Shay Main Frame

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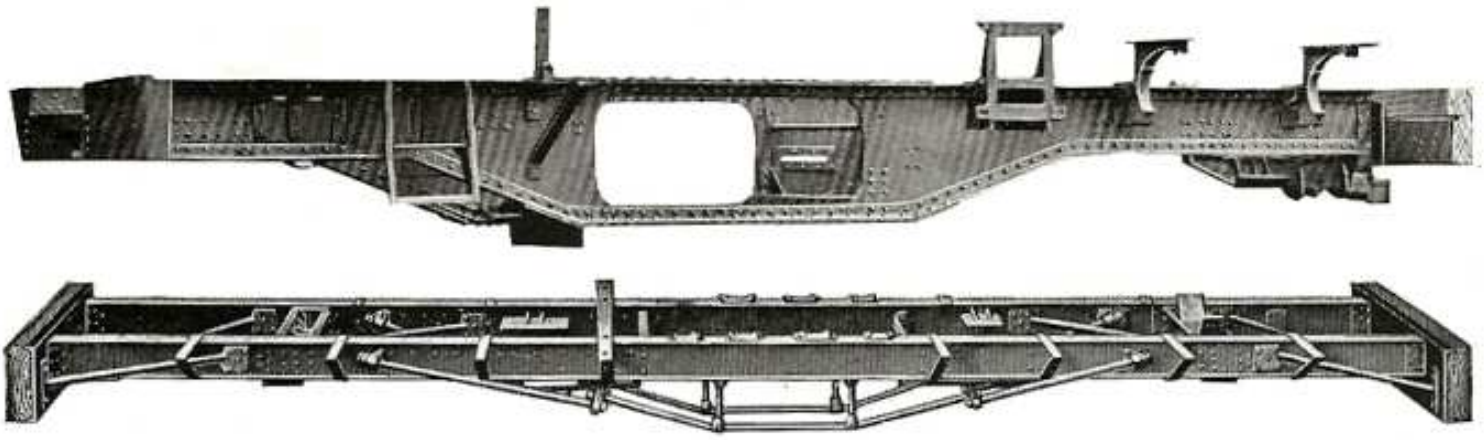
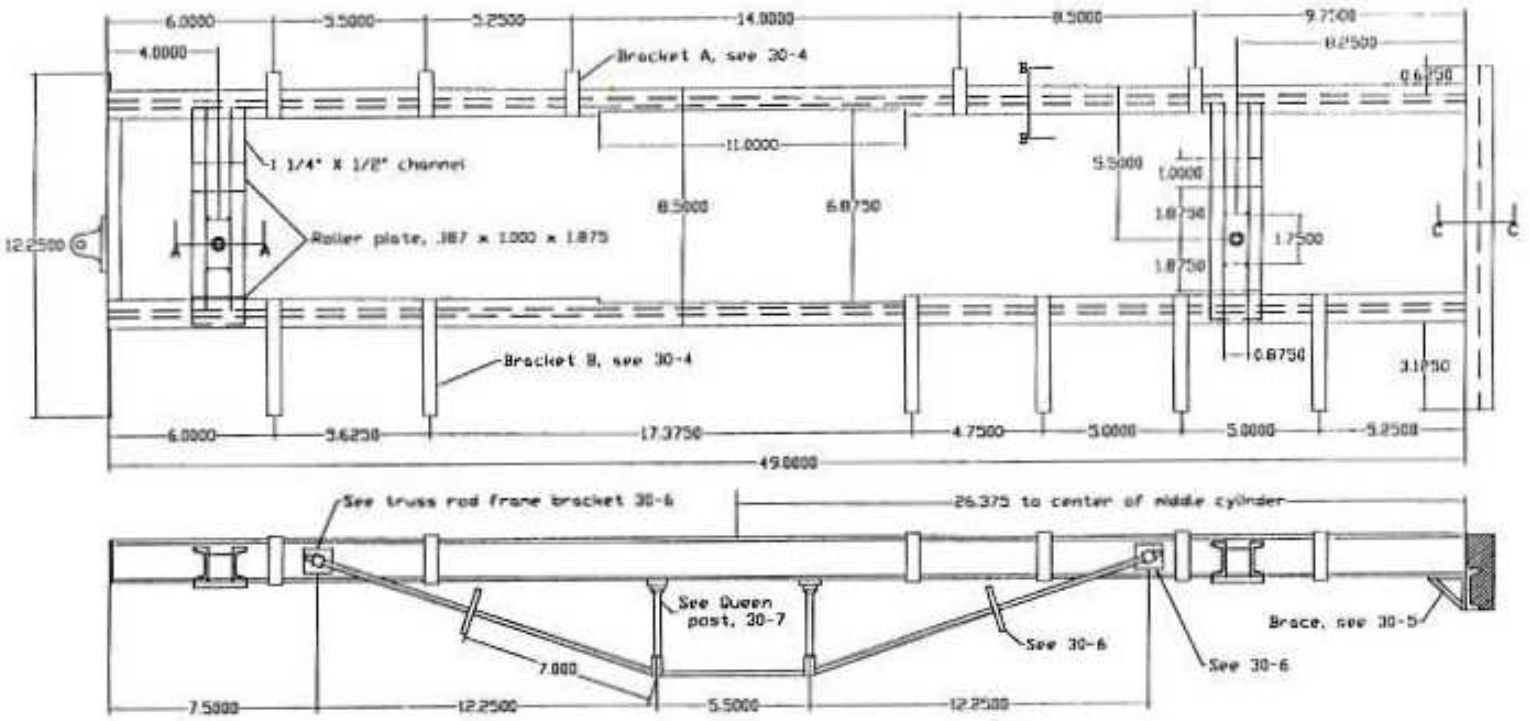
Let's start with a bit of history: Lima used two types of frames on the Class B (2 truck) and Class C (3 truck) shays. The sketch below from a reprint of a Lima Service Department Instruction Booklet shows the two types. Both these frames are for Class B Shays. The Class C frames are nearly identical; the major difference being that the part behind the rear truck is much shorter.

