

Seminar 1 Rigging and Tuning

Section 1 Bart Snow

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1. Tiller Bend / Rudder Motion

Weather helm is when a boat wants to turn into the wind. Lee helm is when a boat wants to turn away from the direction of the wind. When you have weather helm you must pull on the tiller to make the boat go in a straight line. Since Townie rudders are large, when you pull on the tiller the rudder acts as a big water brake and slows the boat down.



Notice the angle of the rudder and tiller in this picture as I am trying to steer the boat in a straight direction.

The cause of weather helm is an unbalance of the Center of Sail Effort (CS) and Center of Underwater Effort (CU), the centerboard. When boats are designed, the CS is typically designed to be 5-8% of the waterline length aft of the CU and this is called "lead". The original Town Class design was balanced and the lead was correct with only a slight weather helm.

In the 1940's and 50s, sail makers made mains larger and larger to make the boats go faster. There was growing concern in the class in the mid 50's and in 1958 the rules were developed to

limit the size of sails. The new specifications were arrived at after measuring all sails in the fleet and coming to agreement on what size would be equitable for all owners. Some owners had sails that were oversize and had to be recut. We use these sail specifications today to measure all new sails.

These new larger sails changed the center of sail effort (CS) and increased the weather helm of the boat. To correct the weather helm, masts must be moved forward or raked forward, moving the CS back to the original design position.

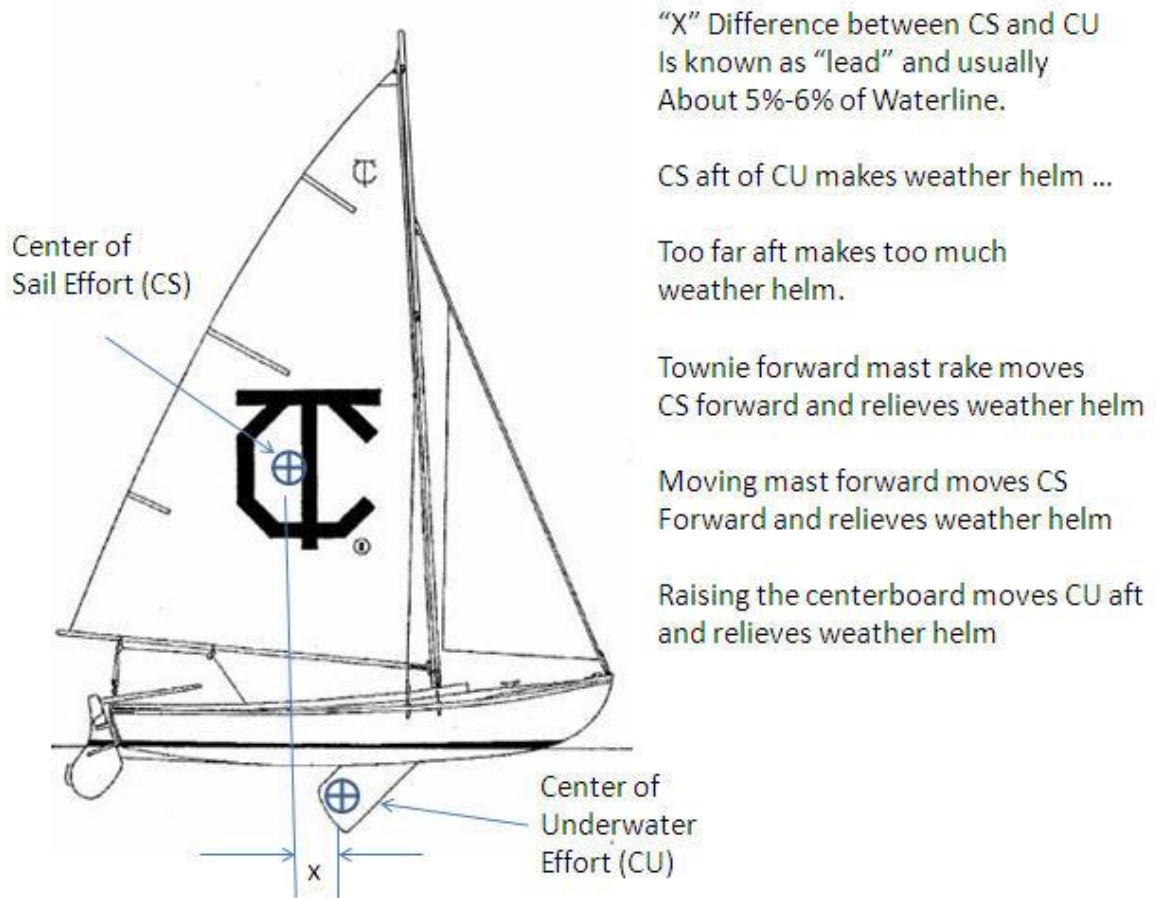


Figure 1-1 CS and CU Illustration (Key 2015)

