critical load carrying elements, the evaluation must also consider other elements such as the bridge deck, bearings and bridge substructure. For the evaluation of concrete bridge decks, the Ministry could adopt the following simplified approach:

- CL625 design vehicle: Decks previously designed to BCFS L75 and greater are acceptable.
- Light Off-Highway design vehicle: Decks previously designed to BCFS L100 and greater are acceptable.
- Heavy Off-Highway design vehicle: Decks previously designed to BCFS L150 and L165 are acceptable.

We recommend the simplified approach, provided that the existing bridges are not showing signs of distress under the current loading and there is no intention to increase the weight of the loads hauled across the bridge.

In addition, the owner should monitor the specific elements during future inspections. If deterioration such as cracking of the concrete deck, bulging bearing pads or settlement of the bridge abutments is noted, and can be attributed to overloading; the owner should give consideration to posting the bridge for a reduced load.

Where the screening tools and/or further detailed evaluation suggest that the bridge is not adequate, the Owner has the following options:

- Consider a specific evaluation vehicle developed using the guidelines prepared by the Ministry. Re-evaluate the adequacy of each bridge using the revised design vehicle. This allows the owner to tailor the evaluation to the vehicles that they are using. However, they must demonstrate that controls are in place to control the G.V.W. of trucks hauling across their bridges.
- Post the bridge for a reduced load and/or consider reducing the vehicles G.V.W. (i.e., haul less timber) so that the safety of the bridge is not compromised.
- Replace or strengthen the bridge.

In addition to the recommendations noted above, we recommend that the Ministry develop load posting guidelines for bridges evaluated using the proposed design vehicles.

7 DESIGN OF NEW BRIDGES

We recommend that Owners designing new bridges be limited to one of the three specified design vehicles rather than developing their own design vehicle based on scale information. This would create consistency across the Province and allow Owners to share road networks. Further, it will simplify the development of standard details.

The only exception to this may be where an Owner's analysis of the weigh scale information suggests that the G.V.W. exceeds that defined for the Heavy Off-Highway design vehicle. In this case, the owner should develop a suitable design vehicle based on guidelines prepared by the Ministry.

With the adoption of the three new design vehicles, the Ministry should also update the Forest Service Bridge Design and Construction Manual to ensure that Owners design and construct bridges in accordance with S6-06.

The Ministry may also consider developing guidelines for the evaluation of rare overloads resulting from the transportation of heavy equipment. This will prevent Owners over-designing bridges or adopting a heavier than necessary design vehicle to account for these loads. For these cases, the owner should evaluate the bridge using the guidelines included in S6-06 Section 14 and those developed by the Ministry.

8 STANDARD BRIDGE DRAWINGS

Over the years, the Ministry has developed a number of standard drawings based on the current design vehicle configurations. The following is a list of drawings that include engineered details:

- Standard composite pre-cast concrete bridge deck drawings,
- Standard non-composite pre-cast concrete bridge deck drawings,
- Shear connected slab bridge drawings,
- Non- shear connected slab bridge drawings,
- Shear connected slab bridge drawings (VG51 series developed by Associated Engineering for Gary MacClelland),
- Standard timber deck drawings,
- Pre-cast concrete footing drawings; and
- 1986 Standard Permanent Bridge and Standard Portable Bridge Drawings prepared by Denis Frie.

With the development of the new design vehicles and the changes to the Canadian Highway Bridge Design Code over the last number of years, the majority of these drawings are obsolete. The updating and revision of these drawings is a time consuming and expensive task. Further, we believe that with the exception of the standard timber deck, bridge rail and pre-cast concrete footing drawings, engineers and fabricators do not reference the drawings. Rather engineers and fabricators have developed their own details based on analysis and fabricator preferences.

In addition to considering the effects of the new design vehicles and relevant Code changes, the Ministry may also wish to develop some standard robust details to resist seismic loads as recommended in the 2003 report, "Evaluation of CAN/CSA-S6-00 (2000 Canadian Highway Bridge Design Code) and the 2008 "Supplement to CAN/CSA-S6-06" prepared by Associated Engineering.

We therefore recommend that the Ministry develop conceptual drawings illustrating acceptable details and if required provide additional guidance for design within the Forest Service Bridge Design and Construction Manual. Engineers can then design the required elements such as deck panels based on owner and fabricator preferences. This would be similar to the methodology adopted for the All-Steel Portable Bridges.

9 CONCLUSIONS

Based on our review of the work completed on the development and implementation of new design vehicles the three design vehicles (BCL-625, light and heavy off highway) used in conjunction with S6-06, with defined variations as captured in other works, are suitable. We recommend that prior to the adoption of the new design vehicles, the Ministry address the following:

- Provide guidance on which design vehicle Owners should adopt for design of new structures and evaluation of existing bridge inventory.
- Develop screening tools to allow Owners to identify which existing bridges in their inventory are suitable for use with the new design vehicle and those that require more detailed evaluation.
- Provide guidance on how to complete detailed evaluations on existing inventory using the new design vehicles.
- Provide guidance on posting load restrictions.
- Develop new bridge design criteria incorporating S6-06 (or a modified version).
- Develop new standard bridge drawings that account for the new design vehicles.

June 12, 2009
Mr. Brian Chow
Ministry of Forests and Range
- 16 -

To develop these guidelines, the Ministry will have to complete the following work:

- Finalize the design vehicle configurations.
- Develop guidelines for deck design.
- Develop a comparative tool to relate the current vehicle designations to the proposed design vehicles.
- For each of the proposed design vehicles create a target G.V.W. that Owners can use to asses their logging trucks.
- Develop guidelines for determining the size of sample required to complete a statistical evaluation of G.V.W. to determine the appropriate design vehicle.
- Develop guidelines for developing alternate design vehicles.
- Develop guidelines for monitoring G.V.W. where an alternative design vehicle has been developed.
- Complete the development of a screening tool to facilitate the evaluation of the adequacy of an existing bridge inventory.
- Develop a screening tool for the evaluation of existing culverts.
- Develop bridge evaluation guidelines.
- Develop load posting guidelines.
- Revise the Standard Bridge Drawings

We trust that this report meets your current needs. Should you have any questions, please contact me.

Respectfully submitted,

Yours truly,

Prepared by:

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA J. HENLEY

12 June 09

Julien Henley, M.A.Sc., P.Eng.
Manager, Resource Infrastructure

Reviewed by:

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA D. I. HARVEY # 14042

2009-06-12

D.I. Harvey, MSc., P.Eng., Struct.Eng.
Senior Bridge Specialist

JH/DH/skn

Enclosure