FRENCH'S

Scientific Timber Cruiser

A COMPENDIUM OF

Valuable Information for Cruisers or Estimators of Timber, Sawyers, Millmen or Owners of Timber Lands

PUBLISHED BY

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PREFACE

Thousands of men for centuries have desired to know the art of cruising timber, or, in other words, know to a certainty the number of feet of boards that could be sawn from the timber standing on their holdings, but up to this time there has been no "hard and fast" rule through which this knowledge might be attained.

Men have scaled the logs prior to sawing, have watched them as they were being reduced to lumber and have tallied the number of feet thereof and in time offered their services as "Timber Cruisers," and have been employed through the understanding that they were able to estimate timber, but in every instance it has been "a guess." They had no set rule by which they could demonstrate their figures.

This book will tell you how to find the number of feet of boards any tree will saw out, and by knowing the number of trees per acre, that number, times the average number of feet in a tree, will give you the number of feet per acre.

As this system is intended for the "amateur" as well as the "expert," I have endeavored to make the wording and explanations so plain that anyone may understand it.

Very respectfully,

T. R. FRENCH.

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LAND SURVEYS OF THE UNITED STATES

Land in the United States is laid off into Townships (six miles square), containing 23,040 acres; Sections (one mile square), containing 640 acres; Quarter-sections (one-half mile square), containing 160 acres, and Quarter Quarter-sections (one-quarter mile square), containing 40 acres.

The law provides that all excesses or deficiencies, either from erroneous measurements or bearings or from the convergence of meridians, shall, so far as possible, be thrown into the northern and western quarter-sections of the township.

Corner monuments have been established on all United States land surveys at all the corners of townships, sections, quarter-sections and meandered lines, except at the point common to four-quarter sections, at the center of each section.

These monuments are of various composition, as

- (a) A stone with pits and earth mound.
- (b) A stone with a mound of stone.
- (c) A stone with bearing trees.
- (d) A post in a mound of stone.
- (e) A post in a mound of earth.
- (f) A post with bearing trees.
- (g) A mound without post or stone.
- (h) A tree without bearing trees.
- (i) A tree with bearing trees.

Whenever possible, certain descriptive marks and letters are cut on the stones, posts and trees, such as described in the following sample field notes. It should also be stated, that any of the styles of marking above-named may be used for any kind of corner, and that the styles described below are not limited to the purposes there named.

STANDARD TOWNSHIP CORNERS

For illustration: I will take a township corner that is marked with a stone and two bearing trees.

The stone is set at the corner of Township 13 North, Ranges 21 and 22 East, and is marked S. C. on North side, with 6 grooves on the North, East, and West faces.

The Bearing Trees are two trees (usually a rod or so distant from the corner) and the tree standing on section 31 in this case will be marked as follows: T 13 N R 22 E S 31 B T.

The Bearing Tree on section 36 will be marked as follows: T 13 N R 21 E S 36 B T.

Often the four township corners do not come together, on account of variations in surveying. When they do, there would be four bearing trees instead of two, and each one would give the township, range, and section on which they stood.

SECTION CORNERS

Section corners can be designated by a post 4 inches square and four feet long, being two feet in the ground, and scribed with the number of the township, and adjoining sections on the sides facing them.

For instance: We will set a stone in the ground

for the corner of sections 9, 10, 15 and 16, marked with 4 notches on South, and 3 notches on the East faces, from which we have 4 bearing trees, one on each section, and they read as follows:

T 2 N R 2 W S 10 B T.—Meaning Township 2 North Range 2 West, Sec. 10, B. T.

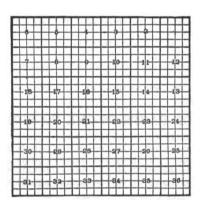
T 2 N R 2 W S 15 B T.—Meaning Township 2 North, Range 2 West. Sec. 15. B. T.

T 2 N R 2 W S 16 B T.—Meaning Township 2 North, Range 2 West, Sec. 16, B. T.

T 2 N R 2 W S 9 B T.—Meaning Township 2 North, Range 2 West, Sec. 9, B. T.

B. T .- Meaning "Bearing Tree."

QUARTER SECTION CORNERS



Quarter-section posts are 3 feet long, 3 inches square, and 12 inches in the ground, and marked 1/4 S. on the North (or West) face.

In cruising timber, or running section or township lines, it is always absolutely necessary to know on

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what degrees of the compass the original survey was made. This can always be found out from any surveyor.

All lines with legal corner boundaries are marked after this method, viz: Those trees which may be intersected by the line will have two blazes or notches cut on the sides facing the line, without any other marks whatever. These are called sight trees or line trees.

MODE OF LAYING OFF SMALL LOTS OF LAND

 $2\frac{1}{2}$ acres is 400 square rods, or 20 rods square, or 330 feet each way.

1 acre is 160 square rods, or 12.65 rods square, or 208 7/10 feet each way.

 $\frac{1}{2}$ acre is 80 square rods, or 8.94 rods square, or $\frac{147}{2}$ feet each way.