There is another way to relieve the weather helm and that is to raise the centerboard, which because the board pivots on the leading edge, moves the CU aft. However, when the board is raised, there is less board in the water and the boat is apt to slide sideways....not a good thing either.

At this point I want to say that all of what we are discussing here should be thought about when preparing your boat and not on the race course. Tactics should be thought about on the race course.

2. Masts and Mast Stepping

The easiest way to step the mast is while the boat is on the trailer, before it is launched, and it is best to have four people. With one person's foot on the butt of the mast, the mast is "walked" to vertical by two people starting at the top of the mast and working their way towards the butt until the mast is vertical. Two people on the ground hold the mast while the other two stand on the deck ready to receive it. Put a piece of rug material on the deck to keep it from getting scratched. With the mast standing straight up, both folks on the ground pick the mast straight up, keeping it balanced vertically, and hand it over to the two folks on deck. The butt of the mast is put on deck and balanced vertically while the two folks on deck get ready for the final lift. The two on deck pick the mast up a few inches, move it over and put it into the mast step. Once the mast is in the step, one person can easily hold the mast while the stays are attached.

Removal of the mast is the exact reverse of stepping.

Masts should be made from Sitka Spruce. Masts have been made from Fir as fir is a lot cheaper and these masts should not be used for racing. Sitka Spruce masts are lighter and much more bendable than fir masts. We will discuss how masts bend later.

3. Shrouds and Mast Foot Location

A Townie has a forestay which goes from the front of the mast to the bow and two stays on each side. The lower stay on the side, attached to the aft chain plate, supports the middle of the mast and acts as a back stay. The upper stay on the side, attached to the forward chain plate, supports the top of the mast.

As we discussed, the placement of the mast foot affects the boat's balance and weather helm. You cannot just move the mast without changing two other things: the chain plates and the jib fairleads.

Chain plate placement is defined in the Town Class Specifications, Page 5, as follows:

ARTICLE IX – HULL FITTINGS:

B. Chain Plates – Specifications are as follows:

1. Shrouds and back stays must be fixed to permanently located chain plates.
2. The position of these may be chosen to achieve proper boat balance. The use of a bar attached to the chain plates in lieu of moving the chain plates is permitted.

3. The forward shroud attachment at deck level shall not be forward of the center line of the mast with the fore stay taut.
4. The distance between the back stay hole and the shroud hole in the shroud attachment shall be 12" minimum.
5. The attachment of the fore stay will be as specified on the Plans and not be forward of the bow.

As you can see by specification #3 above that as you move the mast forward, the chain plates should also be moved. On a temporary basis, you can move the mast forward without moving the chain plates forward and still be legal within the specifications. The only disadvantage is that on a run you cannot let your boom out as far as you would be able to if you move your chain plates forward.

As you can see by specification #2 above, that you are allowed to use a bar attached to the chain plates to attach the bottom of the stays to. These bars allow you to move the placement of the stays as you move the mast back and forth as you try different positions of the rig.

While we are on the subject of chain plates, I should say that it is my opinion that they should be through bolted on all boats with a backing plate of wood or plastic. The backing plate spreads the load. On many fiberglass boats the chain plates are only held in place by a machine bolt threaded into the fiberglass.

The second thing that must be looked at and changed when you move the mast is the jib fairlead. Some boats have replaced their fixed jib fairlead on the deck to one which slides on a track which allows for greater adjustment. If you change from the fixed fairlead to one with a block you probably will have to move it as the block will raise the height of where the sheet hits the deck.

The mast position and fairlead adjustment is all about the slot between the jib and main and how the air comes off the jib onto the main. This slot is very important and the distance from the jib to the main must be the same from bottom to top for proper even air flow. If you move or rake the mast, you will change this slot.

While we are talking about the slot, it changes as you head off the wind. The previous paragraph is true when beating, but when you go off the wind on a reach the slot changes as you bear off. This is why you have a reaching hook for the jib sheet just forward of the forward side stay. I'm sure, after reading this, you will look up more often and be more aware of the slot.

