

ALBERTA SCALING MANUAL

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4.0 Mass Scaling

4.1 Overview

Mass scaling (commonly referred to as weigh scaling) has been an approved scale method in Alberta for several years as an alternative method to scaling each log. Mass scaling procedures are to be conducted in accordance with the *Scaling Regulation (A/R 195/2002)*.

Mass scaling is an estimate of the volume as not every harvested log or tree is measured. The method uses a sampling system in which the load weights are obtained for all harvest sources within a defined scaling population. As each of the loads is weighed sample loads are selected at random. These sample loads are then scaled to obtain a ratio of weight to volume. This ratio is commonly referred to as a conversion factor. Using the conversion factor, the total weight of the wood from a harvest source is converted to a cubic metre volume. It must be kept in mind that measurement accuracy of the sample scale loads in mass scaling is very critical as a small number of randomly selected loads represent a much larger population of loads.

4.2 Responsibilities and Compliance

4.2.1 Scale Operator

The scale site holder is responsible for:

- Weigh scale installation and maintenance.
- Ensuring the scale is compliant with all pertinent legislation.
- Establishing and complying with a statistically defensible sample plan.
- Monitor sample plan activity and submit for adjustments as needed.
- Accurate load tracking and weighing done in accordance with the plan.
- Ensuring random sample load selection is done in a manner approved by the department and in accordance with the approved sample plan.
- That measurement of sample scale loads are done by the scale methodology approved for the site and is conducted by a valid permitted scaler.
- Accurate consolidation of load weight and sample scale data.
- The submission of scale data to the department is done in the form and timeline as required by legislation.*
- All scale data is kept for a minimum of five (5) years and is to be made available to an inspecting forest officer upon request.

* Scale data is to be submitted to the department within 21 days following the month of hauling or scaling activity. The exception will be those scale sites whose dues payment is based on a payment period. In such instances, the requirement shall be to submit the scale data within 21 days following the end of each payment period. Any scale site receiving in excess of 70 000 cubic metres annually is required to submit in an approved electronic format.

4.2.2 Public Land and Forest Division

The Public Land and Forest Division (P.L.F.D.) is responsible for:

- Establishing legislation, policy, and standards under which scaling shall be conducted.
- Authorizing scale sites.
- Examination and licensing of scalers.
- Approval of sample plans.
- Assess compliance through:
 - Site inspections
 - Check scaling
 - Audits

4.3 Approval of Mass Scaling Operations

Before a company uses weigh scales as a method of measuring Crown timber, PLFD must approve the weigh scale, facilities, and the method of dues payment.

4.4 Weigh Scale Specifications

The company is responsible for the installation and regular maintenance of the weigh scales, cabin, and fixtures.

The capacity and length of the weigh scales must be sufficient to determine the mass of the loaded vehicle in one operation.

All weigh scales must conform to the Federal Weights and Measures Act, Regulations and Ministerial Specifications. Note in particular that special conditions apply if the scale is to be unattended.

Unattended Vehicle Scales

65. An unattended vehicle scale shall be used only if it is part of an installation that has:
- (a) an automatic means to indicate to a vehicle operator that the indicating element of the scale has returned to zero and that the operator may drive onto the weighbridge;
 - (b) a printer that automatically prints, for each weighing, a ticket bearing the information required by section 66; and
 - (c) an automatic means of preventing weight indications and printing of a ticket unless
 - (i) the scale has returned to zero prior to weighing a vehicle, and
 - (ii) the load being weighed is fully supported on the weighbridge.

A scale may have been previously certified as a attended scale however if the scale becomes unattended then the above requirements must be met and the scale needs to be recertified as an unattended scale. Contact Measurements Canada or your accredited mass scale service provider for application of this legislation.

Scales must have a printer attached. Printers should be capable of printing on the department's Forest Products Form TM 9 to reduce the possibility of error.

The weigh scales are to be so located that trucks can be weighed loaded and weighed empty immediately after unloading. The weigh scale cabin must be equipped with heat, light and other facilities necessary to ensure proper operation of the scale software and components.

4.5 Weigh Scale Maintenance

Scale testing and calibration by certified personnel will be required at a minimum of once annually. In addition, proper operational procedures and scale maintenance shall be done to ensure accurate load weight capture. The following information is a guide to ensure the weigh scales are always operating properly. Good monitoring procedures are necessary to prevent any malfunction that could result in improper weights, loss of time, and money.

Someone should be assigned to monitor and maintain the weigh scale.

Only qualified personnel should do adjustments to the scale, printer or weighing mechanism.

When weighing is to be commenced, the scales must read zero weight. This may require a scale reset. These resets may be required more frequently during weather conditions that could influence the weight of the deck by accumulations of snow or mud. Balancing procedures for individual scales can be obtained from the manufacturer and should always be kept on hand.

The scale attendant should always keep the deck clear. An accumulation of snow or mud can influence the weight and may damage the weigh scales. The scale attendant should check periodically to ensure the platform is free and not bound by stones or other foreign objects against the sides of the pit or at the end of the scales. Any such constricting material should be removed. A scale, which does not reset, may be a result of accumulated debris or snow the weight of which is greater than 2% of the scale capacity.

The scale attendant should be alert for unreasonable values, which would indicate a problem with the scales. By being familiar with average truck weights and average load weights, the scale attendant will notice when readings are questionable. In winter, the scale attendant should watch for water freezing on the mechanism. This is a common problem and will usually cause recorded weights to be significantly lower than normal. Steam cleaning should be a part of the regular maintenance of the scale particularly during potential melt and freeze situations.

Locking handles on mechanical scales should always be in the locked position when the scales are not in use, or when vehicles are moving onto or leaving the platform. The only time the scales should be unlocked is during the actual weighing process.

An electronic scale indicator should be stored and used in temperature-controlled areas according to the manufacturer's instructions. It should also have a separate grounded power source. The scale indications should not fluctuate more than one or two graduations when the scale is in use.

Section tests should be part of the regular checks of a scale. These checks should occur not less than once per week. A heavy, short truck or loader (minimum weight of 25% of the scale capacity) should be weighed at several positions (length and cross wise) on each segment of the scale deck and the readings compared. The scale should be checked when the difference between readings exceeds 0.10% (1 kg per 1000 kg) and/or when the scale does not return to zero.