1/3 acre is 53 1/3 square rods, or 7.30 rods square, or $120\frac{1}{2}$ feet each way.

¼ acre is 40 square rods, or 6.324 rods square, or 104% feet each way.

% acre is 20 square rods, or 4.475 rods square, or 73% feet each way.

NUMBER OF PACES IN ONE TO EIGHTY RODS

6¼ paces of 31 68/100 inches equals 1 rod

 $62\frac{1}{2}$ paces of 31 68/100 inches equals 10 rods 125 paces of 31 68/100 inches equals 20 rods

250 paces of 31 68/100 inches equals 40 rods

500 paces of 31 68/100 inches equals 80 rods

TO FIND THE DIAMETER OF A STANDING TREE AT THE BUTT

Divide the circumference by 3.1416. This will give the diameter outside the bark. If the bark, for instance, is 3 inches thick, then you have 6 inches of bark, therefore deduct 6 inches from your

diameter, and you have the diameter inside the bark. The same rule applies to the top measure.

Often trees have what is called swell, or churn butts. A proper allowance should always be made in obtaining the diameters of such trees.

CANADIAN LANDS

"Crown lands" shall mean and include such ungranted Crown or public lands or Crown domain as are within and belong to His Majesty in right of the Province and whether or not any waters flow over or cover the same.

"CROWN GRANT"

"Crown grant" shall mean any instrument in writing under the Public Seal of the Province conveying land in fee simple.

Crown Grant or Patent gives absolute ownership in fee simple to land and timber thereon, and on the timber or logs taken from land covered by deeds issued prior to the 7th of April, 1887, there is a tax or export duty of from \$1.00 to \$4.00 per thousand feet, which is refunded if the logs are manufactured into lumber in Canada. On all timber cut on deeded Crown Grant Lands issued since the 7th of April, 1887, and prior to March 12th, 1906, there is a royalty of 50 cents per thousand feet, and no tax. Both these classes are exportable.

On any timber cut from Crown Lands or from Grown Granted Lands deeded since March 12th, 1906, there is a royalty of 50 cents per thousand, but the logs are not exportable and must be sawn in Canada. The lumber, of course, can be exported

DOMINION LEASES

Dominion Government leases were issued by the Federal Government at Ottawa up to 1908, for timber standing within twenty miles either side of the Canadian Pacific Railway, since when all Dominion lands are reserved indefinitely. Dominion leases give the holder the right of all the timber on the land held under lease until cut. The charges on the same are as follows: A ground rent of 5 cents per acre per year in advance, and stumpage or royalty of 50 cents per thousand when cut. There is a charge of fire dues which is too small to take into consideration.

PROVINCIAL LEASES

Prior to 1905 the Provincial Government, which controls all the timber of British Columbia, outside of the Canadian Pacific Railway belt, issued leases covering timber lands, which gave the holder of such leases the right to all the timber on the lands covered by the lease for a period of twenty-one years, with a ground rental of 10 cents per acre per year and 50 cents per thousand stumpage when cut. These leases can be surrendered at any time and renewed for another twenty-one years under existing laws in force at time of surrendering. Leases are subject to the law at time of issue.

SPECIAL PROVINCIAL LICENSES

The Provincial Government, up to 1908, issued Special Provincial licenses, good for twenty-one years from date of issue, which gave the holder the right to all the timber on the land for twenty-one years at a ground rental of \$140.00 per annum per section of 640 acres, and 50 cents per thousand stumpage when cut. East of the Cascade Range the charge is \$115.00 per annum per section of 640 acres, with a stumpage of 60 cents per thousand when cut.

At the beginning of 1908 all Provincial timber was reserved by the Government indefinitely, so that at the present time no timber can be procured in the province of British Columbia from either Government.

All leases and licenses are transferable.

By an act of Parliament April, 1910, "Every special timber license shall be transferable and shall be renewable from year to year while there is on the land included in such license merchantable timber in sufficient quantity to make it commercially valuable." This makes all Special Provincial Timber Licenses perpetual, so long as the yearly license fee of \$140.00 is paid, and this should be paid on or before October 31st of each year. Anyone owning Special Provincial licenses can have them transferred or renewed by surrendering his old license and all privileges appertaining thereto within two years from the first day of April, 1910.

By this act the twenty-one year license is made in perpetuity or perpetual.

TIMBER LIMITS

"Timber Limits shall mean lands specified and comprised in any timber license."

"LEGAL POST"

"Legal Post" shall mean a stake standing not less than four feet above the ground and squared or faced on four sides for at least one foot from the top, and each side so squared or faced shall measure at least four inches on its face so far as squared or faced, and any stump or tree cut off and squared or faced to the above height or size; Provided, when the survey is made, the center of the tree or stump where it enters the ground shall be taken as the point to or from which measurement shall be made.

"PATENTED LANDS"

"Patented Lands" shall mean lands granted by the Crown during the period commencing on the 7th day of April, A. D. 1887, and ending on the 28th day of April, A. D. 1888.

