MAXIMUM REACH ENTERPRISES
1853 Wellington Court
Henderson, NV 89014
Ph: 702 547 1564
kent.goodman @ cox.net
www.maximumreach.com

21 November 2011

INTRODUCTION TO HEAVY HAUL TRAILERS

Part 1 of 2
(Contains the first basic type of heavy haul trailers)

The hauling of heavy construction equipment is a fascinating thing to behold. It usually takes months of planning and preparation before the actual move is made. Sometimes, special transportation equipment has to be fabricated for that move to make it happen or to be street legal. If all of the above is carefully planned and reviewed, then the move itself usually looks very easy and simple.

There are basically three types of heavy haul trailers:

1. The lowboy type trailers with many axles, which must be street legal and usually can travel up to 35 mph legally .

2. The pull type modular trailers that have many axles, are very seldom street legal, travel up to 35 mph and usually used for off highway moves.

3. The self propelled modular trailers (SPMT's) that have many axles, are very seldom street legal, travel at a maximum of 5 mph and are most always used for off highway moves.

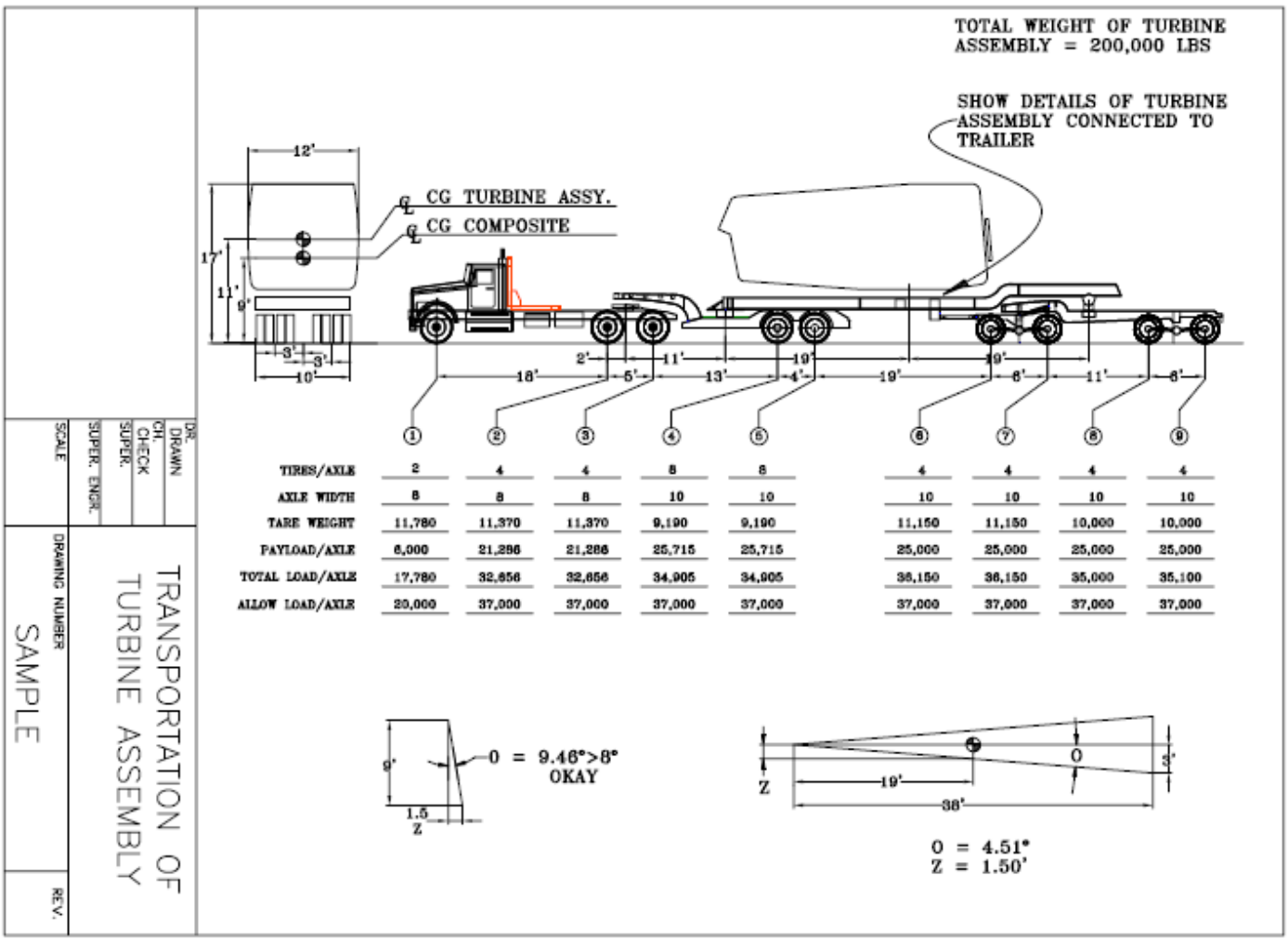
NOTE: If the numbers are not readable in the photos and drawings in the presentation, then either go to view and zoom to 200 % or click on the drawing and pull it down from the bottom right corner until things are legible.