If the scale attendant suspects that something is wrong, he should promptly inform his supervisor.

4.5.1 Section Testing

A weigh scale is constructed with load cells spread out beneath the scale deck. The load cells register pressure and must all be correctly functioning to obtain the proper weight. A section test will indicate whether the scale is weighing with precision at all points on the scale and will provide indication of any malfunctioning of a load cell or lever.

1. The test is conducted using at least the minimum recommended weight of 20,000 kg. A loader is a good choice.
2. Zero the scale; the test vehicle proceeds until just fully on the scale. Record the weight.
3. The test vehicle is moved about three vehicle lengths in the same direction of travel. The weight is recorded. Repeat until the end of the scale is reached and the weight recorded.
4. Turn the vehicle around and travelling in the opposite direction repeat the procedure.
5. The difference between the highest and lowest readings is recorded.

To determine whether the recorded maximum weight difference is acceptable the table of CLASS III HD In-Service Limits of Error table from Measurements Canada is used. A part except from the tables shows:

Verification Scale Interval is 10 kg (standard used for logging trucks scales)

<u>Test Weight</u>	<u>Tolerance</u>
5,000 – 13,000 kg	20 kg
13,000 - 20, 000 kg	30 kg
21,000 - 29,000 kg	40 kg

Example:	23,200	23,210	23,230	23,190
	23,220	23,180	23,290	23,200

Maximum weight difference is $23,290 - 23,200 = 90$ kg.

Error exceeds the 40 kg tolerance so scale maintenance is required.

4.6 Procedures in Case of Weigh Scale Problems

In the event of a scale breakdown the local PLFD is to be contacted. Depending on the nature of the breakdown and the potential down period considerations may include suspension of further weighing or the use of an alternate scale if available.

A basic printer breakdown may be resolved by hand printing and initialing the weights by the scale attendant.

In addition, rather than shut down the complete hauling operation, the following procedures may be applied:

- (1) Average the 10 loads each truck hauled just before the scale breakdown. Use this truck's average as the weight for any of its loads not weighed because of the breakdown.
- (2) Cancel any sample loads that were selected during the breakdown period. These loads will be subject to replacement when the scale is working again. Notify the local PLFD office so they are prepared to help in selecting replacement loads.
- (3) Have the breakdown attended to as quickly as possible.

4.7 Mass Scale Authorization, Suspension, and Cancellation

A scale site authorization may be suspended or cancelled by the Provincial Timber Scaling Supervisor if the scale and operation/maintenance of such is not compliant with any of the above requirements.

4.8 Objectives of the Mass Scaling System

The accuracy of the volume estimate for weigh scaling is based on the sampling error objective. In Alberta the sample error target is set at 5%. This means that 95% of the time, the total estimated volume for the timber year should be within 5% of the true volume.

In order to meet these objectives timber harvest sources are stratified into scaling populations with targets established to meet a statistical sample.

4.9 Mass Scaling Sampling Plans

A key element for mass scaling is the sampling plan. A plan shall comprise of one or more scaling populations. This plan is a legislated requirement under the Scaling Regulation and must be submitted for all timber to be delivered to an authorized mass scale site.

An accurate sampling plan is essential to obtaining reliable harvest volumes, which are used for timber sustainability and crown dues payment. The results must be unbiased and statistically defensible. Accurate haul estimates are very important in ensuring sufficient samples are obtained. An over estimate of the haul will invariably result in under-sampling.

4.9.1 Timber Year

Mass scaling data is consolidated over a 12-month period of time. This period is commonly referred to as the timber year and runs May 1 to April 30th of the following year

4.9.2 Scaling Populations

A scaling population defines an area to be sample scaled. The objective for establishing scaling populations is to combine harvest sources of similar value or characteristics and by doing so less sampling effort is required to obtain a statistical sample.

Key Points

- Population numbers are a three digit number series changing each timber year. The combination of the mill number and population number make each unique.
- Populations are groupings of harvest sources having common species and timber conditions, and which are perceived to have similar weight to volume relationships.
- The utilization standard must be the same for all harvest sources to be included in the scaling population.
- Populations having fewer than 100 loads (other than fixed ratio) should be avoided whenever possible.

- Scaling populations should not be established for the purpose of tracking volumes for contractor payment and are not essential to tracking volumes by working circles.
- Any populations proposing the use of shared sample data between mills requires prior approval before delivery and a signed agreement.
- Populations shall be so established as to meet at least a minimum statistical sample target. There will be consideration for reduced sample targets where the risk is low as a result of few loads to be hauled, and the combination of any species, condition, or utilization standard is unique to the receiving mill and consequently the timber cannot be grouped into another scaling population.

Variables, which impact the weight to volume ratio and which should be taken into consideration when establishing populations, include:

Species - the wood density varies with each species and in particular between the coniferous and deciduous groupings.

Growth rate - fast growing coniferous trees on good sites (lower elevation, fertile) are generally heavier than slower growing trees of the same species.

Age - young trees with a high proportion of sapwood are usually heavier than older trees which has proportionately less sapwood.

Moisture content - has the greatest influence on the weight of green logs, examples include: fire-kill vs green, summer vs winter logging, and short term decked vs long term.

Logging method – Some logging methods will remove more branching and bark material. Short wood timber may have lower ratios than tree length timber due to increased moisture loss.

Defect – A higher ratio results where the timber weight is constant but a lower net volume is experienced as a result of defect.

Log size – larger logs have proportionately less bark percent than smaller timber.

Once the sample plan is approved, departmental staff will enter the values into the Timber Production and Revenue System (TPRS). This information will serve as an edit check against scale data submitted to TPRS

4.9.3 Establishment of Scaling Populations

The creation of an accurate sample plan is the responsibility of both the department and the scale site holder. The scale site holder must initially provide the best possible haul estimates for the upcoming timber year and use reasonable approaches for stratifying into scaling populations. Information sources for population setups should include a review of annual operating plans, woodlands projected purchase volumes, reviews of historical sampling results, and information on stockpiled volumes.