"TIMBER LEASEHOLD"

"Timber Leasehold" shall mean lands included in timber leases granted after the 31st day of December, 1879, and lands included in any timber lease hereafter granted.

PLAN OF TOWNSHIPS

The Crown Lands, where such a system is practicable, shall be laid off and surveyed into quadrilateral townships, containing thirty-six sections, of one mile square in each, by lines running astronomically North and South, crossed by others running astronomically East and West, as shown below.

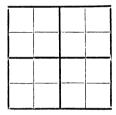
SECTIONS, HOW TO BE NUMBERED

31	32	33	34	35	36
30	29	28	27	26	25
19	20	21	22	23	24
18	17	16	15	14	13
7	8	9	10	11	12
6	5	4	3	2	1

- (2) The sections shall be numbered as shown in the above diagram.
- (3) Quarter-section corners shall be established equidistant between the section corners, except on the section lines closing on the North and West boundaries of Townships, on which they are set at forty chairs from the last section corner, and ex-

cess or deficiency of measure, if any, shall be carried out into the last half mile, and cast upon the North and West sides of the Township.

(4) The quarter-sections composing every section may be divided into quarter quarter-sections of forty acres each, and such quarter quarter-sections may be styled legal subdivisions, bounded and numbered as shown in the following diagram:



Surveyed lots of 640 acres may be subdivided into quarters, and quarter quarters, in the same manner as the subdivision of sections and quarter-sections.

- (5) The dimensions and area of the irregular quarter-sections shall in all cases be returned by the Surveyor at their actual measurements and contents.
- (6) All sections shall be closed by first running a random line East or West, as the case may be, to intersect the opposite corresponding corner post. Should this random line not intersect the post, then the distance shall be measured and a correct line run (care being taken to note the course) East or West, as the case may be, upon which the quarter-

section post shall be established. East and West lines must close with one hundred links.

(7) All lines shall be run to the cardinal points of the compass.

SECTION POSTS

Section posts shall not be less than four inches square, four feet out of the ground, and scribed with the number of the township and adjoining sections on the sides facing them.

QUARTER-SECTION POSTS

Quarter-section posts shall not be less than three inches square, three feet out of the ground, and marked ¼ S.

All posts shall be squared two feet from the top, except half section posts, which shall be flattened only on two sides.

Posts shall be pointed on top to shed the water. In prairies, posts shall have mounds raised round them to a height of at least two feet six inches, either of earth or stones, and the posts to be scribed with the number of Township and Section on each side.

Mounds shall be three feet square at base. At a distance of one foot from each side of each mound a trench shall be dug at least two feet wide and one foot deep.

On rocks, or where it is impossible to sink posts, they shall be surrounded by a cairn of rocks at least thirty inches high, the base to be three feet square. Four bearing trees shall be taken for every post, the trees being marked B. T. with distance from post, and faced towards the post.

The lines through timber shall be thoroughly blazed, two blazes to be made on each tree quartering on the line, so as to be easily distinguished and traced.

No tree shall be blazed at a greater distance than six feet on either side of the line.

All line trees shall be notched with three notches on each side in the direction of the line, and their size, kind of timber, and distance from the last section corner shall be given in field notes.

Lands in Canada are laid off the same as in the United States, but the numbering of the sections is directly the opposite from those in the United States. "The Surveyor shall commence the survey of each township at the southeast corner, and complete the eastern tier of sections, viz: Nos. 1, 12, 13, &c., first; then return to the southern boundary of the township and complete the second tier of sections, viz: 2, 11, 14, &c., and so on until the township is completed."



TO MEASURE THE HEIGHT OF A TREE



Walk on level ground to a distance from the foot of the tree or object about equal to its presumed height. Lie on your back on the ground, stretched at full length. Let an assistant note on a perpendicular staff at your feet the exact point where your line of vision to the top of the object crosses the staff. Measure the height of this, B C, and your own height to your eyes, A B. Then as A B, B C, A D, D E.

Example: The distance from my eyes to my feet is 5 feet 6 inches; from the ground to where the line of vision crosses the staff is four feet; from the point where my eyes were to the foot of the tree is 90 feet, what is the height of the tree?

Answer: As $5\frac{1}{2}$:4::90:about 65 feet, the height of the tree (Multiply 90 by 4 and divide it by $5\frac{1}{2}$) 5.5.

Another way: When a tree stands so that the length of its shadow can be measured, its height can

be readily ascertained as follows: Set a stick upright—let it be perpendicular by the plumb line. Measure the length of the shadow of the stick. Then, as the length of the shadow of the stick is to the height of the stick, so is the length of the shadow of the tree to the height of the tree.

For example: If the height of the stick is four feet and its shadow six feet in length, and the length of the shadow of the tree ninety feet, then 6:4::90 (60) or sixty feet, the height of the tree. In other words, multiply the length of the shadow of the tree by the height of the stick, and divide by the length of the shadow of the stick.

