

CONSTRUCTION OF WOODEN CRAWL TOWER

Introduction

It is not the intention of this lecture to suggest that the type of tower under discussion is required in any one particular district or division. Nor is it the wish to convey the impression, by anything that follows, to be in conflict with any individual Divisional policy regarding such construction, which may be set out by the Inspector in charge. It is realized that every Division has its own specific problems. It is realized that there may be numerous alternate methods to those which will be explained, some of which may or may not be practical. This lecture is based wholly on that which took place and was found to be satisfactory at that time. Alternate methods may be used if practical and it may be stated that in any construction a large amount of the success depends on the resourcefulness and ingenuity of the person in charge.

Purpose

The conception of the Crawl Tower was prompted by the fact that the main Radio Towers were hampered in places by topographical obstructions which produced what are termed Blind Spots. These blind spots may vary from an ordinary ridge obstructing the view, to a slight fall-off of land at the extreme range of the main lookout. In a great many cases main lookout towers have spotted numerous fires behind such obstructions and considering their scattered nature have given excellent detection service. The main use of the Crawl Tower is to give a point of vantage for observation into such blind spots in order that the Ranger may be able to confirm a single bearing from a main tower, to get a look at the base of a fire, and in some cases spot small fires which are not visible to the main lookouts.

Location

It is suggested that these towers would be of considerable use along the edge of the "Green Area" where suitable roads and locations are available, the location of the tower and accessibility being the prime factor. Assistance in locating these sites may be obtained by using aerial photographs. The construction of two of these towers to date has been made possible in one Division by locating a height of land at the extreme end of established settlement roads which were near the edge of the forest zone. This eliminates the necessity of spending large sums of money for the purpose of making them accessible by car. Should roads to the desired location be unavailable, considerable thought should be given to the matter before proceeding with the project. When the desired site is located, a close check should be made of the visibility and a radius of 180 degrees and up is considered ideal, although in isolated circumstances, the construction of a tower of this size may be justified to see into a dangerous blind spot with as low as 90 degrees visibility.

### Establishing Height

The next important step is to establish the height required of the tower in mind. If the land surrounding the tower site falls away quite steeply, the clearing of some timber on its slopes may allow the erection of a shorter tower. If, however, the land falls away quite gently the height of the tower is usually governed by the height of the surrounding timber. This may be established very easily by the use of an Abney Level.

### Selecting Material

It has been found that the ideal type of timber for tower legs is lodgepole pine or suppressed white spruce. When cutting this timber, remember to add five feet to your original height calculations as this amount of leg will be required in the ground. Great care should be taken in picking the four leg timbers, bearing in mind that in point of fact, this is the tower. Uniformity and form class are most important. It is recommended that the butt measurements of such legs do not exceed 12 inches as an excellent form class in lodgepole pine should provide at least a 3 inch top from a 12 inch butt with a length of 60 feet. The importance of obtaining four identical timbers will be seen further on. Once the legs are selected and fallen they should be hauled to the building site, peeled, and checked thoroughly for possible damage during falling. Under no circumstances use a timber whose strength is in doubt. It may be worthy of note that any sign of red heart should be avoided.

### Clearing Site

Depending on

Height of  
Tower

It is suggested that the building site be cleared of all obstacles for at least a distance of 60 by 120 feet. A brush scythe should also be used to clean up small bushes etc. as a clean building site avoids the loss of valuable time and tools.

### Preparing Foundation

In most cases it will probably be found that the ground on which the tower will stand is not level and bearing in mind the fact that the bottom of the two anchor trenches must be absolutely level it is important to establish the amount of fall-off. Drive four small stakes where the legs of the tower will be and by the means of a ten foot straight edge and level, or the rubber hose and water method, establish the actual depth of digging required at each post. Having worked from either the lowest or highest side, mark these measurements on the stakes. When the digging of the trenches is nearly completed a continual check should be made to avoid digging past the required depth as it is highly undesirable that the tower should be set on any loose dirt, which would be the case if in places the trenches were dug too deep and had to be

filled in, to level up. The length of the trenches is governed by the length of the anchor log across the base of the legs. However, for the record, the trench size for the particular tower under discussion is 13 feet long, 5 feet deep and 2 1/2 feet wide. It is the writers opinion that a trench 5 feet deep is sufficient for this type of tower to a height of 60 feet, except in sandy soil. If at all possible sandy soil should be avoided, but in cases where this is impossible the installation of guy wires is recommended. It may be worthy of note that when establishing a site for this tower a post-hole auger could be used to great advantage in determining the type of soil. After the trenches have been dug and the base of these thoroughly checked for level, it is suggested that they be covered with tarps to avoid filling with water while remainder of work continues.

