Portable Dock Project

Bill of Materials

Main Frame
6 channel 8.20 x 107'
2 x 2 x 1/2 x 78' angle
1-1/2 x 3RT x .083 x 32'
2-1/2 x2-l/2RTx.25x31'
1/2x6x18'bar
2 x 2RT x .25 x 62'4"
1/2x3x32'bar

Hinge, Axle, and Wheels
2 x 2RT x .25 x 36'7"
2 x 2 x 1/4 x33'6" angle
1/4x2x8'bar
2-1/2 x 2-1/2RT x .253 x 23 (seamless)
2.875 x .207 x 46' pipe
2.575 x. 157x5'pipe
1.90 x. 148x5'pipe
l/2 x 6 x 15'4"bar
3/4 x 16' round bar
24 x .383 x 3' pipe
3/8-16 x 3-1 /2 bolts, nuts, and lock washers (2); bolts grade-5

Shore Legs and Column
2 x 2RT x 25 x 30'
3/4 x 4 bolts (6) grade-8

Main Frame Pivot Assembly
l/2 x 4 x 11'bar
1-1/2 x 3' round bar
1.90 x. 148x50'pipe
2.375 x. 157 x 18'pipe
3 x 4.10 x48' channel
2-1/2 x 2-1/2RT x .25 x 32' (seamless)
3 x 3RT x .25 x 8' (seamless)

Winch Support
3 x 43' channel

Sides and Decking
2 x 12 x 80' redwood (rough)
2 x 6 x 365' redwood con. common
2 x 6 x 80' redwood con. common
3/8-16 x 3 (58) carriage bolts (cad plated)
3/8-16 (58) nuts
3/8 (58) lock washers/20 lb. 16D galvanized nails

Note: All channel bar and angle are mild steel (ASTM-A36) and all pipe, mild steel (ASTM-A35).

Project Scope
The scope of the project was to design and build a non-floating, removable dock for mooring small recreational craft — up to twenty-four (24) feet in length — in a shallow, sloped, hard-bottomed fresh water lake.

Project Considerations
A.) The dock had to have the capability of being secured at different heights by external means to meet the changing seasonal water levels.

B.) The dock had to have the capability of being removed from the lake for winter storage and repairs.

C.) Cost of the project was a critical consideration as only $1500 was allocated to complete the project. This led to material cost reviews for the lowest cost materials with the longest term minimum maintenance that could be provided.

Portable Dock Project
Main Frame Assembly
A level working platform had to be established before any fabricating could be started. Two parallel chalk lines 6' apart were put on a clean blacktop area. Five lengths of 2 x 2RT x .25 x 6' were positioned 8' apart and perpendicular to the parallel lines. The first length was leveled and then all other lengths were leveled to the first one using a transit level secured in place.

The first step in fabricating the main frame section was to assemble two 36' lengths of 6" 8.20 channel. Since only 20' lengths were available, each length is made up of a 20' and a 16' length butted together with a splice plate welded to the inside of the channel with a butt and plug weldment on the outside areas of the channel.

These 36' channel sections were placed on edge on the level platform with the insides of the channels facing each other. The spliced areas of each channel were positioned so that they were not directly opposite each other in an attempt to equalize stress.

The next step was to lay out and cut the seven 6" 8.20 channel cross members to the desired length and joint design. A sheet metal template of the joint design was made for uniformity of marking and cutting both ends of all seven cross members.

The joints of the entire project were designed to attain maximum metal to metal surface contact and weld area.

The fitting and tacking of all cross members in place was accomplished. Then, all corners of the main frame were squared and temporary diagonal bracing was tacked on to keep the frame square while welding. All flat and horizontal areas of the joints that could be viewed inside and outside of the channel, as seen in the top view, were welded. The frame was then inverted and all the flat and horizontal welds on the other side were made.