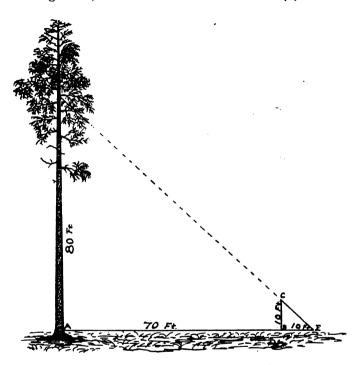
(By permission of publisher of Scribner's Lumber and Log Book.)

HOW TO FIND THE HEIGHT OF A TREE

Another Way: In looking at a tree, suppose you say, "I think the height of that tree from the ground to where it would be cut off at the top, is 100 feet." Now measure off on level ground at right angles, 100 feet from the base of the tree, then measure 10 feet back, and put your 10-foot pole at (b). Have it perpendicular. Then put your eye at (e), looking over the top of the pole at (c), and where the eye strikes the tree at (f), will be 100 feet from (a). You can then allow the height of the stump, by deducting it from the height of the tree.

Your pole should be three or four inches over 10 feet above the ground, for in placing your eye at

(e) your eye would naturally be a few inches from the ground, so a few inches variation at (e) would



make several feet at (f), or the top of the tree.

N. B.—This rule will apply to any tree, or any height. The principles hold true in any case.

(By permission of Publisher of Conklin's Commercial Calculator.)

Another Way: Stand a pole of any length up

against the tree you wish to know its height; then go from the tree, say one or two hundred feet. Stand another pole on the ground in front of you and hold it at arm's length. Holding the pole in your left hand, you take one or two fingers of your right hand, holding them horizontally against the pole in your left hand, and adjust your eyes so in looking over the top and bottom of your fingers, you can just see the top and bottom of the pole at the tree. Now move your fingers up the width of them, which equals the height of the pole at the tree, and as many times as you move your fingers up, the tree is that many times the height of the pole standing against the tree.

For instance, if the pole against the tree was 20 feet long, and you moved your fingers up four times, the height of the tree would be 80 feet.

With a little care you can come very close to the height.



HOW TO CRUISE TIMBER

The Way to Estimate the Number of Feet (Board Measure) an Acre or Tract of Timber Will Saw Out

First, do not let your desire to find a great abundance of timber on your holdings outweigh your better judgment and cause you to over-reach the bounds of reason. Make it a few thousand feet less, rather than too many. You should know what you have, rather than what you think you have.

The most accurate method of finding the height of timber you wish to cruise, is to find a number of fallen trees, selecting several that will represent as nearly as possible the average size of the timber standing.

Ascertain the length of each tree up to where it would be topped, and by adding together their combined lengths and dividing the amount thus obtained by the number of trees, this will give you the average height. Now find their combined diameters at the middle (of each tree) by adding them together and dividing them by the number of trees. This will give the average diameter of the timber.

Ordinarily you will get a more accurate size of the diameter of a tree by measuring it at the center, than you will by adding the diameters of butt and top together and dividing by 2, for often the butt or trunk is extraordinarily large and out of proportion to the balance of the tree.

This system is based on the fact that .8862 represents and stands for a round log or tree, and this is so because by multiplying the diameter of the tree at the center (half way from butt to top) by .8862, you get the side of a square stick of timber equalling in area or substance the actual number of cubic inches or feet that the round log or tree contains; therefore we call .8862 the perfect tree or log, as the case may be

As a certain portion of the tree must always be allowed for saw-dust in manufacturing, also breakages, conk, punk or rot, in estimating timber, and not knowing whether the logs will be sawn into inch or thicker lumber, nor whether they will be sawn by band or circular saws, I have demonstrated and think it unwise to use more than $6\frac{1}{2}$ as a base or multiplier; so by multiplying the diameter of the tree at the center by $6\frac{1}{2}$ or .65 you get one side of a square stick of timber; having the same size from butt to top, and by reducing this stick of timber to feet, board measure, you have what the log or tree will saw out into boards or lumber.

The diameter must always be taken from the middle of the tree.

Having found the average diameter at the center, you multiply this diameter by 6½, and this will give one side of a square stick of timber. For instance: If a tree is 150 feet in length from butt to where it

will be cut off at top, and the diameter is found at the center to be 50 inches, then multiply this diameter (50 inches) by 6½, which will give you 32½. You now have a stick of timber 32½ by 32½—150 feet long. Now square 321/2, by multiplying 321/2 by 32½ and divide the amount by 12, and you have 88 feet, which is 88 feet for every foot in length. Multiply this (88) by 150, the length of the tree, and you have 13,200, the amount of feet the tree will saw out into lumber. No doubt any good tree of this size would saw out more than this amount, but in estimating timber you should always allow something for timber broken in falling, as well as conk, punk, rot or other defects, and this rule allows for that unless the conditions are too bad. This rule is for standing timber and not for logs at the mill.

