DORY PROJECT CHAT SHEET #3: THE TRAILER

Bob Davis

When is the Trailer Needed?

In the construction sequence for the Dory, once the outside-in construction of the hull is completed, and it has been Dynel sheathed, and painted, the hull needs to be turned right-side-up. That requires hiring a crane, because an 8.5 metre hull is a bit too big to be flipped over by hand, short of having a huge band of willing helpers available on the day.

The builder has a choice at this stage. The first option is to turn the hull over and sit it on to a fabricated support cradle, to complete the superstructure, then have the crane – or a bigger one - come back to lift it onto a trailer.

Option #2 is to sit the hull onto its trailer at turn-over stage, and do the rest of the construction with it sitting on its trailer – thus avoiding need to have a second visit by the hire crane and saving some money. It also means the boat becomes mobile – on its trailer, you can move it about rather than it taking up semi-permanent static space for the duration of the build. Upfront, I decided on option #2. That meant I had to acquire the trailer early in the project.

What's required for the Trailer?

Smart move: from the Seamedia.com.au website, buy and read a copy of F&B's *Trailers, Towing & Rooftopping* to get the essential information you need!

What's required is a trailer for an 8.5 metre boat with a total loaded mass of boat on trailer certain to be over 2000Kg - but under 4 tonnes, thus fitting into the category of 'small trailers' in terms of Australian design rules. You can buy one and adapt it for this hull, have somebody build one for you – or, if you can weld, you can buy the components and build it yourself.

If I was rich man, I'd buy a new-breed U-bolted aluminium trailer, to get the tow weight-saving and least corrosion benefits they offer. However – do you have any idea what it costs to buy such a trailer from a trailer manufacturer or importer? An awful lot! As at October 2008, at the high end of the game, an imported made-in-USA aluminium trailer big enough for this boat, and meeting Australian legal requirements for trailers over 2 tonnes, will cost you more than – gasp - $18,000.

I'm assuming here that really, really wealthy folk who could easily afford such a thing probably aren't very interested in DIY boat and trailer projects, and hence that the reader is like me, an 'average income person'. Now that you've recovered from fainting and regained some composure – let me repeat that number: $18,000 - and more if the Oz dollar has slid further relative to the Yankee greenback.

No, it isn't diamond studded and gold plated. It's just a really well designed and made aluminium trailer with top quality undercarriage and braking system. The problem for average income people is that that's more than it might cost to build this boat!

For an 8.5M boat likely to displace somewhere between 1200-1400 Kg (2700-3000 pounds), the trailer itself, assuming steel, can be expected to weigh 800-900Kg, pushing the aggregate loaded mass to well over 2 tonnes, so it requires at least two axles, each able to carry 1200-1400Kg. It also requires tyres with a load index rating over 90.

The 90 index signifies 600Kg load per tyre, providing just a bare minimum load margin, and smart people will want more load margin – using tyres with index ratings of 93+.

I'm figuring on tyres rated over 800kg each and two galvanised AL-KO IRS axles (to save a bit of trailer weight), each able to carry 1400kg.

To be legal on the road, the trailer must have assisted electric, hydraulic or electric-hydraulic brakes, not just basic over-ride brakes, on all four wheels, and it must have full break-away braking capability.

To make those capabilities last, the axles, springs and shackles (if used instead of IRS axles), disk hubs, disk brake callipers, actuators, connectors – all must be marine grade. The metal stuff needs to be galvanised or stainless steel. That's what makes decent boat trailers expensive.

Even if you make the chassis yourself, you still have to buy all of the undercarriage gear and the full-on braking system and this stuff ***is expensive***. There's no point scrimping on it either, because inferior gear just won't last the distance and – most importantly – for safety of yourself and others on the highways, your undercarriage and braking system need to be good quality, effective and dependable.

Trailer Design Considerations

This particular boat, using a Dory hull, has no deadrise and is 'flat' bottomed across its beam. The good news is that there is consequently less complexity required in design of hull support structures than is the case, say, for deep veed hulls. This trailer doesn't need any fancy multi-roller rocker arms. It simply needs a flat bed or cradle.

As well, for a boat this size, having a fully dunk-able drive-on trailer is pretty much a given. That means it can be built without sophisticated roller systems. Slippery support skid systems are fine for this boat.

