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Bridge Engineering

MINISTRY OF FORESTS

DESIGN VEHICLE CONFIGURATION ANALYSIS AND CSA-S6-00 IMPLICATION EVALUATION

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EXECUTIVE SUMMARY

The Ministry of Forests required that the existing Design Configurations in the Forest Service Bridge Manual be evaluated to determine if they are reasonably representative of current logging trucks and if these configurations are appropriate for use with the design and evaluation load factors contained in CAN/CSA-S6-00 (CHBDC).

Buckland & Taylor Ltd. was retained by the Ministry of Forests to evaluate the effectiveness of the existing Design Configurations in the Forestry Manual and to determine if the live load factors contained in CHBDC are appropriate for use with these Design Configurations. If appropriate, recommendations for revisions to the existing Design Configurations and applicable live load factors are to be provided.

The Design Configurations and live load factors were evaluated using data collected from a survey of logging truck weights conducted by the Forestry Engineering Research Institute of Canada, FERIC, for the Ministry of Forests. The goal of this survey was to provide sufficient measurements of logging truck weights and dimensions to statistically describe the load demands that the various categories of logging trucks would produce on bridges. Although a sufficient amount of data was collected that described legal highway configurations operating on and off-highway (L75 Category), data representative of the logging trucks in the L100, L150 and L165 categories were not obtained. In addition, the survey did not target and did not obtain data on trucks conducting movements of logging equipment. It is recommended that sufficient data for these vehicles be obtained during future surveys.

All the survey data was analyzed and where appropriate live load factors derived using a methodology consistent with that used to calibrate load factors for CHBDC.

The average weights of highway logging trucks were found to slightly exceed the legal limits and to require higher live load factors for shorter spans than for longer spans. Load factors derived for the general population of highway logging trucks are similar to CHBDC load factors for type PA traffic, while load factors derived for highway logging trucks equipped with only tridem axles were lower and consistent with CHBDC load factors for type PS traffic.

The L75 Design Configuration was only found to be partially effective in producing force effect envelopes representative of those produced by the actual logging trucks in this category. Separate sets of design and evaluation live load factors were required for bridge spans above and below 15 m and for bridge girders subject to negative moments. Load factors derived for use with the existing L75 Design Configuration were significantly different from the load factors for any category of traffic in CHBDC. Modifications to the L75 Design Configuration are recommended that would allow the use of a single set of live load factors for the design and evaluation of forestry bridges.

The factored loadings required for L75 type logging trucks were found to be slightly less on spans over 15 m in length than those previously required by the Forestry Design Manual and CAN/CSA-S6-88. However, the factored demands on spans less than 15 m have increased by about 25%. This implies that new bridges with spans less than 15 m will require heavier members and that some existing bridges may be substandard for this loading.

No evaluation of the effectiveness of the L100, L150 and L165 Design Configurations or derivation of applicable load factors could be conducted for these categories of logging trucks due to lack of representative data.

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1 INTRODUCTION

The Ministry of Forests (BCFS) requires a review of the Forest Service Bridge Design and Construction Manual and CAN/CSA-S6-00 (CHBDC) to determine the following:

- Do the existing BCFS Design Vehicle Configurations produce force effect envelopes that are reasonably representative for the logging vehicles now being used in the British Columbia forest industry?
- Are the existing BCFS Design Vehicle Configurations appropriate for use with the load factors in CHBDC?

Buckland & Taylor Ltd. were retained by the Ministry of Forests to conduct these reviews based on surveys of logging truck weights and configurations provided by the Ministry. If appropriate, recommendations for revisions to the BCFS Design Configurations and applicable load factors were to be provided.

2 METHODOLOGY

2.1 GENERAL

For a bridge design standard to provide the desired level of safety, it is essential that all aspects governing the design process are considered in a consistent manner. The level of safety provided is dependent on the variations and interrelationship between the various bridge loadings, member resistances and structural behaviours of the bridge system. The level of safety provided can be significantly affected if modifications are made to any of the design requirements without considering the impact on the overall design philosophy.

The load factors provided by a bridge design standard are typically based on the expected statistical variations of the actual bridge loading from the specified design loads. New truck configurations or changes in the level of weight enforcement can significantly alter these statistics and change the level of safety provided. Measurements of the actual truck populations being considered are required to assess the appropriateness of the current design standards.

2.2 STUDY PROCEDURES

The following describes the general methodology used for this study:

1. A survey of actual truck weights and configurations using the forest road bridges was conducted by the Forest Engineering Research Institute of Canada, through the Ministry of Forests. The goal of the survey was to provide sufficient data to produce reliable statistical information on the weight variations of the logging truck types that exist in various regions of the Province.

2. Computer models were used to determine the envelope of maximum force effects (bending and shear) produced by the surveyed trucks on single span and two span bridges of various lengths. The resulting envelopes of maximum force effects were compared against the envelopes of maximum force effects produced by the appropriate Design Configuration on the same spans. The statistical variations for the ratios of maximum force effects were determined for each truck type and a variety of span lengths.

3. The resulting statistics for truck events were converted to the maximum annual truck for each force effect on selected span lengths.

4. Live load factors for each force effect and each truck type on selected span lengths were calculated utilizing a methodology similar to that used to derive the live load factors for CHBDC. Force effects with similar

statistical variations were grouped together and a single live load derived for the grouping.

5. For truck categories where sufficient weigh scale data was available, the consistency of the required live load factors were compared for selected span lengths and types of force effects. Significant deviations in the live load factors for varying span lengths and force effect types were investigated. Where appropriate, recommendations were made for changes to the Design Configuration models or live load factors to improve the consistency of the design loadings.

2.3 LIMITATIONS OF STUDY

This study is not a comprehensive review or check of all aspects of either CAN/CSA-S6-00 or the Forest Service Bridge Design Manual with respect to their suitability for the design of logging bridges. The study concentrated only on the issues of design loadings and load factors.

3 REVIEW OF EXISTING LIVE LOAD REQUIREMENTS FOR LOGGING TRUCKS

3.1 FOREST SERVICE BRIDGE DESIGN MANUAL

The Forest Service Bridge Design and Construction Manual [1] specifies that all bridges must be designed according to the Canadian Standard CAN/CSA-S6-88 Design of Highway Bridges [2], except for the variations listed below. The Manual also states that when the Canadian Standard CAN/CSA-S6-00 “Canadian Highway Bridge Design Code” (CHBDC) [3] comes into effect, it shall supersede CAN/CSA-S6-88.

The Manual specifies a series of Design Configuration truck models for off-highway logging trucks, as shown in Appendix A. The truck models are to be applied with the load factors specified in CAN/CSA-S6 but the trucks are to be located with an eccentricity to the centre line of bridge. Eccentricities are specified for typical single lane two girder bridges.

Logging trucks typically display an unbalance in wheel loadings from side to side. The unbalance generally results from the methods used to load the trucks and variations in the distribution of log weights. To account for this effect the L75, L100 and L150 Design Configurations require that 60% of the total truck or axle load be allocated to the side of the truck that will produce the most severe force effect in the component being considered. The L165 Design Configuration requires a 55% to 45% distribution of axles loads between the sides of the truck.

A dynamic load allowance of 0.30 is specified for all axle and truck loadings on all bridges.

The Manual does not specify a lane loading but bridges exceeding 40 m in length from abutment to abutment are to be designed for two Design Configuration vehicles. The Design Configuration vehicles are to be separated by a distance equal to half the length of the design vehicle.

The Manual specifies that the design life for forestry bridges shall be 45 years.

No guidance is provided for the design or assessment of bridges for loadings produced by trucks carrying heavy equipment (grapple yarders, etc.).

3.2 CAN/CSA-S6-88 AND CAN/CSA-S6-00

The characteristics and variations of logging trucks, either highway or off-highway, were not considered in the development of the design and evaluation provisions for either CAN/CSA-S6-88 or CAN/CSA-S6-00 (CHBDC). Therefore, the load factors contained in either of these standards are not necessarily appropriate for use with the design configurations specified in the Forest Service Manual.

Studies of highway vehicle loadings conducted during the development of Ontario Highway Bridge Design Code (OHBDC) and CHBDC indicated that individual axles or axle group loadings were significantly more variable than the overall truck loading. Loadings that are more variable require a higher load factor to maintain the same level of safety as with less variable loadings. The higher variability of axle loadings was addressed in CHBDC by increasing the weight of the tandem axles on the design vehicle or by specifying a higher set of load factors for 'Short Spans' if the axle weights have not been increased. S6-88 did not adequately consider the higher variability of axle loads in the design of new bridges. Therefore, highway bridges with shorter spans, designed to meet S6-88, are often found to be deficient for the new design loadings in the CHBDC.

S6-88 and CHBDC do not consider axle loadings with an unbalance from side to side and specify dynamic load allowances that differ somewhat from those specified in the Forest Manual.

S6-88 and CHBDC specified that new bridges shall have a design life of 50 years and 75 years, respectively.

4 SURVEY OF LOGGING TRUCKS

4.1 GENERAL

Surveys of the actual truck weights and dimensions using the forest road bridges were required to evaluate the effectiveness of the existing BCFS Design Configurations for bridge design and to derive load factors appropriate for use with these Design Configurations. Sufficient survey data was required to provide an accurate statistical description of the variations in truck weights and dimensions for the various logging truck categories and locations of logging truck operations in the Province.

The Forest Engineering Research Institute of Canada (FERIC), through the Ministry of Forests, surveyed and recorded the logging truck data used for this study.

For each distinct category of logging trucks operating in the Province, sufficient survey data is required to statistically define the following parameters.

1. Weights for each side of each axle or each axle group for each truck in the sample population. This data is used to determine the variations in overall truck weights, axle or axle group weights and the degree of side to side unbalance in vehicle loadings.
2. Spacings of axles for each truck in the sample population.
3. Total number of loaded trucks using the route during the survey period. This is used to approximate the number of loaded trucks annually using a bridge.
4. Truck type. This is used to group trucks into the appropriate category.

4.2 LOGGING TRUCK CATEGORIES

Discussions with the Ministry, FERIC and Buckland & Taylor Ltd. were held to determine the number and characteristics of the logging truck categories required for this study and to determine the guidelines for the target size of each survey sample.

The Ministry indicated that the specified Design Configurations, L75 through L165, did not necessarily represent the target weights for various truck categories or enforcement levels for the truck categories. The Design Configurations mandated in the Forest Design Manual were developed to reflect the actual characteristics of the logging truck population in the Province.

FERIC indicated that the logging truck population in the Province contains four main categories; 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.

Based on FERIC's recommendation, it was agreed that the four logging truck populations described by FERIC be selected for investigation in this study. Buckland & Taylor Ltd. requested that data for each of the four categories be collected at multiple locations with total sample sizes for each category of 30 to 50 trucks.

4.3 COLLECTED DATA

Logging trucks were surveyed at the following locations for each of the four logging truck populations selected for study. Summaries of truck weight and configuration data collected at each location are presented in Appendix B.

4.3.1 Off-Highway - Coastal (L150-L165)

Location of Survey	Number of Trucks Surveyed
Honeymoon Bay Dryland Sort	47
Port McNeill, Dryland Sort	28
Port McNeill, Dewatering	11
Stillwater, Dryland Sort	39

Off-Highway – Coastal (L75)

Location of Survey	Number of Trucks Surveyed
Menzies Bay, North Island Dryland Sort	40

4.3.2 Highway Logging Trucks - Coastal

Location of Survey	Number of Trucks Surveyed
Menzies Bay, North Island Dryland Sort	29

4.3.3 Off-Highway - Interior (L75)

Location of Survey	Number of Trucks Surveyed
Okanagan	28
Fraser Lake	45
Mackenzie	33

4.3.4 Highway Logging Trucks - Interior

Location of Survey	Number of Trucks Surveyed
Okanagan	57
Kamloops, Dryland Sort	32

4.4 DISCUSSION OF SURVEY DATA

In general, the samples of truck weights and dimensions collected during the surveys were of sufficient size to provide reliable statistical parameters for the variations of the sampled trucks.

Data for highway legal logging trucks and off-highway logging trucks in the L75 category appear to be reasonable in comparison with the Design Configurations.

The off-highway trucks surveyed in the coastal regions appear to be approximately 15 to 20% lighter than either the L150 or L165 Design Configurations. Informal industry inquiries, conducted by the Ministry, indicated that significant numbers of logging trucks exist in the coastal regions with weights that approach or exceed the L150 and L165 Design Configuration loadings. Therefore, the data collected for off-highway coastal trucks was considered to be non-representative of the L150 or L165 truck categories. It is recommended that data representative of the L150 and L165 Design Configurations be obtained for the derivation of appropriate live load factors. Note that it may be possible to obtain this information based on records from scales operated by the industry. However, any industry records should be supplemented by a limited number of independent field surveys of truck weights.

The survey did not target areas where the L100 Design Configuration is required for bridge designs. It is recommended that off-highway logging trucks be surveyed in these areas for the derivation of appropriate live load factors.

No trucks moving heavy logging equipment were encountered during the survey. Although roadway movements of this type of equipment are infrequent, loadings produced by these equipment moves could exceed those produced by the logging trucks. It is recommended that data on the weights and variations of logging equipment during roadway movements be obtained and evaluated. Since roadway movements of this type of equipment are relatively infrequent, it may prove difficult to collect sufficient truck weight data based on field surveys alone. However, the logging industry may be able to provide useful data pertaining to the truck weights produced during these equipment moves that could supplement field surveys.

5 ANALYSIS OF LOGGING TRUCK DATA

5.1 GENERAL METHODOLOGY

For each category of logging trucks, the data collected at each survey location was evaluated to determine if significant differences existed between the data sets. If no significant differences were identified, the data sets for each logging truck category were combined into a single data set.

Then the maximum force effects, moments and shears, produced by each truck in the data set were determined for single spans and two span continuous bridges of varying span lengths. These maximum force effects were normalized by dividing by the maximum force effect generated by the appropriate Design Configuration on the same span lengths. This provides a statistical distribution describing the force effects produced by the passage of a single random truck relative to the force effects of the Design Configuration truck. The variations in the ratios of maximum force effects were evaluated and discussed for the various types of force effects and bridge span lengths. Representative statistical parameters were selected for each type of force effect and various bridge span lengths. Force effects with similar statistical variations are grouped together. These statistical parameters are referred to as event statistics since they describe the probability that the next truck will produce a particular level of force effects.

The event statistical parameters are then converted into maximum annual statistical parameters. Maximum annual statistical parameters describe the variations of the maximum force effect expected to be generated on a bridge by the heaviest truck or truck axles in a one year period. These are the statistics that are used to derive live load factors appropriate for each force effect and bridge span length.

The side to side unbalance of trucks and individual axle groups are considered in the off-highway Design Configurations, but not for Highway Logging Trucks, in accordance with current practice. The variations of the unbalanced loadings for each truck sample were determined relative to the unbalance specified in the Design Configurations.

5.2 HIGHWAY LOGGING TRUCKS

5.2.1 Data Sources for Highway Logging Truck Characteristics

Highway logging truck configurations, conducting highway hauls, at the following locations were used to determine live load factors appropriate for highway bridge evaluations.

- Menzies Bay, North Island Dryland Sort (2002 January 15-16)

- Kamloops, Dryland Sort (2002 January 24)
- Okanagan Falls (2002 January 22-23)

For each logging truck in the samples, the maximum force effects produced on bridge spans of varying length were determined for the actual measured truck weights and the maximum legal weights for that particular logging truck configuration. Dynamic load allowances were applied to both the surveyed and legal truck configurations in accordance with the requirements of CHBDC.

Maximum legal weights for the various highway logging truck configurations were obtained from FERIC Field Note No: Loading and Trucking-58. FERIC Field Note No: Loading and Trucking-58 “Popular B.C. Vehicle Configurations for Hauling Full Length Logs: Maximum Weights and Dimensions Guide”, is in Appendix C. All highway logging truck data was collected during period when winter weight allowances were in effect.

The ratios of the maximum force effects produced by the actual truck and the legal truck weights were used to assess the variability of the trucks and to derive live load factors.

5.2.2 Assessment of Highway Logging Truck Samples

On Figures 5.2.2(a)-(d) envelopes of the force effect ratios produced by all trucks in the samples are shown for moments and shears on simple spans and positive and negative moments on continuous spans. Envelopes of the force effect ratios for moments on simple spans are shown on Figure 5.2.2(e) for trucks with tridem axles. On each figure the average ratio of the force effects, the average ratio plus one standard deviation and the maximum ratio obtained are shown. The larger the difference between the average and maximum force effect ratios, the higher the variability of the force effects on bridges of that span length. Typically, force effects that with higher variability require higher live load factors.

In almost all cases the average force effect ratio equals or exceeds 1.0, which indicates that the average highway logging truck is slightly exceeding both axle group and gross vehicle weight limits. The maximum force effect ratios tend to be higher on bridge spans of 10 m or less for moments and 6 m or less for shears. This is caused by the higher variability of individual axle group loads compared to the variability of the entire truck. Separate sets of statistical parameters were determined for ‘Short’ and ‘Other’ bridge spans, to account for these different levels of variability, when deriving suitable load factors. Spans of 10 m or less for moments and 6 m or less for shears are considered to be ‘Short’ spans. Longer spans are designated as ‘Other’ spans. This is consistent with the span length designations in Section 14 of CHBDC.

Figure 5.2.2(a) - Force Effect Ratios for Bending Moments on Simple Spans (All Highway Legal Trucks)

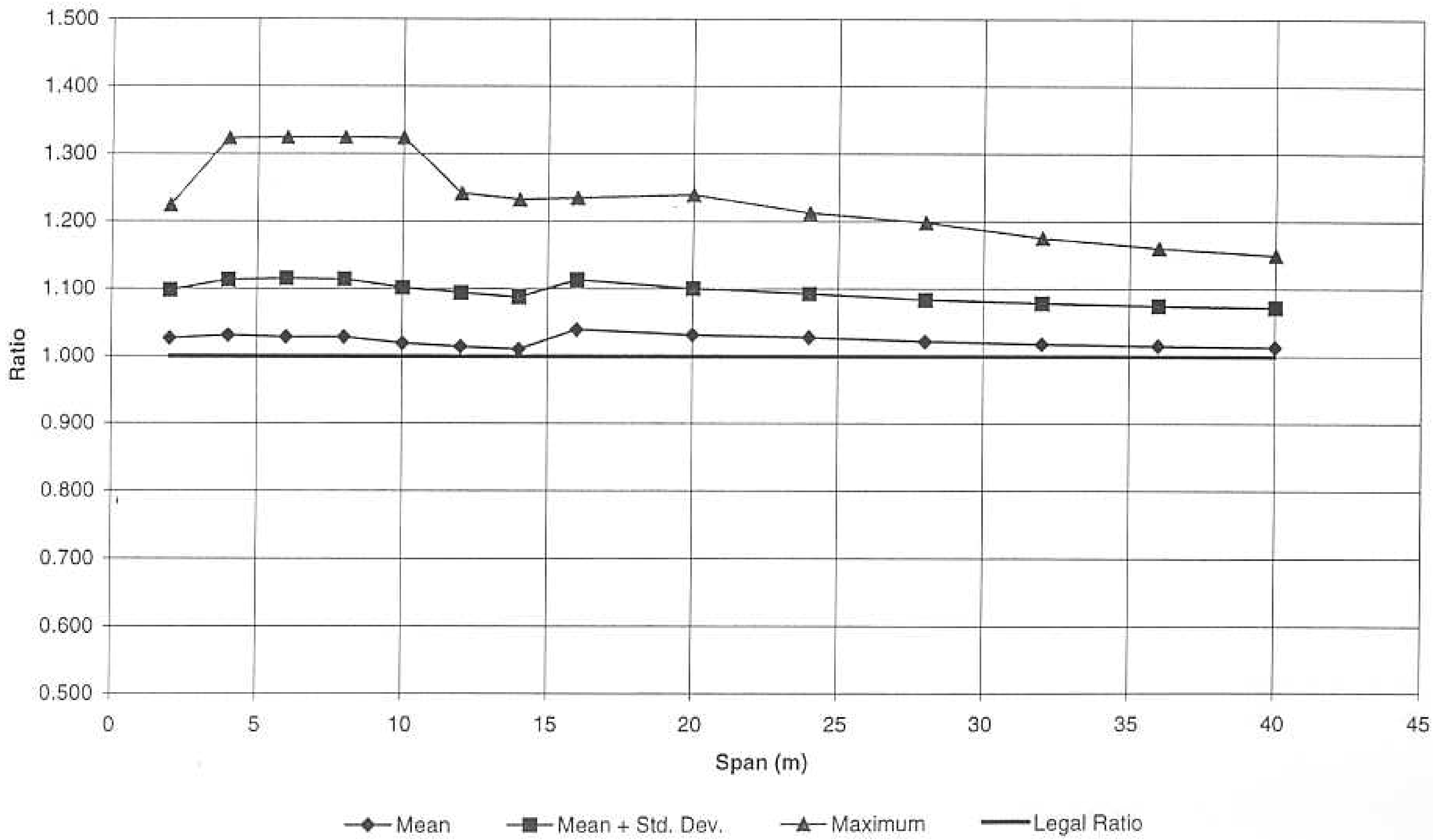


Figure 5.2.2(b) - Force Effect Ratios for Shear on Simple Spans (All Highway Legal Trucks)

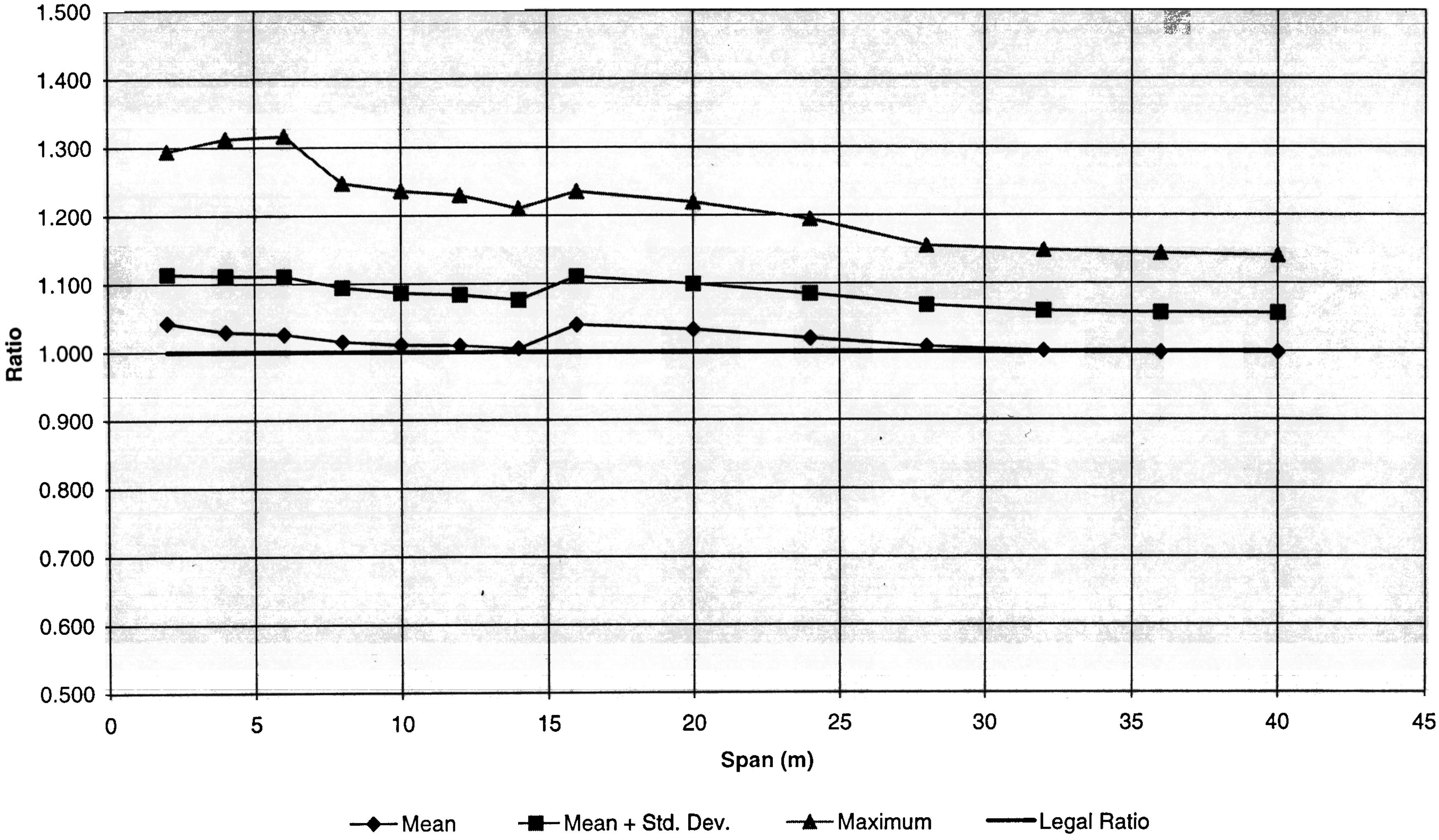


Figure 5.2.2 c) - Force Effect Ratios for Positive Bending Moment on Continuous Spans (All Highway Legal Trucks)