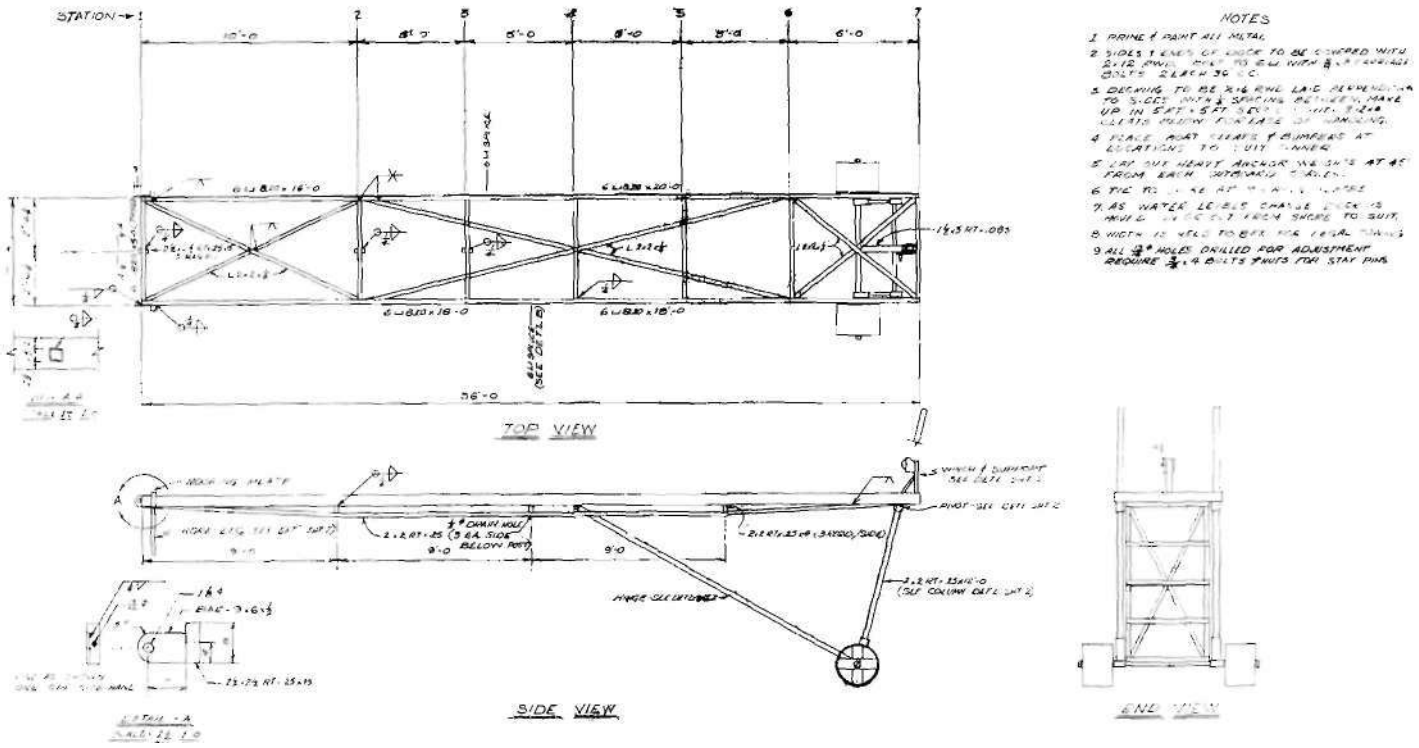
The main frame section was then rotated on its side and braced in position. All flat and horizontal welds that could be done in this position were made. The frame was then inverted and the process repeated. The structure was then placed in the top view position for laying out, cutting, and welding in place the diagonal bracing.