Scaling populations must be established and approved prior to the delivery of the timber to the mill.

Departmental staff is responsible for ensuring haul estimates are reasonable, stratification is appropriate, and that the plans meet the required sample targets.

If there is failure to consistently provide accurate haul targets or meet the required sample targets the PLFD may take action such as:

- Adjust sample intensities.
- Disallow the use of a fixed ratio for which sample scaling was required.
- Suspend/cancel the scale site authorization.

The following form TM262 is what is used for a scaling population.



Alberta
SUSTAINABLE RESOURCE
DEVELOPMENT

FOREST BUSINESS BRANCH

TM 262 (Rev. 09/02)

Scaling Population

MILL NAME: _____ POPULATION #: _____

MILL NUMBER: _____

UTILIZATION STANDARD (butt/top): _____ ESTIMATED # OF LOADS: _____

MINIMUM TOP DIAMETER SCALED: _____ COEFFICIENT OF VARIATION %: _____

PURCHASED WOOD: Y N SAMPLE INTENSITY %: _____

FIXED RATIO: Y N

Complete this section only for populations using fixed conversions, otherwise proceed to SPECIES/... section

RATIO:

NETSCALES: correspond
netscale value
with species
using the
number in
brackets

(1) <input style="width: 80px;" type="text"/>	(2) <input style="width: 80px;" type="text"/>	(3) <input style="width: 80px;" type="text"/>	(4) <input style="width: 80px;" type="text"/>
(5) <input style="width: 80px;" type="text"/>	(6) <input style="width: 80px;" type="text"/>	(7) <input style="width: 80px;" type="text"/>	(8) <input style="width: 80px;" type="text"/>
(9) <input style="width: 80px;" type="text"/>	(10) <input style="width: 80px;" type="text"/>	(11) <input style="width: 80px;" type="text"/>	(12) <input style="width: 80px;" type="text"/>

SPECIES / CONDITION / PRODUCT DESIGNATION: Codes must be consistent on TM262, TM32, TM44 and TM7

(1) <input style="width: 80px;" type="text"/>	(2) <input style="width: 80px;" type="text"/>	(3) <input style="width: 80px;" type="text"/>	(4) <input style="width: 80px;" type="text"/>
(5) <input style="width: 80px;" type="text"/>	(6) <input style="width: 80px;" type="text"/>	(7) <input style="width: 80px;" type="text"/>	(8) <input style="width: 80px;" type="text"/>
(9) <input style="width: 80px;" type="text"/>	(10) <input style="width: 80px;" type="text"/>	(11) <input style="width: 80px;" type="text"/>	(12) <input style="width: 80px;" type="text"/>

LIST DISPOSITIONS FOR THIS POPULATION OR CHOOSE: Private Land Salvage

FOREST OFFICER (print) _____

FOREST OFFICER (sign) _____ DATE: _____

COMPANY REP (print) _____

COMPANY REP (sign) _____ DATE: _____

Figure 4.1 TM262

1. MILL NAME – the name of the operation receiving and processing the timber.
2. MILL NUMBER – the number assigned to the operator by the PLFD.
3. POPULATION – the population number. An operator may assign any number to the population, as long as the current timber year's numbering sequence is followed. For example:
 - 2002/2003 timber year = 100 population series
 - 2003/2004 timber year = 200 population series
 - 2004/2005 timber year = 300 population series
4. UTILIZATION STANDARD – the utilization standard for the dispositions included on the population. All dispositions included on a population must have the same utilization standard; otherwise a separate population must be established.
5. MINIMUM TOP DIAMETER SCALED – the top diameter to which the mill regularly processes. An operator must always scale to the minimum top as dictated by the utilization standard, but when logs are regularly harvested to a diameter less than the minimum top, the actual processing top will be recorded in this space.
6. ESTIMATED NUMBER OF LOADS – the best estimate of the anticipated number of loads, based on operating plans, woodlands projected purchase volumes, reviews of historical sampling results, and information on stockpiled volumes.
7. COEFFICIENT OF VARIATION (CV) – the coefficient of variation is either assumed to be the default value of 8.00%, but when historical sample information is available (ie: previous timber year's sample data from the same dispositions) a known CV can be calculated by conducting a mass scale analysis (see section 4.9.4).
8. SAMPLE INTENSITY – the sample intensity as determined by the formula detailed in appendix 3.

9. FIXED RATIO SECTION – this section is to be completed when a fixed ratio is being used. The ratio is recorded in the appropriate space, and the NETSCALES are recorded in the numbered spaces, which correspond to the SP CD PR code fields (also numbered). Fixed ratios are expressed as a kg/m³ value, and a percent breakdown of SP CD PR composition is also given. To calculate the net scales, the following procedure is followed:

1. Divide the ratio into 100 000kg
2. The resultant net scale is then further divided into the relative percent composition for each SP CD PR code.

For example: if a ratio of 791.517kg/m³ is given with product code breakdowns of SP GR 01 – 82%, and SP GR 06 – 18%, then:

1. $100\,000\text{kg} \div 791.517\text{kg/m}^3 = 126.340\text{m}^3$
2. 82% of 126.340 = 103.608m³ net scale for SP GR 01
18% of 126.340 = 22.732m³ net scale for SP GR 06

10. SP CD PR SECTION – the species, condition, and product codes being scaled are recorded (corresponding to the net scales when a fixed ratio is being used). No other codes may be reported other than those indicated on the TM262.

11. HARVEST AUTHORITY SECTION – the dispositions/ sources included in the population are listed.

12. SIGNATURES – no population is considered valid until signed and dated by both the operator and a PLFD representative. Populations that are submitted without being signed and dated will not be entered into TPRS, and will be sent back to the operator. Failure to have valid, approved populations established before hauling may result in penalty action.

4.9.4 Mass Scale Analysis

A mass scale analysis (MSA) is a simple statistical evaluation of mass-scale data, and it is a valuable process used when establishing populations. The results of the MSA show the variability between sample loads, and this data is used to determine required sample intensity minimums.

When determining sampling intensities, the coefficient of variation (CV) is a key value. When no historical data exists to analyze, a default CV value of 8.00% is used in the calculations detailed below.

