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Ministry of Forests
Resource Tenures and Engineering Branch Ministry of Forests
P.O. Box 9510 Stn Prov Govt
727 Fisgard Street
Victoria, BC V8W 9C2

Attention: Mr. Brian Chow, P.Eng., Senior Structures and Roads Engineer

Dear Sirs,

Re: Suitability of Forestry Vehicle Populations for Use with the Proposed New MoF
Design Vehicle Configurations

Buckland & Taylor Ltd.'s report to the Ministry of Forests, entitled 'Design Vehicle Configuration Analysis and CSA-S6-00 Implication Evaluation Phase III', originally contained a methodology for assessing the suitability of a particular population of forestry vehicles for use with the proposed New Design Vehicle Configurations. It was also described how the provisions could be used to define an alternate design vehicle configuration for use with a particular population of forestry vehicles. However, these methodologies were subsequently removed from the report when the Ministry of Forests expressed concerns regarding the potential for misuse by the industry. Therefore, these methodologies are now being separately provided to the Ministry.

Methodology for Monitoring Suitability of Design Vehicle Models

The Off-Highway Interior, Off-Highway Light Coastal and Off-Highway Heavy Coastal design vehicle load models contained in the report entitled 'Design Vehicle Configuration Analysis and CSA-S6-00 Implication Evaluation Phase III' were developed to provide bridge designs suitable for the surveyed weights of the logging truck populations currently operating in these regions. Loading practices for logging trucks vary significantly from operation to operation. Should an unsurveyed population of significantly heavier logging trucks exist or should the logging truck weights increase significantly in the future, these proposed design vehicle configurations could produce unconservative results. Therefore, a means for assessing the suitability of the proposed design vehicle configurations for use with a particular population of logging trucks is desirable.

The techniques used to develop design vehicle load models for this study, and for bridge codes in general, are beyond the experience of most bridge engineers and can be difficult

to apply in a consistent manner. Therefore, a more straightforward methodology is required for assessing the suitability of the proposed design vehicle load models for a particular population of logging trucks.

In general, bridge design requirements are intended to provide a structure with sufficient capacity to safely carry the heaviest loadings that are expected to be applied during the life of the structure. For truck loadings, this is typically taken as the heaviest truck expected to cross the bridge annually. Therefore, only the heaviest trucks in the annual population of logging trucks have a significant effect on the level of safety being provided by the design vehicles. The weights of the proposed Interior Region and Coastal Region design vehicles are approximately equal to the average weights of the heavier types of logging trucks operating in the regions. Therefore, many of the logging trucks are expected to be heavier than the design vehicle weights. However, if the number of logging trucks with weights exceeding the weights of the design vehicles are maintained within the following limits, the expected level of safety can be considered to be achieved:

Less than 2.5% of the logging trucks (one truck in 40 trucks) should have weights that exceed the weight of the design vehicle by more than 19%.

Less than 0.15% of the logging trucks (one truck in 667 trucks) should have weights that exceed the weight of the design vehicle by more than 27.5%.

No logging trucks should have weights that exceed the weight of the design vehicle by more than 36%.

If these limits are consistently being exceeded, consideration should be given to reducing trucks weights, strengthening the bridge(s) as required or conducting a more detailed assessment of the logging truck population using the bridge.

For the Off Highway Interior design vehicle and the Off Highway Heavy Coastal design vehicle the weight limits derived from these criteria are shown in the following Table.

Required Characteristics of Logging Truck Populations to be Suitable for Use with Proposed Design Vehicle Configurations				
	Design Vehicle Weight	Weight Not To Be Exceeded by More Than 2.5% of Trucks	Weight Not To Be Exceeded by More Than 0.15% of Trucks	Weight Not To Be Exceeded by Any Trucks
Off Highway Interior	73,400 kg	87,350 kg	93,600 kg	99,800 kg
Off Highway Heavy Coastal	113,660 kg	135,250 kg	144,900 kg	154,600 kg

As an example, for a bridge designed to accommodate the Interior Design Vehicle and with an annual logging truck population of 2500, up to 63, 4 and 0 logging trucks with weights exceeding 87,350 kg, 93,600 kg and 99,800 kg, respectively, could be permitted annually.

This technique is an approximate method for assessing the suitability of the proposed design vehicles for use with a particular population of logging trucks. Limitations of the technique include the following:

- Technique requires the use of site specific weigh scale data on logging truck weights.
- Results obtained for small samples of logging truck weights can be very sensitive to the presence of a single heavier truck.
- The technique cannot define the significance of exceeding the prescribed limits for logging truck weights and frequencies. It can only be said that the truck population meets or does not meet the limits.

Alternate Design Vehicles

The proposed new design vehicle configurations are intended to provide design loadings suitable for the surveyed logging operations using the heaviest trucks. However, the surveys indicated that a number of forestry industry licensees in both the Interior and Coastal regions employ lighter logging trucks in part or all of their activities and have routes with bridges designed for lower truck weights. Depending on the actual weights of a licensee's logging trucks, use of the proposed bridge design vehicles may be conservative and have a substantial impact on the licensee's operations. Although a more consistent level of design for all forestry bridges is a desirable goal, an appropriate method for modifying the proposed design vehicle configurations to suit actual logging truck weights specific to some operations may be needed.

Although the methodology discussed above is intended for monitoring the suitability of a truck population for use with the proposed design vehicles, it also provides a method for making adjustments to the required design vehicle configuration weights based on surveys of the truck population weights. The overall weight of a bridge design vehicle could be lowered until the percentage of trucks in the surveyed population with weights exceeding the revised design vehicle weight reach the limits given above. For example, if the weight of the Off Highway Interior design vehicle is reduced from 73,394 kg to 65,000 kg, only 2.5% of the trucks in the population using the bridge can exceed 77,350 kg, only 0.15% can exceed 82,875 kg and no trucks in the population can exceed 88,400 kg. Compliance with these requirements must be monitored and maintained throughout the duration of operations on any such forestry bridges.

This procedure can also be used to establish appropriate design vehicle weights for populations with increasing logging truck weights.

Closing

Please contact us if you have any questions or comments.

Yours truly,

BUCKLAND & TAYLOR LTD.

Darrel P. Gagnon, P.Eng.