For another illustration we will take a tree 60 feet in length, and we find the diameter at the center, or 30 feet from the butt, to be 15 inches. Multiply the diameter (15) by 6½, or you can multiply the circumference by twenty (20), and you have a stick of timber 9¾ by 9¾—60 feet long. Therefore 9¾ multiplied by 9¾ by 60, and divided by 12, will give you 8 feet per foot, or 480 feet, the amount the tree will saw out.

An acre of land is 208 7/10 square feet, therefore after you have satisfied yourself as to the average size and height of the timber, and you desire to know how much timber there is on any certain acre, you start from some designated spot and pace off 104

feet, or half the distance across one side of an acre, and stand facing the acre you wish to cruise. Therefore you will look 104 feet on each side of you and 208 feet in front, which will contain a piece of land 208 feet square, or one acre.

You will now count the merchantable trees on this acre. If it is difficult to correctly count them so far away, then count them only 104 feet in front of you and double the number so obtained to get what stands on one acre. Now multiply the average feet in one tree by the number of trees on the acre, and the result will be the number of feet on the acre.

In cruising large tracts of timber, the Estimator or Cruiser has what is called a Compassman to run the line. The corner of the land to be cruised must first be located, and for explanation will say, that we will begin at the south-west corner of Section 31. As our object is to cruise the timber standing on the South-West quarter of the South-West quarter of Section 31, the Compassman will stand at the corner facing north. The Cruiser steps off 10 rods, or 62½ paces due east on the south line of the forty, and will also face the north. The Compassman being on the line, both he and the Cruiser start north; the Compassman following the line and counting his steps, while the Cruiser estimates or counts the trees ten rods on each side of him as he advances.

At the end of the first twenty rods, or 125 paces, the Compassman calls out "Tally one." The

Cruiser in going the twenty rods will have counted the trees or estimated the timber on a piece of land twenty rods square, or two and a half acres.

As he has kept tally of each particular kind of timber as he advanced, he makes a notation of this in a book for that purpose, and this is kept up for every twenty rods until the Compassman calls out "Tally four." Thus he has gone four tallies of 125 paces each, or across the forty acres—80 rods. Both men now being on the north line of the forty, they both step off 125 paces, or 20 rods, due east, and facing south, return to the south line of the forty, and so on until the whole forty acres has been cruised.

The Cruiser always endeavors to keep ten rods from his Compassman.

By cruising each 2½ acres, all marshes, streams and where timber grows scantily may be noted, and as the trees are carefully counted you get as accurate an estimate as it is possible to get.

The great secret is to know the amount of lumber the average tree contains, and then count your timber.

When you cannot find any fallen timber by which to obtain a reasonably accurate average of size and height, then resort to the methods on pages 17, 18 and 19. You cannot guess accurately the height of a tree. Heights are very deceptive, especially in Western Fir, Hemlock, Larch and Cedar. In some cases a tree with 48 inches diameter at the butt will attain a height from 250 to 300 feet, while in other

localities the same diameter will not be over 150 feet in height. Thus it is necessary to fully know the average size and height. By measuring the circumference of the butts of standing trees and even finding a down tree here and there, you can get a very good average of the height and size of the timber. Measurements must be inside of the bark.

Care should be taken in cruising Cedar, as it is usually rotten at the butt, and much so in large timber.

Don't try to get the "very last tree" on an acre, for there are always more or less defects you cannot see, and you surely want it to cut out up to your estimate, whether you are buying or selling.

NUMBER OF FEET PER FOOT IN ANY TREE

This table shows the number of feet per lineal foot the different diameters of trees at the middle will saw out by the rule of $6\frac{1}{2}$. The length of the tree in feet, multiplied by the number of feet per foot will give you the number of feet the tree contains.

Dia	ameter			Dia	ameter			
in	Center.	Per	Ft.	in	Center.		Per	Ft.
6	inches							ft.
7	inches							ft.
8	inches	 21/4						ft.
9	inches	 3	ft.	47	inches		78	ft.
10	inches	 31/2				· · · · · · · · · · · ·		ft.
11	inches	 41/4				· · · · · · · · · · · ·		ft.
12	inches	 5	ft.	50	inches		88	ft.
13	inches	 6	ft.	51	inches		92	ft.
14	inches	 7	ft.	52	inches		95	ft.
15	inches	 8	ft.	53	inches		99	ft.
16	inches	 9	ft.	54	inches		103	ft.