A coefficient of variation is an expression, in the form of a ratio of standard deviation to the mean, of the variability among units.

Based on previous sample load data, the following three values are calculated:

- Average volume per load
- Standard Deviation
- Coefficient of variation

These values are then used in the sampling intensity formula:

$$n = \frac{(N \times t^2) \times (C^2)}{(N \times E^2) + (t^2 \times C^2)}$$

Where: N = number of loads

n = number of samples from previous year

t = 2 (probability)

E = 5 (allowable sampling error)

C = coefficient of variation (%)

A detailed example of a mass scale analysis and the resultant sample intensity can be found in appendix 3.

4.9.5 Sample Plan Revision

An ongoing evaluation of the actual hauling relative to the sample plan is required. In the event the forecasted haul is anticipated to change then a review of the existing sampling plan is necessary. The review shall be conducted with the input of the scale site holder and PLFD to come to a final resolution. It must be kept in mind that statistical sample must be obtained and that such samples are to be fully representative of the population. The review of a plan may result in one of the following options and require a resubmission of the TM262 form where appropriate:

- No change, if sufficient representative samples will still be obtained under a revised haul forecast.
- Revised sample intensities.
- New populations.

Where revisions are required to scaling population a new TM262 form shall be submitted.

Procedures for Population Sample Intensity Adjustment

These procedures detail the process whereby sample intensities are adjusted during the hauling period to account for load over or under estimations.

Example 1 – Load over-estimation

TM262 information:

Original load estimation = 1500

Original sample intensity = 1% (one sample for every 100 loads)

Resultant samples = 15

After 400 loads (and therefore 4 samples) it is determined that only a total of 800 loads will be delivered under the population. If sampling continues at 1% then the population would be under sampled with only 8 samples. In order to achieve the sample target of 15 samples the sample intensity has to be adjusted.

A further 11 samples have to be obtained in the projected remaining 400 loads.

$(11/400)*100 = 2.75\%$ sampling intensity for the remainder of the haul.

2.75% sampling intensity for 400 loads = 1 sample for every 36 loads.

To document the change in sampling intensity, and to obtain authorization to do so, the PLFD district office must be contacted and a new TM262 completed.

The new TM262 will show the following information. Please note that the TM262 will not reflect the sample intensity actually used for the remainder of the haul (2.75% in this example). The intensity indicated on the form reflects only the overall sampling level, and the intensity used for the remainder of the haul must be noted on the TM262 as a comment.

Revised load estimation = 800

Revised sample intensity = $(15/800)*100 = 1.88\%$ (one sample for every 53 loads)

Resultant samples = 15

By adjusting the actual sample intensity, the required number of samples is obtained. By adjusting the TM262 to reflect the overall sampling, it is easy to evaluate scaling performance after the fact.

Example 2 – Load under-estimation

TM262 information:

Original load estimation = 1500

Original sample intensity = 1% (one sample for every 100 loads)

Resultant samples = 15

After 1000 loads have been hauled (and therefore 10 samples) it is determined that a total of 2500 loads will be delivered under this population rather than the original forecast of 1500. If sampling continues at 1%, the population would be sampled above the intended target.

In order to achieve the required 15 samples in this case, the sample intensity has to be adjusted. 10 samples have been obtained in 1000 loads therefore 5 additional samples have to be obtained in the remaining 1500 loads (it is very important to remember that the samples must be taken at intervals throughout the haul).

$(5/1500)*100 = 0.33\%$ sampling intensity for the remainder of the haul.

0.33% sampling intensity for 1500 loads = 1 sample for every 300 loads.

To document the change in sampling intensity, and to obtain authorization to do so, the district PLFD office must be contacted and a new TM262 completed.

The new TM262 will show the following information. Please note that the TM262 will not reflect the sample intensity actually used for the remainder of the haul (2.75% in this example). The intensity indicated on the form reflects only the overall sampling level, and the intensity used for the remainder of the haul must be noted on the TM262 as a comment.

Revised load estimation = 2500

Revised sample intensity = $(15/2500) * 100 = 0.6\%$ (one sample for every 167 loads)

Resultant samples = 15

Once again, by adjusting the actual sample intensity, the required number of samples is obtained. By adjusting the TM262 to reflect the overall sampling, it is easy to evaluate scaling performance after the fact.

4.10 Weighing Procedure

The company must conduct their weighing of forest products such that there is minimum chance of error when capturing the weight and haul form information. The department supports the use of full time scale attendants and software controls.

All loads must be weighed when entering the yard and the trucks re-weighed immediately after they are unloaded. The exception will be for those operations approved under procedures for "weigh scaling for smaller timber operations" (Appendix 2).

To provide positive identification of the source, the properly completed haul form such as an approved Forest Products Haul Form TM9 must accompany each load.

Information that must be captured on each weight slip (Form TM9 or other approved form) includes the following minimum information:

- Date of Haul
- Species and Product Hauled
- Harvest Authority
- Vendor and Receiver
- Vehicle identification
- Load number

Printed:

- Gross weight of loaded vehicle
- Tare weight of vehicle
- Calculated Net weight of load
- Population

Any deviation from having this information on the completed haul forms must be approved by the department.

4.10.1 Unit of Measure

The weigh scales will record the mass of the load in kilograms to the nearest 10. This weight may include bark, moisture, rot and foreign material.

The net mass will be converted to a cubic metre volume of sound wood by applying sample scale data or fixed conversions.

4.11 Accounting of Loads

4.11.1 General

The information for each load of timber must be accurately accounted for by either using the appropriate departmental form, form equivalent or through computer software record. Alternatives to departmental forms must contain the same information and have the ability to consolidate the data in the same manner. Additional information such as cutblock identifiers may be included ie: haul distance modifiers.

Loads from each harvest source must be recorded separately from other sources of wood. This applies even when sample loads are chosen from several sources and combined to get one conversion (i.e., combined population).

Load numbers should be unique within a scaling population and each one to be numbered consecutively from the beginning of the timber year (i.e., from May 1). There is however some load tracking software, which numbers otherwise. This is acceptable but there is some potential to end up with duplicate sample load numbers.