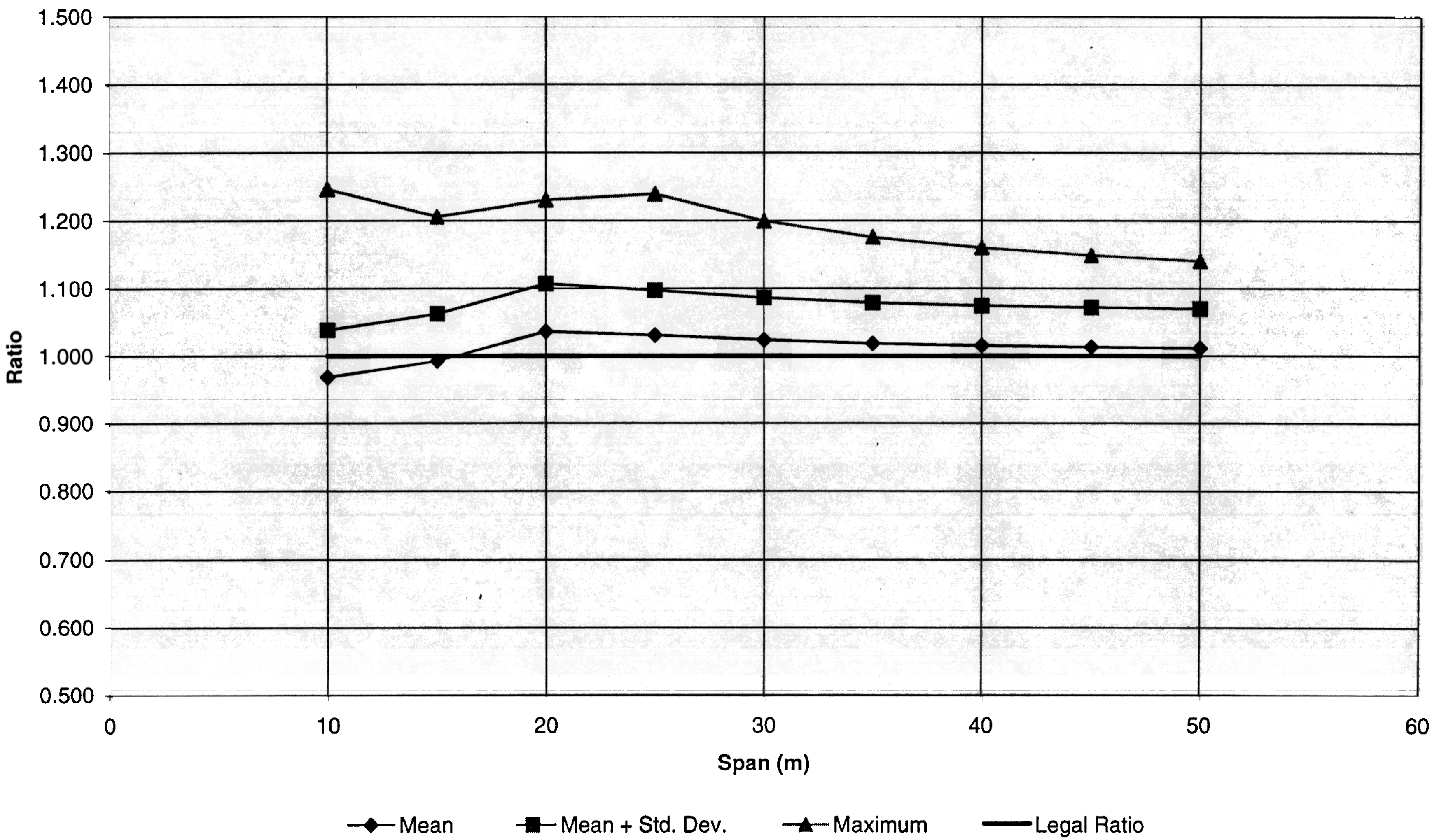


Figure 5.2.2 d) - Force Effect Ratios for Negative Bending Moment on Continuous Spans (All Highway Legal Trucks)

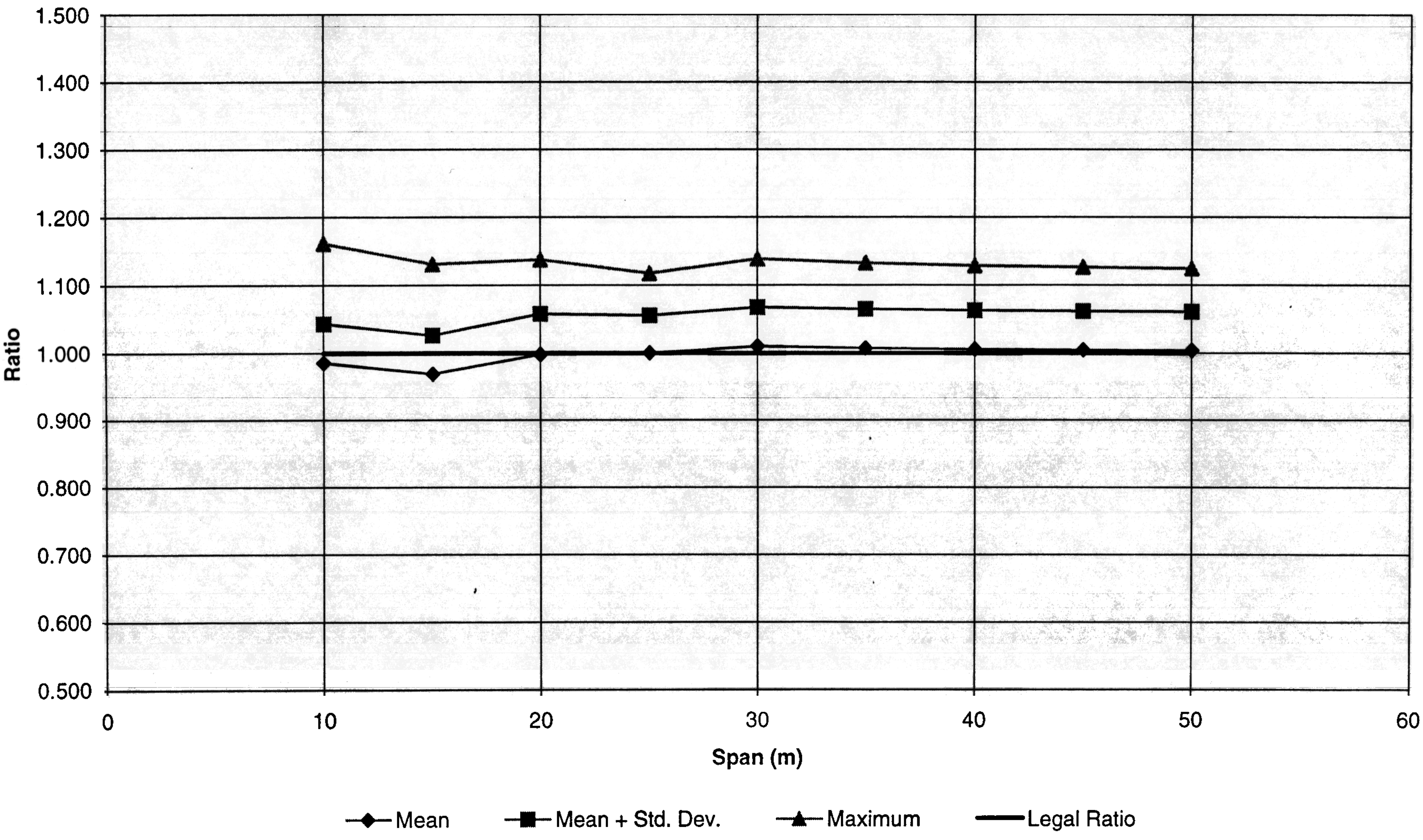
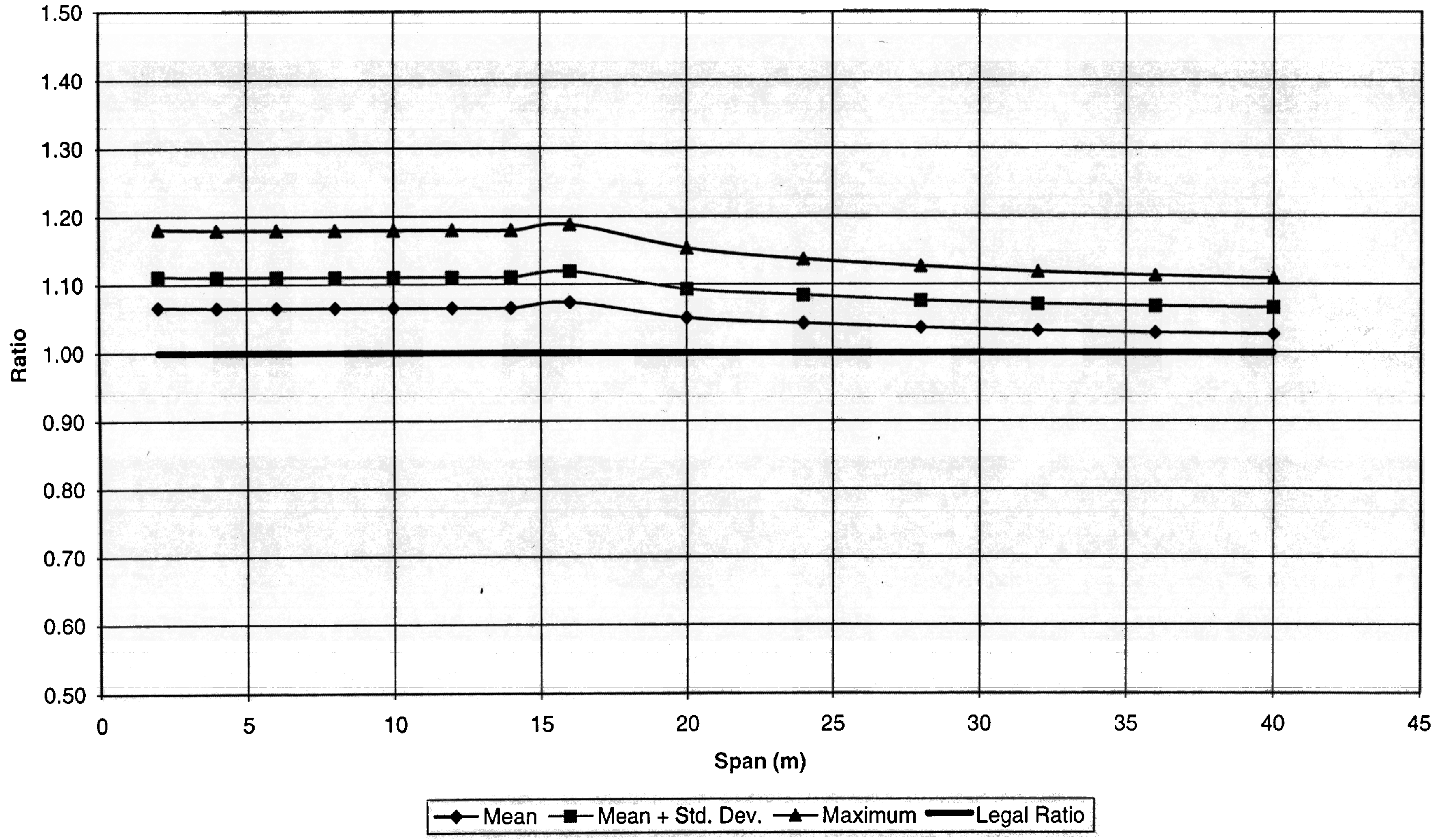


Figure 5.2.2(e) - Force Effects Ratios for Bending Moment on Simple Spans (Tridem Axle Trucks Only)



For bridges with spans in the 'Other' category, the variations in the maximum force effect ratios were relatively consistent at all three sampling locations. The average force effects produced by the sampled trucks typically exceeded the maximum legal force effects by ratios of 1.01 to 1.05. The highest ratio obtained on these spans was about 1.20 or 20% over the legal maximum. Since there is little variation in the force effect ratios obtained at the various sampling locations, all data was combined for spans in the 'Other' category.

For bridges with spans in the 'Short' category, average force effect ratios were also consistent for all three sampling locations. The average force effect ratio was 1.03 and the maximum was 1.32. However, the variations about the average value were approximately twice as large at the Kamloops and Okanagan sites as at the Menzies Bay site. The Menzies Bay sample consisted solely of trucks with tridem axles while the other sites contained mixtures of trucks with various combinations of tridem and tandem axles. Although typically lighter than the tridem axles, the tandem axles weights are more variable which results in higher force effect ratios. Therefore, for 'Short' span bridges the data was analyzed both for a population containing all the surveyed trucks and for a population containing only the trucks with tridem axles.

A comparison of Figures 5.2.2(a) and 5.2.2(e) shows that variability of the force effect ratios is lower for trucks containing only tridem axles than for the entire sample of trucks. A review of the data sample indicated that tandem axles, particularly the drive tandems, were much more prone to being overloaded than tridem axles. Therefore, a separate set of statistical parameters were calculated for the tridem axles to determine if a separate set of live load factors for tridem axles would be appropriate.

The side to side unbalance of axle loads is not considered in the design or evaluation of highway bridges. Therefore, the effect of unbalanced loading has not been considered in the statistical parameters for weights of highway logging trucks.

5.2.3 Maximum Annual Truck Statistics

Figures 5.2.2(a)-(e) indicate the statistical parameters of the force effects produced by a single random truck event. However, the statistical parameters for the maximum annual force effects produced by heaviest of all the trucks using a bridge per year are required to derive live load factors consistent with CHBDC.

The truck event statistics were converted into maximum annual truck statistics following the method contained in Kennedy et al. [4]. An annual population of 4400 loaded highway logging trucks was assumed to be using a typical bridge based on the number of trucks observed during the survey period. Statistical parameters for both truck events and the maximum annual truck are presented in Table 5.2.3. Note that the maximum annual truck statistics are insensitive to large changes in the number of annual trucks using a bridge.

Table 5.2.3 – Statistical Parameters for Highway Logging Trucks

Truck Type	Span Length	Event Bias Coef.	Event Coef. of Variation	Annual Bias Coef.	Annual Coef. of Variation
All Trucks in Sample	Short	1.03	0.087	1.32	0.033
	Other	1.02	0.062	1.24	0.025
Tridem Axles Trucks	Short	1.066	0.045	1.22	0.017
	Other	1.037	0.039	1.17	0.017

The maximum annual statistical parameters for trucks with tridem axles are 7 to 10% less than those for the entire population of sampled trucks. Therefore, live load factors for tridem axle highway logging trucks should be lower than those for other highway logging trucks by similar amounts.

5.3 L75 OFF-HIGHWAY TRUCKS

5.3.1 Data Sources for L75 Truck Characteristics

Highway legal logging truck configurations conducting off-highway hauls at the following locations were used to assess the effectiveness of the force effect envelopes produced by the L75 Design Vehicle Configuration:

- Menzies Bay, North Island Dryland Sort (2002 January 15-16)
- Okanagan Falls (2002 January 22-23)
- Fraser Lake (2002 January 29-30)
- MacKenzie (2002 January 31)

5.3.2 Assessment of L75 Type Logging Truck Samples

No significant differences were observed in the statistical parameters for the sets of truck and axle weights obtained at the four locations and all data sets were combined.

Maximum moment and shear force effects were determined for each surveyed truck and the L75 Design Configuration. Moments and shears were calculated for simple spans of up to 40 m in length and positive and negative moments were calculated for two span continuous bridges with clear spans of up to 50 m. A dynamic amplification factor of 0.3 was applied to all trucks.

For simple spans only one vehicle was considered to be on the bridge, and this was compared to one Design Vehicle. For continuous spans it was found that the force effect ratios for single truck events conservatively covered the case of two trucks on the bridge. Therefore, for simplicity, single trucks were considered for continuous spans also.

Figures 5.3.2 a), b), c) and d) show envelopes of the ratios of the maximum force effects produced by the surveyed trucks compared to the maximum force effects produced by the L75 Design Configuration for simple span moments, simple span shears, continuous span positive moments and continuous span negative moments, respectively. On each figure the average ratio of the force effects, the average ratio plus one standard deviation and the maximum ratio obtained are shown to indicate the average force effects and the variability of the force effects produced by the surveyed trucks. The larger the difference between the average and maximum force effect ratios, the higher the variability of the force effects on bridges of that span length.

Except for one case the average force effects produced for the sample population were less than the force effects produced by the L75 Design Configuration. However, significant variability exists in the sample population of trucks, which results in many force effect ratios being higher than 1.0.

Force effect ratios for simple span moments, Figure 5.3.2 a), are highest and more variable for shorter spans, 2 to 16 m. The force effect ratios dip for span lengths near 20 m and increase slowly at longer spans.

Force effect ratios for simple span shears, Figure 5.3.2 b), are also highest and more variable for shorter spans, 4 to 10 m. The ratios are fairly level for spans over 12 m in length.

Ratios for positive moments on continuous spans, Figure 5.3.2 c), are also somewhat higher and more variable on short spans, 15 m or less. For spans of 20 m or greater the ratios are lower and less variable.

Ratios for continuous span negative moments, Figure 5.3.2 d), are lower for shorter spans but increase sharply for spans near 20 m in length and then drop for longer spans. If a single truck is applied to the bridge the maximum negative moment for spans of 20 m occurs when the truck is located over the centre support. The large increase in force effect ratios for spans of 20 m results from the fact that a typical measured truck is somewhat longer than the L75 Design Configuration. For all spans over 20 m the maximum

Figure 5.3.2 a) - Force Effect Ratios for Bending Moments on Simple Spans (L75 Design Configuration)

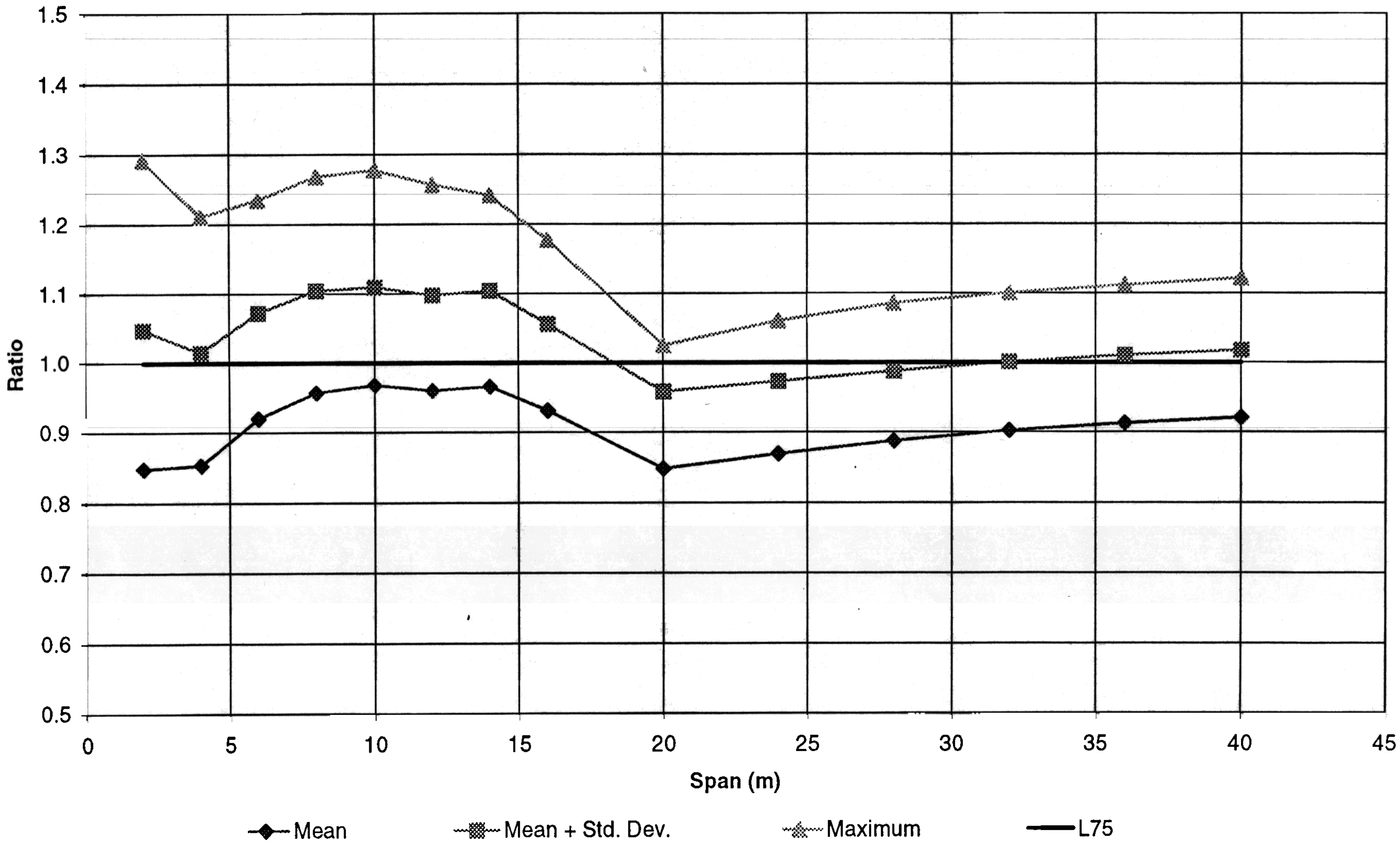


Figure 5.3.2 b) - Force Effect Ratios for Shears on Simple Spans (L75 Design Configuration)