4. Mast Rake

As we discussed earlier, mast rake affects the boat balance and weather helm. I also think that it is necessary to rake your mast as a result of the enlargement of the mainsail in the 40's and 50's. The larger main had to have an impact on the slot between the jib and main. Be aware that raking your mast forward has a definite effect on the slot and the location of where your jib sheets hit the deck.

If you decide to rake your mast forward, you may have to cut a larger hole in the deck for the mast. A word of caution is to be careful cutting structural cross members in your boat and if you do cut one, be sure to replace it.

Another heads up is if you decide to rake your mast forward, your head stay may be too long. If it is too long, my suggestion is to remove the turnbuckle and replace it with a shorter forestay adjuster.



The one shown here is available from Annapolis Performance Sailing or APS.

5. The Forestay

The forestay holds up the mast, but more importantly it controls the bend of the mast and the shape of the mainsail.

In light air you want the biggest, fullest mainsail possible and in heavy air you want it flatter so that the air will exit quicker. In light air you want a straight mast and a straight boom. This will give you the fullest mainsail possible. This is easy so long as you pull your boom in with the main sheet and not down.

In heavy air you want a flat mainsail. This is achieved by bending the mast and boom in an arc. Key to mast bend is the forestay. In heavy air you pull the boom down. This does several things. It bends the boom to flatten the sail and it pulls on the leach of the sail which pulls the top of the mast aft. You can also use the vang to assist in this.

Years ago, prior to the rule change removing the wire from the jib luff in the 90's, we would pull the jib halyard up tight, before raising the main, and you could see a definite forward bend in the mast, the top

bending aft. You would let off on the jib halyard until the mast was straight and you were set to sail. In light air your mast was straight, but as soon as the wind picked up, the mast would bend. Without the wire in the jib, it is a little harder. Your forestay must be tight to hold the mast, but not bend it in light air. The jib halyard without the wire controls the luff tension of the jib and not the bend of the mast. This is why the tightness of the forestay is so critical.

I believe the mast should float and be blocked at the deck level only on the front side. When I leave the boat on the mooring I have cleats on the deck for the halyards. When I sail I do not use those cleats to secure my halyards. My jib halyard is fastened to a jib tensioner which is secured to the mast and my main halyard is wire and secured by a swedged ball and a Race-Lite Heavy-Duty Halyard Lock (available at APS) on the mast.



6. Tuning the Stays

The tension on your stays should be loose enough so that if you grab the two starboard stays in your right hand about four feet above the deck and grab the two port stays in your left hand about four feet above the deck, both stays will be about two inches apart on each side. This is loose enough to allow the mast to lean to leeward and allow the air to leave the sail at a higher level. To keep the rig stable when I leave the boat at the mooring, I tie a clove hitch around the stays to keep them tight.

As discussed above, the forestay should be adjusted first. Then the aft stays on each side so that the tension is as stated in the previous paragraph and when the mast is in its most forward position, both aft stays have about the same tension.