Each record of load information is assigned to a scaling population, which has been established prior to the wood arriving at the mill. The information is compiled monthly and submitted to the department using the proper form or through electronic submission to the Timber Production and Revenue System (TPRS).

4.11.2 Mass Scale Load Record

The TM35 "Weight Scale Load Record Sheet" (Refer to figure 4.3 a, b, c, d) is provided by the PLFD for manual compilation of the weights for each harvest source. The header information for the sheet must contain:

- Disposition or harvest source (where cutting is from a source other than a crown timber disposition)
- Sub-Group -Used for FMA's working circles or equivalent identifiers.
- Disposition Holder or owner of non-disposition timber.
- Mill – Name of mill location receiving the timber
- Mill number – Number assigned by the department to receiving mill.

For each load, the following information is recorded on the Weight Scale Record Sheet (Form TM35) or other approved record or form:

- Date of delivery
- Load number
- Form TM9 number
- Net weight
- Designated sample loads

A separate Form TM35 is required for each source per month. If more than one sheet is required for any one month, the sheet is numbered (i.e., sheet 1, 2, 3, etc.). Be sure to fill in the header information for each TM35 sheet used. TPRS users with several sources of private and salvage do not need to report each individual land location for private wood or salvage authority. It is acceptable to simply roll up the information and report as salvage or private. A TPRS client must however keep in their possession and make available for departmental inspection, the individual harvest source records used in the roll up.

At the end of the month, each column is totaled. The calculated total net weight and the number of loads delivered are transferred to a corresponding Weight Scale Volume Compilation Sheet (Form TM44) or other approved form. The TM35 forms are attached to the TM44 and submitted to the department. In those instances where computer software is used to track the load information then the software must have the ability to capture individual load information as stated, tag the header and scaling population information, and then roll up for monthly reporting at the harvest source level. (Refer to TPRS entry).

4.12 Sample Load Selection

Sample scale loads will be selected in a stratified random manner throughout the haul. This means that a sufficient number of loads shall be selected within a fixed interval of deliveries and of which the interval shall not exceed 100 where the sample percent is 1% or greater. The selection shall be such that it is at the intensity pre-determined by the sample plan, and the selection of any sample load must not be known in advance of arrival at the weigh scale. The selection may be accomplished by:

1. Weight Scale Sample cards (Form TM86) prepared by PLFD. These are pre-determined random numbers for the selection of sample loads.
2. Secure random load selection software as approved by the PLFD.

The identity and integrity of each sample load selected must be preserved to facilitate scaling or check scaling. The scale site holder must therefore ensure the loads are kept fully intact, properly identified, and placed in an area to facilitate the scale.

Occasionally a sample load is lost or mixed up, and in such circumstances, a replacement load will be chosen at random, as arranged with a local PLFD representative.

4.12.1 Identification of Loads

In order to identify sample scale loads for weigh scale operations, two or three sample-load identification cards, TM 38's are attached to the butts of logs in a load. These cards shall be attached at the weigh-scale, and they will provide at least the following information: load or pile number, disposition or source, and, after scaling, the date the load was scaled.

Below is an example of a sample card, exhibiting the minimum amount of information, and the bright colour that should be used for easy visibility.

Sample Load

Load No. _____

Form TM9 No. _____

Source _____

Date Weighed _____

Figure 4.2 Sample Load Identifier

A mill may develop their own customized sample load cards and/or load identification procedures.

4.13 Sub Sampling

There is significant effort to conduct 100% scale where there are a substantial number of small stems in a scale load.

The department will give consideration to use of a sub-sampling method where the receiving scale site provides a statistical alternative to scaling all pieces in the load.

Any alternative methodology must achieve an error level of +/- 5% at a 95% probability and shall only be applicable to those loads, which have in excess of 600 pieces. Proposals must provide historical proof of achieving these results.

Methods, which may be considered, include simple random sampling, systematic sampling, or 3-P sampling.

4.14 Calculating Mass Scale Volumes

4.14.1 General

The end product of the load weighing and sample load measurement processes is the consolidation of the data to determine the monthly delivered volume. It is this volume for which the receiving mill is ultimately accountable for and under specific circumstances, the volume on which crown dues will be based on for the month.

The departmental form used for this compilation record is a TM44 "Weigh Scale Volume Compilation Sheet. The Weight Scale Volume Compilation Sheet (Form TM44) is compiled monthly however the information for each month is carried forward through to the end of the haul within the current timber year. This accumulation process is consistent with the sample plan setup and thus by the end of the haul season provides the best accurate haul estimates through monthly corrections. In other words, the volume estimates improve with the addition of sample scale data when added to the accumulated net load weight data.

Note: There is often significant variation of weight to volume relationships between each year. This is often as a result of variations of annual precipitation or climatic conditions. Thus, the TM44 process starts fresh each new timber year and for the first month of haul in each timber year there should be no entries from prior months.

4.14.2 Form TM44 – Weigh Scale Volume Compilation Sheet

The Timber Production and Revenue System (TPRS) provides facilities to generate the mass scale compilation however the department supports the use of independent software to replicate the process and provide further assurances of the correct TPRS end result. Users, which are not on line with TPRS, are required to submit the departmental TM44 form or an approved equivalent. The following information describes the information required on the TM44 form as well as the calculation processes involved. TPRS uses the same computation procedures.

- A separate TM44 is required for each crown timber disposition source (excepting LTP's)
- Other sources of timber (LTP, private, salvage) must be labeled separately but may be reported on a single TM44. Note that each data source is however entered separately into TPRS such that there is a record of volume for each.

- In TPRS, a single TM44 is generated for each monthly reported scaling population but displays volumes for all timber sources for which hauling was reported for that month. The system is actually calculating an internal TM44 for each source by using the information accumulated for that exact source and summing the total. Consequently, there is a difference of total volume if one were to compare a TM44 having more than one source (carries totals forward for all sources regardless of being inactive for the month) than for a TPRS TM44, which calculates, based only on those sources reporting for the month. If hauling is completed from a specific crown timber disposition prior to having all the sample loads obtained for the scaling population (under which the source load weight data was reported) then an adjustment is necessary. (See TPRS year end adjustments). These adjustments do not apply to LTPs, private or salvage.