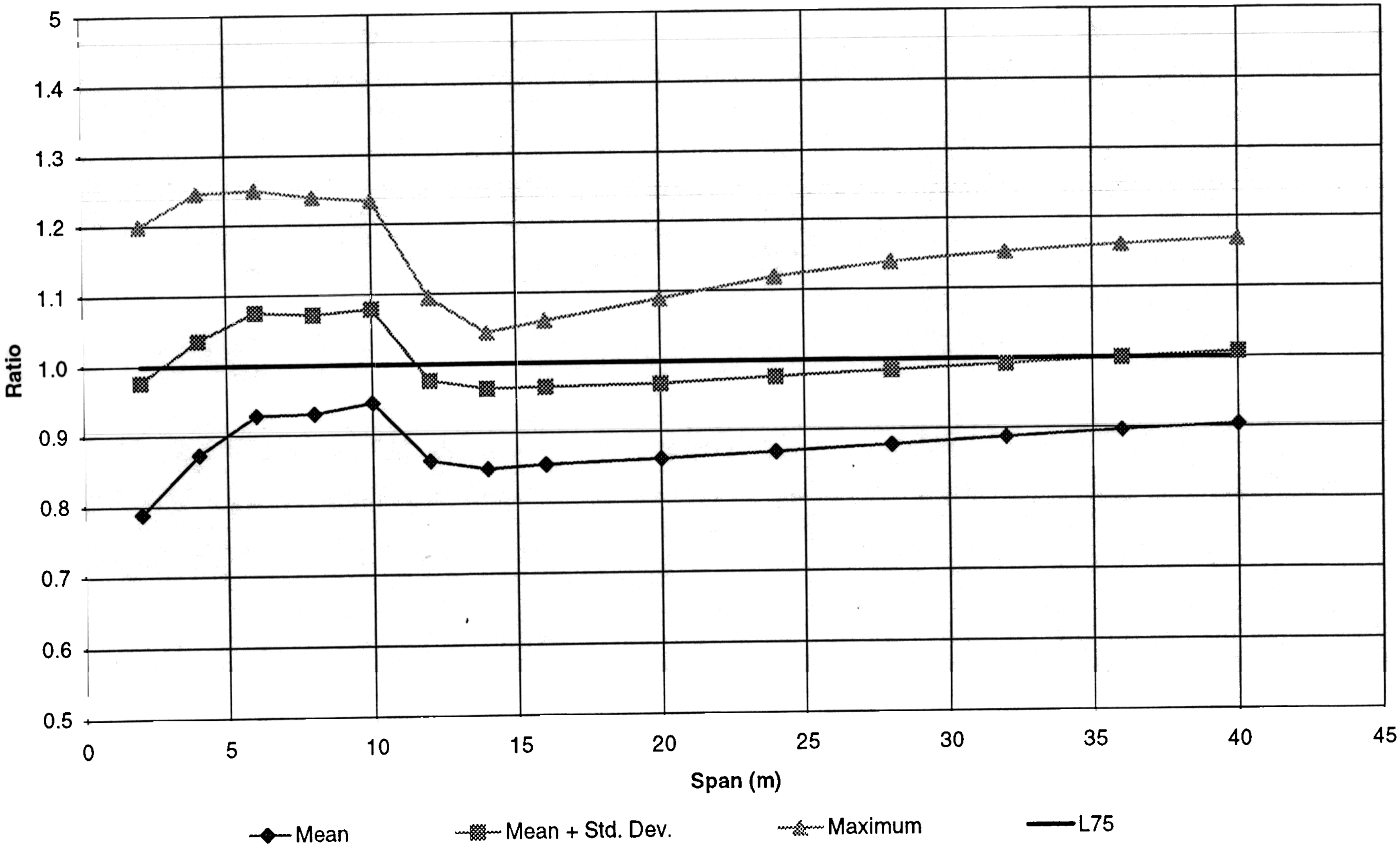
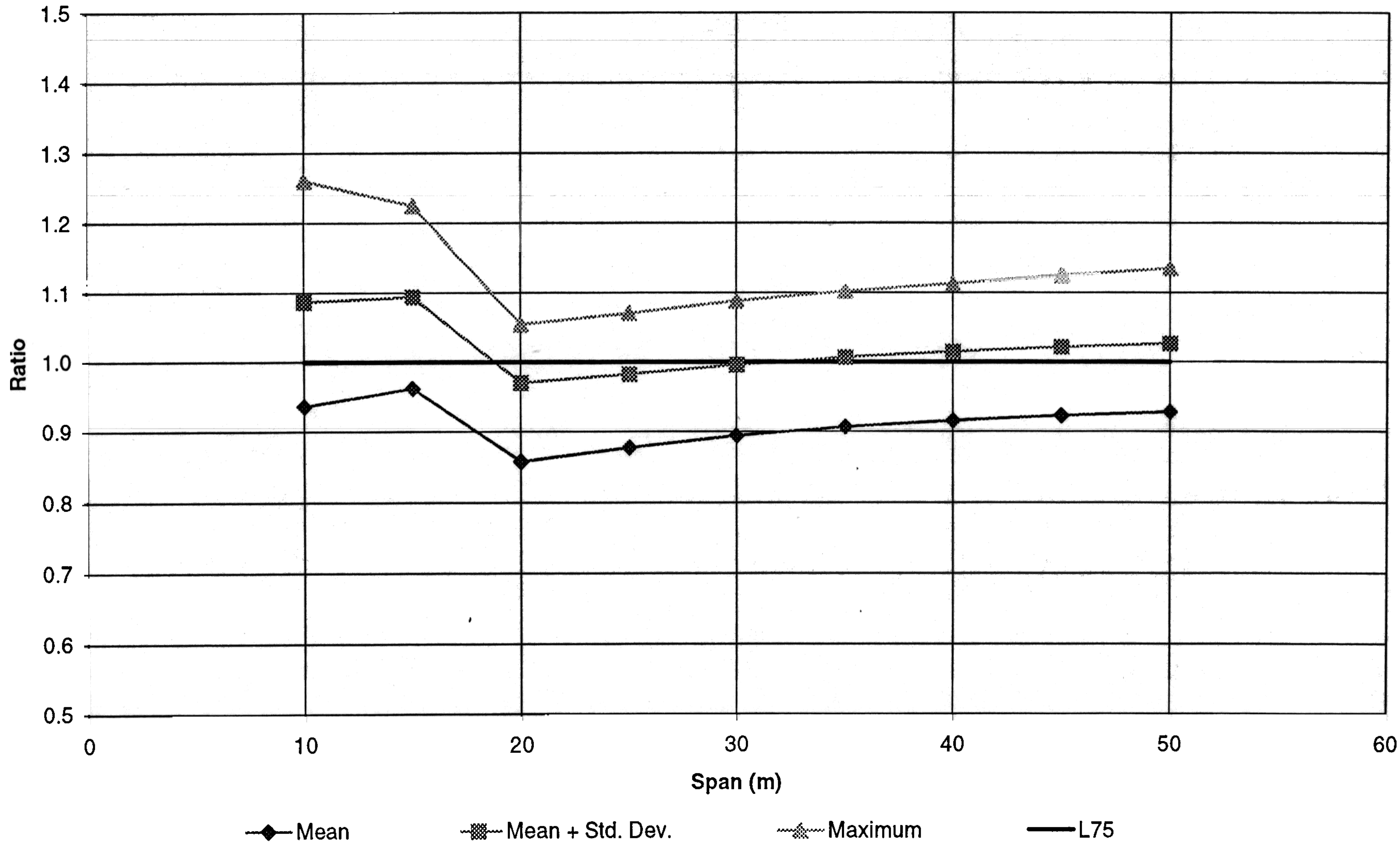
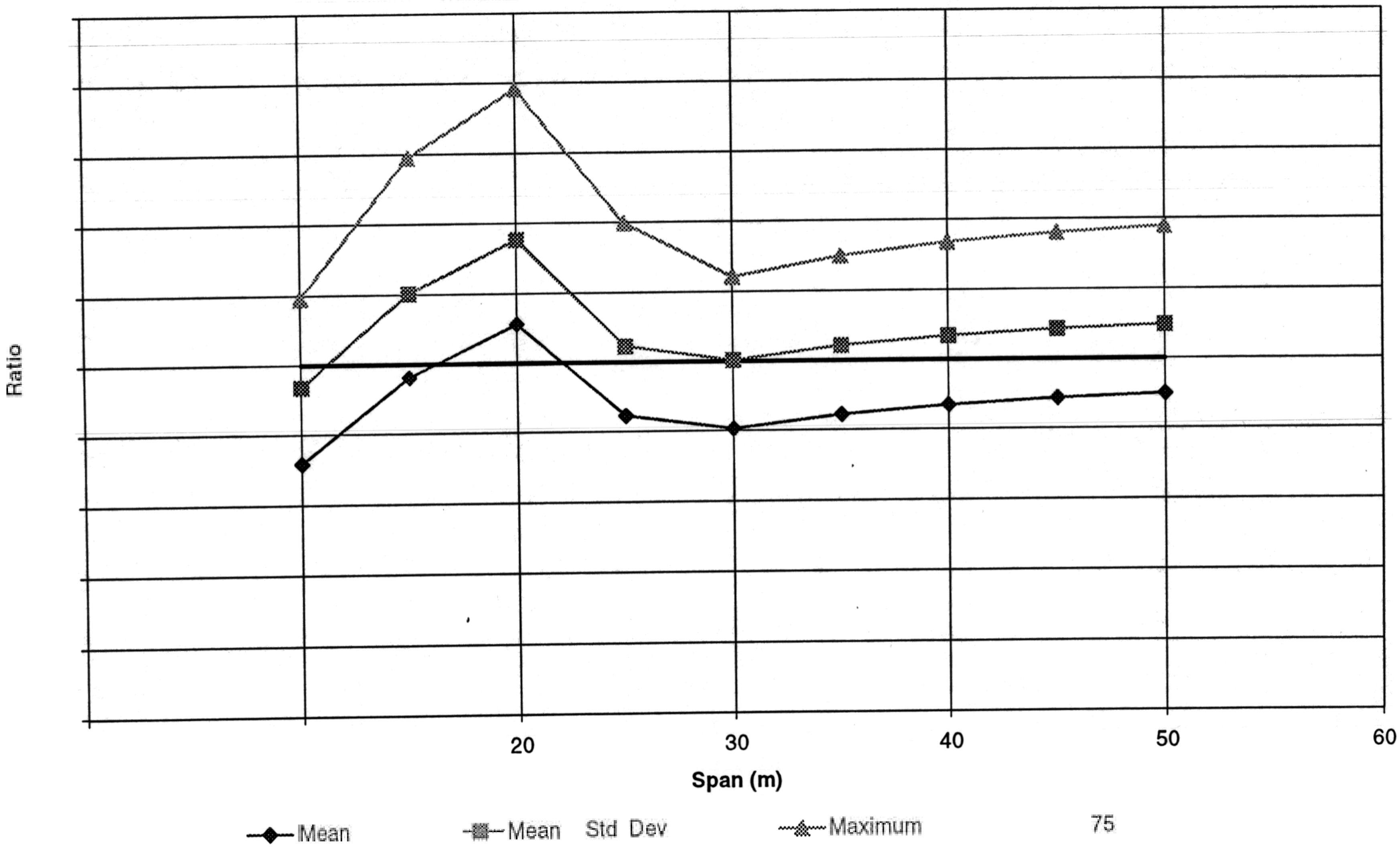


Figure 5.3.2 c) - Force Effect Ratios of Positive Bending Moments on Continuous Spans (L75 Design Configuration)



[redacted]

Figure 3.2 d Force Effect Ratio or Negative Bendin; Moments
on Continuous Spans (L75 Design Configuration)



negative moments are produced by having two trucks on the bridge, one on each side of the support. This results in lower force effect ratios since the longer lengths of the actual trucks now reduces the force effects compared to those produced by the Design Configuration. Note that the force effect ratios shown on Figure 5.3.2 d) are based on a single truck, as described previously, and are conservative for span lengths over 20 m, particularly so for spans just over 20 m in length.

When the total bridge length exceeds 40 m, designs are typically governed by the requirement to have two Design Configuration trucks separated by half a Design Configuration truck length. The chance of having two heavily loaded trucks on the bridge at once is than the chance of having one heavy truck. However, the same Design Configuration truck is used whether one or two trucks produce the force effect. Therefore, high force effect ratios are less likely to occur when multiple trucks produce the force effect than when a single truck produces the force effect. Using a single actual truck and a single Design Configuration vehicle produces conservative force effect ratios for single spans in excess of 40 m and continuous spans typically in excess of 20 m. However, this conservatism is typically relatively small on logging bridges with clear spans less than 60 m.

5.3.3 Unbalanced Loadings

The side to side unbalance in the wheel loadings were assessed based on the surveyed sample for L75 type trucks.

The average side to side unbalance was found to be typically less than that required with the L75 Design Configuration but the unbalance was highly variable from truck to truck. On average the heavier sides of the trucks were 1.107 times heavier than the lighter sides with a standard deviation of 0.083. This corresponds to an average side to side distribution of 52.5% and 47.5%, which is less than the 60% to 40% distribution required with the L75 Design Configuration. The girder force effects produced by this unbalance are also a function of girder spacing and vehicle offset from centre of roadway. For the typical 3.0 m design girder spacing, with the truck offset 400 mm from centre of roadway, the maximum girder loading from the survey sample was 0.93 of the L75 truck.

Similarly for the heaviest axle group for each truck in the survey sample, the heaviest side was on average 1.148 times the lighter side with a standard deviation of 0.1286. On the typical 3.0 m design girder spacing, the maximum girder loading from the survey sample was 0.938 of the L75 truck. For the derivation of live load factors the statistical variations of unbalanced loadings were incorporated into the statistics for the lateral distributions of live loads.

5.3.4 Maximum Annual Truck Statistics

In general, the average force effects produced by the surveyed trucks are less than those produced by the L75 Design Configuration. However, maximum force effects in excess of the L75 levels were identified which indicates that the distribution of force effect ratios has a significant variation.

Statistical parameters describing the variation of the force effect ratios are required to establish live load factors appropriate for design and evaluation of bridges for the L75 Design Configuration.

The higher ratios for force effects obtained for shorter spans are an indication that the L75 Design Configuration is more effective at producing the actual force effect envelope on longer spans than on shorter spans. In addition, the variability of the force effect ratios are higher for shorter spans as indicated by the increased spread between the average ratio and the ratio for the average plus one standard deviation.

The ratio of force effects appears to be bimodal for all force effects. Therefore, two sets of truck event statistical parameters were selected for each force effect, one for shorter spans and one for longer spans. The event statistics were converted to maximum annual statistics. This is required to derive live load factors following the method contained in Kennedy et al. [4]. An annual L75 truck population for a bridge of 9000 was assumed based on the surveyed truck volumes. Statistical parameters for both truck events and the maximum annual truck are presented in Table 5.3.4 for selected force effects.

Maximum annual statistics for simple span moments and shears and continuous span positive moments were very similar and these force effect categories were grouped together for the derivations of load factors. The maximum annual statistics for simple span moments were used to represent this grouping.

Maximum annual statistics for negative moments in continuous span girders were significantly different from the other force effects and were maintained as a separate category.

Table 5.3.4 – Statistical Parameters for L75 Category Trucks

Force Effect	Span Length	Event Bias Coef.	Event Standard Deviation	Annual Bias Coef.	Annual Coef. Of Variation
Simple Span Moments	8 m	0.935	0.145	1.41	0.046
	32 m	0.93	0.0725	1.195	0.029
Simple Span Shears	6 m	0.945	0.125	1.405	0.041
	28 m	0.885	0.100	1.205	0.036
Continuous Span Positive Moments	15 m	0.96	0.13	Same as Simple Span Moments	
	40 m	0.92	0.10		
Continuous Span Girders Negative Moments	20 m	1.05	0.135	1.55	0.039
	40 m	0.95	0.0925	1.295	0.031

5.4 L150 AND L165 CATEGORY OFF-HIGHWAY TRUCKS

5.4.1 Data Sources for Truck Characteristics

Off-highway logging trucks at the following locations were collected for the assessment of the effectiveness of the force effect envelopes produced by the L150 and L165 Design Vehicle Configuration:

- Honeymoon Bay, Dryland Sort (2001 December 12-19)
- Port McNeill, Dryland Sort (2002 January 15-16)
- Port McNeill, Dewatering (2001 November 26)
- Stillwater, Dryland Sort (2001 December 06-07)

5.4.2 Assessment for Type L150 and L165 Logging Trucks

As discussed in Section 4.4, the data samples collected at the above locations do not appear to represent either the L150 or the L165 Design Configurations. The average truck weight for the samples is equivalent to a L115 Design Configuration, while the heaviest truck is equivalent to a L132 Design Configuration. However, information obtained by the Ministry from industry sources indicates that logging trucks with total weights conforming to the L150 Design Configuration are common in the coastal region.

If logging trucks conforming to the L150 Design Configuration are common, the trucks comprising the data sample are 23% lighter than the typical L150 truck. Using this data sample as the basis for a statistical description of the L150 Design Configuration would result in live load factors that are significantly unconservative. Therefore, the data sample was considered to be inadequate for use in this study and no statistical parameters were developed for L150 or L165 Design Configurations. It is recommended that additional data samples be obtained that accurately describe the L150 and L165 category trucks operating in the Province.

Although these data samples could not be used to derive statistics for L150 and L165 Design Configurations, they were evaluated to determine the variability of the truck weights in the sample and the side to side unbalanced loadings. The truck weight samples collected from the Stillwater, Dryland Sort was not included in this assessment since the trucks weights collected at this location were substantially lower than the truck weights at the other sampled locations.

The coefficient of variation for the weights of this truck sample is 0.077, which is similar to, but slightly lower than, the coefficient of variation of 0.110 obtained for the weights of the L75 truck sample.

The side to side unbalance of loadings for the sample were 51.7% to 48.3% for the entire truck weight and 52.9% to 47.1% for the heaviest axle group. The average side to side unbalance of loads is again similar to the values obtained for the L75 truck sample.

The levels of variability observed in both the sample of coastal logging trucks and the sample of L75 type trucks are relatively similar for both gross vehicle weights and side to side unbalance of loadings. This suggests that the relative level of load variability may be consistent for all off-highway logging trucks regardless of the truck category. If previously recommended additional load studies support this finding, it may be possible to establish a single set of design and evaluation load factors for all off-highway logging trucks.

6 DERIVATION OF LOGGING TRUCK LOAD FACTORS

6.1 GENERAL

A slightly modified version of the methodology used to calibrate the design and evaluation load factors contained in the CHBDC was used to calibrate live load factors for logging trucks. The base calibration methodology is described in detail in Kennedy et al. [4]. However, the calibration methodology was modified slightly to include the effects of load models with an unbalance in wheel loads from side to side. The effects of unbalanced loads are incorporated into the load factor calibration for off-highway trucks by combining the appropriate unbalanced load statistics with the statistics for the lateral distribution of live loads.

S6-00 specifies that highway bridge designs are to target a design life of 75 years, while the Forest Service Manual specifies a design life of 45 years for forestry bridges. However, such a difference in design life span will have very little effect on the load factors required for the design of bridges. In general, the heavier the truck the less likely it is that such a truck will arrive at a bridge, but as the total number of trucks using a bridge increases so does the liklihood that the heavier overweight trucks will arrive. While one would expect the heaviest truck to be experienced in 45 years to be greater than the heaviest truck to be experienced in one day, the difference from 45 years to 75 years is small. On typical bridges the 75 year truck is statistically expected to be less than 1% heavier than the 45 year truck.

6.2 NON LIVE LOAD STATISTICAL PARAMETERS

The statistical parameters recommended in the Commentary to Section 14 of CHBDC [3] for all non-truck components of the bridge loadings and member resistances were used in the calibration process. These parameters are shown in Table 6.2 a).

Table 6.2 a) – Statistical Parameters for Other Loadings and Resistances

Type of Loading, Analysis or Resistance	Bias Coefficient	COV
Dead Load Type 1 (D1)	1.03	0.08
Dead Load Type 2 (D2)	1.05	0.10
Dead Load Asphalt (D3)	1.03	0.30
Dynamic Load, Other Spans	0.40	0.80
Dynamic Load, Short Spans	0.67	0.60
Resistance, Plastic Moment Steel (R)	1.126	0.095

Statistical parameters for lateral distribution of live loads used in the calibration were also obtained from CHBDC but were modified for off-highway vehicles to include the statistics for side to side unbalanced loading of trucks. These statistical parameters are shown in Table 6.2 b).

Table 6.2 b) – Statistical Parameters for Lateral Distribution of Live Load

Logging Truck Type	Analysis Type	Bias Coefficient	Coefficient of Variation
Highway	Statically	1.0	0.0
	Sophisticated	0.98	0.07
	Simplified	0.93	0.12
L75 Off-Highway Short Spans	Statically	0.938	0.137
	Sophisticated	0.919	0.154
	Simplified	0.872	0.182
L75 Off-Highway Long Spans	Statically	0.93	0.089
	Sophisticated	0.911	0.113
	Simplified	0.865	0.149
All other Off-Highway	All	NA*	NA*

* No data available.

Dead load and resistance factors used in the calibration process were also consistent with CHBDC and are shown in Table 6.2 c).

Table 6.2 c) – Load and Resistance Factors Used in Calibration

Load or Resistance	Reliability Index, b						
	2.50	**2.75**	**3.00**	**3.25**	**3.50**	**3.75**	**4.00**
a_{D1}	1.05	1.06	1.07	1.08	1.09	1.10	1.11
a_{D2}	1.10	1.12	1.14	1.16	1.18	1.20	1.22
a_{D3}	1.25	1.30	1.35	1.40	1.45	1.50	1.55
f_R	0.95	0.95	0.95	0.95	0.95	0.95	0.95

6.3 HIGHWAY LOGGING TRUCKS

Live load factors were derived for Highway Logging Trucks in accordance with the methodology described in Section 6.1 for reliability indices, β, from 2.50 to 4.00 for both 'Short' and 'Other' spans. In addition, a separate set of live load factors were derived for use with tridem axle highway logging trucks. The derivations were based on the statistical parameters given in Table 5.2.3 and Section 6.2.

The sets of live load factors derived for use with all highway logging trucks and for use with trucks containing tridem axles are presented in Table 6.3. The load factors are to be applied to the force effects produced by a truck model with a gross vehicle weight and axle loadings within the the specified limits. The live load factors associated with the target β for bridge design of 3.75 have been highlighted.

Table 6.3 – Live Load Factors for Highway Logging Trucks

Truck Type	Span	Analysis Type	Reliability Index, b						
			2.50	**2.75**	**3.00**	**3.25**	**3.50**	**3.75**	**4.00**
All Trucks	Short	Static.	1.47	1.52	1.58	1.65	1.71	**1.78**	1.85
		Soph.	1.49	1.56	1.62	1.69	1.77	**1.84**	1.92
		Simp.	1.51	1.59	1.67	1.75	1.84	**1.93**	2.03
	Other	Static.	1.26	1.31	1.35	1.41	1.46	**1.52**	1.57
		Soph.	1.27	1.32	1.37	1.43	1.49	**1.55**	1.61
		Simp.	1.27	1.32	1.38	1.45	1.51	**1.58**	1.65
Tridem Axles	Short	Static.	1.35	1.40	1.45	1.51	1.57	**1.63**	1.69
		Soph.	1.37	1.43	1.49	1.55	1.62	**1.69**	1.76
		Simp.	1.39	1.46	1.53	1.61	1.69	**1.77**	1.86
	Other	Static.	1.19	1.23	1.28	1.33	1.38	**1.43**	1.49
		Soph.	1.20	1.25	1.30	1.35	1.41	**1.47**	1.53
		Simp.	1.20	1.25	1.31	1.37	1.43	**1.49**	1.56

6.4 L75 OFF-HIGHWAY TRUCKS

Live load factors were derived to be applied to the L75 Design Configuration in accordance with the methodology described in Section 6.1 for each grouping of force effects and for reliability indices, β, from 2.50 to 4.00. The derivations were based on the statistical parameters given in Table 5.3.4 and Section 6.2.

The derived live load factors for the L75 Design Configuration force effect groupings are presented in Table 6.4. The live load factors associated with the design target β of 3.75 have been highlighted.

Table 6.4 – Live Load Factors for L75 Design Configuration

Force Effect Type	Span	Analysis Type	Reliability Index, b						
			2.50	**2.75**	**3.00**	**3.25**	**3.50**	**3.75**	**4.00**
Simple Span Moments & Shears and Continuous Span Positive Moments	< 15m	Static.	1.55	1.63	1.71	1.80	1.89	**1.99**	2.09
		Soph.	1.56	1.65	1.74	1.83	1.93	**2.04**	2.15
		Simp.	1.57	1.66	1.76	1.86	1.97	**2.09**	2.22
	> 15m	Static.	1.18	1.23	1.29	1.34	1.40	**1.46**	1.52
		Soph.	1.19	1.24	1.30	1.36	1.42	**1.48**	1.55
		Simp.	1.18	1.24	1.30	1.36	1.43	**1.50**	1.57
Continuous Span Girders Neg. Moments	20 m*	Static.	1.53	1.60	1.67	1.74	1.81	**1.88**	1.96
		Soph.	1.54	1.61	1.68	1.76	1.84	**1.92**	2.00
		Simp.	1.53	1.61	1.69	1.77	1.86	**1.95**	2.04
	25 m and over	Static.	1.28	1.34	1.39	1.45	1.51	**1.58**	1.64
		Soph.	1.29	1.34	1.40	1.47	1.53	**1.60**	1.67
		Simp.	1.28	1.34	1.41	1.47	1.55	**1.62**	1.70

*Based on a single truck loading only.

6.5 L100, L150 AND L165 OFF-HIGHWAY TRUCKS

The samples of logging truck weights collected for this study were not considered to be representative of the L150 or L165 Design Configurations, and no statistics were available for the L100 Design Configuration. Therefore, no live load factors were derived for the L100, L150 and L165 Design Configurations.