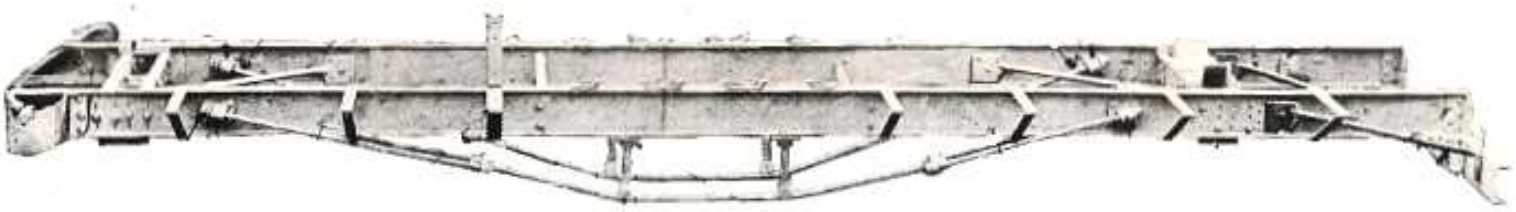


The upper frame is the later Girder type introduced in the 1910 - 1920 period. The lower frame is the **I** Beam or Truss Rod type used from the beginning on the Class B and Class C Shays and is the type Kenneth used in his design.

The main frame construction went much easier than the tender frame because I'd developed some expertise doing the tender frame. The following drawing is the 3-Truck Main frame provided by Kenneth. There' a half dozen more drawings for the main frame showing details such as coupler pockets, queen posts, etc. (These drawings are available from Kenneth.)