4.14.2.1 Header Information

The TM44 header information must be filled in for all completed TM44's. The information required is:

- Disposition or harvest source (where cutting is from a source other than a crown timber disposition).
- Sub-Group - Used for FMA's working circles or equivalent identifiers.
- Mill number - Number assigned by the department to the receiving mill.
- Month - Month of reportable activity.
- Sample Population – Assigned stratum (See section 4.9).
- Disposition Holder or owner of non-disposition timber.
- Mill location - Location of mill receiving the timber.
- Contractor or Vendor – Field completed where someone other than the owner of the timber does the delivery or purchase arrangement.
- Sample cards – A sample card reference where departmental sample card selectors are used.

4.14.2.2 TM44 Calculation Processes

The TM44 calculation process is undertaken as follows:

1. The net load weigh information is transferred from each column of the TM35 for the month and entered under the Summary of Weights column on the TM44.
2. All measured sample scale loads for the month and population are entered in the Sample Load Ledger fields. The sample load number and its corresponding net weight are entered under the columns thus labeled. In the Net Scales columns the Species, Condition, and Product (SPCDPR) combinations that occur in the sample loads are put in as scale volume headers as well as on Line 8. Up to three different combinations may be used on a single TM44 sheet. A second TM44 sheet must be used where more than three combinations occur in the sample scale loads. Under each SPCDPR code the corresponding sample scale volume (3 decimal places) for each load is entered.
3. Line 1 (This Months Totals) - The current month totals for the number of loads, total net weight, total net weight of the sample loads, and the sample scale volumes are calculated and placed on this line.
4. Line 2 (Last Mths Accumulated Totals) - This line represents the accumulation of load weight and sample scale data from prior months. This line is blank for the first month of haul in the timber year. In subsequent months the values entered here are from Line 3 of the preceding month.
5. Line 3 (This Mths Accumulated Totals) - This line is the sum of lines 2 and 3. It is the record of the total load weight (A), sample load weight (B), and sample scale volumes(C,D,E) that has occurred to-date.
6. Line 4 (Multiplier) – The relationship between the weight of all the loads and the weight of the sample scale loads. It is calculated by dividing the total load net weight from line 3 (box A) by the total sample load net weight in line 3 (box B). The answer is rounded to 3 decimals.

7. Line 5 (Total Converted Volume) - To calculate the total volume estimated to be delivered to-date, multiply each sample scale volume for each SPCDPR (boxes C,D, and E) by the multiplier calculated in step 7. The results are rounded to the nearest whole number and entered on line 5 under the appropriate SPCDPR.
8. Line 6 (Last Months Converted Volume) - The total converted volume in line 5 is the total for the year to date. To obtain the current month's volume, enter the previous month's converted volume from line 6 of the previous month's sheet. Note that in Figure 4.3 there is no last month's converted volume since this was the first month that wood was delivered. However, in Figure 4.3, the volume from the previous month (line 5 of Figure 4.3) is brought forward.
9. Line 7 (This Months Volume) - To obtain the current month's weight scale volumes, subtract line 6 from line 5. These volumes are recorded on the Monthly Timber Return (Form TM7) to calculate dues and reforestation charges.
10. Ratio – This value is the relationship of the weight of the sample scale loads (weighed in kilograms) to the scaled volume (cubic metres) of the same loads. The result is the average weight of one cubic metre of wood and changes monthly with the addition of sample scale loads. The value is calculated by using the accumulated sample load weight in box B and dividing this number by the sum of the sample scale volumes found in boxes C, D, and E.

First Month Reporting

Figure 4.3a – TM35 Load Record Sheet for First Month of Haul

TM 35 WEIGH SCALE - LOAD RECORD SHEET															
PAGE <u> 1 </u> of <u> 1 </u>															
DISPOSITION : <u>CTLA090044</u>				Sub <u> </u>		Disposition Holder: <u>ATHA LOGGING</u>				Month <u>200212</u>					
SOURCE (IF NON-DISP.): <u> </u>				Mill <u>ATHA LOG</u>				Mill Number <u>M000999</u>							
DAY	LOAD	FORM 9 NUMBER	NET WEIGHT	DAY	LOAD	FORM 9 NUMBER	NET WEIGHT	DAY	LOAD	FORM 9 NUMBER	NET WEIGHT	DAY	LOAD	FORM 9 NUMBER	NET WEIGHT
9	1	A971624	43500	13	26	A971649	43300	18	51	A971674	43660				
	2	A971625	45040		27	A971650	47820		52	A971675	36400				
	3	A971626	43240		28	A971651	46120		53	A971676	37640				
	4	A971627	43860		29	A971652	46440		54	A971677	50720				
10	5	A971628	41040		30	A971653	47560								
	6	A971629	39160		31	A971654	45340								
	7	A971630	46980		32	A971655	42480								
	8	A971631	43700		33	A971656	42400								
	9	A971632	35920		34	A971657	45080								
	10	A971633	46880		35	A971658	51220								
	11	A971634	41240	15	36	A971659	46960								
11	12	A971635	45120		37	A971660	42720								
	13	A971636	46840		38	A971661	31580								
	14	A971637	43400		39	A971662	39040								
	15	A971638	41880		40	A971663	39620								
	16	A971639	46720		41	A971664	37500								
	17	A971640	44540		42	A971665	41760								
12	18	A971641	45280		43	A971666	51140								
	19	A971642	52260	16	44	A971667	46420								
	20	A971643	50820		45	A971668	44080								
	21	A971644	54140		46	A971669	49540								
	22	A971645	54180		47	A971670	45480								
	23	A971646	48740		48	A971671	39140								
	24	A971647	44360		49	A971672	54320								
	25	A971648	47660		50	A971673	49260								
TOTAL No. 1			1136500	TOTAL No. 2			1116320	TOTAL No. 3			168420				