7 DISCUSSION OF DESIGN MODELS AND LOAD FACTORS

7.1 HIGHWAY LOGGING TRUCKS

The following trends were observed in the sampled population of highway logging trucks:

1. On average, the weights of the highway logging trucks contained in the sample population exceeded both the axle weight and gross vehicle weight limits by approximately 3%. This is an indication that logging truck weights regularly exceed the legal highway limits.
2. Axle group weights were found to be more variable than the gross vehicle weights. This is typical for most types of highway trucks and results in higher load factors for span lengths governed by an axle group loading.
3. Although subject to the same average level of overloading, the weights of tridem axle groups were found to be only half as variable as tandem axle groups. This indicates that higher levels of overloading occur in tandem axle groups than do in tridem axle groups.

The live load factors presented in Table 6.3 were derived for bridge span categories of ‘Short’ and ‘Other’ for both the entire truck population and for trucks with tridem axle groups. On ‘Other’ spans the load factors were 6% higher for the entire truck population compared to trucks with only tridem axles. On ‘Short’ spans the load factors for entire truck population were 9% higher than the load factors for trucks with only tridem axles. Note that although tandem axles require a higher live load factor, they are typically significantly lighter than the tridem axles and may not govern a bridge design or evaluation.

When compared to the live load factors for Normal Traffic (Alternate Loading) contained in Section 14 of CAN/CSA-S6-00 (CHBDC), the load factors derived for this study were less in all cases. Highway logging trucks generally fit the CHBDC description for type PA permit traffic, which is intended to represent trucks making many transits in a year with only moderate controls on the vehicle loadings. Live load factors derived for the entire population of highway logging trucks sampled for this study are very similar to the PA category load factors in CHBDC. However, load factors derived for trucks with only tridem axle groups are lower and very similar to the PS category load factors in CHBDC. Therefore a single category of the live load factors in CHBDC does not accurately represent all types of highway logging trucks. It is recommended that highway logging trucks be classified as type PA traffic for evaluation by CHBDC, except for trucks with only tridem axles (except for steering axle), which could classified as type

PS traffic. Alternatively the live load factors given in Table 6.3 of this report could be applied for the evaluation of highway bridges for logging trucks.

A previous study of logging truck tridem axle weights, conducted for the Ministry of Transportation in 1998 [3], provided live load factors about 5% lower than those derived for the sample population used in this study. The average weights of tridem axles obtained in the 1998 study were 4% less than the legal limits compared to the average value of 2% over the legal limit observed in this study. Variations of the tridem axle weights about the average value were similar in both studies. Therefore, the main reason for the increase in tridem axle load factors derived in this study compare to the 1998 study is the increase in the average weights of tridem axles.

7.2 L75 OFF-HIGHWAY TRUCKS

7.2.1 General

The envelopes of maximum force effects produced by the L75 logging trucks were similar for all truck populations sampled and all samples were combined for the analysis. The following trends were observed in the force effects produced by the sample population of trucks:

1. The ratios of maximum force effects produced on spans less than 15 m had higher average values and higher maximum values than those on spans greater than 15 m. This is typical for most types of trucks.
2. The ratios of force effects for simple span moments and shears and continuous span positive moments were similar enough to describe these force effects with a single set of statistical parameters.
3. The ratios of force effects for negative moments were significantly higher than the other types of force effects for span lengths near 20 m.
4. On average, the side to side unbalance of axle loads was 52.5% to 47.5%, which is less than the 60% to 40% split required in the Forest Manual. However, the degree of unbalance was found to be rather variable from truck to truck and axle group to axle group.

Ideally, a design load model should produce force effects that are a relatively consistent ratio of the maximum force effects produced by the actual truck population on bridges of all spans and for all force effect types. When significant variations exist in the ratios of force effects produced by the design model and the actual truck population, as described above for the L75 population, multiple sets of live load factors are required to provide a consistent level of safety for all bridges and bridge members.

Live load factors appropriate for the design and evaluation of forestry bridges with the L75 Design Configuration were derived. As discussed previously, separate sets of live load factors were required to provide a consistent level of safety for spans longer and shorter than 15 m and for bridge girders subject to negative moments. The load factors presented in Table 6.4 are appropriate for designing or evaluating bridges with the L75 Design Configuration. However, the derived load factors are not consistently similar to any of the load factors for the traffic categories contained in CHBDC.

For spans over 15 m, the live load factors associated with a $\beta = 3.75$, the target reliability index for design, have an approximate value of 1.50 or slightly less, see Table 6.4. This is somewhat lower than the 1.6 load factor contained in CAN/CSA-S6-88 and the 1.7 load factor in CAN/CSA-S6-00 CHBDC. Therefore, logging bridges designed to S6-88, with spans exceeding 15 m, should have some extra capacity when evaluated with the load factors derived for this study.

For spans less than 15 m, live load factors near 2.0 were derived for use with the L75 Design Configuration, which are approximately 35% higher than the live load factors required for longer spans. The higher live load factors for shorter spans reflects the significantly higher variability of axle group weights, which control short span loadings, compared to the variability of gross vehicle weights. This is consistent with the findings for non-permit highway trucks surveyed for the development of CHBDC.

The higher load factors of about 2.0 for short spans represent a 25% increase in the 1.6 load factor previously required by S6-88. The increased load factors for short spans will result in larger short span components for new bridges and some existing bridges may prove to be deficient. Again this is consistent with the findings for many existing highway bridges as the design requirements moved from S6-88 to CHBDC.

Higher load factors are necessary for two span continuous bridges with clear span lengths between 15 and 20 m. As discussed in Section 5.3.2, this primarily results because the Forestry Manual does not require the application of two Design Configuration trucks on bridges with total lengths less than 40 m.

7.2.2 Modified L75 Truck Model

The use of multiple sets of load factors for the design and evaluation of forestry bridges may prove to be cumbersome. The following modifications to the L75 Design Configuration and Section 3.4.4 ‘Number of Vehicles on the Bridge’ of the Forestry Design Manual would reduce the number of live load factors to a single set of values for all types of force effects and for both short and longer spans:

1. Modify the L75 Design Configuration to increase the drive tandem loadings by 55.6 kN per axle to 209 kN and reduce the rear tandem axle weights by 55.4 kN per axle to 98 kN. This modification maintains the same total vehicle weight but intensifies the unfactored force effects on shorter spans.
2. Modify the requirements of Section 3.4.4 of the Forestry Manual to require two L75 Design Configuration vehicles on any bridge with a minimum separation of half a Design Configuration vehicle length. This modification should have little or no change to most types of force effects but would produce appropriate levels of negative moments in two span continuous bridges with clear spans of 20 m or less.
3. Consider all bridges to be statically determinate for the lateral distribution of live loads. Most forestry bridges are designed with a statically determinate lateral distribution of live loads and only small increases of the live load factors occur for either Sophisticated or Simplified types of lateral distribution of live loads.

Table 7.2 presents live load factors appropriate for the design and evaluation of forestry bridges to the Modified L75 Design Configuration.

Table 7.2 – Live Load Factors for the Modified L75 Design Configuration

Force Effect Type	Span Length	Analysis Type	Reliability Index, b						
			2.50	**2.75**	**3.00**	**3.25**	**3.50**	**3.75**	**4.00**
All	All	All	1.18	1.23	1.29	1.34	1.40	**1.46**	1.52

The load factors developed for use with the L75 Design Configuration and the Modified L75 Design Configuration are appropriate for the population of L75 category logging trucks observed during this study. However, if the gross vehicle weights or axle weights of these trucks increase significantly from the current levels the derived load factors may be non-conservative.

7.2.3 CL-W Load Model

At the 2002 September 10 seminar held following the submission of the draft of this report it was suggested that the adoption of the CL-W configuration from CAN/CSA-S6-00 may be another potential option.

This option was briefly studied and the initial findings suggested that the CL-W configuration was not a significant improvement over the existing L75 truck model. Although the CL-W model was developed to produce the higher axle loadings produced by highway trucks compared to GVW loadings, the longer length of this truck compared to the actual logging trucks tended to cause significant variations in the levels of safety that would be provided for bridges of different span lengths. Therefore as with the existing L75 design truck model, multiple sets of load factors would be required to provide a consistent level of safety for all bridges without undo conservatism on some structures.

7.3 L100, L150 AND L165 OFF-HIGHWAY TRUCKS

As previously discussed, weigh scale surveys of logging trucks representative of these categories were not available for this study. Therefore, no live load factors could be derived for use with the L100, L150 and L165 Design Configurations. As previously recommended, the weights of representative logging trucks should be obtained and load factors derived for these truck categories.

The data collected for this study suggests that the relative levels of variations in logging truck weights may be relatively consistent for all off-highway truck categories. If future surveys of truck weights confirm this finding, if may be possible to derive a single set of load factors that are applicable to all off-highway truck categories.

7.4 BRIDGE DECKS

At the 2002 September 10 seminar, concern was expressed regarding the impact the revised load factors or modified L75 model would have on the design and evaluation of concrete decks on forestry bridges. Industry representatives stated that although this study indicated that concrete decks may be underdesigned for the existing loadings, the decks themselves were performing very well.

It was discussed at the seminar that concrete bridge decks often exhibit higher load carrying capacity than expected. Various participants of the seminar suggested that additional study of the behaviour and capacities of the decks used on forestry bridges was indicated prior to adopting the recommendations of this report for the design of forestry bridge decks.

8 CONCLUSIONS AND RECOMMENDATIONS

The Ministry of Forests required that the existing Design Configurations in the Forest Service Bridge Manual be studied to determine if they are reasonably representative of current logging trucks and if these configurations are appropriate for use with the load factors in CHBDC. This study resulted in the following conclusions and recommendations:

1. Surveys, conducted for the Ministry of Forest, obtained weigh scale data for a sufficiently large population of trucks to accurately describe the statistical variations of the weights of highway legal logging truck configurations conducting both highway and off-highway hauls (L75).
2. Weigh scale data representative of the logging trucks comprising the L100, L150 and L165 Design Configurations was not available for this study. It is recommended that appropriate data be obtained for use in evaluating the effectiveness of the L100, L150 and L165 Design Configurations. Note that it may be possible to obtain the required information based on data records from industry weigh scales and supplemented by a limited independent field survey of truck weights.
3. The survey conducted for this study did not target trucks transporting logging equipment. It is recommended that appropriate data be obtained for use in evaluating the demands that this type of loading places on the forestry bridges. Since roadway movements of this type of equipment are relatively infrequent, it is suggested that companies conducting these transports be approached for load data pertaining to the equipment being transported and configurations of the transporting trucks.
4. The side to side unbalance of axle loadings on off-highway logging trucks was found to be on average less than the level specified in the Design Configurations. However, the side to side unbalances were found to be highly variable.
5. All the data samples were analyzed and live load factors derived using methodologies that are consistent with those used for deriving the load factors in CAN/CSA-S6-00 (CHBDC). Using a 45 year design life instead of a 75 year design life does not significantly reduce the required load factors.
6. The average weights of highway legal logging trucks were found to slightly exceed legal limits. Plus, the force effects produced by these trucks were found to be more variable at shorter spans than for longer spans. The weights of highway logging trucks equipped only with tridem axles were found to be less variable than the weights of logging trucks equipped with tandem axles. Therefore, separate sets of live load factors were derived for the entire population of highway logging trucks and for

highway logging trucks equipped with only tridem axle groups (other than steering axle). Load factors derived for the entire population of highway logging trucks are similar to CHBDC load factors for type PA traffic, while those derived for logging trucks equipped only with tridem axles were similar to CHBDC load factors for type PS traffic. It is recommended that the CHBDC load factors for types PS and PA traffic be used to evaluate highway bridges for tridem equipped and non-tridem equipped logging trucks, respectively. Alternatively the load factors presented in Table 6.3 of this report could be used to evaluate bridges for these trucks.

7. The L75 Design Configuration was found to be only partially effective in producing consistent ratios of force effects compared to the force effects produced by the actual truck population. Significant variations in the force effect ratios existed between bridges with span lengths longer and shorter than 15 m and for negative moments compared to other types of force effects. The L75 Design Configuration significantly under estimated the force effects produced by individual axle groups compared to the force effects produced by the total truck. In addition, the forces on the negative moment regions of two span continuous bridges would be under estimated on clear spans of 20 m. The multiple sets of live load factors presented in Table 6.4 are required to provide consistent levels of safety for all bridges if applied with the L75 Design Configuration. None of the categories of live load factors contained in CHBDC are similar to the live load factors derived for the L75 Design Configuration.

8. In general, the L75 Design Configuration with the applicable load factors from this report results in slightly reduced demands compared to the requirements of S6-88 for spans over 15 m. However, for spans less than 15 m the factored demands on a bridge increase by approximately 25%. A similar increase in factored demands occurred for highway bridges with the move from the S6-88 code to the CHBDC. This will result in heavier designs being required for new forestry bridges with spans less than 15 m and some existing forestry bridges may be deficient.

9. Modifications to the L75 Design Configuration and the requirements of the Forestry Bridge Design Manual for the presence of multiple design vehicles are suggested in 7.2.2 of this report. If these suggestions are adopted a single load factor of 1.46 (perhaps rounded to 1.5) could be used for design of new bridges (and a single set of live load factors could be used for the design and evaluation) of all bridges for L75 category traffic.

10. Use of the CAN/CSA-S6-00 CL-W design truck configuration does not provide a significant improvement over the L75 truck model. Both models

require the use of multiple load factors to provide consistent levels of safety for all typical bridge spans.

11. The revised load factors and load models recommended in this report may show that some previous concrete bridge deck designs are not adequate. However, it is known that in many cases the design of concrete bridge decks is conservative. Additional study on the behaviour and capacity of the existing bridge deck designs is recommended.

12. In summary, the recommended load factors for the existing L75 Design Configuration are 1.99 and 1.46 for single spans < 15 m and > 15 m, respectively. For continuous bridges the recommended load factors are 1.88 for individual bridge spans between 20 m to 25 m and 1.58 for bridges spans over 25 m.

9 REFERENCES

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[2] Canadian Standards Association. "CAN/CSA-S6-88 Design of Highway Bridges". (Canadian Standards Association, Toronto, 1988 June).

[3] Canadian Standards Association. "CAN/CSA-S6-00 Canadian Highway Bridge Design Code". (Canadian Standards Association, Toronto, 2000).

[4] Kennedy, D.J.L., Gagnon, D.P., Allen, D.E., and MacGregor, J.G., "Canadian highway bridge evaluation: load and resistance factors", Can. J. Civ. Eng. 19 (1992) 992-1006.

APPENDIX A

Design Configuration Truck Models

From Appendix B of the

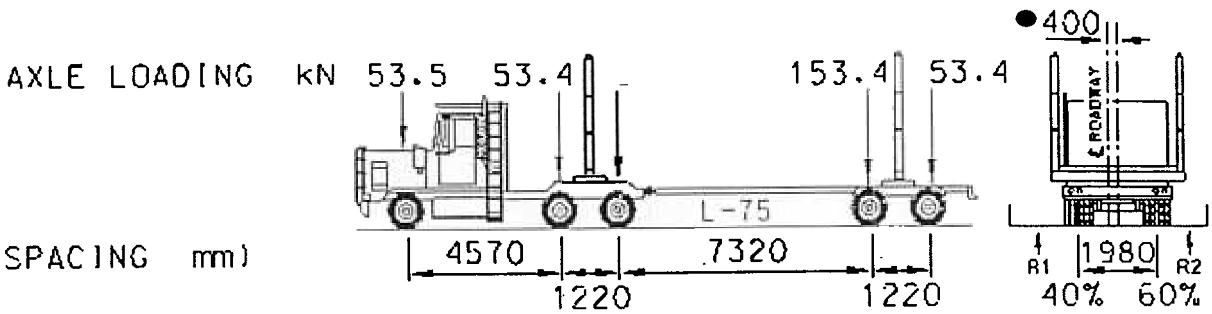
Forestry Service Bridge Design and Construction Manual

APPENDIX B

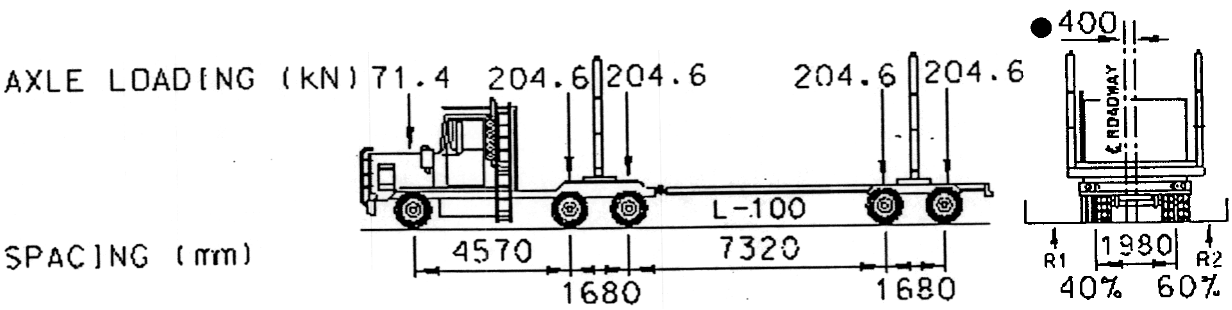
VEHICLE LOADING DIAGRAMS

Logging truck design loads on forest road bridges

Ministry of Forests



L-75 (OFF HIGHWAY) GVW 68,040 kg



L-100 (OFF HIGHWAY) GVW 90,680 kg

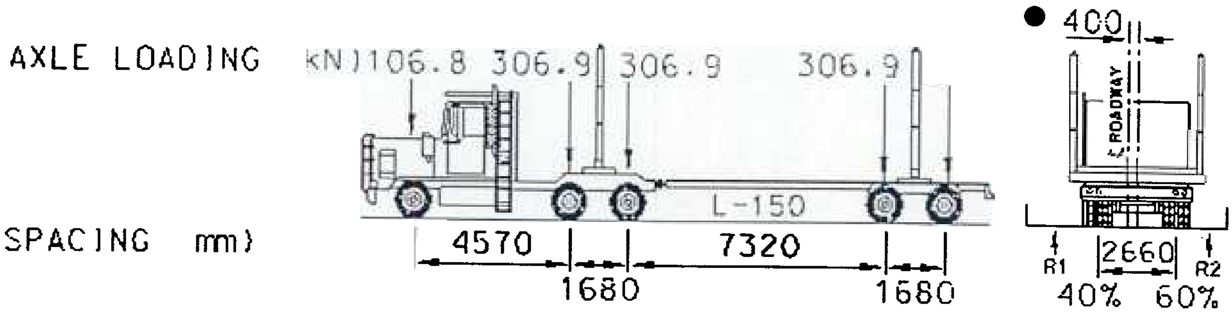
- Above eccentricity applies only to bridges with 2 girders 3000 apart.

For non standard deck widths, increase eccentricity by 50% of deck width over 4300.

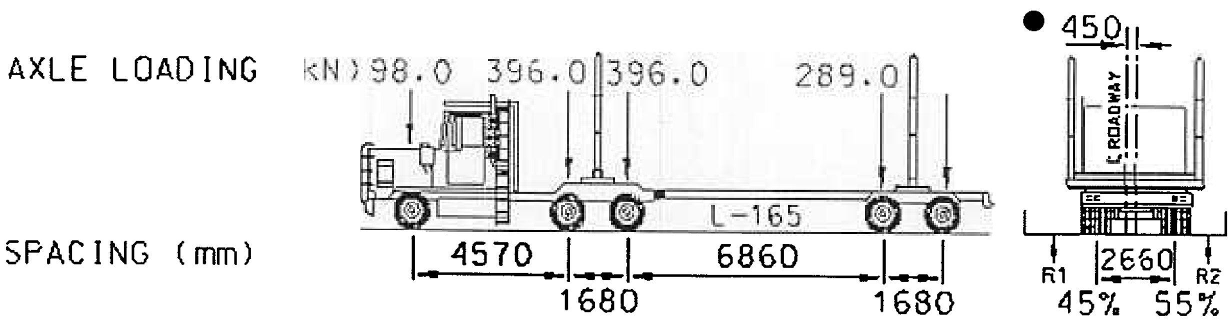
VEHICLE LOADING DIAGRAMS

Logging truck design loads on forest road bridges

Ministry of Forests



L-150 (OFF HIGHWAY) GVW 136,090 kg



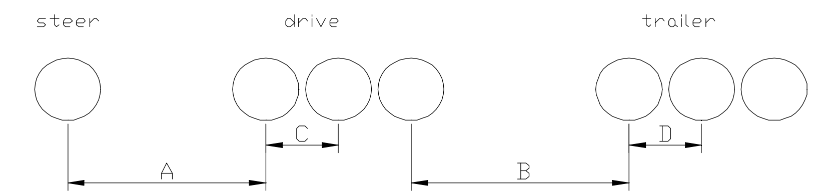
L-165 (OFF HIGHWAY) GVW 149,700 kg

● Above eccentricity applies only to bridges with 2 girders 3600 apart.
For non standard deck widths, increase eccentricity by 50% of deck width over 4900.