### Horizontal Assembly

Lay out the legs in opposing pairs with their butts in line with the trench in which each pair will stand. From the plans decide the location of all bolt holes. Mark these, then after checking, begin drilling. It is important that the anchor logs, the first and second bent logs, be drilled and attached first. This procedure predetermines the length of the cross braces. When this has been completed, attach the required cross braces as per plan. You should now have two complete halves of the tower lying on the ground. It is relatively simple to establish the position of the remaining braces which will join these two halves together when the tower is erected. Attach these braces at the top ends only and the bents at whatever end is most convenient. Do not drill the bottom ends of these swinging cross braces. When these two halves are complete and ready for erection go ahead and construct the ladders. These should be temporarily wired or tied to the outside of the first half to be raised. This provides a means of going aloft to work on the tower later.

### Erection

The next step is to prepare for lifting of the tower and it might be said that occasionally one tower may go up with little or no trouble, and on the other hand the next tower cause considerable difficulty. This interjection is made to point out that many unforeseen troubles and problems may arise in this part of tower construction. The only advice is given at this point is to carefully study all possibilities and dangers before deciding on the course of action. Slip boards may now be placed in the trench. These boards are recommended to be 8 feet in length and 2 by 8 or 2 by 10 spruce, two being required. Place these planks in the trench in a vertical position immediately opposite the base of the legs which are going to be raised. A can of ordinary wagon axle grease is now required and the face of the planks should be thoroughly greased from the point where the base of the legs contact them to approximately 2 feet below the level of the ground. The next step is by means of an axe to round off the upper edge of the base of the tower leg, such as you would

when preparing building skids. This rounded face will come in contact with the greased surface of the slip boards when that half is being raised. Next is to attach the lifting bar, recommended diameter of this no less than 6 inches. The position of this is illustrated on the supplied sketches, but for the records is recommended to be from two-thirds to three-quarters of the distance up. From a central position of this bar the hoisting rope may be attached. Note:- do not attempt to raise the tower from its extreme tips. This is obviously wrong for the following reasons. You are decreasing the angle of lift, increasing the sag of the legs, and the possibility of breakage to both legs and equipment is compounded. Next step erect a tripod. The position and size of which is determined by individual circumstances, but at all times is governed by a few fundamental principles which are evident on the sketch supplied as a suggested method of raising the tower. Be sure the bases of the tripod legs are well dug in. Establish your block on the ground from where the actual pull will take place. A suitable stump, or if not available, a deadman may be used for the purpose. With this done and a thorough check of all equipment made you should now be ready to raise the first half into position. Ideal power was found in a power wagon with winch, however, use whatever is available. This may affect rigging because in the case of a team of horses reduction blocks may be required.

It is suggested that there be at least a 3 man crew to raise the tower. Fasten approximately two lengths, 50 feet each, of light rope to the upper end of half being raised. These ropes may be used by 2 men to guide the half on the way up to prevent it from falling sideways. It is important at this point to mention that extreme care be taken by all personnel for the other man's safety and the lift should take place with slow steady power and in approximately 3 stages. Two husky men should be able to lift the extreme tips of the half of the tower being raised at least four feet off the ground. At the same time the power unit should take up the strain. The reason for the desirability for this manual lift is that it tends to allow all equipment to move into its proper position and to decrease the sharp angle and dead weight of the beginning of the lift. After the men have stepped away a check of all equipment should be made, special attention being paid to the leads from block to block and from block to tower. If the leads are not central at all times considerable trouble may be encountered. The next stage is continue the lift until the tower is approximately at a 45 degree angle with the ground. A halt should be called at this point and the progress of the legs on the slip boards carefully checked. If everything appears in order finish the lift. The first half will drop into the trench and when this trench is at least half filled with dirt you can climb the ladder. Attach a block to the original lifting bar and after re-laying your blocks and equipment you can use the first half to raise the second half of the tower into position.