Figure 4.3b – TM44 Volume Compilation Sheet for First Month of Haul

WEIGHT SCALE - VOLUME COMPILATION SHEET												
DISPOSITION: <u>CTLA090044</u>				DISPOSITION HOLDER: <u>ATHABASCA LOGGING</u>								
SUB GROUP: <u>ATHA</u>				SOURCE (IF NON-DISP): <u>FORT MCMURRAY</u>								
MILL NUMBER: <u>M000999</u>				MILL LOCATION: <u>FORT MCMURRAY</u>								
MONTH: (YYYYMM) <u>200212</u>				CONTRACTOR OR VENDOR: <u>H00091</u>								
SAMPLE POP NO.: <u>101</u>				SAMPLE CARDS: <u>H00091</u>								
SUMMARY OF WEIGHTS					SAMPLE LOAD LEDGER							
(From Load Record)												
Total No.	Loads	Net Weight			Sample Load	Net Weight	Net Scales					
1	25	1136500			9	35920	SP/GR/01	F GR01				
2	25	1116320			38	31580	43.787	6.463				
3	4	168420			52	36400	30.753	0.237				
4							44.622					
5												
6												
7												
8												
9												
10												
1 This Months Totals		54	2421240			103900	119.162	6.700	0.000			
2 Last Mths Accumulated Totals												
3 This Mths Accumulated Totals A		A	2421240		B	103900	C	119.162	D	6.700	E	0.000
4 Multiplier							23.304					
5 Total Converted Volume							2777	156		0		
6 Last Months Converted Volume (From Line No.5 of Last Month)							2777	156		0		
7 This Months Volume							SP/GR/01	F /GR/01				
8 Designate species, condition and product												
Compiled By: <u> </u>			Date <u> </u>			Contact Phone No: <u> </u>						
Forest Officer			Date			Ratio (Line 3) = (B)/(C+D+E)			825.507			

Second Month of Reporting

Figure 4.3c – TM35 Load Record Sheet for Second Month of Haul

TM 35 WEIGH SCALE - LOAD RECORD SHEET															
DISPOSITION :		CTLA090044		Sub	Disposition Holder:				ATHA LOGGING		Month		200301		
SOURCE (IF NON-DISP.):		MILL				ATHA LOG		MILL NUMBER		M 000999					
DAY	LOAD	FORM 9 NUMBER	NET WEIGHT	DAY	LOAD	FORM 9 NUMBER	NET WEIGHT	DAY	LOAD	FORM 9 NUMBER	NET WEIGHT	DAY	LOAD	FORM 9 NUMBER	NET WEIGHT
2	55	A 971678	38520		80	A 971703	44140								
	56	A 971679	38860		81	A 971704	34220								
	57	A 971680	39400		82	A 971705	34320								
	58	A 971681	40700	8	83	A 971706	37080								
	59	A 971682	37840		84	A 971707	40800								
	60	A 971683	30080		85	A 971708	29520								
	61	A 971684	36580		86	A 971709	39460								
3	62	A 971685	40060		87	A 971710	30180								
	63	A 971686	38000		88	A 971711	39820								
	64	A 971687	37320												
	65	A 971688	38580												
	66	A 971689	28400												
	67	A 971690	37380												
	68	A 971691	32160												
	69	A 971692	31040												
4	70	A 971693	33060												
	71	A 971694	34600												
	72	A 971695	33820												
	73	A 971696	30720												
	74	A 971697	37620												
6	75	A 971698	38240												
	76	A 971699	37120												
	77	A 971700	39960												
	78	A 971701	39890												
	79	A 971702	40900												
TOTAL No. 1			910850	TOTAL No. 2			329540	TOTAL No. 3			0				

Figure 4.3d – TM44 Volume Compilation Sheet for Second Month of Haul

WEIGHT SCALE - VOLUME COMPILATION SHEET											
DISPOSITION :		CTLA090044			DISPOSITION HOLDER :		ATHABASCA LOGGING				
SUB GROUP :		ATHA			SOURCE (IF NON-DISP)		FORT MCMURRAY				
MILL NUMBER :		M 000999			MILL LOCATION :		FORT MCMURRAY				
MONTH : (YYYYMM)		200301			CONTRACTOR OR VENDOR :						
SAMPLE POP NO. :		101			SAMPLE CARDS :		H00091				
SUMMARY OF WEIGHTS (From Load Record)				SAMPLE LOAD LEDGER							
Total No.	Loads	Net Weight		Sample Load	Net Weight	Net Scales					
1	25	910850		79	40900	SP/GR/01	F GR01				
2	9	329540		88	39820	48.675					
3						45.995					
4											
5											
6											
7											
8											
9											
10											
1 This Months Totals	34	1240390			80720	94.670	0.000			0.000	
2 Last Mths Accumulated Totals		2421240			103900	119.162	6.700				
3 This Mths Accumulated Totals A	A	3661630		B	184620	C	213.832	D	6.700	E	0.000
4 Multiplier				19.833							
5 Total Converted Volume						4241	133			0	
6 Last Months Converted Volume (From Line No.5 of Last Month)						2777	156				
7 This Months Volume						1464	-23			0	
8 Designate species, condition and product						SP/GR/01	F/GR/01				
Compiled By:		Date			Date		Contact Phone No:				
Forest Officer							Ratio (Line 3) = (B/(C+D+E))				
							837.157				

4.14.3 Adjustments

The combining of two or more crown timber dispositions in a single scaling population requires that all sample scale data be applied to hauling for all dispositions within the population. This is required as the targeted sample intensity for the scaling population is determined by the projected haul for all sources assigned to the population.

If hauling from one of the dispositions is completed prior to obtaining all sample loads for the population then it is necessary to make adjustments. The adjustments are automated through the Timber Production and Revenue System (TPRS) and will show in the system as volumes adjustments to the timber disposition and for each month in which hauling occurred. The adjustments are basically calculated as shown in the following example:

Figure 4.4 YEAR END ADJUSTMENT CALCULATION EXAMPLE

Month One for Disposition		LOADS		SAMPLE DATA			
This Months Totals		75	3092250	104200	120.362	6.876	
Last Mths Accumulated Totals							
This Mths Accumulated Totals	A	75	3092250	B 104200	C 120.362	D 6.876	
Multiplier				29.676			
Total Converted Volume					3572	204	
Last Months Converted Volume (From Line No.5 of Last Month)					0	0	
This Months Volume					3572	204	
Designate species, condition and product		Ratio		818.9377	SP/GR/01	F /GR/01	
Year end adjustment for each month of reporting	→	Adjustment = $-1252 * 3092250 / 4345050 =$		-891			
		Adjustment = $346 * 3092250 / 4345050 =$			246		