Appendix B

Surveys of Logging Truck

Weights and Dimensions



All trucks in this list sampled were 7-axle **highway** truck tridem-drive with tri-axle pole trailer EXCEPT truck 002
Location: Stillwater Dryland Sort
Participants: Weyerhaeuser, Stillwater Division
LeRoy Trucking -- Truckmake: Kenworth, Western Star

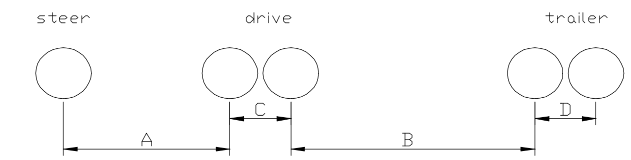
Axle-group weights

Width Dimensions (m) drive & trailer measured at tread face

Inter-group Spacing (m)

Axle-group Spread (m)

				Left Weight (kg)				Right Weight (kg)							Tire	Dual	Overall	Track	str-drv	drv-trlr	Drive	Trailer	
Truck No	Owner	Date	Time	L Steer	L Drive	L Trailer	L Total	R Steer	R Drive	R Trailer	R Total	TOTAL	Truck No	Owner	Width	Width	Width	Width	A	B	C	D	Type
002	LeRoy	Dec-06	n/a	3740	17700	12280	33720	4140	21060	14140	39340	73060	002	LeRoy	0.22	0.55	2.60	2.05	6.30	6.80	1.37	1.37	Tandem/Tri
002	LeRoy	Dec-06	n/a	3520	18960	10960	33440	3660	19640	13960	37260	70700	002	LeRoy	0.22	0.55	2.60	2.05	6.30	6.80	1.37	1.37	Tandem/Tri
002	LeRoy	Dec-06	n/a	3460	12880	over		4140	15580	over			002	LeRoy	0.22	0.55	2.60	2.05	6.30	6.80	1.37	1.37	Tandem/Tri
002	LeRoy	Dec-07	9:30	3420	13400	13380	30200	3980	18520	14120	36620	66820	002	LeRoy	0.22	0.55	2.60	2.05	6.30	6.80	1.37	1.37	Tandem/Tri
002	LeRoy	Dec-07	11:29	3840	17040	12840	33720	4280	21260	15780	41320	75040	002	LeRoy	0.22	0.55	2.60	2.05	6.30	6.80	1.37	1.37	Tandem/Tri
002	LeRoy	Dec-07	2:35	3720	15240	13200	32160	4080	17900	18040	40020	72180	002	LeRoy	0.22	0.55	2.60	2.05	6.30	6.80	1.37	1.37	Tandem/Tri
003	LeRoy	Dec-06	n/a	4320	18940	13980	37240	4120	19280	16500	39900	77140	003	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
003	LeRoy	Dec-06	2:40	4000	16560	13560	34120	4000	18080	16260	38340	72460	003	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
003	LeRoy	Dec-07	7:52	4340	19500	12660	36500	4120	18780	16460	39360	75860	003	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
003	LeRoy	Dec-07	10:16	4100	17760	10760	32620	4660	21960	16780	43400	76020	003	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
003	LeRoy	Dec-07	12:40	4260	16740	11700	32700	4660	22260	18460	45380	78080	003	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
003	LeRoy	Dec-07	3:12	4200	17580	15100	36880	4200	20840	18940	43980	80860	003	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
003	LeRoy	Dec-07	5:07	3960	16880	13760	34600	3980	18580	15540	38100	72700	003	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
005	LeRoy	Dec-06	1:10	3860	15800	13000	32660	4120	17940	15520	37580	70240	005	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
005	LeRoy	Dec-06	3:26	3920	15580	13980	33480	4020	21160	15940	41120	74600	005	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
005	LeRoy	Dec-07	8:52	3920	15700	14120	33740	4420	20500	16160	41080	74820	005	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
005	LeRoy	Dec-07	11:11	4000	15900	15360	35260	4600	21420	14880	40900	76160	005	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
005	LeRoy	Dec-07	1:22	4120	16040	14800	34960	4440	19120	15220	38780	73740	005	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
006	LeRoy	Dec-07	9:52	4180	16500	13100	33780	4180	22400	18680	45260	79040	006	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
006	LeRoy	Dec-07	12:00	4380	21100	11840	37320	4380	26360	17440	48180	85500	006	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
006	LeRoy	Dec-07	2:40	4420	19480	13260	37160	4480	29200	19240	52920	90080	006	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
006	LeRoy	Dec-07	4:17	4280	16820	13900	35000	4340	22580	14960	41880	76880	006	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
007	LeRoy	Dec-06	n/a	3800	17140	13620	34560	3760	18360	13780	35900	70460	007	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
007	LeRoy	Dec-06	1:29	3820	15200	14960	33980	3840	22240	15900	41980	75960	007	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
007	LeRoy	Dec-06	3:47	3880	18520	12720	35120	3800	19420	16920	40140	75260	007	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
007	LeRoy	Dec-07	9:05	3920	18320	12980	35220	3880	19820	15580	39280	74500	007	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
007	LeRoy	Dec-07	11:17	4160	19020	15720	38900	4160	22340	20540	47040	85940	007	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
007	LeRoy	Dec-07	1:34	3920	19240	12420	35580	3920	16880	15820	36620	72200	007	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
007	LeRoy	Dec-07	3:38	3840	19420	13420	36680	3860	20680	14460	39000	75680	007	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
007	LeRoy	Dec-07	n/a	3800	17140	13620	34560	3760	18360	13780	35900	70460	007	LeRoy	0.22	0.55	2.60	2.05	5.20	6.00	1.37	1.37	Tri/Tri
14	Bayline	Dec-07	11:02	5080	13520	12680	31280	4540	13320	9840	27700	58980	14	Bayline	0.22		2.52		5.20	3.7	1.37	1.37	Tri/Tri w/picker
14	Bayline	Dec-07	11:56	5320	14240	12660	32220	4460	11540	10920	26920	59140	14	Bayline	0.22		2.52		5.20		1.37	1.37	Tri/Tri w/picker
14	Bayline	Dec-07	12:46	5140	11120	9080	25340	4440	10000	8620	23060	48400	14	Bayline	0.22		2.52		5.20		1.37	1.37	Tri/Tri w/picker
29	Bayline	Dec-07	n/a	4940	13720	14600	33260	4220	12300	11280	27800	61060	29	Bayline	0.22	0.57	2.4	1.83	5.43	7.8	1.37	1.37	Tan/Tan w/picker
29	Bayline	Dec-07	n/a	5020	13440	13300	31760	4200	13060	8960	26220	57980	29	Bayline	0.22	0.57	2.4	1.83	5.43	7.8	1.37	1.37	Tan/Tan w/picker
36	Bayline	Dec-07	10:00	5420	11080	16620	33120	4200	9380	14020	27600	60720	36	Bayline	0.22	0.58	2.6	2.02	5.63	6.7	1.37	1.37	Tan/Tan w/picker
36	Bayline	Dec-07	4:07	5460	11760	12560	29780	4220	10000	11300	25520	55300	36	Bayline	0.22	0.58	2.6	2.02	5.63	6.7	1.37	1.37	Tan/Tan w/picker
39	Bayline	Dec-07	1:58	4560	15560	15360	35480	4400	13720	12240	30360	65840	39	Bayline	0.22		2.4		5.72	6.9	1.37	1.37	Tan/Tan w/picker
39	Bayline	Dec-07	3:32	4580	15440	13660	33680	4320	13340	10480	28140	61820	39	Bayline	0.22		2.4		5.72	6.9	1.37	1.37	Tan/Tan w/picker



All trucks in this list sampled were 5-axle **off-highway** trucks.
Location: Port McNeill, Dryland Sort
Participants: Weyerhauser, Pt. McNeill
Truckmake: Pacific

Axle-group weights

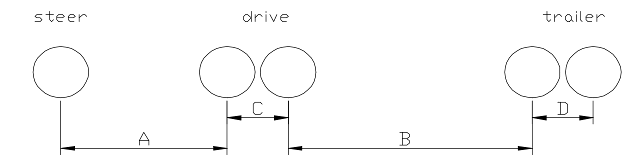
Width Dimensions (m) drive & trailer measured at tread face

Inter-group Spacing (m)

Axle-group Spread (m)

Truck No	Picture file #	Date	Time	Left Weight (kg) L Steer	L Drive	L Drive	L Trailer	L Trailer	L Total	Right Weight (kg) R Steer	R Drive	R Drive	R Trailer	R Trailer	R Total	TOTAL	Tire Width	Steer Overall Width	Steer Track Width	Drive Dual Width	Drive Overall Width	Drive Track Width	Trailer Dual Width	Trailer Overall Width	Trailer Track Width	str-drv A	drv-trlr B	Drive C	Trailer D	Type
H74	n/a	15-Jan-02	9:03 AM	6130	11830	11800	12110	13360	55230	4950	12770	11380	13290	14890	57280	112510	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H122	995/996	15-Jan-02	9:50 AM	5950	12110	11470	12760	12230	54520	5890	12140	11460	13760	11740	54990	109510	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H87	997/998	15-Jan-02	10:23 AM	5540	11290	12710	11970	10940	52450	5280	12020	13450	13520	13720	57990	110440	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H109	999/1000	15-Jan-02	10:55 AM	5580	11850	12040	10500	10810	50780	5720	12440	12470	10990	11240	52860	103640	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H109	1001/1002	15-Jan-02	12:00 PM	5050	10700	10550	11660	11640	49600	4910	13020	11420	12900	11080	53330	102930	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H122	1003/1004	15-Jan-02	1:01 PM	5400	11110	10820	10700	10260	48290	5560	12710	12290	8960	8910	48430	96720	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H109	1005/1006	15-Jan-02	1:32 PM	5710	11530	11330	10260	9750	48580	5940	12960	12500	8640	8470	48510	97090	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H85	07,8,9,10,	15-Jan-02	2:09 PM	5620	11830	12420	10120	10460	50450	5940	11650	12220	10740	11990	52540	102990	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H87	1012/1013	15-Jan-02	2:39 PM	5910	14610	14490	13320	11910	60240	5480	12290	12330	13600	14720	58420	118660	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H109	1014/1015	15-Jan-02	2:48 PM	5450	10720	10740	9080	9230	45220	5210	12320	11500	9410	9560	48000	93220	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	7.00	1.69	1.69	Off Highwa
H74	1016/1017	15-Jan-02	3:53 PM	5740	10210	10760	11710	12420	50840	5310	11550	11090	10890	10680	49520	100360	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H109	1018/1019	15-Jan-02	4:01 PM	5210	10560	10350	11690	11670	49480	5840	12840	12760	12900	12080	56420	105900	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H87	1020	15-Jan-02	4:22 PM	5650	12740	12650	11040	10570	52650	5380	14230	14020	10890	11040	55560	108210	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H122	1021/1022	15-Jan-02	4:30 PM	5480	14370	14940	9800	9220	53810	4890	10720	10660	13050	11690	51010	104820	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H87	1023/1024	16-Jan-02	9:23 AM	5730	9610	11120	9190	9150	44800	5460	11640	10940	8650	8920	45610	90410	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H74	1025/1026	16-Jan-02	9:30 AM	6320	10980	10870	8480	9390	46040	4610	11910	11320	10480	10130	48450	94490	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H109	1027/1029	16-Jan-02	10:02 AM	5290	12060	11650	12940	13050	54990	5230	10690	10270	12790	13040	52020	107010	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	6.55	1.69	1.69	Off Highwa
H87	1030/1031	16-Jan-02	10:40 AM	5860	12550	12460	10740	10160	51770	5650	12610	12890	12160	9860	53170	104940	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H122	1032/1033	16-Jan-02	11:12 AM	5960	9210	9500	5780	5200	35650	5910	10300	10280	6130	6280	38900	74550	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	5.20	1.69	1.69	Off Highwa
H121	1034/1035	16-Jan-02	11:53 AM	5630	10780	11630	8820	9380	46240	5550	10600	11400	11110	12890	51550	97790	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H87	1036/1037	16-Jan-02	11:58 AM	5830	13510	12510	9240	8780	49870	5760	13100	12640	11520	10770	53790	103660	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H74	1038/1039	16-Jan-02	12:29 PM	6290	10700	11880	10210	10410	49490	5520	10830	10980	12120	8640	48090	97580	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H87	1040/1041	16-Jan-02	1:17 PM	6010	12300	12430	10970	10620	52330	5780	12340	13090	9800	9730	50740	103070	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H109	1042/1043	16-Jan-02	1:59 PM	5770	8890	9390	10160	11060	45270	5970	10010	9830	10970	13200	49980	95250	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	7.05	1.69	1.69	Off Highwa
H87	1044/1045	16-Jan-02	2:36 PM	6220	12800	12840	9570	9380	50810	6050	12320	12630	9530	9440	49970	100780	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H122	1046/1047	16-Jan-02	2:39 PM	5380	12690	13400	11120	10750	53340	5370	12840	13940	11650	10800	54600	107940	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H121	1048/1049	16-Jan-02	3:48 PM	5800	9690	8320	11920	11740	47470	5860	9950	7900	12370	12390	48470	95940	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa
H87	1050/1051	16-Jan-02	3:52 PM	6010	13430	13210	9560	9130	51340	5840	11790	12480	11280	11240	52630	103970	0.34	2.65	2.31	0.76	3.30	2.54	0.79	3.31	2.52	4.76	8.00	1.69	1.69	Off Highwa

NB: right and left numbers were transposed on previous version.
This one has been corrrected.



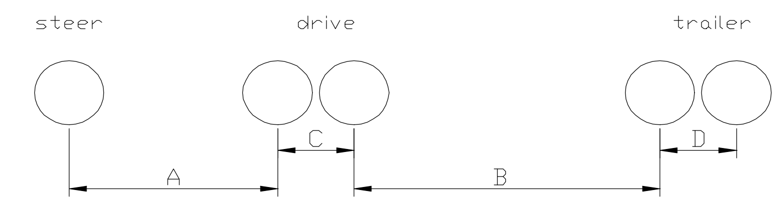
All trucks in this list sampled were large 5-axle **off-highway** trucks.
Location: Honeymoon Bay Dryland Sort
Participants: TimberWest, Honeymoon Bay Division
Truckmake: Pacific, Hayes

Axle-group weights

c=corrected

				Left Weight (kg)						Right Weight (kg)							
Truck No	Owner	Date	Time	L Steer	L Drive	L Drive	L Trailer	L Trailer	L Total	R Steer	R Drive	R Drive	R Trailer	R Trailer	R Total	TOTAL	
T479	Hayes	12-Dec	15:05	3436	over	over	14545	over	*	5209	16173	15955	11636	over	*	*	c
T20	Hayes	12-Dec	16:00	5591	12891	14873	over	8873	*	5936	15336	16145	11609	11027	60053	*	c
40-91	TW	13-Dec	12:30	5270	11000	11000	12780	12800	52850	5870	13180	12460	12040	11150	54700	107550	
40-132	TW	13-Dec	10:00	4745	12045	12000	12482	12091	53363	5682	12755	13555	11645	12209	55846	109209	
T-20	Hayes	13-Dec	10:15	5482	14091	13664	11400	14373	59010	5791	14773	16500	11818	12136	61018	120028	
40-96	TW	13-Dec	9:02	5145	10527	9636	7600	12736	45644	6536	11845	11609	9990	10545	50525	96169	?
T-619	Hayes	13-Dec	12:40	4810	16400	16200	13180	11860	62450	5390	17990	17360	6905	5920	53565	116015	
T-479	Hayes	13-Dec	11:50	5000	over	over	15455	over	*	4655	15964	14364	13100	14755	62838	*	c
40-132	TW	13-Dec	14:25	4920	10340	12270	11240	11400	50170	5640	13910	14690	10000	10000	54240	104410	c
40-96	TW	13-Dec	13:40	5460	11390	11530	12420	11450	52250	6130	12180	13070	10870	12060	54310	106560	
T-20	Hayes	13-Dec	14:45	5570	14500	15030	12130	14440	61670	5000	12920	14000	10020	9270	51210	112880	
40-96	TW	14-Dec	9:52	5700	9580	9370	13980	13360	51990	5810	10960	10110	10450	11200	48530	100520	
40-132	TW	14-Dec	9:30	5170	10930	11150	11800	10780	49830	5640	11980	13330	8930	8650	48530	98360	
T20	Hayes	14-Dec	10:00	5550	12930	12980	14560	14600	60620	6090	14230	14620	9820	10000	54760	115380	
40-91	TW	14-Dec	10:25	5910	12680	11570	10380	10440	50980	5790	12650	11640	10210	8090	48380	99360	
T479	Hayes	14-Dec	11:00	5120	13920	13200	14050	13940	60230	5255	over	15590	12760	13100	*	*	c
40-73	TW	14-Dec	11:22	4860	12250	11360	11570	12330	52370	5150	14000	12500	10660	10490	52800	105170	c
40-131	TW	14-Dec	12:35	5700	12290	12100	12570	11750	54410	5780	14570	over	11610	11700	*	*	c
T615	Hayes	14-Dec	13:37	4830	13200	15200	9830	9670	52730	5610	13950	14600	11220	9890	55270	108000	
40-91	TW	14-Dec	13:25	5282	11720	11550	11980	11250	51782	5970	11820	12830	9550	10140	50310	102092	
40-127	TW	14-Dec	13:43	5280	11840	11500	11120	11120	50860	5640	13350	11640	8690	8500	47820	98680	
40-132	TW	14-Dec	13:53	4930	10800	11150	11740	11300	49920	5550	11460	12630	8930	8760	47330	97250	
T-20	Hayes	14-Dec	14:47	6010	15230	15440	14960	14980	66620	5630	13770	over	11000	11100	*	*	c
40-91	TW	14-Dec	14:26	5880	11800	11400	10670	12130	51880	6170	13540	12000	10400	9060	51170	103050	
40-91	TW	17-Dec	11:40	5730	11030	11150	12660	13500	54070	5940	11770	11440	11510	10190	50850	104920	
40-73	TW	17-Dec	14:20	4290	13230	12110	10880	10710	51220	4630	14850	13740	12360	12000	57580	108800	
40-132	TW	17-Dec	15:10	5240	12340	12650	12150	11440	53820	5100	11550	12230	10200	9900	48980	102800	
40-128	TW	17-Dec	14:40	5500	10460	11170	9790	9260	46180	5320	12400	12670	9160	8540	48090	94270	
40-127	TW	17-Dec	12:05	6210	15410	11790	11310	12680	57400	5210	14120	14320	11720	10100	55470	112870	c
40-131	TW	17-Dec	11:55	5780	15950	15620	12080	12460	61890	5910	14850	over	11270	11930	*	*	c
40-128	TW	18-Dec	13:41	5610	11390	12720	11650	12780	54150	5530	12840	12790	11270	10340	52770	106920	
40-73	TW	18-Dec	11:20	4790	14550	13450	10090	9740	52620	4480	13380	13550	10920	9820	52150	104770	
40-132	TW	18-Dec	10:51	5250	11630	12170	9730	9420	48200	5840	12530	12080	n/a	n/a	*	*	c
40-91	TW	18-Dec	10:36	5820	11740	12900	11270	10430	52160	5960	12260	12500	12080	13310	56110	108270	
40-73	TW	18-Dec	14:28	4590	11960	11640	12450	10970	51610	5120	14260	13250	11370	10280	54280	105890	
40-132	TW	18-Dec	14:30	5130	11940	12160	12340	12190	53760	5750	12640	13000	11150	9070	51610	105370	
40-96	TW	18-Dec	14:35	5880	12140	11550	10960	10980	51510	4850	11620	11460	10570	8330	46830	98340	
40-132	TW	19-Dec	9:40	5290	11540	12310	10420	10410	49970	5640	12510	13410	9920	9910	51390	101360	
40-91	TW	19-Dec	10:22	5890	11570	11990	13740	14650	57840	5650	14360	13830	13020	11040	57900	115740	
40-138	TW	19-Dec	10:33	5300	11350	12460	11680	11920	52710	5970	12380	13280	10750	10410	52790	105500	
40-73	TW	19-Dec	11:15	4530	13950	13530	13340	11680	57030	5110	14120	12370	12650	11500	55750	112780	
40-132	TW	19-Dec	13:10	5380	12610	13430	12130	12150	55700	5580	11500	12640	11970	11430	53120	108820	
40-128	TW	19-Dec	14:04	5860	10690	11360	12100	12210	52220	5460	12460	12550	10470	10560	51500	103720	
40-91	TW	19-Dec	14:13	5690	12210	11010	13800	14120	56830	5740	13540	12320	11280	12780	55660	112490	
40-138	TW	19-Dec	15:12	5360	10690	11270	11440	12340	51100	6050	12270	12510	10330	11460	52620	103720	
40-73	TW	19-Dec	15:31	4970	14070	13530	13290	12610	58470	5350	13630	13420	12670	12470	57540	116010	
40-140	TW	19-Dec	15:36	6020	11370	12170	10240	10100	49900	6150	12260	12690	10520	10210	51830	101730	

			Width Dimensions (m) drive & trailer measured at tread face			Inter-group Spacing (m)		Axle-group Spread (m)		
			Tire	Dual	Overall	str-drv	drv-trlr	Drive	Trailer	
Truck No	Owner	Time	Width	Width	Width	A	B	C	D	Type
T20	Hayes	n/a	0.33	0.77	3.30	4.75	7.00	1.65	1.80	Off Highway
T479	Hayes	n/a	0.33	0.77	3.30	4.75	7.00	1.65	1.80	Off Highway
T615	Hayes	n/a	0.33	0.77	3.30	4.75	7.00	1.65	1.80	Off Highway
T619	Hayes	n/a	0.33	0.77	3.30	4.75	7.00	1.65	1.80	Off Highway
40-73	TimberW	n/a	0.33	0.77	3.30	5.15	7.10	1.80	1.80	Off Highway
40-91	TimberW	n/a	0.33	0.77	3.30	5.15	7.10	1.80	1.80	Off Highway
40-96	TimberW	n/a	0.33	0.77	3.30	5.15	7.10	1.80	1.80	Off Highway
40-127	TimberW	n/a	0.33	0.77	3.30	5.15	7.10	1.80	1.80	Off Highway
40-128	TimberW	n/a	0.33	0.77	3.30	5.15	7.10	1.80	1.80	Off Highway
40-131	TimberW	n/a	0.33	0.77	3.30	5.15	7.10	1.80	1.80	Off Highway
40-132	TimberW	n/a	0.33	0.77	3.30	5.15	7.10	1.80	1.80	Off Highway
40-138	TimberW	n/a	0.33	0.77	3.30	5.15	7.10	1.80	1.80	Off Highway
40-140	TimberW	n/a	0.33	0.77	3.30	5.15	7.10	1.80	1.80	Off Highway



26-Nov-01
All trucks sampled were 5-axle **off-highway** tandem truck/tandem pole trailer
Location: Port McNeil dewatering
Participants: Western Forest Products, Truck make: Kenworth
Lamare Lake Contracting, Truck make: Pacific

Axle-group weights

Width Dimensions (m)
drive & trailer
measured at tread face

Inter-group Spacing (m)

Axle-group Spread (m)

			Left Weight (kg)				Right Weight (kg)								Tire	Dual	Overall	Track	str-drv	drv-trlr	Drive	Trailer
Truck No.	**Owner**	**Time**	**L Steer**	**L Drive**	**L Trailer**	**L Total**	**R Steer**	**R Drive**	**R Trailer**	**R Total**	**TOTAL**	**Truck No**	**Owner**	**Time**	**Width**	**Width**	**Width**	**Width**	**A**	**B**	**C**	**D**
29	WFP	9:49	4160	31600	20750	56510	5120	36790	17550	59460	115970	29	WFP	9:49	0.34	0.77	3.30	2.53	4.65	6.80	1.80	1.80
319	Lamare	9:54	4610	29670	19170	53450	5360	23390	20920	49670	103120	319	Lamare	9:54	0.34	0.77	3.30	2.53	4.70	6.85	1.80	1.80
48	WFP	10:39	5670	28390	16510	50570	6210	27540	19120	52870	103440	48	WFP	10:39	0.34	0.77	3.30	2.53	5.30	6.65	1.80	1.65
314	Lamare	10:58	4070	23250	18500	45820	5480	28930	20800	55210	101030	314	Lamare	10:58	0.34	0.77	3.30	2.53	4.70	6.85	1.80	1.65
2120	WFP	11:34	7360	32500	22820	62680	6690	29580	17870	54140	116820	2120	WFP	11:34	0.34	0.77	3.30	2.53	4.65	6.95	1.80	1.80
308	Lamare	11:38	4860	23280	23920	52060	5920	31910	23010	60840	112900	308	Lamare	11:38	0.34	0.77	3.30	2.53	5.20	6.65	1.65	1.65
309	Lamare	12:04	5790	22800	22660	51250	6040	38580	20800	65420	116670	309	Lamare	12:04	0.34	0.77	3.30	2.53	5.10	6.90	1.65	1.65
2117	WFP	12:26	6000	31220	21570	58790	6310	32180	16060	54550	113340	2117	WFP	12:26	0.34	0.77	3.30	2.53	4.75	6.90	1.65	1.65
319	Lamare	12:56	4050	29850	18010	51910	5810	34350	21240	61400	113310	319	Lamare	12:56	0.34	0.77	3.30	2.53	4.70	6.85	1.80	1.80
2122	WFP	13:20	5920	27060	24600	57580	6920	30280	22550	59750	117330	2122	WFP	13:20	0.34	0.77	3.30	2.53	4.65	6.95	1.80	1.80
305	Lamare	13:33	5240	23110	21590	49940	9800	33070	23660	66530	116470	305	Lamare	13:33	0.34	0.77	3.30	2.53	5.20	6.65	1.65	1.65
?	WFP	10:15																				
?	Lamare	10:21																				
29	WFP	12:56																				
48	WFP	13:45																				
?	Lamare	14:12																				
?	WFP	14:30																				
308	Lamare	14:40																				
2117	WFP	15:03																				
309	Lamare	15:10																				
29	WFP	15:17																				

This was the last sample before the scales failed
and started giving erratic readings.