The sketch below is from a reprint of a Lima Spare Parts Book . This main frame went with the tender frame sketch shown in the tender frame note. My guess is that it's from the 1900 - 1910 period. Excepting the curved rear end, it's a nearly exact match for Kenneth's drawing above.



If one examines the frame drawing it will be obvious that the frame is not symmetrical around the center line of the track or trucks. Recall that the engine is on the right side of the locomotive. The boiler is off center toward the left side of the locomotive to make room for the engine and to balance the weight of the engine. The boiler is centered on the side **I** beams with the engine attached to the outside of the right **I** beam.

I made my main frame is exactly to Kenneth's drawing with the following exceptions:

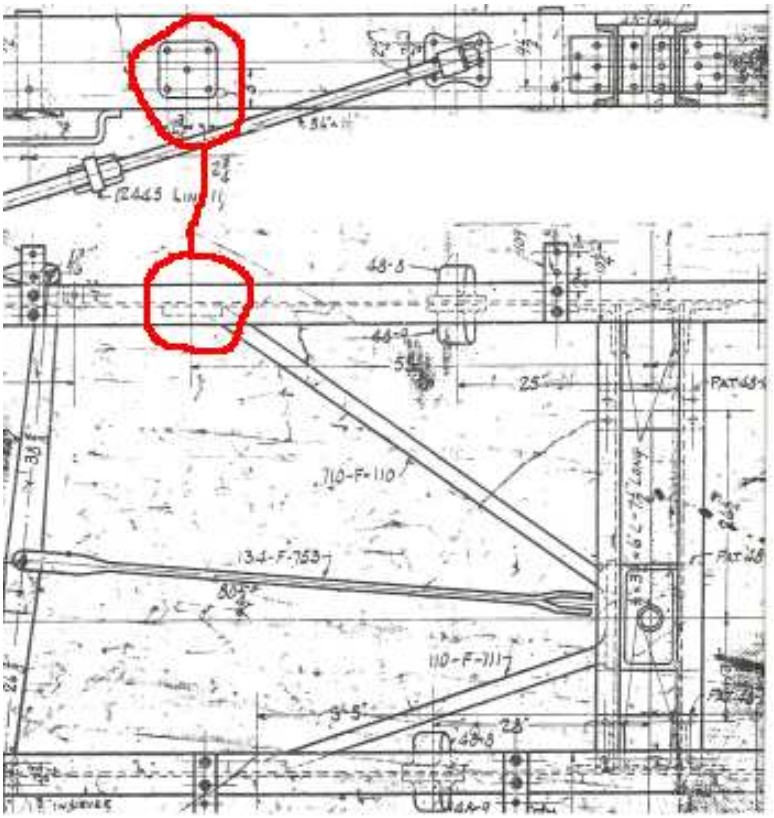
1. The channels were screwed together using button head cap screws (simulated rivets) rather than welded
2. The triangle frame brackets were used instead of the flat bar frame brackets.
3. Some cosmetic details were added such as rivet detail for bolster supports and a front sill support.

The following construction sequence was used on the main frame. This is a little different from the tender frame since I knew where I was headed and had a pretty good idea of how to get there.

1. Construct the pair of bolsters.
2. Make the side **I** beams (two channels screwed together) and attach to bolsters.
3. Make and install **I** beam truss rod details.
4. Make and install (triangle) frame brackets
5. Make the end channels and attach to **I** beams.