Month Two for Disposition		LOADS		SAMPLE DATA			
This Months Totals		32	1252800	77380	124.244	0.000	
Last Mths Accumulated Totals		75	3092250	104200	120.362	6.876	
This Mths Accumulated Totals	A	107	4345050	B 181580	C 244.606	D 6.876	
Multiplier				23.929			
Total Converted Volume					5853	165	
Last Months Converted Volume (From Line No.5 of Last Month)					3572	204	
This Months Volume					2281	39	
Designate species, condition and product		Ratio		722.0397	SP/GR/01	F /GR/01	
Year end adjustment for each month of reporting	→	Adjustment = $-1252 * 1252800 / 4345050 =$		-361			
		Adjustment = $346 * 1252800 / 4345050 =$			100		

		YEAR END SAMPLE DATA				
Total delivered weight for given scaling population and timber disposition.	→	107	4345050	B 285090	C 301.86	D 33.540
				15.241		
Calculated adjustments required	→			4601	511	
				5853	165	
				-1252	346	
Year End Ratio				850.000	SP/GR/01	F /GR/01

4.15 Fixed Conversions

Analysis of historical sample scale data may indicate a stable relationship of weight to volume over time and consequently a fixed ratio may be developed and applied in the calculation of volume. A scale site holder may not implement a fixed ratio at their site unless there is agreement to do so. This agreement shall take the form of a signed TM262 in the case of a regional fixed ratio and for a site-specific ratio, a fixed ratio agreement and the completion of a TM262.

The calculation procedures for a fixed ratio TM44 are similar to the procedures noted for a monthly rolling TM44 as noted above except that the sample scale values in boxes B to E remain constant throughout the timber year. An example of a TM44 using a fixed weight to volume ratio is shown in Figure 4.5.

Regional fixed conversions are based on rolling five-year periods. Sample scale loads will therefore be required (as per agreement) to be randomly selected, measured, and submitted to the department for annual recalculation of such fixed ratios. A scale site receiving less than 50 loads under the fixed ratio population shall obtain 1 scale load, and for any sites receiving 50 loads or greater 3 sample scale loads are required.

4.15.1 Calculating Fixed Conversion Factors

The following must be considered for establishing fixed conversions:

- (1) The variance of the weight to volume ratio should prove to be stable from year to year and not be influenced by changes in harvesting methods. The data must have been scaled by similar scale methods and to the same utilization standard.
- (2) A minimum of 75 loads spread (equal distribution) over a four-year span is required for the analysis. If there is an unequal annual distribution of samples over the period then weighing by the total delivered load weight (from which the sample scales were taken) will be necessary.
- (3) The results of the fixed conversion must be satisfactory to both the company and the Provincial Timber Scaling Supervisor.
- (4) The fixed conversion is subject to annual revision and representative sampling must occur each year to facilitate this recalculation.
- (5) Sample data such as log size, cull and species, condition and product group percentages will no longer be available. If this information is desired for other planning functions, then sampling will be necessary.

4.15.2 Short Term Conversions

Short-term conversions are used for small quantities of wood that are to be delivered, where normal sampling would not be feasible. This method should be restricted to situations where fewer than 100 loads are going to be hauled. The fixed conversion may be obtained from the previous year's data or from adjacent dispositions. Assistance in calculating and assessing fixed conversions from the Provincial Timber Scaling Supervisor.

4.15.3 Application for Fixed Ratio

Any scale site, which wishes to pursue a site specific fixed ratio, shall make application to the Timber Scaling Supervisor. The application shall provide the calculation of the overall ratio, statistics surrounding the data variance and computed ratio, and the individual scale load data summaries used in the compilation. The preferred format is an Excel spreadsheet. Fixed ratio approvals will be contingent upon strong data correlations exhibited over a period of time.

The analysis will provide the overall ratio value and the percentage by volume for each SPCDPR combination. Using this information, preset fixed values can be determined and assigned for the TM44 calculation.

4.15.4 Sample TM44 – Fixed Ratio

Figure 4.6 is an example of a completion of a TM44, which uses a fixed weight to volume ratio. The sample load data are constant values. This example also shows a TM44, which has more than source. This form of submission is acceptable where the sources of timber are private, salvage, or LTP. The volume calculated is for all timber sources indicated on the form.

Figure 4.5 TM44 Fixed Ratio Volume Compilation Sheet

WEIGHT SCALE - VOLUME COMPILATION SHEET					
DISPOSITION:			DISPOSITION HOLDER:	ATHABASCA LOGGING	
SUB GROUP:	ATHA		SOURCE (IF NON-DISP):	Various Purchases	
MILL NUMBER:	M000999		MILL LOCATION:	FORT MCMURRAY	
MONTH: (YYYYMM)	200301		CONTRACTOR OR VENDOR:		
SAMPLE POP NO.:	120		SAMPLE CARDS:	H00094	

SUMMARY OF WEIGHTS (From Load Record)						SAMPLE LOAD LEDGER					
			Net Scales								
Total No.	Loads	Net Weight	Sample Load	Net Weight	SP/GR/01	F GR01	SP/GR/06				
PLA020021	1	24	951360								
LTP0005789	2	10	386200								
SW23-48-2-W5	3	7	288540								
	4										
	5										
	6										
	7										
	8										
	9										
	10										
				FIXED RATIO							
				THESE VALUES REMAIN CONSTANT FOR THE POPULATION AND TIMBER YEAR.							
1 This Months Totals		41	1626100								
2 Last Mths Accumulated Totals											
3 This Mths Accumulated Totals	A	A	1626100	B	100000	C	89.614	D	7.342	E	26.241
4 Multiplier					16.261						
5 Total Converted Volume							1457		119		427
6 Last Months Converted Volume (From Line No.5 of Last Month)							1457		119		427
7 This Months Volume							SP/GR/01		F /GR/01		
8 Designate species, condition and product											

Compiled By:	Date	Date	Contact Phone No:
Forest Officer			Ratio (Line 3) = (B/(C+D+E)) 811.708