Highway haul
Location: Kamloops Dryland Sort
Participants: Weyerhaeuser, Kamloops
Truckmake: various
Configuration: various

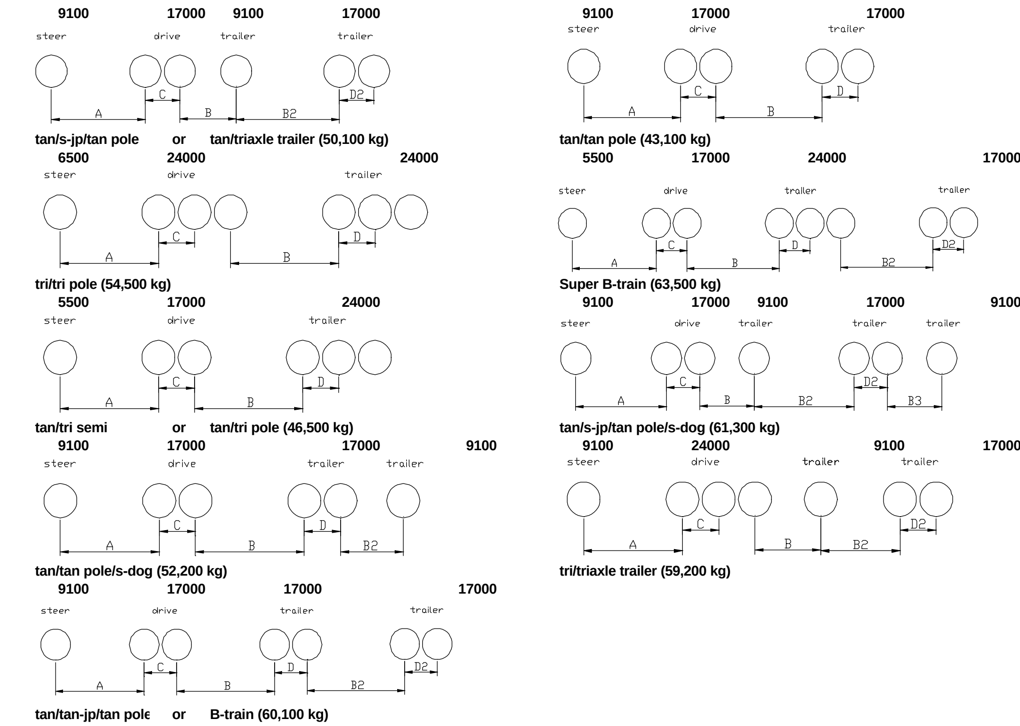
Axle-group weights

Width Dimensions **(m)**
drive & trailer
measured at tread face

Inter-group
Spacing **(m)**

Axle-group
Spread **(m)**

	Config.				Left Weight (kg)					Right Weight (kg)								Steer	Drive	Trailer	Trailer2								
																		Overall	Overall	Overall	Overall	str-drv	drv-trlr	trlr1-trlr2	Drive	1stTrailer	2ndTrailer		
pic#	Truck No	Type	Date	Time	L Steer	L Drive	L Trailer	LTrailer2	L Total	R Steer	R Drive	R Trailer	RTrailer2	R Total	TOTAL	Truck No	Type	Width	Width	Width	Width	A	B	B2	C	D	D2		
n/a	36	tan/tri ser	24/Jan	8:50	3120	9300	12700	0	25120	2940	8900	12180	0	24020	49140	36	tan/tri semi		2.44	2.59	n/a	5.16	8.86	n/a	1.29	1.52	n/a	1	
n/a	364	tan/tri-axl	24/Jan	9:07	3080	10280	3800	6700	23860	2920	9560	6020	7080	25580	49440	364	tan/tri-axle		2.44	2.44	2.44	6.00	5.11	3.80	1.37	n/a	1.36	2	
1110/111	612	tri/tri-axle	24/Jan	9:40	3320	12840	3620	6220	26000	3380	11380	4460	6200	25420	51420	612	tri/tri-axle	2.45	2.59	2.59	2.59	5.43	4.09	3.27	1.37	n/a	1.37	3	
1112/111	352	tan/tan pc	24/Jan	9:59	3160	8760	9340	0	21260	3260	9900	10120	0	23280	44540	352	tan/tan pole		2.44	2.44	n/a	n/a	n/a	n/a	n/a	n/a	n/a	4	
1114/111	364	Super-B	24/Jan	10:04	3000	8860	12500	8100	32460	3440	10800	13100	7960	35300	67760	364	Super-B		2.59	2.59	2.59	5.58	5.75	6.35	1.37	1.52	1.37	5	vc
1116/111	399	tri/tri pole	24/Jan	10:17	3600	12880	11920	0	28400	3680	14820	13340	0	31840	60240	399	tri/tri pole		2.59	2.59	n/a	5.23	7.50	n/a	1.37	1.37	n/a	6	
1118/111	258	tan/s-jp/ta	24/Jan	10:22	3120	11040	5040	8980	28180	3120	11400	5500	8860	28880	57060	258	tan/s-jp/tan pole		2.44	2.59	2.44	5.42	3.65	6.55	1.37	n/a	1.3	7	
1120/112	385	tan/tan pc	24/Jan	10:32	2500	10020	9360	0	21880	2820	11200	9060	0	23080	44960	385	tan/tan pole		2.44	2.44	n/a	5.34	9.35	n/a	1.41	1.33	n/a	8	
1122/112	993	tan/tri-axl	24/Jan	10:50	3280	10940	3420	7320	24960	3300	10700	4060	7120	25180	50140	993	tan/tri-axle		2.44	2.44	n/a	6.10	4.94	3.98	1.42	n/a	1.37	9	
1124/112	153	tan/s-jp/ta	24/Jan	11:25	2820	8880	4760	9260	25720	2920	9940	5340	9880	28080	53800	153	tan/s-jp/tan pole		2.44	2.59	2.59	5.35	3.55	6.86	1.37	n/a	1.38	10	
1126/112	20	tri/tri pole	24/Jan	11:32	3480	14220	10820	0	28520	3460	12920	13560	0	29940	58460	20	tri/tri pole		2.59	2.59	n/a	5.23	8.85	n/a	1.37	1.37	n/a	11	
1128/112	381	tri/tri pole	24/Jan	11:37	3600	12820	13380	0	29800	3680	14120	12760	0	30560	60360	381	tri/tri pole		2.59	2.59	n/a	5.23	8.33	n/a	1.37	1.37	n/a	12	
1130/113	986-7	tan/tri ser	24/Jan	11:51	2660	9940	13840	0	26440	2600	10460	13980	0	27040	53480	986-7	tan/tri semi		2.44	2.59	n/a	5.42	8.94	n/a	1.38	1.52	n/a	13	
1132/113	200	tri/tri pole	24/Jan	12:27	3340	12680	12260	0	28280	3540	15000	12400	0	30940	59220	200	tri/tri pole		2.59	2.59	n/a	5.23	8.80	n/a	1.37	1.37	n/a	14	
1134/113	176	Super-B	24/Jan	12:32	3360	8580	11500	8020	31460	2940	9360	12400	8260	32960	64420	176	Super-B		2.44	2.59	2.59	4.87	6.27	5.00	1.37	1.37	1.37	15	
1136/113	823	tan/tri-axl	24/Jan	12:56	3140	8680	3780	6880	22480	3200	8480	4260	7200	23140	45620	823	tan/tri-axle		2.44	2.59	2.59	5.15	4.85	4.50	1.37	n/a	1.43	16	
1138/113	645	tan/tan pc	24/Jan	13:49	2900	10100	8540	0	21540	2840	11240	7960	0	22040	43580	645	tan/tan pole		2.44	2.44	n/a	5.32	7.97	n/a	1.43	1.37	n/a	17	
1140/114	368	Super-B	24/Jan	13:58	2940	8160	12060	7920	31080	3360	10180	12380	8320	34240	65320	368	Super-B		2.44	2.59	2.59	4.87	6.27	5.00	1.37	1.37	1.37	18	
1142/114	72	tan/tan pc	24/Jan	14:01	4300	8400	9120	5200	27020	4660	10440	9540	5140	29780	56800	72	tan/tan pole/s-dog		2.44	2.44	2.44	4.52	7.35	3.67	1.37	1.38	n/a	19	
1144/114	399	tri/tri pole	24/Jan	14:28	3520	12860	12220	0	28600	3600	14540	13080	0	31220	59820	399	tri/tri pole		2.59	2.59	n/a	5.23	7.34	n/a	1.37	1.42	n/a	20	
1146/114	612	tri/tri-axle	24/Jan	14:31	3460	12040	4020	6520	26040	3360	12720	4500	7640	28220	54260	612	tri/tri-axle	2.45	2.59	2.59	2.59	5.43	4.09	3.27	1.37	n/a	1.37	21	
1148/114	218	tan/s-jp/ta	24/Jan	14:33	3040	9400	4240	9060	25740	3040	10080	5240	8540	26900	52640	218	tan/s-jp/tan pole		2.44	2.59	2.59	5.52	3.62	7.24	1.42	n/a	1.37	22	
1150/115	78	tan/tan pc	24/Jan	14:36	2980	9660	8960	4520	26120	3140	10400	8360	4160	26060	52180	78	tan/tan pole/s-dog		2.44	2.44	2.44	5.61	6.80	3.67	1.42	1.37	n/a	23	
1152/115	202	tri/tri pole	24/Jan	14:40	3380	13460	12620	0	29460	3460	13060	11820	0	28340	57800	202	tri/tri pole		2.59	2.59	n/a	5.23	6.90	n/a	1.37	1.37	n/a	24	
1154/115	227	tan/s-jp/ta	24/Jan	14:51	3040	8100	4120	9120	24380	3080	9580	5120	8400	26180	50560	227	tan/s-jp/tan pole		2.44	2.44	2.44	5.51	3.32	6.70	1.41	n/a	1.37	25	
1156/115	204	tri/tri pole	24/Jan	15:14	3720	12040	12080	0	27840	3780	14940	12500	0	31220	59060	204	tri/tri pole		2.59	2.59	n/a	5.23	6.86	n/a	1.37	1.37	n/a	26	
1158/115	967	tan/tan pc	24/Jan	15:16	2820	9560	9600	5280	27260	2780	11900	10260	4580	29520	56780	967	tan/tan pole/s-dog		2.44	2.44	2.44	5.60	5.67	3.80	1.37	1.38	n/a	27	
1160/116	157	tan/s-jp/ta	24/Jan	15:22	3180	7500	4420	9480	24580	3300	10340	5400	9080	28120	52700	157	tan/s-jp/tan pole		2.44	2.59	2.44	5.23	3.64	5.48	1.40	n/a	1.44	28	
1162/116	382	tan/tan pc	24/Jan	15:40	3380	10460	13260	0	27100	3440	10160	14460	0	28060	55160	382	tan/tan pole/s-dog		2.44	2.44	2.44	5.17	7.93	2.57	1.37	1.37	n/a	29	
1164/116	005	Super-B	24/Jan	15:46	2680	8400	10060	8220	29360	2800	9380	11760	8040	31980	61340	005	Super-B		2.44	2.59	2.59	4.46	7.05	5.30	1.39	1.38	1.37	30	
1166/116	225	tan/s-jp/ta	24/Jan	15:51	2880	9280	3740	9300	25200	2680	9700	5620	8280	26280	51480	225	tan/s-jp/tan pole		2.44	2.44	2.44	5.50	3.68	6.22	1.38	n/a	1.41	31	
1168/116	001	Super-B	24/Jan	16:02	2780	7500	10160	7380	27820	2720	9080	10020	7300	29120	56940	001	Super-B		2.44	2.59	2.59	4.80	6.57	5.49	1.39	1.30	1.37	32	



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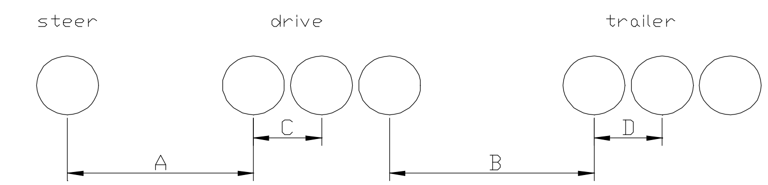


GVW 54,500 kg

Highway haul

All trucks sampled were 7-axle **highway type** truck tridem-drive with tridem pole trailer
Location: Menzies Bay, North Island Dryland Sort
Participants: Weyerhaeuser, North Island
Truckmake: Kenworth

29 samples

			Left axle group weights (kg)				Right axle group weights (kg)				
Truck No	**Date**	**Time**	**L Steer**	**L Drive**	**L Trailer**	**L Total**	**R Steer**	**R Drive**	**R Trailer**	**R Total**	**OTAL (kg)**
19	16/Jan	12:52	3560	14920	15400	33880	3340	14800	9180	27320	61200
244	16/Jan	12:05	3460	13780	12900	30140	3160	11140	11660	25960	56100
517	16/Jan	11:47	3680	14420	12140	30240	3240	12500	11060	26800	57040
517	16/Jan	14:12	3620	13920	12460	30000	3120	12040	9080	24240	54240
245	16/Jan	13:45	3580	13740	12100	29420	3340	12560	9240	25140	54560
16	16/Jan	13:25	3420	14840	15400	33660	3080	15240	9740	28060	61720
244	16/Jan	13:23	3620	14740	12340	30700	3260	11840	10300	25400	56100
517	16/Jan	13:04	3640	14400	12060	30100	3240	12140	11160	26540	56640
244	16/Jan	10:36	3600	13980	12680	30260	3280	13100	9540	25920	56180
16	16/Jan	10:24	3480	14200	14700	32380	3260	13600	9200	26060	58440
19	16/Jan	9:50	3480	12820	15560	31860	3260	15540	9560	28360	60220
244	16/Jan	9:31	3680	15420	13500	32600	3400	11760	10040	25200	57800
517	16/Jan	10:20	3760	15000	13040	31800	3360	13280	9800	26440	58240
517	16/Jan	9:08	3660	13180	12680	29520	3240	12180	9400	24820	54340
244	16/Jan	8:40	3480	13720	13120	30320	3160	12940	9420	25520	55840
16	15/Jan	13:21	3440	15080	15000	33520	3420	11740	12820	27980	61500
516	15/Jan	13:23	3560	16740	13760	34060	3340	12440	10820	26600	60660
517	15/Jan	13:37	3720	14020	13620	31360	3160	12540	11500	27200	58560
244	15/Jan	14:04	3520	14580	14880	32980	3100	12120	11940	27160	60140
244	15/Jan	15:13	3520	14140	13360	31020	3200	12320	9220	24740	55760
19	15/Jan	15:34	3720	14720	12380	30820	3300	11480	8360	23140	53960
517	15/Jan	14:46	3660	14540	12900	31100	3260	12700	10660	26620	57720
244	15/Jan	16:30	3480	14240	13220	30940	3140	12460	10100	25700	56640
16	15/Jan	16:10	3440	15260	13700	32400	3060	11800	11980	26840	59240
517	15/Jan	16:00	3660	14300	12640	30600	3220	12960	10520	26700	57300
245	15/Jan	3:08	3600	13240	13520	30360	3300	13640	10000	26940	57300
244	15/Jan	12:35	3500	14160	13520	31180	3120	13680	9240	26040	57220
19	15/Jan	13:00	3760	15480	15280	34520	3340	11700	11040	26080	60600
245	15/Jan	12:50	3600	14380	12680	30660	3140	12920	9780	25840	56500

Width Dimensions (m)

Inter-group Spacing (m) | **Axle-group Spread (m)**

	Steer		Drive			Trailer							
	Tire	**Overall**	**Tire**	**Dual**	**Overall**	**Tire**	**Dual**	**Overall**	**str-drv**	**drv-trlr**	**Drive**	**Trailer**	
Truck No	**Width**	**Width**	**Width**	**Width**	**Width**	**Width**	**Width**	**Width**	**A**	**B**	**C**	**D**	**Type**
All other units identical													
H518	0.23	2.30	0.21	0.55	2.56	0.21	0.55	2.54	5.90	7.80	1.40	1.40	Tri/Tri

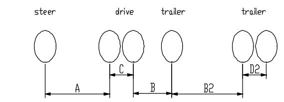
Highway haul
Location: Okanogan Falls
Participants: Weyerhaeuser, OK. Falls
Truckmake: various
Configuration: various

Axle-group weights

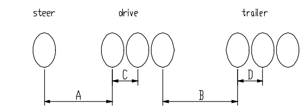
Width Dimensions **(m)** drive & trailer | Inter-group Spacing **(m)** | Axle-group Spread **(m)**

pic#	Config. ruck No.	Config. Type	Date	Time	Left Weight (kg) L Steer	L Drive	L Trailer	LTrailer2	L Total	Right Weight (kg) R Steer	R Drive	R Trailer	RTrailer2	R Total	TOTAL	ruck No	Type	Steer Overall Width	Drive Overall Width	Trailer Overall Width	Trailer2 Overall Width	str-drv A	drv-trlr B	trlr1-trlr2 B2	Drive C	1stTraile D	ndTrailer D2	
	396	tan/s-jp/ta	22/Jan	12:40	3020	8980	4980	8200	25180	3300	9040	4760	9520	26620	51800	396	tan/s-jp/tan pole	2.44	2.44	2.44		5.47	3.62	6.07	1.37	n/a	1.37	1
	213	tan/s-jp/ta	22/Jan	12:46	3180	9200	4340	7900	24620	2920	8520	4560	10000	26000	50620	213	tan/s-jp/tan pole	2.44	2.44	2.44		5.47	3.62	6.62	1.37	n/a	1.37	2
	223	tri/tri pole	22/Jan	12:55	3640	13020	11360	0	28020	3760	14960	13640	0	32360	60380	223	tri/tri pole	2.59	2.59	n/a		5.23	7.51	n/a	1.37	1.37	n/a	3
	595	tan/tri ser	22/Jan	13:09	2820	8820	12000	0	23640	2960	10100	13380	0	26440	50080	595	tan/tri semi	2.44	2.59	n/a		5.10	8.15	n/a	1.42	1.42	n/a	4
	806	tan/tan p	22/Jan	13:17	3260	8820	8200	4220	24500	3160	8820	8220	4340	24540	49040	806	tan/tan pole/s-dog	2.44	2.44	2.44		5.60	7.15	3.80	1.37	1.37	n/a	5
	823	tan/tri-axl	22/Jan	13:20	3240	9000	4520	5820	22580	3260	9660	5100	7920	25940	48520	823	tan/tri-axle shortwc	2.44	2.59	2.59		5.15	4.85	4.50	1.37	n/a	1.43	6
	941	tan/tri ser	22/Jan	13:25	3280	9900	12600	0	25780	3120	9940	13900	0	26960	52740	941	tan/tri semi	2.44	2.59	n/a		5.15	9.80	n/a	1.42	1.37	n/a	7
	838	tan/tri pol	22/Jan	13:33	3040	9460	11460	0	23960	3040	9680	13140	0	25860	49820	838	tan/tri pole	2.44	2.59	n/a		5.77	7.78	n/a	1.37	1.37	n/a	8
	844	tan/tri pol	22/Jan	13:40	3060	9500	11300	0	23860	2940	9120	13640	0	25700	49560	844	tan/tri pole	2.44	2.59	n/a		5.25	7.89	n/a	1.37	1.37	n/a	9
	176	Super-B	22/Jan	14:02	3440	8740	10360	7340	29880	3020	9660	11980	8120	32780	62660	176	Super-B	2.44	2.59	2.59		4.87	6.27	5.00	1.37	1.37	1.37	10
	840	tri/tri pole	22/Jan	14:08	3460	11700	13760	0	28920	3320	12420	13880	0	29620	58540	840	tri/tri pole	2.59	2.59	n/a		5.23	7.80	n/a	1.37	1.37	n/a	11
	877	tan/tan-jp	22/Jan	14:12	2600	8600	7800	8700	27700	2560	10500	10640	9120	32820	60520	877	tan/tan-jp/tan pole	2.44	2.59	2.44		5.19	5.39	4.81	1.37	1.37	1.37	12
	218	tan/s-jp/ta	22/Jan	14:19	3140	12100	4800	7860	27900	3200	11840	5440	9920	30400	58300	218	tan/s-jp/tan pole	2.44	2.59	2.59		5.52	3.62	7.24	1.42	n/a	1.37	13
	809	tan/tri pol	22/Jan	14:22	3100	10360	12180	0	25640	2980	9360	13180	0	25520	51160	809	tan/tri pole	2.44	2.59	2.59		5.20	9.03	n/a	1.37	1.37	n/a	14
	846	tan/s-jp/ta	22/Jan	14:38	2960	8840	4840	7720	24360	3060	8720	5360	10860	28000	52360	846	tan/s-jp/tan pole											15
	830	tri/tri pole	22/Jan	14:55	3260	14060	10700	0	28020	3260	13560	14440	0	31260	59280	830	tri/tri pole	2.59	2.59	n/a		5.23	7.30	n/a	1.37	1.37	n/a	16
	807	tan/tan-jp	22/Jan	15:04	2760	8080	7800	7380	26020	2960	9420	9780	10360	32520	58540	807	tan/tan-jp/tan pole	2.59	2.59	2.44		5.63	5.12	5.41	1.37	1.37	1.37	17
	29	tan/tri-axl	22/Jan	15:28	2940	10540	5080	9760	28320	3080	10500	5460	9180	28220	56540	29	tan/tri-axle longlog	2.44	2.59	2.59		5.57	6.72	3.69	1.37	n/a	1.37	18
	396	tan/s-jp/ta	23/Jan	7:30					0					0	0	396	tan/s-jp/tan pole	2.44	2.44	2.44		5.47	3.62	6.07	1.37	n/a	1.37	19
	224	tri/tri pole	23/Jan	7:35	3620	13880	10740	0	28240	3560	12540	13900	0	30000	58240	224	tri/tri pole	2.59	2.59	n/a		5.33	7.42	n/a	1.37	1.37	n/a	20
	806	tan/tan p	23/Jan	7:39	3280	8960	7940	3940	24120	3100	8800	9040	4740	25680	49800	806	tan/tan pole/s-dog	2.44	2.44	2.44		5.60	7.15	3.80	1.37	1.37	n/a	21
	20	tri/tri pole	23/Jan	7:48	3520	12460	12020	0	28000	3680	14400	12620	0	30700	58700	20	tri/tri pole	2.59	2.59	n/a		5.23	7.29	n/a	1.37	1.37	n/a	22
	699	tan/tri ser	23/Jan	7:53	3220	11760	11600	0	26580	3040	9020	13200	0	25260	51840	699	tan/tri semi	2.44	2.59	n/a		5.10	7.89	n/a	1.37	1.37	n/a	23
	210	tan/s-jp/ta	23/Jan	7:58	3060	10000	4620	7460	25140	3040	9220	5320	9400	26980	52120	210	tan/s-jp/tan pole	2.44	2.44	2.44		5.09	3.66	6.22	1.37	n/a	1.37	24
	47	tri/tri pole	23/Jan	8:01	3280	14900	11340	0	29520	3260	16020	14540	0	33820	63340	47	tri/tri pole	2.59	2.59	n/a		5.23	7.77	n/a	1.37	1.37	n/a	25
	202	tri/tri pole	23/Jan	8:11	3400	12720	11760	0	27880	3520	12540	12940	0	29000	56880	202	tri/tri pole	2.59	2.59	n/a		5.23	6.90	n/a	1.37	1.37	n/a	26
	808	B-train	23/Jan	8:14	2760	8940	7660	8420	27780	2840	9600	8160	9180	29780	57560	808	tan/tan B-train	2.44	2.59	2.59		5.55	4.40	7.31	1.37	1.37	1.37	27
	595	tan/tri ser	23/Jan	8:32	2960	9120	13040	0	25120	3100	10080	12860	0	26040	51160	595	tan/tri semi	2.44	2.59	n/a		5.22	8.23	n/a	1.42	1.42	n/a	28
	218	tan/s-jp/ta	23/Jan	8:35	3180	12560	5120	8160	29020	3120	11060	4880	9040	28100	57120	218	tan/s-jp/tan pole	2.44	2.59	2.59		5.52	3.62	7.24	1.42	n/a	1.37	29
	33	tri/tri pole	23/Jan	8:40	3240	12480	11140	0	26860	3480	13920	13700	0	31100	57960	33	tri/tri pole	2.59	2.59	n/a		5.23	7.32	n/a	1.37	1.37	n/a	30
	941	tan/tri ser	23/Jan	8:42	3300	10220	12420	0	25940	3180	9280	11720	0	24180	50120	941	tan/tri semi	2.44	2.59	n/a		5.16	9.71	n/a	1.42	1.37	n/a	31
	200	tri/tri pole	23/Jan	9:04	3420	13280	11820	0	28520	3400	13680	13420	0	30500	59020	200	tri/tri pole	2.59	2.59	n/a		5.23	7.68	n/a	1.37	1.37	n/a	32
	52	tri/tri pole	23/Jan	9:31	3200	13820	11740	0	28760	3340	15100	13720	0	32160	60920	52	tri/tri pole	2.59	2.59	n/a		5.23	7.48	n/a	1.37	1.37	n/a	33
	125	tri/tri pole	23/Jan	9:45	3820	13100	12660	0	29580	3840	14800	12720	0	31360	60940	125	tri/tri pole	2.59	2.59	n/a		5.23	7.78	n/a	1.37	1.37	n/a	34
	237	tri/tri pole	23/Jan	9:47	3760	13780	11740	0	29280	3600	13080	13520	0	30200	59480	237	tri/tri pole	2.59	2.59	n/a		5.23	7.31	n/a	1.37	1.37	n/a	35
	209	tri/tri pole	23/Jan	9:55	3440	13440	11620	0	28500	3340	13080	12720	0	29140	57640	209	tri/tri pole	2.59	2.59	n/a		5.23	7.53	n/a	1.37	1.37	n/a	36
	212	tri/tri pole	23/Jan	11:09	3440	12880	10840	0	27160	3420	12680	13340	0	29440	56600	212	tri/tri pole	2.59	2.59	n/a		5.23	7.39	n/a	1.37	1.37	n/a	37
	28	tan/s-jp/ta	23/Jan	11:17	2980	10840	4560	8180	26560	3040	9260	5500	9600	27400	53960	28	tan/s-jp/tan pole	2.44	2.44	2.44								38
	806	tan/tan p	23/Jan	11:22	3400	10640	8180	4180	26400	3220	10360	8020	4100	25700	52100	806	tan/tan pole/s-dog	2.44	2.44	2.44		5.60	7.15	3.80	1.37	1.37	n/a	39
	9	tan/tri-axl	23/Jan	11:31	3380	10920	5600	8620	28520	3460	13580	5600	8280	30920	59440	9	tan/tri-axle longlog	2.44	2.59	2.59		5.89	6.98	4.63	1.37	n/a	1.37	40
	3	tan/tri-axl	23/Jan	11:36	3420	9860	5260	8300	26840	3380	10300	5640	9800	29120	55960	3	tan/tri-axle longlog	2.44	2.44	2.44		5.55	6.71	3.51	1.37	n/a	1.42	41
1063/106	808	B-train	23/Jan	11:49	2660	9020	7600	7780	27060	2780	10160	8880	9380	31200	58260	808	tan/tan B-train	2.44	2.59	2.59		5.55	4.40	7.31	1.37	1.37	1.37	42
1065/106	223	tri/tri pole	23/Jan	11:58	3640	13960	10960	0	28560	3640	13920	14000	0	31560	60120	223	tri/tri pole	2.59	2.59	n/a		5.23	7.36	n/a	1.37	1.37	n/a	43
1068/106	818	tan/s-jp/ta	23/Jan	12:15	3360	9980	4620	8240	26200	3260	9900	5420	10040	28620	54820	818	tan/s-jp/tan pole	2.44	2.44	2.44		5.04	3.75	6.17	1.37	n/a	1.37	44
1070/107	243	tri/tri pole	23/Jan	12:21	3540	12640	11180	0	27360	3740	13600	13520	0	30860	58220	243	tri/tri pole	2.59	2.59	n/a		5.23	7.44	n/a	1.37	1.37	n/a	45
1072/107	872	tan/s-jp/ta	23/Jan	12:25	3300	12260	4400	10640	30600	3260	11560	4600	11100	30520	61120	872	tan/s-jp/tan pole	2.59	2.59	2.44		5.19	3.14	7.32	1.37	n/a	1.37	46
1074/107	699	tan/tri ser	23/Jan	12:29	3260	10580	12400	0	26240	3040	9840	13340	0	26220	52460	699	tan/tri semi	2.44	2.59	n/a		5.10	7.89	n/a	1.37	1.37	n/a	47
1078/107	396	tan/s-jp/ta	23/Jan	12:45	3000	8220	4500	7520	23240	3240	8880	4800	10860	27780	51020	396	tan/s-jp/tan pole	2.44	2.44	2.44		5.47	3.62	6.07	1.37	n/a	1.37	48
1080/108	174	tri/tri pole	23/Jan	12:53	3680	13540	11860	0	29080	3640	15640	12100	0	31380	60460	174	tri/tri pole	2.59	2.59	n/a		5.23	7.64	n/a	1.37	1.37	n/a	49
	595	tan/tri ser	23/Jan	13:31	2900	9240	11160	0	23300	3040	9840	13300	0	26180	49480	595	tan/tri semi	2.44	2.59	n/a		5.22	8.23	n/a	1.42	1.42	n/a	50
	176	Super-B	23/Jan	13:45	3380	8440	10060	7180	29060	3020	9540	10940	8000	31500	60560	176	Super-B	2.44	2.59	2.59		4.87	6.27	5.00	1.37	1.37	1.37	51
1084/108	809	tan/tri pol	23/Jan	14:16	3040	10120	11600	0	24760	3000	10180	12640	0	25820	50580	809	tan/tri pole	2.44	2.59	2.59		5.20	9.03	n/a	1.37	1.37	n/a	52
1086/108	228	tri/tri pole	23/Jan	14:20	3740	12860	11540	0	28140	3600	13320	13740	0	30660	58800	228	tri/tri pole	2.59	2.59	n/a		5.23	7.47	n/a	1.37	1.37	n/a	53
1090/109	807	tan/tan-jp	23/Jan	14:38	2860	9260	9020	7380	28520	2920	8600	9260	10000	30780	59300	807	tan/tan-jp/tan pole	2.59	2.59	2.44		5.63	5.12	5.41	1.37	1.37	1.37	54
1094/109	29	tan/tri-axl	23/Jan	14:55	2940	10020	5640	8700	27300	2980	9700	5040	10000	27720	55020	29	tan/tri-axle longlog	2.44	2.59	2.59		5.57	6.72	3.69	1.37	n/a	1.37	55
1096/109	838	tan/tri pol	23/Jan	14:57	3060	9500	11820	0	24380	3060	10120	13100	0	26280	50660	838	tan/tri pole	2.44	2.59	n/a		5.77	7.78	n/a	1.37	1.37	n/a	56
1100/110	844	tan/tri pol	23/Jan	15:12	3080	9300	11600	0	23980	2900	9180	13300	0	25380	49360	844	tan/tri pole	2.44	2.59	n/a		5.25	7.89	n/a	1.37	1.37	n/a	57