Diam. in			Diam. in		
Center	Pe	r Ft.	Center	Per	Ft.
17 inches	 10	ft. 5	5 inches	107	ft.
18 inches	 11	ft. 5	6 inches	110	ft.
19 inches	 13	ft. 5	7 inches		ft.
20 inches	 14	ft. 5	8 inches		ft.
21 inches	 16	ft. 5	9 inches	123	ft.
22 inches	 17	ft. 6			ft.
23 inches	 19	ft. 6			ft.
24 inches	 20	ft. 6	2 inches	$\dots 135$	ft.
25 inches	 22	ft. 6		139	ft.
26 inches	 24	f t. 6	4 inches	144	ft.
27 inches	 26	ft. 6		149	ft.
28 inches	 28	ft. 6	6 inches	153	ft.
29 inches	 30	ft. 6		158	ft.
30 inches	 32	ft. 6		163	ft.
31 inches	 34		9 inches	168	ft.
32 inches	 36	ft. 7		173	ft.
33 inches	 38	ft. 7		178	ft.
34 inches	 41		2 inches	183	ft.
35 inches	 43	ft. 7		188	ft.
36 inches	 46		4 inches	193	ft.
37 inches	 48	ft. 7		198	ft.
38 inches	 51	ft. 7		$\dots 203$	ft.
39 inches	 54		7 inches	208	ft.
40 inches	 56	ft. 7			ft.
41 inches	 59	ft. 7			ft.
42 inches	 62	् ft. 8	0 inches	$\dots 225$	ft.
43 inches	 65	Pt.			

Do not compare these figures with any log scale, as the diameters above shown are taken at the center of the log, while the scale rules measures the log at the small end.



TABLE SHOWING CIRCUMFERENCE OF ANY LOG

From 20 to 300 Inches, With Diameter of the Same.

Circum. is 20 inches	3	Diam	eter is	Circ	cum. is		Diam	eter is
20 inches		61/4	inches	140	inches		44	inches
22 inches		7	inches	142	inches		4416	inches
24 inches		71/2	inches	144	inches		451/4	inches
26 inches		81/4	inches	1146	inches		453/4	inches
28 inches	3	9	inches	148	inches		461/2	inches
30 inches	3	91/2	inches	1 á 0	inches		47	inches
32 inches	3 <i>.</i>	10	inches	152	inches		473/4	inches
34 inches		103/4	inches	154	inches	<i>.</i>	48	inches
36 inches	· · · · · · · · ·	$11\frac{1}{2}$	inches	156	inches		49	inches
38 inches	3	12	inches	1158	inches		491/2	inches
40 inches	3	$12\frac{1}{2}$	inches	160	inches		50	inches
42 inches	3 . <i></i>	131/4	inches	162	inches		$50\frac{3}{4}$	inches
44 inches	·	14	inches	164	inches	• • • • •	$51\frac{1}{2}$	inches
46 inches	3	141/2	inches	166	inches	• • • • • •	52	inches
48 inches	3	151/4	inches	168	inches	• • • • • •	$52\frac{3}{4}$	inches
50 inches	· · · · · · · · ·	15%	inches	170	inches	• • • • •	$53\frac{1}{2}$	inches
52 inches	• • • • • • •	161/2	inches	172	inches	• • • • • •	54	inches
54 inches	· · · · · · · ·	17	inches	174	inches	• • • • • •	54 3/4	inches
56 inches	· · · · · · · ·	171/2	inches	176	inches	• • • • •	551/2	inches
58 inches	3 .	181/4	inches	178	inches	• • • • • •	56	inches
60 inches		19	inches	180	inches	• • • • •	561/2	inches
62 inches								
64 inches		20 '	inches	184	inches	· · · · · ·	573/4	inches
66 inches	• • • • • •	20%	inches	186	inches	• • • • •	581/2	inches
68 inches								
70 inches								
72 inches		22%	inches	192	inches	• • • • •	601/4	inches
74 inches	· · · · · · · ·	23 1/4	inches	194	inches	• • • • • •	61	inches
76 inches		24	inches	196	inches	• • • • • •	61 1/2	inches
78 inches		24 1/2	inches	198	inches	• • • • • •	621/4	inches
80 inches		25 1/4	inches	200	inches	• • • • • •	62%	inches
82 inches		25%	inches	202	inches	• • • • • •	031/2	inches
84 inches		20 1/2	inches	204	inches	• • • • •	64 1/4	inches
86 inches								
88 inches	· · · · · · · · ·	21%	inches	208	inches	• • • • • •	651/2	inches
90 inches	3	28 1/4	incres	210	inches		66	inches

Circ	cum is	Dia	meter is	Circ	cum. is	Dia	meter is inches
92	inches	 29	inches	212	inches	 66%	inches
94	inches	 291/2	inches	214	inches	 671/2	inches
96	inches	 301/4	inches	216	inches	 68	inches
98	inches	 31	inches	218	inches	 68%	inches
100	inches	 311/2	inches	220	inches	 691/4	inches
102	inches	 32	inches	222	inches	 70	inches
104	inches	 323/4	inches	224	inches	 701/2	inches
106	inches	 331/4	inches	226	inches	 711/4	inches
108	inches	 34	inches	228	inches	 71%	inches
					inches		
112	inches	 35	inches	235	inches	 74	inches
114	inches	 35%	inches	240	inches	 751/2	inches
					inches		
118	inches	 37	inches	250	inches	 78%	inches
					inches		
122	inches	 381/4	inches	260	inches	 82	inches
124	inches	 39	inches	265	inches	 831/2	inches
126	inches	 391/2	inches	270	inches	 85	inches
128	inches	 40	inches	275	inches	 861/2	inches
130	inches	 40%	inches	280	inches	 88	inches
					inches		
134	inches	 42	inches	290	inches	 91	inches
136	inches	 423/4	inches	295	inches	 921/2	inches
					inches		

TAMARACK PILING

Following table computed on a weight of 4,500 lbs. to the thousand feet. B. M.