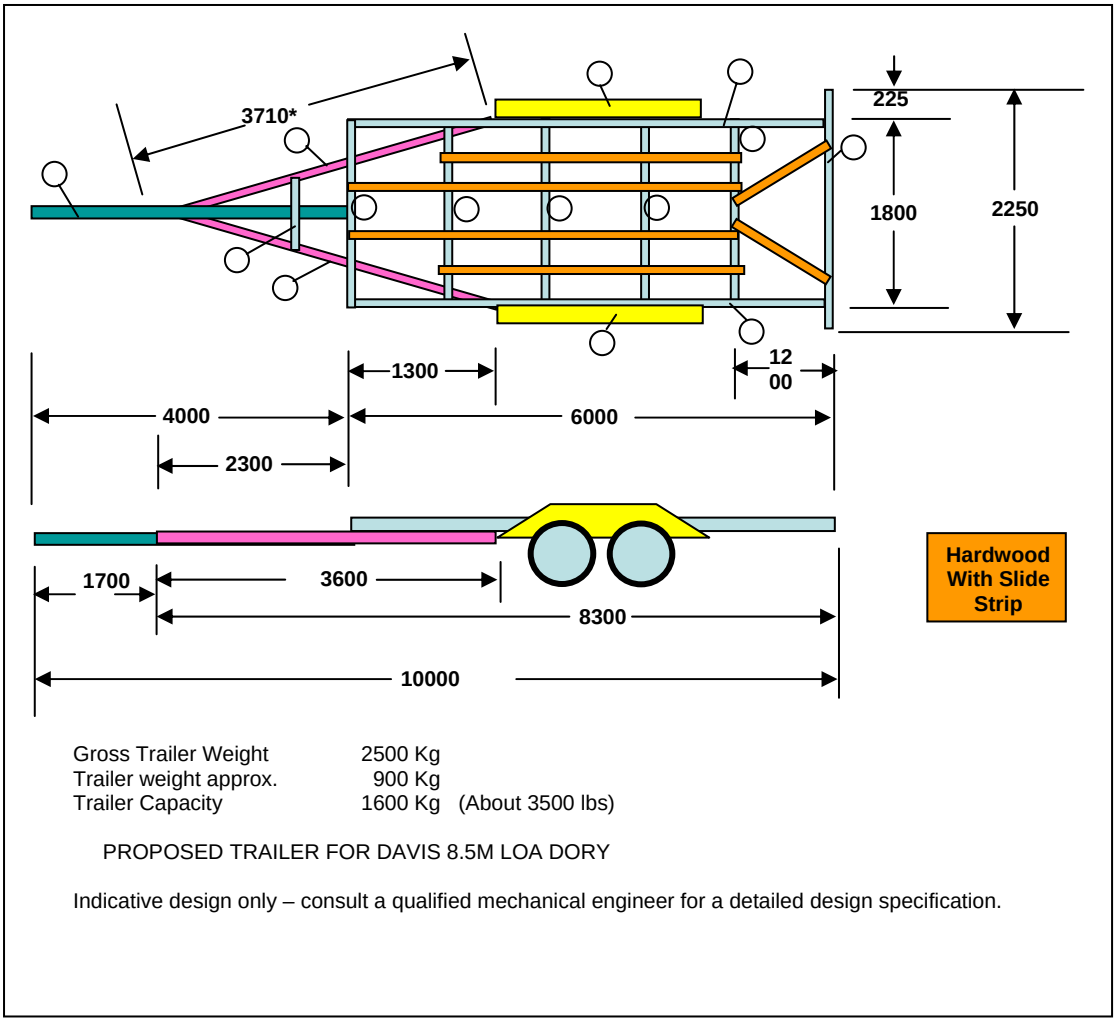
That actually makes the chassis a relatively simple DIY build for anyone with reasonably well developed amateur electric arc welding skills, with access to a welder capable of working on 3-4mm steel.

The trick with DIY steel work for strong trailers is to find designs that do not have "bends" in the hollow box section or channel steel. What you want is simple, straight runs of steel that weld together in flat-to-flat joints, or butt joints of an edge-end to a flat surface, both of which can be easily reinforced with simple gussets, flat strap overlays and/or use of angle iron in square corners.

Avoiding designs requiring any edge-to-edge joints, whether straight or creating bends, is smart – such welds really should be left to experienced professionals.

Step outside the 'boating' square for a moment. The most common type of flat-bed trailer we see on the roads is the typical so-called 'car trailer'. Such a structure can be adapted, with the flat bed frame extended to accommodate a boat measuring about 7.3 metres on its bottoms, and the drawbar altered to enable a gooseneck to be fitted as a hitching prop for the stem and to carry a winch.

The flatbed structure is simplicity itself – just two strong hollow box section beams, to form the longitudinal sides, and to which the undercarriage can be attached, using u-bolts, and a series of cross beams. You don't really need the strong floor decking typically seen on a car trailer, although some people might like to put in thinner galvanised sheeting or even exterior grade plywood (sealed and painted) to protect the hull from road debris, and to enable walking on the trailer.



Gross Trailer Weight	2500 Kg	
Trailer weight approx.	900 Kg	
Trailer Capacity	1600 Kg	(About 3500 lbs)

PROPOSED TRAILER FOR DAVIS 8.5M LOA DORY

Indicative design only – consult a qualified mechanical engineer for a detailed design specification.