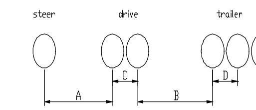
(ALL THE SAME AS THOSE FOR KAMLOOPS DATA)



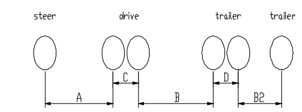
tan/s-jp/tan pole **or** **tan/triaxle trailer** **tan/tan pole**



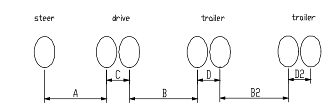
tri/tri pole **Super B-train**



tan/tri semi **or** **tan/tri pole** **tan/s-jp/tan pole/s**



tan/tan pole/s-dog



tan/tan-jp/tan pole **or** **B-train**

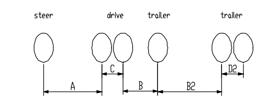
Off-highway haul
Location: Okanogan Falls
Participants: Weyerhaeuser, OK. Falls
Truckmake: various
Configuration: various

Axle-group weights

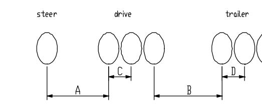
		Config.			Left Weight (kg)						Right Weight (kg)						
pic#	Truck No	Type	Date	Time	L Steer	L Drive	L Trailer	L Trailer2	L Trailer3	L Total	R Steer	R Drive	R Trailer	RTrailer2	RTrailer3	R Total	TOTAL
	816	tan/tri pc	22/Jan	12:28	3280	13780	13360	0	0	30420	3400	15340	14780	0	0	33520	63940
	808	tan/tan B	22/Jan	12:52	2700	9840	8280	8640	0	29460	2820	10460	9000	9540	0	31820	61280
	872	tan/s-jp/t	22/Jan	13:14	3260	13620	4800	10240	0	31920	3240	12740	4860	10620	0	31460	63380
	813	tri/tri pole	22/Jan	14:00	3360	14680	11680	0	0	29720	3480	19280	14920	0	0	37680	67400
	908	tan/tan p	22/Jan	14:40	3200	11940	7760	0	0	22900	3140	10640	7420	0	0	21200	44100
	812	tan/s-jp/t	22/Jan	14:51	3500	11400	4320	8700	4740	32660	3420	13380	5000	9600	4900	36300	68960
	898	tan/s-jp/t	22/Jan	15:53	2960	10300	6920	6780	0	26960	3000	10280	6060	8100	0	27440	54400
	849	tan/s-jp/t	22/Jan	16:04	3360	14220	4340	8560	3460	33940	3200	12620	4020	10040	4060	33940	67880
	817	tan/s-jp/t	22/Jan	16:06	3740	12460	3720	8340	4060	32320	3860	14260	6340	10380	4880	39720	72040
	816	tan/tri pc	22/Jan	16:23	3420	15380	12580	0	0	31380	3560	16340	13260	0	0	33160	64540
	20	tan/s-jp/t	22/Jan	16:31	3380	15840	4600	8620	0	32440	3200	14920	4700	10800	0	33620	66060
	831	tan/tri-ax	23/Jan	7:26	3160	13480	6000	8760	0	31400	3080	13760	5200	10920	0	32960	64360
	872	tan/s-jp/t	23/Jan	7:47	3340	14000	5860	10420	0	33620	3300	13060	4940	11300	0	32600	66220
	898	tan/s-jp/t	23/Jan	9:11	2940	10560	6200	6560	0	26260	2920	9940	6140	7500	0	26500	52760
	812	tan/s-jp/t	23/Jan	10:58	3600	12020	4580	8440	4420	33060	3560	13140	4940	10000	5060	36700	69760
	817	tan/s-jp/t	23/Jan	11:02	3720	13380	4480	8240	4100	33920	3600	13200	5240	8580	4280	34900	68820
	813	tri/tri pole	23/Jan	11:14	3520	17320	10820	0	0	31660	3540	18660	12940	0	0	35140	66800
	908	tan/tan p	23/Jan	11:27	3140	10920	6860	0	0	20920	3540	12200	9180	0	0	24920	45840
1061/10	816	tan/tri pc	23/Jan	11:46	3460	14540	11320	0	0	29320	3440	16800	15100	0	0	35340	64660
1076/10	834	tan/tan p	23/Jan	12:41	2680	11840	11460	4300	0	30280	2840	12380	12020	4660	0	31900	62180
1082/10	831	tan/tri-ax	23/Jan	12:58	3160	11780	5640	8160	0	28740	3060	12620	4660	9700	0	30040	58780
	898	tan/s-jp/t	23/Jan	13:27	3000	10600	6680	7060	0	27340	2980	10400	6880	8660	0	28920	56260
1088/10	854	tri/tri pole	23/Jan	14:24	3660	16800	12180	0	0	32640	3440	15520	13100	0	0	32060	64700
1092/10	812	tan/s-jp/t	23/Jan	14:50	3560	11500	4600	8260	4440	32360	3520	13500	5020	9380	4680	36100	68460
1098/10	817	tan/s-jp/t	23/Jan	15:10	3660	12420	4640	9960	4940	35620	3480	12320	4740	9780	4820	35140	70760
1102/11	846	tan/s-jp/t	23/Jan	15:21	3020	12140	4380	9740	0	29280	3320	12320	5320	13600	0	34560	63840
1104/11	813	tri/tri pole	23/Jan	15:27	3640	16740	10560	0	0	30940	3640	19320	13580	0	0	36540	67480
1106/11	877	tan/tan-jp	23/Jan	15:30	2560	9240	8620	8300	0	28720	2560	9740	9840	8600	0	30740	59460
																	63741
																	5992.6
																	0.094

Width Dimensions **(m)** drive & trailer; Inter-group Spacing **(m)**; Axle-group Spread **(m)**

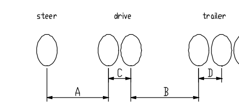
		Steer	Drive	Trailer	Trailer2	Trailer3								
		Overall	Overall	Overall	Overall	Overall	str-drv	drv-trlr	trlr1-trlr2	trlr2-trlr3	Drive	1stTrailer	2ndTrailer	
Truck No	Type	Width	Width	Width	Width	Width	A	B	B2	B3	C	D	D2	
816	tan/tri pole	2.44	2.59	n/a			5.08	8.54	n/a		1.37	1.37	n/a	1
808	B-train	2.44	2.59	2.59			5.55	4.40	7.32		1.37	1.37	1.37	2
872	tan/s-jp/tan pole	2.59	2.59	2.44			5.22	3.05	8.42		1.42	n/a	1.37	3
813	tri/tri pole	2.59	2.59	n/a			5.23	7.71	n/a		1.37	1.37	1.37	4
908	tan/tan pole	2.44	2.44	n/a			5.10	7.75	n/a		1.42	1.37	n/a	5
812	tan/s-jp/tan pole/s	2.44	2.59	2.44	2.44		5.15	3.05	4.80	3.67	1.37	n/a	1.37	6
898	tan/s-jp/tan pole	2.44	2.44	2.44			5.15	3.61	6.78		1.37	n/a	1.37	7
849	tan/s-jp/tan pole/s	2.44	2.44	2.44	2.44		5.30	2.97	3.93	3.74	1.37	n/a	1.37	8
817	tan/s-jp/tan pole/s	2.59	2.44	2.59	2.44		5.19	3.00	5.19	3.64	1.37	n/a	1.37	9
816	tan/tri pole	2.44	2.59	n/a			5.12	8.49	n/a		1.37	1.37	n/a	10
20	tan/s-jp/tan pole	2.44	2.44	2.44			5.52	2.94	5.52		1.37	n/a	1.37	11
831	tan/tri-axle longlo	2.44	2.59	2.59			5.11	5.17	3.95		1.37	n/a	1.37	12
872	tan/s-jp/tan pole	2.59	2.59	2.44			5.19	3.14	7.32		1.37	n/a	1.37	13
898	tan/s-jp/tan pole	2.44	2.44	2.44			5.15	3.61	6.78		1.37	n/a	1.37	14
812	tan/s-jp/tan pole/s	2.44	2.59	2.44	2.44		5.15	3.05	5.39	3.67	1.37	n/a	1.37	15
817	tan/s-jp/tan pole/s	2.59	2.44	2.59	2.44		5.19	3.00	5.19	3.64	1.37	n/a	1.37	16
813	tri/tri pole	2.59	2.59	n/a			5.23	7.71	n/a		1.37	1.37	1.37	17
908	tan/tan pole	2.44	2.44	n/a			5.10	7.75	n/a		1.42	1.37	n/a	18
816	tan/tri pole	2.44	2.59	n/a			5.08	8.54	n/a		1.37	1.37	n/a	19
834	tan/tan pole/s-dog	2.44	2.44	2.44										20
831	tan/tri-axle longlo	2.44	2.59	2.59			5.11	5.17	3.95		1.37	n/a	1.37	21
898	tan/s-jp/tan pole	2.44	2.44	2.44			5.15	3.61	6.78		1.37	n/a	1.37	22
854	tri/tri pole	2.44	2.59	n/a			5.23		n/a		1.37	1.37	n/a	23
812	tan/s-jp/tan pole/s	2.44	2.59	2.44	2.44		5.15	3.05	5.39	3.67	1.37	n/a	1.37	24
817	tan/s-jp/tan pole/s	2.59	2.44	2.59	2.44		5.15	3.05	5.39	3.67	1.37	n/a	1.37	25
846	tan/s-jp/tan pole	2.44	2.59	2.59										26
813	tri/tri pole	2.59	2.59	n/a			5.23	7.71	n/a		1.37	1.37	1.37	27
877	tan/tan-jp/tan pole	2.44	2.59	2.44			5.19	5.39	4.81		1.37	1.37	1.37	28



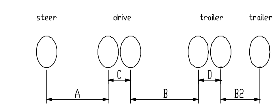
tan/s-jp/tan pole or **tan/triaxle trailer** — **tan/tan pole**



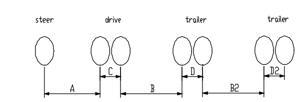
tri/tri pole — **Super B-train**



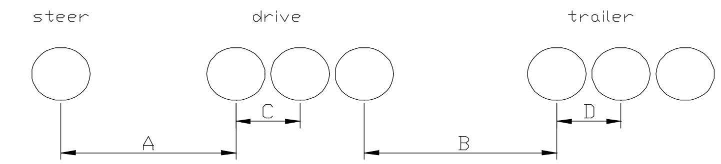
tan/tri semi or **tan/tri pole** — **tan/s-jp/tan pole/s-dog**



tan/tan pole/s-dog



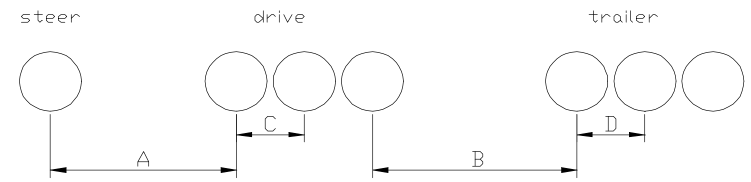
tan/tan-jp/tan po or **B-train**

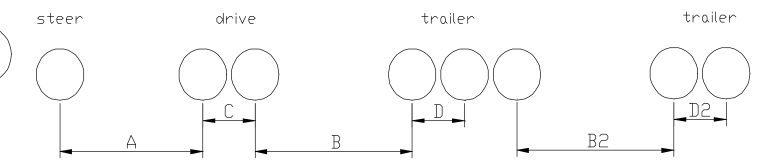


Off-highway haul dimensions and configuration type listed on sheet 2
All trucks sampled were 5 to 7-axle **highway type** truck / pole trailer configurations
40 Location: Fraser Lake — Participants: West Fraser, Fraser Lake Sawmills
samples

pic #	Truck No	Date	Time	Left axle group weights (kg) L Steer	L Drive	L Trailer	L Total	Right axle group weights (kg) R Steer	R Drive	R Trailer	R Total	OTAL (kg)
	644	29/Jan	1:52	3260	16240	14540	34040	3200	15600	13100	31900	65940
	621	29/Jan	2:11	2960	16860	11500	31320	3080	17500	11760	32340	63660
	640	29/Jan	2:18	3380	17840	13680	34900	3220	18180	11160	32560	67460
	933	29/Jan	2:25	4140	18360	15880	38380	5100	20260	16660	42020	80400
	623	29/Jan	2:29	3600	18380	12780	34760	3480	16400	11440	31320	66080
	783	29/Jan	2:40	3480	18760	14840	37080	3220	14240	13960	31420	68500
	404	29/Jan	2:44	3100	17180	13580	33860	2760	17980	12380	33120	66980
	381	29/Jan	2:52	3540	17360	15560	36460	3240	14680	13900	31820	68280
	635	29/Jan	2:52	3020	19760	14360	37140	2860	15660	13340	31860	69000
	629	29/Jan	3:00	3500	18780	13620	35900	3640	17420	12680	33740	69640
	566	29/Jan	3:00	3720	19560	18560	41840	3800	21340	13960	39100	80940
	786	29/Jan	3:05	3540	15640	11800	30980	3460	16180	10860	30500	61480
	385	29/Jan	3:07	3680	19800	15500	38980	3480	19560	13280	36320	75300
	788	29/Jan	3:18	3320	16640	16980	36940	3360	17100	14480	34940	71880
	697	29/Jan	3:20	3240	15360	12060	30660	3080	13260	12120	28460	59120
	713	29/Jan	3:23	4380	20600	15560	40540	4240	18820	16180	39240	79780
	787	29/Jan	3:26	3320	17320	15260	35900	3160	16800	10740	30700	66600
	600	29/Jan	3:40	3660	16540	16960	37160	3540	15340	14620	33500	70660
	617	29/Jan	3:45	3620	18900	11700	34220	3260	17140	10320	30720	64940
	880	29/Jan	3:51	3060	17060	14520	34640	3280	20160	11860	35300	69940
	710	29/Jan	3:54		20520	15180			17940	13980		
	789	29/Jan	3:57	3440	16580	15160	35180	3420	17600	13000	34020	69200
	888	29/Jan	4:08	3120	18460	12000	33580	3080	17460	11680	32220	65800
	383	29/Jan	4:11	3240	19920	13820	36980	2980	15980	12120	31080	68060
	632	29/Jan	4:17	3980	19520	14240	37740	4140	20020	13020	37180	74920
	785	29/Jan	4:33	3300	16680	11280	31260	3580	16060	10000	29640	60900
	805	29/Jan	4:37	3040	18600	15440	37080	3020	16700	17100	36820	73900
	766	29/Jan	4:41	3400	18280	12380	34060	3560	20260	13120	36940	71000
	632	29/Jan	4:43	3020	16780	17620	37420	2920	15000	14120	32040	69460
1170/117	713	30/Jan	9:00	4080	16180	14260	34520	4020	16180	15520	35720	70240
1172/117	789	30/Jan	9:08	3360	15520	14800	33680	3280	16700	12900	32880	66560
1174/117	111	30/Jan	9:15	3160	15320	15860	34340	3420	17200	12020	32640	66980
1176/117	805	30/Jan	9:24	3140	17820	14880	35840	3180	16900	15580	35660	71500
1178/117	880	30/Jan	9:32	3120	17780	17060	37960	3100	16680	15180	34960	72920
1180/118	624	30/Jan	9:51	3340	17000	14940	35280	3320	16200	12180	31700	66980
1182/118	632	30/Jan	9:58	3980	16560	16000	36540	4000	16860	15800	36660	73200
1184/118	785	30/Jan	10:13	3220	15440	14380	33040	3560	13200	13560	30320	63360
1186/118	710	30/Jan	10:16	3720	18420	16100	38240	3440	20040	13640	37120	75360
1188/118	933	30/Jan	10:18	4660	19440	14500	38600	5400	18360	16340	40100	78700
1190/119	629	30/Jan	10:20	3500	18180	16800	38480	3580	17040	15000	35620	74100
1192/119	706	30/Jan	10:26	4020	17540	15920	37480	3740	17480	12500	33720	71200
1194/119	632	30/Jan	10:34	3060	15520	16480	35060	2960	16280	14100	33340	68400
1196/119	635	30/Jan	10:39	2940	17220	13540	33700	2800	16160	12080	31040	64740
1198/99/:	600	30/Jan	11:06	3860	18060	13380	35300	3600	16320	14360	34280	69580
1201/02/(	617	30/Jan	11:30	3720	20340	11560	35620	3320	19240	10900	33460	69080
												69607
												4978
												0.072

Truck No	Width Dimensions (m) Steer Overall Width	Drive Overall Width	Trailer Overall Width	Inter-group Spacing (m) str-drv A	drv-trlr B	Axle-group Spread (m) Drive C	Trailer D	Type
644								
621	2.25	2.44	2.44	5.50	9.01	1.44	1.37	tan/tan pole
640	2.30	2.44	2.44	5.5	9.45	1.45	1.37	tan/tan pole
933		2.60	2.6	5.2	8.24	1.39	1.37	tri/tri pole
623	2.25	2.44	2.44	5.52	9.69	1.37	1.37	tan/tan pole
783	2.25	2.44	2.44	5.5	7.42	1.37	1.37	tan/tan pole
404	2.25	2.44	2.44	5.58	10.38	1.34	1.37	tan/tan pole
381	2.25	2.44	2.44	5.2	8.34	1.32	1.37	tan/tri pole
635	2.25	2.44	2.44	5.56	9.28	1.33	1.42	tan/tan pole
566		2.60	2.6	5.23	8.15	1.37	1.37	tri/tri pole
629	2.28	2.60	2.6	5.23	8.16	1.37	1.37	tri/tri pole
786	2.25	2.44	2.44	5.54	8.27	1.37	1.41	tan/tan pole
385		2.60	2.6	5.23	7.98	1.37	1.37	tri/tri pole
788	2.22	2.44	2.44	5.56	9.26	1.4	1.4	tan/tan pole
697		2.44	2.44	5.51	8.36	1.41	1.4	tan/tan pole
713	2.25	2.60	2.6	5.23	7.45	1.37	1.37	tri/tri pole
787	2.25	2.44	2.44	5.63	8.86	1.37	1.39	tan/tan pole
600		2.44	2.6	5.54	7.67	1.37	1.37	tan/tri pole
617	2.25	2.44	2.44	5.31	10.09	1.41	1.37	tan/tan pole
880	2.25	2.44	2.6	5.6	8.68	1.4	1.4	tan/tri pole
710		2.60	2.6	5.23	7.68	1.37	1.37	tri/tri pole
789	2.25	2.44	2.44	5.59	8.22	1.41	1.37	tan/tan pole
888	2.23	2.44	2.44	5.5	10.26	1.4	1.39	tan/tan pole
383		2.44	2.44	5.36	9.8	1.37	1.37	tan/tan pole
632	2.27	2.60	2.6	5.23	7.54	1.37	1.37	tri/tri pole
785	2.25	2.44	2.44	5.58	8.71	1.37	1.44	tan/tan pole
805		2.44	2.6	5.52	7.77	1.4	1.42	tan/tri pole
766		2.60	2.6	5.23	8.39	1.37	1.37	tri/tri pole
632		2.44	2.44	5.2	7.43	1.37	1.37	tan/tan pole