The diameter of piling at the center is found by adding together the top and butt diameters, and dividing by two.

In these tables, the actual feet of timber, board measure, per foot is given. There is nothing taken out for saw-dust or slab. It is as though you had a log of putty and had molded it into a square stick of timber, and then found the number of feet.

To find the number of inches a log will square, which would give you the side of an equal square.

that is, giving you a square stick of timber containing the same number of cubic inches or cubic feet of lumber that is contained in the round log, you multiply the diameter in the middle of the log by .8862 (a decimal). Then multiply the width of this timber by the thickness, dividing that by 12. This will give you the number of feet (board measure) there are in one lineal foot. To find the number of feet in the whole stick, you multiply the length in feet by the number of feet per foot or pounds, as the case may be.

To find the number of pounds a lineal foot will weigh, multiply the number of feet per foot by the weight per thousand feet.

The following tables are very convenient in computing the cost of freight when making a delivered price on piling, etc.:

			V	Veight,
Dia. in Center.	Per L	in. Ft.	Per	Lin. Ft.
7 inches	31/5	feet	14	pounds
8 inches	4 1/5	feet	19	pounds
9 inches	53/7	feet	24	pounds
10 inches	61/2	feet	29	pounds
11 inches	7 9/10	feet	35	pounds
12 inches	9 3/8	feet	42	pounds
13 inches	11	feet	50	pounds
14 inches	124/5	feet	58	pounds
15 inches	$14\ 3/4$	feet	66	pounds
16 inches	163/4	feet	75	pounds
17 inches	$18\ 3/4$	feet	85	pounds
18 inches	$21\ 1/4$	feet	95	pounds
19 inches	$23 \ 1/2$	feet	106	pounds
20 inches	26	feet	117	pounds
22 inches	32	feet	144	pounds
24 inches	38	feet	171	pounds

FIR PILING

Computed on a Weight of 3,500 Pounds Per 1,000 Feet, Board Measure

The same instructions relative to Tamarack piling apply to Fir, etc.

Watcht

			vv	eignt,
Dia. in Center.	Per Li	in. Ft.	Per	Lin. Ft.
8 inches	4 1/5	feet	143/4	pounds
9 inches '	53/7	feet	18	pounds
10 inches	61/2	feet	23	pounds
11 inches	7 9/10	feet	28	pounds
12 inches	9 3/8	feet	33	pounds
13 inches	11	feet	39	pounds
14 inches	$12 \ 4/5$	feet	45	pounds
15 inches	14 3/4	feet	51	pounds
16 inches	163/4	feet	58	pounds
17 inches	183/4	feet	66	pounds
18 inches	$21\ 1/4$	feet	74	pounds
19 inches	$23 \ 1/2$	feet	82	pounds
20 inches	26	feet	91	pounds
22 inches	32	feet	1 11	pounds
24 inches	38	feet	132	pounds

Green White Pine, Norway Pine and Fir weigh about the same amount to the cubic foot. Green Hemlock will weigh about 4,000 lbs. to the thousand feet. Oak, 5,200 lbs.



A VALUABLE TABLE

The circumference of a circle or log, multiplied by .2821 equals side of an equal square. The diameter of a circle or log, multiplied by .8862 equals side of an equal square.

The circumference of a circle or log, multiplied by .2251 equals side of an inscribed square. The diameter of a circle or log, multiplied bq .7071 equals side of an inscribed square.

The square of the circle of a circle or log, multiplied by .07928 equals the area.

The side of a square multiplied by 1.4142 equals diameter of its circumference circle. The area of a circle or log, multiplied by .6366 equals side of the inscribed square.

(To multiply the side of any square timber by 1.4142 will give you the diameter of a round The side of a square multiplied by 4.443 equals circumference of its circumference circle. log from which the timber could be taken.)

The side of a square multiplied by 1.128 equals diameter of an equal circle.

The side of a square multiplied by 3.545 equals circumference of an equal circle.

To find the surface of a sphere or globe, multiply the diameter by the circumference.

To find the solidity of a sphere, multiply the square of the diameter by 3.1x16.

To find the solidity of a shaft or cylinder, multiply the area of one end by the length.

WHAT IS THE SIDE OF AN EQUAL SQUARE?

It is the side of the greatest square that can be made from a circle, and equals the area of the circle. It is as though you had a log of putty and you pressed it into a square timber. It would contain the same number of cubic inches that the log would contain, and the weight of each would be the same.

Q. How may I find the side of an equal square, or the size of this square stick of timber from any log?

Ans. Multiply the diameter in the center by .8862, or the circumference by .2821. By so doing you will have every cubic inch or cubic foot in the timber that the log contained, and the size of the stick will be the same from end to end.