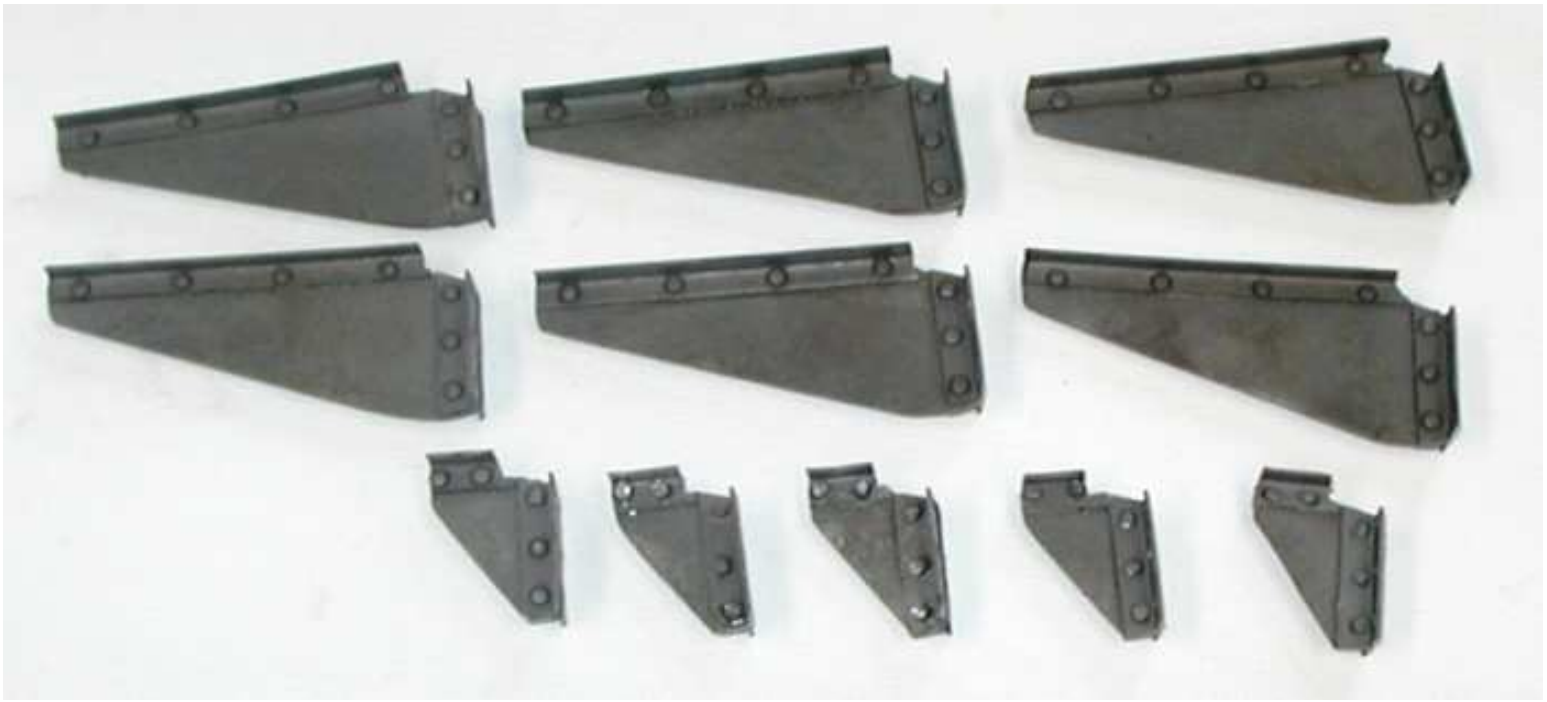
The bolsters shown on the right were assembled first. All the parts except the angle brackets were first screwed together and then silver soldered. The angle brackets were then screwed into the bolster but not silver soldered. The holes for the screws between the **I** beams and the bolster were drilled later using the holes in the **I** beams as the drilling template. The truck pivot pin holes illustrate the off center relationship between the frame and trucks.

Scale **I** beams for the side frame pieces are not available so **I** beams are made by fastening two channels back-to-back. Kenneth welded his channels together. Because of nonexistent welding skills I decided to screw the channels together. Review of the Lima Drawings revealed braces from the bolsters to the **I** beams. I had no intention of installing those braces but the the rivets on the **I** beam end were used to hold the two channels of each **I** beam together. A clearance hole was drilled in the outer channel and the inner channel threaded for button head cap screws. There are two like the one shown below on each side of the main frame. .