Off-highway haul

All trucks sampled were 5 to7-axle **highway type** trucks with pole trailers

Location:Mackenzie   Participants: Abitibi-Consolidated, MacKenzie

				Left axle group weights (kg)					Right axle group weights (kg)					
pic #	Truck No	Date	Time	L Steer	L Drive	L Trailer	L Trailer2	L Total	R Steer	R Drive	R Trailer	R Trailer2	R Total	TOTAL (kg)
1205	48	31/Jan	10:08	3020	16720	15500	n/a	35240	3120	16920	13500	n/a	33540	68780
1206	690	31/Jan	11:31	3180	12960	13760	n/a	29900	2980	13400	13820	n/a	30200	60100
1207	105	31/Jan	12:06	3060	17260	16340	n/a	36660	3100	17240	15060	n/a	35400	72060
1208	25	31/Jan	12:15	3000	13380	15700	n/a	32080	3080	13760	16100	n/a	32940	65020
1209	45	31/Jan	12:17		18080	15880	n/a			16760	17720	n/a		
1210	125	31/Jan	12:20	3040	13920	19300	n/a	36260	2820	13380	16960	n/a	33160	69420
1211	20	31/Jan	12:30	3380	16980	15640	n/a	36000	3320	18100	14540	n/a	35960	71960
1212	924	31/Jan	12:31	2840		18700	n/a		2960		17220	n/a		
1213	4	31/Jan	12:38	3040	15340	20040	n/a	38420	3160	17620	22060	n/a	42840	81260
1214	8	31/Jan	12:40	3160	15320	19500	n/a	37980	3060	16020	19980	n/a	39060	77040
1215	134	31/Jan	12:50	2940	18140	21560	n/a	42640	3140	16100	21520	n/a	40760	83400
1216	109	31/Jan	13:09	3280	14420	18840	n/a	36540	3180	15380	18660	n/a	37220	73760
1217	885	31/Jan	13:20	3160	15460	14360	n/a	32980	3440	18520	17460	n/a	39420	72400
1218	94	31/Jan	13:23	3040	14700	20300	n/a	38040	2960	14360	19160	n/a	36480	74520
1219	6	31/Jan	13:28	3540	14360	18160	n/a	36060	3520	14220	16960	n/a	34700	70760
1220	3	31/Jan	13:30	3340	15900	19960	n/a	39200	2980	15440	20400	n/a	38820	78020
1221	14	31/Jan	14:02	2900	12680	16920	n/a	32500	2840	12700	17000	n/a	32540	65040
n/a	12	31/Jan	14:05	3240	14060	18340	n/a	35640	3240	14600	18340	n/a	36180	71820
n/a	49	31/Jan	14:08	2880	13660	20340	n/a	36880	2920	13900	19060	n/a	35880	72760
1222	146	31/Jan	14:18	3180	15360	20620	n/a	39160	3020	15540	19640	n/a	38200	77360
1223	70	31/Jan	14:20	3340	18340	14640	n/a	36320	3180	17640	15600	n/a	36420	72740
1224	19	31/Jan	14:32	3220	14040	20320	n/a	37580	3040	14560	20780	n/a	38380	75960
1225	99	31/Jan	14:42	3080	13000	20560	n/a	36640	2820	15560	20500	n/a	38880	75520
1226	104	31/Jan	15:01	3240	14020	20700	n/a	37960	3040	15200	20480	n/a	38720	76680
1227	9	31/Jan	15:08	2920	12900	18580	n/a	34400	3000	13520	18840	n/a	35360	69760
1228	46	31/Jan	15:14	3180	10900	18580	n/a	32660	2940	12540	21000	n/a	36480	69140
1229	134	31/Jan	15:24	3200	13300	16780	n/a	33280	3140	13620	19180	n/a	35940	69220
1230	98	31/Jan	15:38	3040	19220	12020	n/a	34280	3220	20760	14080	n/a	38060	72340
1231	47	31/Jan	15:46	3440	15780	13040	n/a	32260	3520	17780	15520	n/a	36820	69080
1232	5	31/Jan	16:03	3180	12000	14540	10680	40400	3280	12460	14660	9980	40380	80780
1233	142	31/Jan	16:08	3380	12980	18700	n/a	35060	3480	15360	18820	n/a	37660	72720
1234	690	31/Jan	16:25	3200	13360	14520	n/a	31080	2980	14460	14380	n/a	31820	62900
n/a	48	31/Jan	16:45	2880	15640	15420	n/a	33940	2980	18160	13960	n/a	35100	69040

72302	
5228	
0.072	
83400	1.153
60100	0.831

	Steer	Drive	Trailer	Trailer2							
	Overall	Overall	Overall	Overall	str-drv	drv-trlr	trlr1-trlr2	Drive	Trailer	Trailer2	
Truck No	Width	Width	Width	Width	A	B	B2	C	D	D2	Type
48		2.44	2.44	n/a	5.39	8.05	n/a	1.37	1.42	n/a	tan/tan
690		2.44	2.60	n/a	5.50	8.61	n/a	1.37	1.37	n/a	tan/tri semi
105		2.44	2.60	n/a	5.48	9.42	n/a	1.42	1.37	n/a	tan/tan pole
25		2.44	2.60	n/a	5.52	9.28	n/a	1.43	1.37	n/a	tan/tri semi
45		2.44	2.60	n/a	5.15	9.07	n/a	1.43	1.37	n/a	tan/tan pole
125		2.44	2.60	n/a	5.48	8.27	n/a	1.43	1.37	n/a	tan/tri semi
20		2.44	2.60	n/a	5.53	9.05	n/a	1.40	1.42	n/a	tan/tan pole
924		2.44	2.60	n/a	5.52	9.28	n/a	1.42	1.37	n/a	tan/tri semi
4		2.44	2.60	n/a	5.42	8.86	n/a	1.40	1.64	n/a	tan/tri semi
8		2.44	2.60	n/a	5.43	8.32	n/a	1.37	1.42	n/a	tan/tri semi
134		2.44	2.60	n/a	5.38	9.37	n/a	1.45	1.28	n/a	tan/tri semi
109		2.60	2.60	n/a	5.16	8.62	n/a	1.39	1.40	n/a	tan/tri semi
885		2.44	2.44	n/a	5.40	8.47	n/a	1.37	1.40	n/a	tan/tan pole
94		2.60	2.60	n/a	5.52	8.68	n/a	1.40	1.40	n/a	tan/tri semi
6		2.60	2.60	n/a	5.48	8.85	n/a	1.37	1.37	n/a	tan/tri semi
3		2.60	2.60	n/a	5.52	8.96	n/a	1.37	1.64	n/a	tan/tri semi
14		2.44	2.60	n/a	5.08	9.26	n/a	1.37	1.27	n/a	tan/tri semi
12		2.44	2.60	n/a	5.39	9.09	n/a	1.50	1.24	n/a	tan/tri semi
49		2.44	2.60	n/a	5.47	9.38	n/a	1.40	1.60	n/a	tan/tri semi
146		2.44	2.60	n/a	5.03	8.85	n/a	1.24	1.37	n/a	tan/tri semi
70		2.44	2.44	n/a	5.22	8.51	n/a	1.37	1.37	n/a	tan/tan pole
19		2.44	2.60	n/a	5.41	8.38	n/a	1.40	1.80	n/a	tan/tri semi
99		2.44	2.60	n/a	5.17	8.79	n/a	1.40	1.40	n/a	tan/tri semi
104		2.44	2.60	n/a	5.56	8.48	n/a	1.39	1.51	n/a	tan/tri semi
9		2.60	2.60	n/a	5.53	9.13	n/a	1.37	1.33	n/a	tan/tri semi
46		2.44	2.60	n/a	4.85	9.19	n/a	1.37	1.25	n/a	tan/tri semi
134		2.60	2.60	n/a	5.17	9.62	n/a	1.40	1.26	n/a	tan/tri semi
98		2.44	2.60	n/a	5.09	9.42	n/a	1.41	1.33	n/a	tan/tan pole
47	2.27	2.44	2.44	n/a	5.12	8.57	n/a	1.42	1.52	n/a	tan/tan pole
5		2.44	2.59	2.59	4.82	6.38	7.04	1.38	1.37	1.42	Super B-train
142		2.44	2.60	n/a	5.07	8.58	n/a	1.50	1.37	n/a	tan/tri semi
690		2.44	2.60	n/a	5.50	8.69	n/a	1.41	1.37	n/a	tan/tri semi

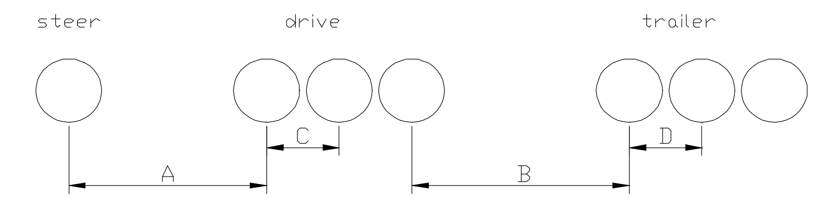
Off-highway haul

All trucks sampled were 7-axle **highway type** truck tridem-drive with tridem pole trailer

40 Location: Menzies Bay, North Island Dryland Sort Participants: Weyerhaeuser, North Island

samples Truckmake: Kenworth

			Left axle group weights (kg)				Right axle group weights (kg)				
Truck No	Date	Time	L Steer	L Drive	L Trailer	L Total	R Steer	R Drive	R Trailer	R Total	OTAL (kg)
515	15/Jan	13:09	3740	15480	13720	32940	3320	10680	11420	25420	58360
518	15/Jan	12:31	3700	14280	14100	32080	3340	11300	12600	27240	59320
245	15/Jan	13:48	3580	15420	13620	32620	3360	13760	11060	28180	60800
521	15/Jan	14:18	3800	16380	13560	33740	3220	13860	10640	27720	61460
518	15/Jan	14:27	3680	15700	13500	32880	3220	12560	12040	27820	60700
516	15/Jan	14:38	3700	15040	11180	29920	3440	12120	10100	25660	55580
521	15/Jan	13:04	3940	14360	15820	34120	3260	16260	9340	28860	62980
515	15/Jan	14:04	3780	15900	13820	33500	3140	10700	12280	26120	59620
521	15/Jan	15:36	3640	15400	13120	32160	3260	12480	10000	25740	57900
518	15/Jan	15:25	3720	15140	13320	32180	3400	12360	10260	26020	58200
518	15/Jan	16:25	3760	16100	12260	32120	3380	12820	11380	27580	59700
245	15/Jan	16:27	3560	14780	10740	29080	3420	13120	10400	26940	56020
516	15/Jan	16:00	3600	13520	12340	29460	3380	12480	10340	26200	55660
515	15/Jan	15:08	3860	15920	14120	33900	3180	12360	12680	28220	62120
245	16/Jan	8:46	3500	15480	13380	32360	3220	12340	12200	27760	60120
521	16/Jan	9:05	3640	13820	13600	31060	3220	11660	10120	25000	56060
515	16/Jan	9:06	3600	16300	14800	34700	3300	13420	10980	27700	62400
516	16/Jan	9:22	3660	14300	12840	30800	3420	12820	8540	24780	55580
245	16/Jan	9:32	3720	15860	12560	32140	3400	13500	11960	28860	61000
523	16/Jan	9:57	3720	15600	13340	32660	3360	12120	11400	26880	59540
521	16/Jan	10:09	3680	14320	13960	31960	3140	13040	9120	25300	57260
515	16/Jan	10:15	3780	15200	12920	31900	3300	12860	11560	27720	59620
516	16/Jan	10:30	3600	13860	12740	30200	3260	11760	10620	25640	55840
245	16/Jan	10:54	3600	15740	12140	31480	3400	12940	11800	28140	59620
523	16/Jan	10:58	3600	14880	12120	30600	3340	11600	9960	24900	55500
515	16/Jan	11:15	3880	15580	12840	32300	3260	12640	10540	26440	58740
521	16/Jan	11:19	3780	16900	14600	35280	3020	12820	11440	27280	62560
515	16/Jan	13:19	3840	15200	12820	31860	3180	10960	11380	25520	57380
516	16/Jan	13:30	3620	14680	12080	30380	3360	12360	9160	24880	55260
523	16/Jan	13:45	3820	15100	13960	32880	3320	13520	9820	26660	59540
516	16/Jan	14:33	3700	15080	12300	31080	3360	11360	9120	23840	54920
523	16/Jan	14:35	3540	14960	12060	30560	3380	14020	10640	28040	58600
245	16/Jan	15:00	3680	16420	11940	32040	3380	11860	11440	26680	58720
521	16/Jan	15:20	3760	17480	14920	36160	3460	14200	11220	28880	65040
516	16/Jan	11:50	3740	13980	13760	31480	3500	12860	10380	26740	58220
523	16/Jan	12:11	3640	15220	12980	31840	3280	12180	11920	27380	59220
245	16/Jan	12:18	3560	14460	12620	30640	3440	13780	11460	28680	59320
521	16/Jan	13:05	3660	15140	12620	31420	3240	12020	9700	24960	56380
515	16/Jan	12:26	3980	17920	13400	35300	3360	14200	10840	28400	63700
523	16/Jan	13:00	3700	16460	14180	34340	3520	13540	11060	28120	62460
											59026
											2586
											0.044



Width Dimensions (m)

Inter-group Spacing (m) **Axle-group Spread (m)**

	Steer		Drive			Trailer							
	Tire	Overall	Tire	Dual	Overall	Tire	Dual	Overall	str-drv	drv-trlr	Drive	Trailer	
Truck No	Width	Width	Width	Width	Width	Width	Width	Width	A	B	C	D	Type
All other units identical													
H518	0.23	2.30	0.21	0.55	2.56	0.21	0.55	2.54	5.90	7.80	1.40	1.40	Tri/Tri

-dog

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Appendix C

FERIC Field Note No: Loading and Trucking-58

"Popular B.C. Vehicle Configurations for Hauling Full Length Logs: Maximum Weights and Dimensions Guide"

FOREST ENGINEERING RESEARCH INSTITUTE OF CANADA
Western Division

INSTITUT CANADIEN DE RECHERCHES EN GÉNIE FORESTIER
Division de l'ouest

April 1998

Field Note No: Loading and Trucking-58
Previous Reference No: Loading and Trucking-48, 59

POPULAR B.C. VEHICLE CONFIGURATIONS FOR HAULING FULL LENGTH LOGS: MAXIMUM WEIGHTS AND DIMENSIONS GUIDE, Effective October 1997

This is a basic guide to maximum weights and dimensions for **on-highway** vehicle configurations hauling full length logs and operating under the British Columbia Commercial Transport Act Regulations. **It does not replace government regulations.** An additional guide is available covering combinations for hauling-cut-to-length logs.[1]

Weight Allowances. Unless highway signage restricts vehicles by weight, all log-hauling vehicles may exceed their allowable gross weights by the allowances indicated below, *with the exception that no allowance is applicable to the drive axle group of a tridem log truck when pulling a tridem pole trailer unless the tridem-tridem interaxle spacing is 7.0 m or greater.*

Summer (Mar. 2 to Nov. 30). Single axle (not including steering axle) 500 kg. Tandem or tridem axle groups, 1100 kg. Maximum for a vehicle combination, 1500 kg.

Winter (Dec. 1 to Mar. 1). Single axle (not including steering axle) 500 kg. Tandem or tridem axle groups, 1500 kg. Maximum for a vehicle combination, 2500 kg.

All Year. The gross vehicle weight (GVW) including all applicable logging truck weight allowances must not, without a permit, exceed 63,500 kg. See also Motor Vehicle Act Reg 19.11.

Maximum dimensions common to all combinations: Height 4.15 m, width 2.6 m (mirrors not to extend more than 20 cm each side).

Legal Axle Weights for Log Truck/Pole Trailers and other Non-TAC Combinations[2]

Tandem drive log truck and tandem drive truck tractor with various trailers

- Steering axles and single axles - including an individual axle in a tandem or tridem group - up to 9100 kg, subject to max. tire loading limits.
- Tire loading limited to 110 kg/cm of nominal tire width. e.g. for typical 11R24.5 steer axle tires, 27.9 cm (11") x 110 kg/cm x 2 (tires) = 6147 kg. This is the legal steering axle load; although axle components may be rated for 9100 kg, the tires are the limiting factor in this case.
- Max. tandem axle load is 17,000 kg for common axle spreads in the range 1.2 m to 1.85 m inclusive.
- Max. tridem axle load is 24,000 kg (pole trailer only).
- Consult Regulations for load limitations on other axle groupings with spreads up to 8.0 m.

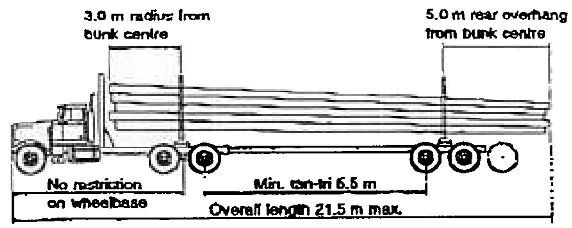
Tridem drive log trucks (Only permitted with pole trailers)

- To achieve maximum tridem drive axle load, steering axle load must be a minimum of 6100 kg.
- Maximum steering axle load is 6500 kg, or 9100 kg with a self-loader, subject to the limitation of 110 kg/cm of nominal tire width.
- Minimum steering axle tire width permitted is 315 mm (12.4") regardless of tire load capacity.
- Maximum tandem axle load (on pole trailer) is 17,000 kg and requires an axle spread of not less than 1.2 m nor more than 1.85 m.
- Maximum tridem or tridem drive axle load is 24,000 kg and requires an axle spread of not less than 2.4 m, nor more than 2.8 m for a drive group or 3.1 m for a pole trailer group.
- Adjacent axles within tandem and tridem groups must be load equalized to within 1000 kg.

TAC Combinations

The only TAC vehicle combinations that might be considered for hauling full length logs are the tandem truck tractor with a tandem or tridem semi-trailer. This guide does not cover these configurations due to their low payload capacities (typically 23,800 kg and 30,000 kg respectively) and poor off-tracking characteristics.

Tandem Log Truck/ Pole Trailer



Tridem Log Truck/Pole Trailer

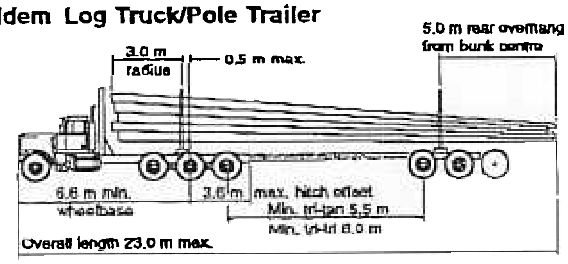


Figure 1. Maximum overall dimensions, log truck/pole trailers.

INFORMATION. The information contained in this Field Note is based on the Commercial Transport Act Regulations of the Province of British Columbia and is published solely to disseminate information to FERIC members and partners. More information may be obtained from FERIC, or the Insurance Corporation of B.C. at (250) 387-4404.

C.R. Webb P.Eng., Tranportation and Maintence

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[1] These two guides supercede FERIC's October 1995 guide, Field Note No.: Loading and Trucking - 48.

[2] Other non-TAC combinations include jeeps, dog loggers and full trailers.

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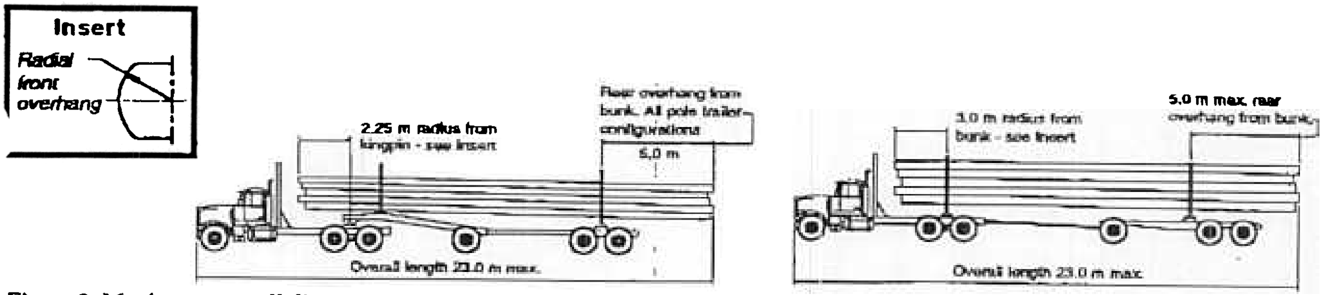
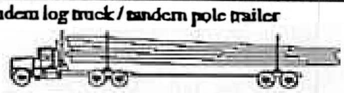
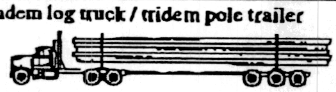
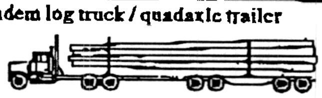
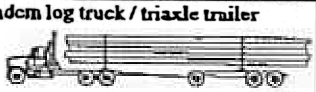
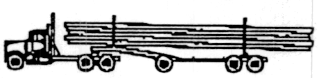
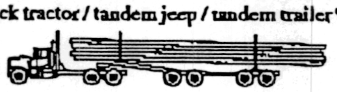
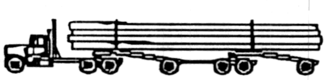


Figure 2. Maximum overall dimensions, other combinations.

Table 1. Typical B.C. Vehicle Configurations.

Configuration	Max. GVW [a] (kg)	Max.load [a]/ axle group [b] (kg)	Typical tare / max. net capacity (kg)	GVW [a] with popular 11-in. steer [d] tires (kg)	Axles (no.)	Articulation points (no.)
Tandem log truck / tandem pole trailer 	43 100	Steer: 9 100 Drive: 17 000 Trailer: 17 000	13 875 / 29 225	40 147	5	1
Tandem log truck / tridem pole trailer 	50 100	Steer: 9 100 Drive: 17 000 Trailer: 24 000	15 700 / 34 400	47 147	6	1
Tridem log truck / tandem pole trailer 	47 500	Steer: 6 500 [c] Drive: 24 000 Trailer: 17 000	16 960 / 30 540	47 500	6	1
Tridem log truck / tridem pole trailer 	54 500	Steer: 6 500 [c] Drive: 24 000 Trailer: 24 000	18 780 / 35 720	54 500	7	1
Tandem log truck / quadaxle trailer 	60 100	Steer: 9 100 Drive: 17 000 Tandem: 17 000 each	17 000 / 43 100	57 147	7	2
Tandem log truck / triaxle trailer 	52 200	Steer: 9 100 Drive: 17 000 Single: 9 100 Tandem: 17 000	15 700 / 36 500	49 247	6	2
Truck tractor / jeep / tandem pole trailer [e] 	52 200	Steer: 9 100 Drive: 17 000 Jeep: 9 100 Trailer: 17 000	16 700 / 35 500	49 247	6	2
Dog logger [c] 	52 200	Steer: 9 100 Drive: 17 000 Tandem: 17 000 Dog: 9 100	16 500 / 35 700	49 247	6	2
Truck tractor / tandem jeep / tandem trailer [e] 	60 100	Steer: 9 100 Drive: 17 000 Jeep: 17 000 Trailer: 17 000	19 400 / 40 700	57 147	7	2
Truck tractor / jeep / dog logger [c] 	61 300	Steer: 9 100 Drive 17 000 Jeep: 9 100 Tandem: 17 000 Dog: 9 100	19 400 / 41 900	58 347	7	3
Truck tractor / jeep / triaxle trailer 	61 300	Steer: 9 100 Drive: 17 000 Jeep: 9 100 Single: 9 100 Tandem: 17 000	18 600 / 42 700	58 347	7	3

[a] Weights do not include allowances, see notes for specification. [b] Restrictions apply to axle group and steering axle loading, see text for clarification. [c] Legal steering axle load can be increased to 9100 kg for configurations equipped with a self loader. [d] Steer axle load reduced to 6147 kg with 11" tires on all combinations, except to 6500 kg with 315 mm tires on tridem log trucks. All other axles at maximum allowable loads. [e] Tridem pole trailer not to be used in combination with jeeps or dogloggers.