By this rule, if you are shipping logs or piling, you can tell exactly how many actual feet every stick contains, and if you know what the usual weight of such timber is, you can tell how much every log or pile weighs.

On page 30 you will find a table giving the diameters of piling from 7 to 24 inches, showing the number of feet and weight per lineal foot according to above rule.

Example: What will be the size of an equal square from a log 18 inches in diameter at the center?

Answer: Multiply the diameter 18 by .8862 and you have 16 inches, or a stick 16 x 16. If you wish to know how many feet there are in each lineal foot, multiply 16 by 16, and divide by 12. Then multiply the number of feet in one foot by the length of the

log or timber, and you have every foot board measure the log contains, no matter what the length might be.

Multiplying the diameter by .8862, or the circumference by .2821, will bring the same result.

The center or middle of a log means the top and butt diameters added together and divided by 2, or diameter of the log half way between butt and top.

WHAT IS AN INSCRIBED SQUARE?

It is the greatest square that can be contained in a circle.

Multiplying the small end of any log by 7 will give in inches what the log will square without any bark on the edges. For instance, a log 20 inches in diameter at the small end will square or saw out a stick of timber 14 by 14, or in other words 14 inches square.

If you wish to know the largest square stick of timber you can get out of a log, multiply the diameter at the small end by 7.

WEIGHTS OF WOOD, EARTH, IRON AND STONE

Cast Iron, per cu. ft 450 lbs	١.
Water, per cu. ft	١.
White Pine, dry, per cu. ft., ab't 30 lbs	١.
White Oak, dry, per cu. ft., ab't 50 lbs	ł.
Loose Earth, per cu. ft 95 lbs	ł.
Gravel, per cu. ft	١.
Common Soil, per cu. ft	١.
Clay, per cu. ft., about	ł.
Clay with stones, per cu. ft 160 lbs	١.
Marble, per cu. ft 166 lbs	š.
Granite, per cu. ft 169 lbs	ŝ.
Brick, per cu. ft	3.
Lead 708% Copper 486% Brass 55	5

RAILWAY TIES Number Per Mile

16 inches from center to center, 3960 ties 18 inches from center to center, 3520 ties 21 inches from center to center, 3017 ties 24 inches from center to center, 2640 ties 27 inches from center to center, 2348 ties 30 inches from center to center, 2113 ties 33 inches from center to center, 1921 ties 36 inches from center to center, 1761 ties

GRADE PER MILE

This table shows the grade per mile as indicated below:

An incline of 1 foot in 1 is 5280 feet per mile An incline of 1 foot in 2 is 2640 feet per mile An incline of 1 foot in 3 is 1760 feet per mile An incline of 1 foot in 4 is 1320 feet per mile 5 is 1056 feet per mile An incline of 1 foot in An incline of 1 foot in 6 is 880 feet per mile 8 is An incline of 1 foot in 660 feet per mile An incline of 1 foot in 10 is 528 feet per mile An incline of 1 foot in 15 is 352 feet per mile An incline of 1 foot in 20 is 264 feet per mile An incline of 1 foot in 25 is 211 feet per mile An incline of 1 foot in 30 is 176 feet per mile An incline of 1 foot in 35 is 151 feet per mile An incline of 1 foot in 40 is 132 feet per mile An incline of 1 foot in 45 is 117 feet per mile An incline of 1 foot in 50 is 106 feet per mile An incline of 1 foot in 75 is 70 feet per mile An incline of 1 foot in 100 is 53 feet per mile An incline of 1 foot in 125 is 42 feet per mile An incline of 1 foot in 150 is 35 feet per mile

PERCENT OF GRADE

1 per cent. grade is
2 per cent. grade is
3 per cent. grade is
4 per cent. grade is
5 per cent. grade is
6 per cent. grade is
73 feet per mile
106 feet per mile
264 feet per mile
264 feet per mile
317 feet per mile

7 per cent. grade is 370 feet per mile 8 per cent. grade is 422 feet per mile 9 per cent. grade is 475 feet per mile 10 per cent. grade is 528 feet per mile 11 per cent. grade is 581 feet per mile 12 per cent. grade is 634 feet per mile 13 per cent. grade is 686 feet per mile 14 per cent, grade is 739 feet per mile 15 per cent. grade is 792 feet per mile 16 per cent. grade is 845 feet per mile 17 per cent. grade is 898 feet per mile 18 per cent. grade is 950 feet per mile 19 per cent. grade is 1003 feet per mile 20 per cent. grade is 1056 feet per mile 21 per cent. grade is 1109 feet per mile 22 per cent. grade is 1161 feet per mile 23 per cent. grade is 1214 feet per mile 24 per cent. grade is 1267 feet per mile 25 per cent, grade is 1320 feet per mile

WATER-PROOF LEATHER PRESERVATIVE

"Take one pint of boiled linseed oil, half a pound mutton suet, six ounces clean bees-wax, and four ounces rosin; melt and mix over a fire, and apply while warm. A good way is to put it on with a brush, and warm it in well." Fine for Cruiser boots.



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