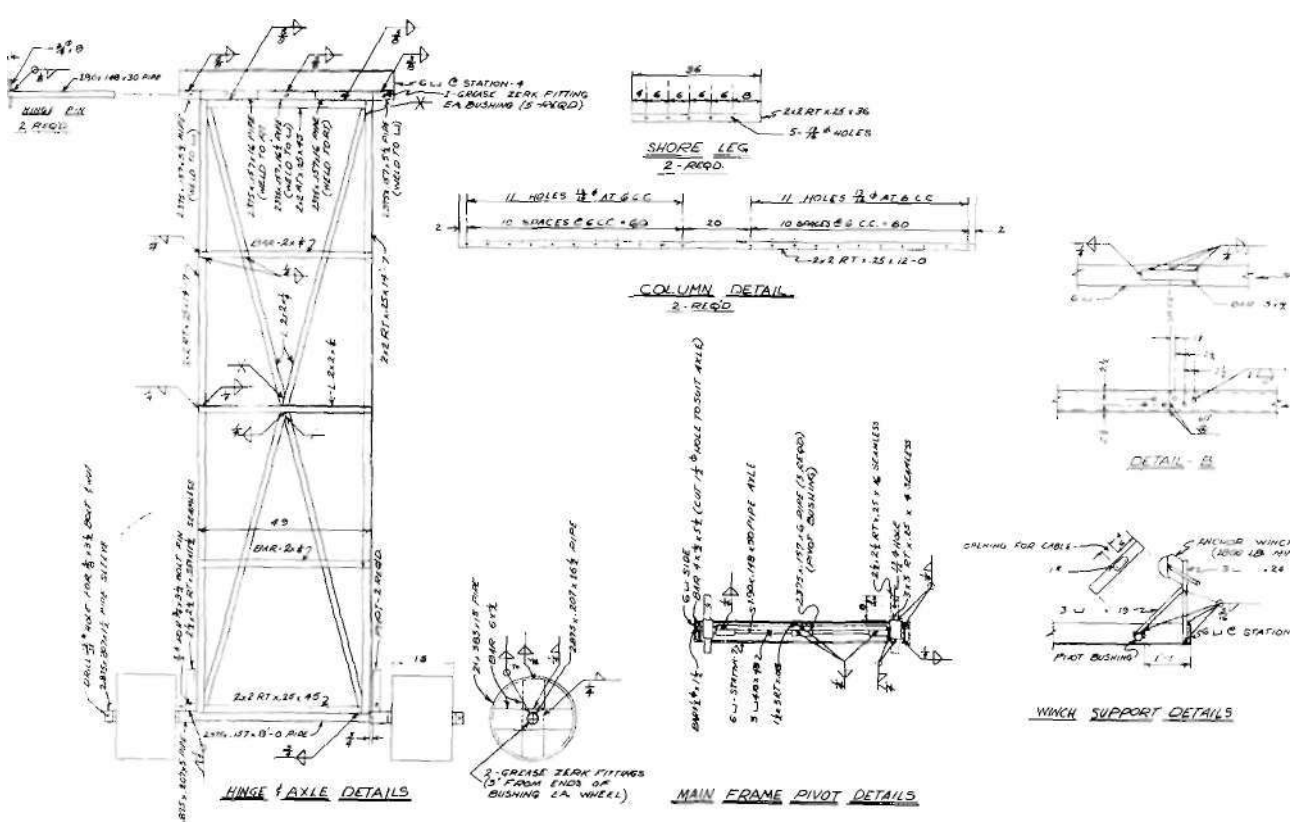
Square holes were cut and sleeves welded in place in the first three cross members from the shore end. These sleeves were installed for the use of an optional towing device. The frame was inverted to complete all the flat and horizontal welding of the diagonal bracing and sleeves.

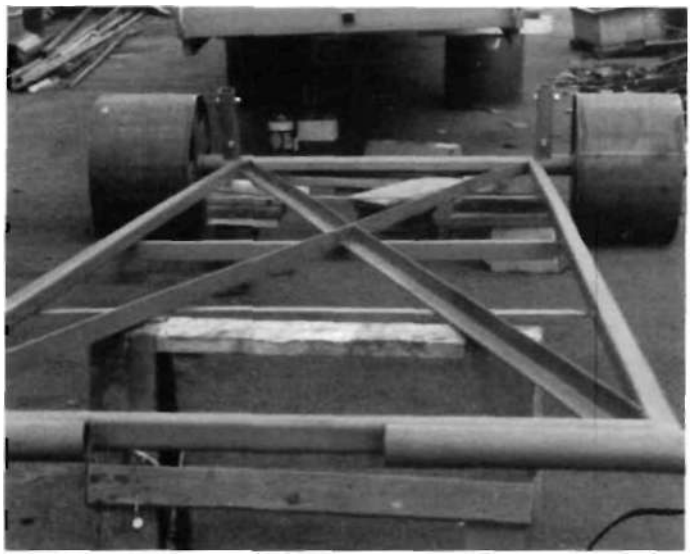
At this point, the frame was bottomside up and the six truss posts were welded in place. The diagonal cuts (4) of the truss member were laid out and cut. The truss member was then tacked to the truss posts with the diagonal cut facing down, facing the edge of the 36' channel.

A weight of about 75 pounds was placed on the top of the truss member about 4' from the end. The area of the truss member on the outboard side of the end truss post was heated all around with a rosebud torch. When hot enough, the weight slowly bent the free end of the truss member down until the diagonal cut fitted up to the bottom edge of the main frame. "C" clamps were used to secure the truss member to the frame while the joint was tacked in several places. This procedure was repeated three times.

At this time, the shore leg sleeve and mooring plate were welded onto the main frame. The main frame remained in this inverted position until the hinge part of the hinge and axle assembly was fitted up and the main frame pivot assembly was welded into place.