For supports for the hull, given its shape on the bottoms, hardwood longitudinal planks set on their edge, connected via angle steel lugs welded to the trailer cross beams, and with skid plastic strips fixed to their top edge, should work well.

For the drawbar, on box trailers and many car trailers, you typically see a vee structure with the hitch mounted on a plate at the head of the vee, rather than seeing the single central box section drawbar we typically see on steel boat trailers. The vee-shaped drawbar members are connected to the underside of the primary chassis framing, rather than being an extension of the side beams. This gets away from bends in the primary chassis members.

By retaining that design idea, it doesn't take a lot of genius to see that you can add a heavier central beam, braced by the vee form. With the sides of the vee form connected to the undersides of the first two cross beams and to the side beams of the chassis you have the strengths of three welded connections. No corners, no bends, just simple straight runs of hollow box section steel, and no difficult welds.

For my build, the steel specification looks something like this – all ordered in painted RHS hollow box sections:

- Central Drawbar 150x100x4mm
- Gooseneck 150x100x4mm
- Side beams 100x50x3mm
- Front &Rear beams 100x50x3mm
- Other cross beams 75 x 50x 3mm

I also ordered an assortment of flat strap and angle. Steel merchants, for a modest fee, will cut your sections accurately to specified lengths. The plan and specifications tell you the lengths of sections required. That saves an awful lot of work on your part – or on the part of your local professional welder, if you decide to commission that part of the project.

The trick is to talk to your steel merchant, and they will tell you the standard lengths that different steel sections are supplied in, from the manufacturers. Knowing the standard lengths lets you calculate how much to purchase, in the context of the known lengths required for each section, to minimise waste from off-cuts. Your merchant may even be prepared to sell you part lengths, instead of you needing to buy full standard lengths of each type of section.

Design Specifications

Now – *please note carefully* - I am NOT a mechanical or structural engineer, so remember, you need to consult a professional engineer, to get your own design specification to build, to ensure it can be certified for registration in your State.

Here's the good news. You can purchase Australian engineer-designed plans and full specifications to build car trailers, including tilting car trailers, on the Internet. That's what I did. The cost for the drawings and specifications was less than $100, which I was able to pay online.

Because I subsequently adapted (changed) the plans, it would not be reasonable of me to name the firm from whom I acquired the plans and specifications, because they cannot be held responsible for my changes to their design. However – if you do a Google search on 'car trailer plans' you will find a source for plans to use for your own adaptation – but please consult a professional mechanical engineer if you are in any doubt as to your adaptation. You can find them listed in the Yellow Pages.

I thought carefully about whether to make the trailer tilting or not and ultimately decided 'not' because (in the design I purchased) the extended vee section required addition of angled bends, running to the tilt-tray pivot structure just forward of the front axle – and that definitely requires welding by a professional.

It also meant making upfront decisions about the forward-most position of the front axle, and that's always a problem before a boat is built and thus before you know its loaded weight distribution profile.

Remember that you need to be able to adjust the position of the U-bolt connected undercarriage, to get optimum weight distribution to your drawbar and hitch coupling. There's a very good explanation of this in F&B's *Trailers, Towing and Rooftopping*.

Hence I decided to go for a non-tilting tray, and resolved to myself that I would be dunking the trailer to enable drive-on retrievals. With that decision made, all I needed to do, to adapt the car trailer chassis design to meet the needs of this boat, was to add the central drawbar – and I added the four metre 150x100x4mm box section to that end, as shown in the diagram. That brings the overall length of the trailer to 10 metres

Going Bare Steel?

Having resolved that the trailer will be immersed for boat retrievals, the notion of corrosion risk becomes a big issue. Steel and saltwater just don't mix well. Heck, bare steel and freshwater don't mix too well either!

There are places in Capital Cities and in some larger regional centres where you can send your steel chassis to be sand blasted and galvanised. That involves two-way freight costs, plus the costs of the blasting and galvanising. It is *the smartest thing to do*, and everyone recommends it for boat trailers.

There are other options – like using proper primers, cold galvanising paint, poly or epoxy resin based coatings – that are workable, provided that you are prepared to be super vigilant, always wash down your trailer, and are prepared for regular anti-rusting and maintenance work. Going down this path pretty much requires that you weld sealed ends onto every box section member to keep water out. The old trick of keeping oil inside the sealed box section members is also worth a serious thought.

Braking System

For this trailer, I chose to go with galvanised IRS axles from AL-KO, along with their marine disk braking system on all wheels.

AL-KO Axles, Dunbier Wheels & Steel: Ready to Build

For the assisted brake actuator and break-away system, I decided on electric/hydraulic brakes, giving me the choice of a NZ-made Sens-a-Brake unit distributed by AL-KO, or options like a Hydrastar unit combined with a Tekonsha P3 control unit in the vehicle.

I chose the new Sens-a-Brake system, from AL-KO.

I'll update this chat sheet, or provide additional sheets, with additional information as necessary.