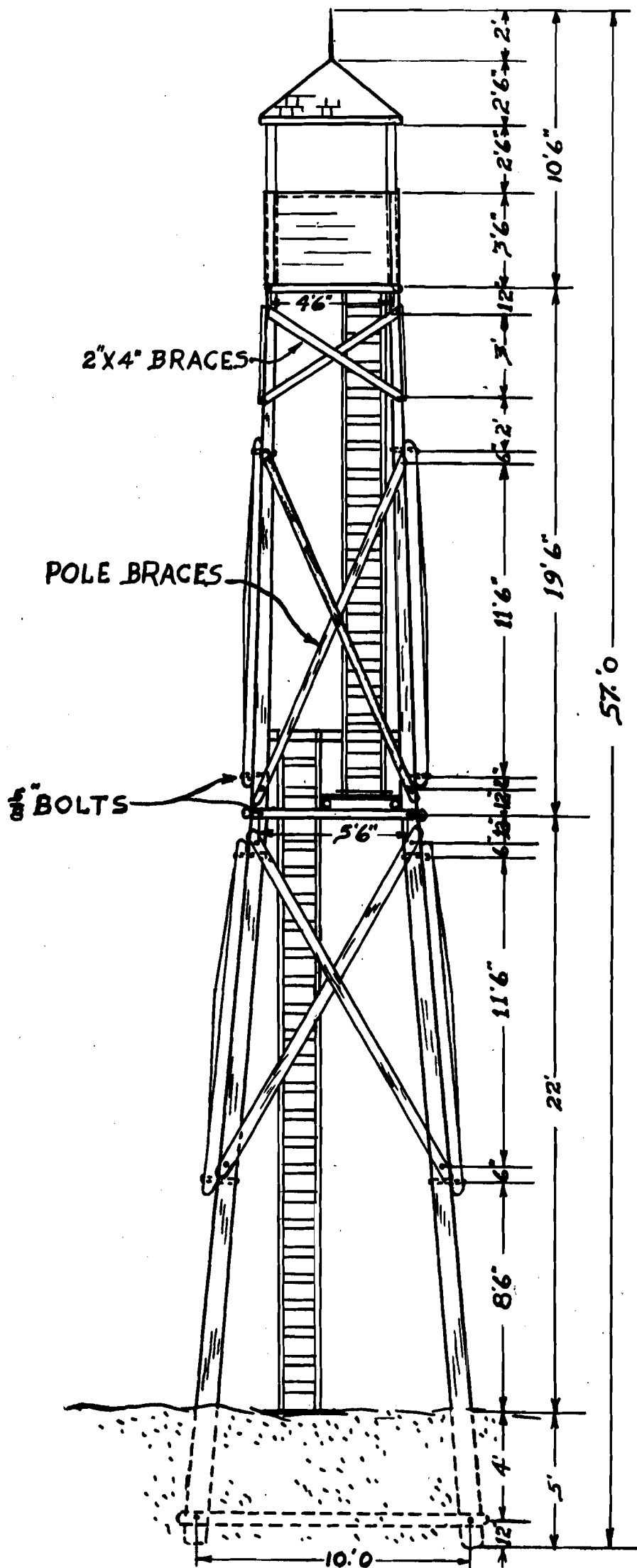
When these two halves have been raised the next step is to install the second or top joining bents. Next the lower or first joining bents. It may require a car puller or fence wire stretcher to

pull the legs together close enough to bolt the lower bents in place. If these tools are not available a rope tourniquet or spanish windlass may be used. It may be best now to check the whole structure for being vertical. After making any required adjustments, fill and tamp the base trenches. The swinging cross braces may now be put into place. It is obvious why these were left to last as their position is determined by the installation of the lower bents.

It is suggested that an upper temporary platform be established and if suitable power is available a swinging scaffold or Bo's'n's chair can be used to good advantage for working on the remainder of the structure. The construction of the cupola is elementary and reasonably explained in the plans of the tower. It is not considered that guy wires are required on a tower of less than 50 feet. This however, as pointed out before depends on the type of soil, and must be left up to the discretion of the Inspector in charge of the Division. It should however, be borne in mind that guy wires would considerably increase the cost of such a tower which at this date may be built for \$150.00 not including Ranger labour. If the first six feet of each leg has a heavy coat of Osmosc and the remainder of the structure is painted with ~~two~~ coats of paint this tower should last at least ten years. In view of the small cost of these towers, their justification is obvious, should one fire be spotted from such a tower in time to prevent a serious spread.

Suggested list of equipment other than actual tower material:

50 feet miscellaneous logging chain	2 pieces 2 x 8" or 2 x 10", 8' long spruce
150 feet 1 1/4 inch rope for lifting	25 or 30 feet miscellaneous 3/4 inch rope
150 feet 1 3/8 inch rope for guiding	Power as available
3 snatch blocks	2 large wrenches
1 can axle grease	Pliers
	Haywire



NAME: CRAWL TOWER NO 1  
 DATE: 27/12/50

SCALE: 1 INCH = 5 FT.  
 DRAWN BY: H.M. RYHANEN