Hinge and Axle Assembly

The hinge and axle assembly is designed to be totally removed from the main frame and to fit inside the bottom of the main frame at the point of attachment when assembled. This section has the axle wheel assembly at one end and half of the hinge to main frame at the other end.

The weight of the lake end of the dock rests on the axle and wheels attached to the support columns by a pivoting column to axle socket arrangement. The column passes down through the sleeves of the main frame pivot assembly and into the column to axle socket where it is secured with a 3/4"x 3-1 /2" bolt, nut, and lock washer. The column secures to the main frame pivot assembly by aligning the holes of the pivot sleeve and column and inserting a 3/4"x 5" bolt (grade eight).

The frame of the hinge section was fitted, tacked, and squared with temporary bracing and the joints welded on one side. The frame was inverted and the other sides of the joints were welded. The diagonal and cross bracing was cut, fitted, and welded into place. The axle was welded to the end of the frame with multiple passes on both sides, air-cooling and alternating passes from side to side. Temporary braces were placed from the end of the axle to a point on the frame 5' back from the axle. This was done to minimize distortion of the free ends of the axle. These braces remained in place until the axle returned to ambient temperature naturally.

The pivoting column to axle socket, called the pivot on the hinge and axle detail, allows the wheels to be positioned outside the width of the main frame for maximum stability. The square sockets of the pivots are spaced and aligned vertically with the sleeves of the main frame pivot assembly. The pipe section of the pivot is drilled, taped, and fitted with a zerk fitting for lubricating.

The wheels are designed for rolling the dock in and out of the lake and not for towing in transport. They may be removed from the axle. The rolling sections of the wheels were cut from a section of 24" well casing manually with a torch. The outer radius and hub holes of the spokes were cut with a torch on a magnetic tracer machine. (See hinge and axle detail for more information.)

At the other end of the hinge frame is the actual hinge assembly. It consists of five sections of 2.375 x . 157 steel pipe and two lengths of 1.90 x . 148 steel pipe as seen in hinge and axle detail. Two 16" lengths of the larger pipe with a 16-1/2" length between were aligned on a 5' section of the smaller pipe. This assembly was positioned against the extreme end of the frame and centered with the outboard ends of both 16" sections aligned flush with the sides of their respective frames. The 16" sections were tacked at each end on both sides of the pipe to the 2 x 2RT x .25. The 16-1 *I"* center section was not tacked. The tacked sections were then welded 1 /3 of the way on one side. Then the frame was inverted and 1/3 of the pipe at the opposite end of each section was welded. This process was repeated until welds were full length on both sides.

At this point the main frame section was still positioned with the bottom side up. The hinge end of the hinge frame, minus the wheels, was placed on the main frame, and was stationed at the fourth cross member from each end, with the wheel end at the lakeside end of the main frame. With the pipe sections centered on the cross section, a 5-1 /2" section of the same pipe was placed over each end of the 5' section of the smaller pipe. These short sections were positioned flush with the outside edges of the main frame, with the entire assembly aligned left to right and fore to aft on the cross member. The assembly was then clamped into position and both ends and center sections of pipe were tacked to the cross section of the main frame. The 5' aligning pipe was then removed and the frame section removed from the main frame. The aligning pipe was put back in place through the three sections of pipe tacked to the cross member. The sections were horizontally welded, alternating from side to side to keep sectioning from rolling. Between each five sections of the hinge arrangement exists a 1/8" gap and each section is fitted with a zerk fitting for lubrication.

The 5' aligning pipe was then removed and each end drilled and a 3/4"x 8" round bar inserted and welded in place. The pipe was cut in half with a pipe cutter and reamed. These two sections make up the hinge pins.

Column and Shore Legs

The support column supports the weight of the lake end of the dock against the axle and wheel arrangement. Shore legs support the other end, resting directly on the ground.

Main Frame Pivot Assembly

The main frame pivot assembly is designed to guide and secure the support columns to the main frame and to allow for unbinding movement of the columns through the sleeves while changing the vertical distance between the wheels and the main frame. This assembly was built on the bench with in-place fittings and adjustments. It was positioned and welded to the bottom inside of the main frame so that the downward force of the main frame would be in compression vice tension with the pivot assembly. All the members of the front half of the 6' section are tied together structurally. This assembly is not removable.

Winch Support

The winch and support were installed to raise and lower a suitable anchor to help maintain stability during high wind and wave conditions.