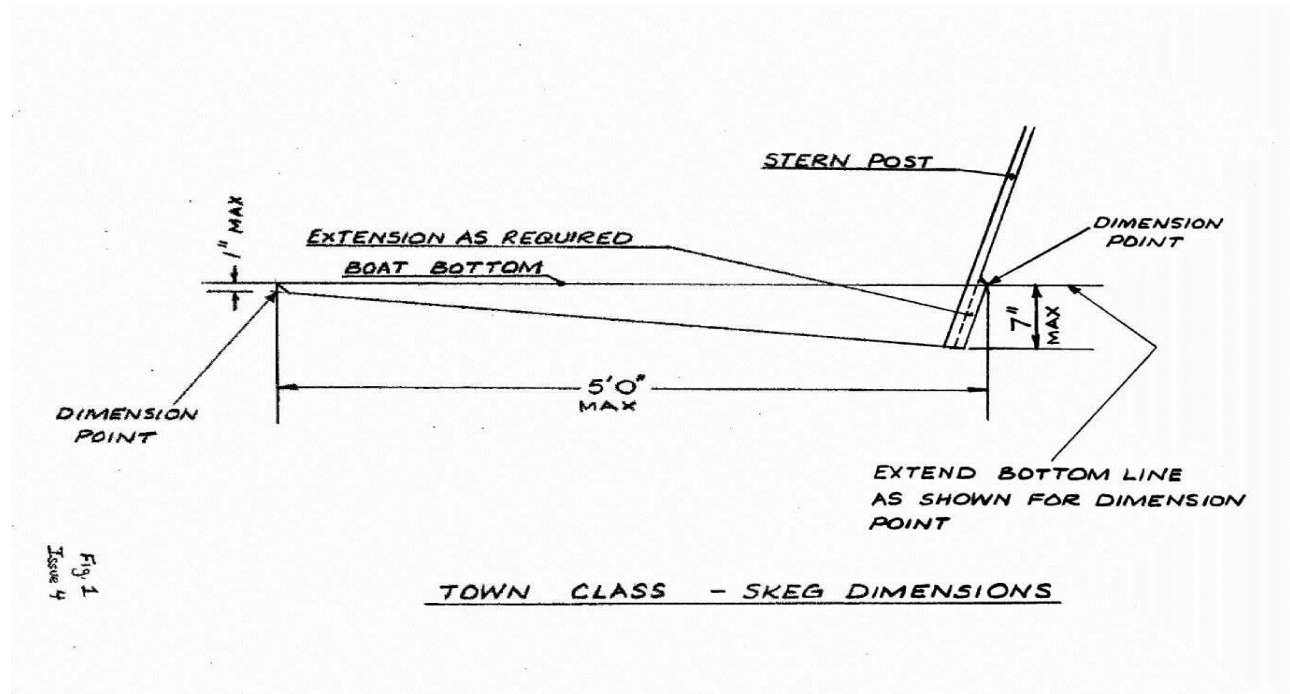
Lastly you adjust the forward stay on the sides. After the short stay is adjusted to the right tension, get someone to sit on the leeward rail and you sit on the leeward side and look up your mast sail track. It should be straight from top to bottom. If the top of the mast leans off to leeward, tighten the forward stay which goes to the top of the mast. If the top of the mast leans to windward, loosen the forward stay which goes to the top of the mast. Now adjust the stays on the other side. When both sides are done and the mast is straight, make sure the tension of the stays is correct as explained above.

You have now tuned your rig as you would a violin, but you must keep it in tune. On a windy day when your crew is sitting on the rail and they want something to hold on to, do not allow them to hold onto the stay which is a common practice. Ask them to hold on to the turnbuckle as close to the deck as possible. Pulling on to the stay will change the shape of the mast.

After sailing a wood boat many times in a summer the sides of the boat will warp towards the center of the boat and the deck will begin to rise. This will change the tune of a boat and you should install a turnbuckle between the mast step and the underside of the deck. If you tighten the turnbuckle in the spring it will prevent the deck from rising and the sides from warping in.

7. The Skeg

The skeg has an effect on the center of underwater effort (CU) and therefore your weather helm. As well, a larger skeg seems to drive the boat upwind better. Therefore, you should make sure that your skeg is close to the maximum dimensions as allowed in the specifications, page 10, figure 1:



If your skeg is undersize, you can build it up by adding a piece of wood or making a mold of wood with wax paper on the inside and adding layers of fiberglass mat. I prefer the fiberglass method as it was easy and less time consuming. I cut the mat into $\frac{3}{4}$ " wide pieces, saturated them with epoxy resin and laid them in the mold. When it dried I filled the voids and sanded it with a 4' long board. Using this method, it came out very straight.

The front edge of the skeg which is no more than 1" high, I rounded. The fastest shape through air or water is like an airplane wing, round on the front, feathered on the rear and the thickest dimension about $\frac{1}{3}$ rd of the way back.

8. The Jib

The jib should be raised before the main to allow you to look at the mast and make sure that the jib halyard is not putting a bend in the mast. The jib halyard should only be used to tension the jib luff.

Many sailors have installed a couple of blocks called a jib tensioner which allows them to adjust the jib luff tension while underway.

The jib sheet should be adjusted so that the telltales on the luff of the jib lay flat against the sail. If the ones on the windward side of the jib fly up, you are sailing too high into the wind or your jib needs to be pulled in. If the ones on the leeward side of the jib fly up, you are sailing too low off the wind or your jib needs to be let out.

In my boat when we come about, my crew goes to the other side, at the same time pulls the jib in and cleats it and gets out on the rail and we get the boat going. Our jib is cleated to a double sided brass jam cleat located on top of the centerboard trunk which makes it easy for me, the helmsman, to adjust. I adjust the main for the wind conditions and then adjust the jib so that they both luff at the same time.

If you have any questions or need advice, do not hesitate to call me.

Bart Snow