The truss rods looked to be a quick job until I counted up all the required parts as shown in the photo below. (When the truss rods were installed later it was discovered that 4 more of the brass nuts were required.) As you'll see later, the truss rods add nice detail.

The frame brackets were made using the same technique as described for the tender. If fact, the same fixture used on the tender frame was used to fabricate the smaller brackets. These brackets were made from 20 gauge steel. The brackets and the truss rod details above took over half the main frame effort.

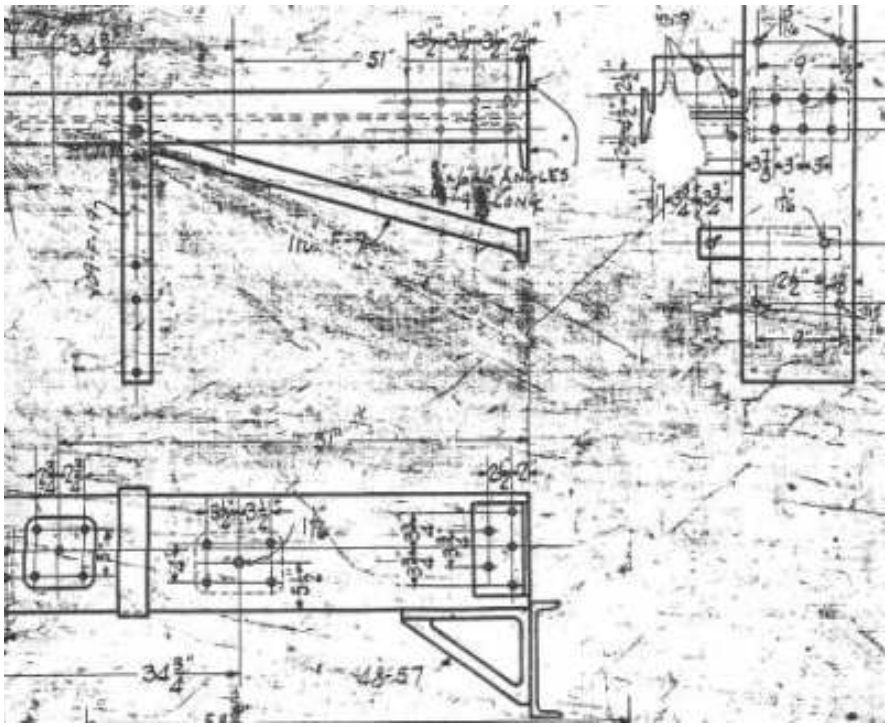


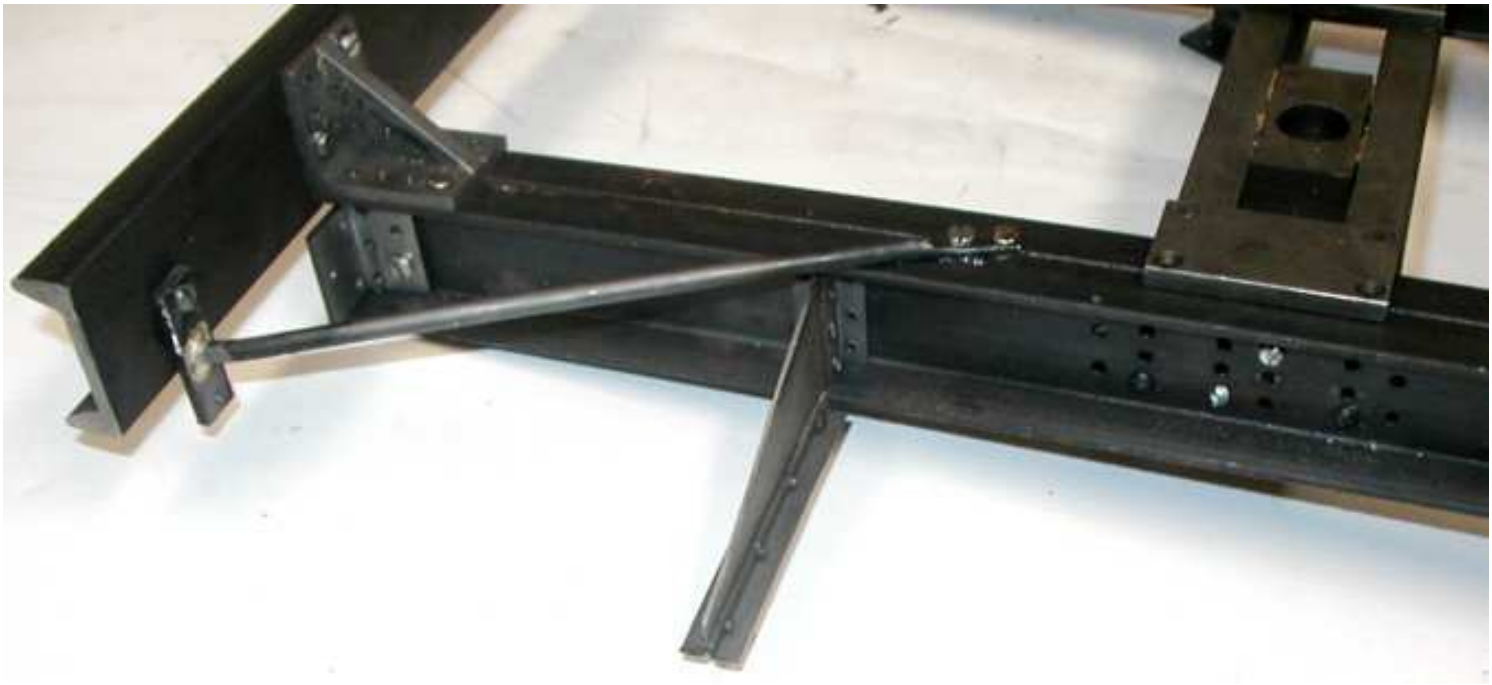
I reviewed the Lima drawing shown on the right before deciding how to fabricate the front sill and related brackets, braces, etc. The bracket between the frame and the sill channel is exactly like the bracket Kenneth shows in his drawings. I made angle brackets for each side of each **I** beam to attach to the upper part of the wooden sill.

There is a brace from the right **I** beam to the back of the sill to support the sill that sticks out quite a distance from the **I** beam. This brace makes a nice detail to add.

The photo directly below the drawing shows one of these braces on Cass No 5. The end that attaches to the **I** beam is different from the drawing above. Also note that the bottom of the triangle bracket is cut to provide clearance for the brace. The brace seems to be bent a bit to make room and to support the tool/storage box.

My model of this area is shown in the photo below. That is the the under side of the right front. The frame was still under construction at this point and only a few screws are used to hold everything together. Button head screws (simulated rivets) will be used everywhere except into the sill where 4-40 hex head screws (simulated bolts) will be used.





Excepting the offset, the rear sill shown below is essentially a mirror image of the tender front sill.

The following photos show completed frame after the 368 screws were installed.

Update 2/20/2004: Careful measurement of the frame revealed the the I beams bowed out about 1/4" midway between the two bolsters. The photo on the right shows an added cross brace to prevent the bowing. The photo is after the frame had been painted. Note that the new channel is even with the top of the

frame I beams. I later found that it interfered with the bottom of the boiler. A small amount of material was removed at the top center to provide clearance. The brace could have been aligned with the bottom of the I beams like the bolsters and there would have been no problem. However, I like the appearance with the cross brace in the upper position.

Some of the techniques used to fabricate some of the frame parts are described in the accompanying note Main Frame Fabrication.

The next task is to construct the pivot blocks and rollers that are the interface between the trucks and the frames. The construction of the brake system will complete the trucks.

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