LOWBOY TYPE TRAILERS:

I will first address the lowboy type trailers and the fabrication that makes them work, ie, axle width, axle spacing, axle loading, method of supporting the load, etc. The method of supporting the load is usually one of the following, Schnabel hitch, bridge beams, or lowboy.

See the drawing below for an example of a special 9 axle lowboy with a configuration that will haul 100 tons in Nevada. Note that the trailer behind the tractor with axle lines 4 & 5 is usually called a jeep.

Sometimes the rear trailers on lowboy type trailers are connected to the load with a tongue and all steering comes from the prime movers. But, most rear trailers are steered independently from the front trailer by a tiller man and an auxiliary engine with a hydraulic pump, very similar to steering a fire truck. The tiller man has a cab mounted somewhere on the rear trailer. Jake's placed a cab on both sides of the rear trailer so the tiller man could move to that side of the trailer where he needed to see better.



10’ WIDE, 9 AXLE LOWBOY

In addition to the movable fifth wheel on the tractor, there is a movable fifth wheel on the jeep (see axle lines 4 & 5). The location of the swivel connection for the rear trailer (see axle lines 6 through 9) is fixed so that 50% of the vertical reaction at that point goes to axle lines 6 & 7 and the other 50% goes to axle lines 8 & 9. The heavy haul contractor laid out this move on paper and then pre-set the locations of the fifth wheels so that when the load was located on a pre-determined location on the low boy, the axle loadings would not exceed the allowable axle loadings. This heavy load would require low speed, pilot cars, special permits, special move times, etc., which all cost money. So shippers try to use the smallest trailer configuration that they can.

The calculations and diagrams at the bottom of the drawing are for tipping stability. Note in the stability triangle, that the CG is 1.5’ from either edge and the resulting angle of stability is 9.46 degrees. As a rule of thumb, if this angle is greater than 8 degrees, then the load is stable. What I like to do is make a common sense check and relate it to a 5:1 safety factor. For example, for a 10’ width trailer (120”), the maximum out of level sideways based on the 9.46 degrees is 19.72”. Dividing the 19.72”/5 = a safety factor of 3.94”. Common sense tells me that the trailer platform can be kept level within 3.95” during travel, maybe push it to 8” for slowly getting on and off of the highway.

Structural stability is not considered for this type of trailer as the street legal requirement prevents the trailer components, ie, tires, hydraulics, etc, from being overloaded.

The photo below shows a move that we made when I was with Jake’s where we transported a 425,000 lbs. autoclave from Salt Lake City to Carlin, NV, a distance of 275 miles. Note that bridge beams were used in a

Schnabel fashion, ie, 1-1/8" lashing was connected to the ends of the bridge beams and went over the autoclave and other 1-1/8" lashing was connected inboard to the bridge beams and went under the autoclave between the permanent saddles and the tangent lines of the heads. See the bottom photo for a clearer picture of the lashing.

JAKE'S 17-axle JXS moving a 425,000 lb. autoclave 275 miles from Salt Lake City, UT, to the Barrick Goldstrike Mine 45 miles northwest of Elko, NV for Stebbins Eng. & Mfg. Co. The route encompassed 5 miles of city streets, 205 miles of freeways, 45 miles of two-lane paved roads, and 20 miles of gravel roads. Overall, the loaded transporter measured 262 feet long, 21 feet wide, and 18 feet high, and grossed over 700,000 lbs.

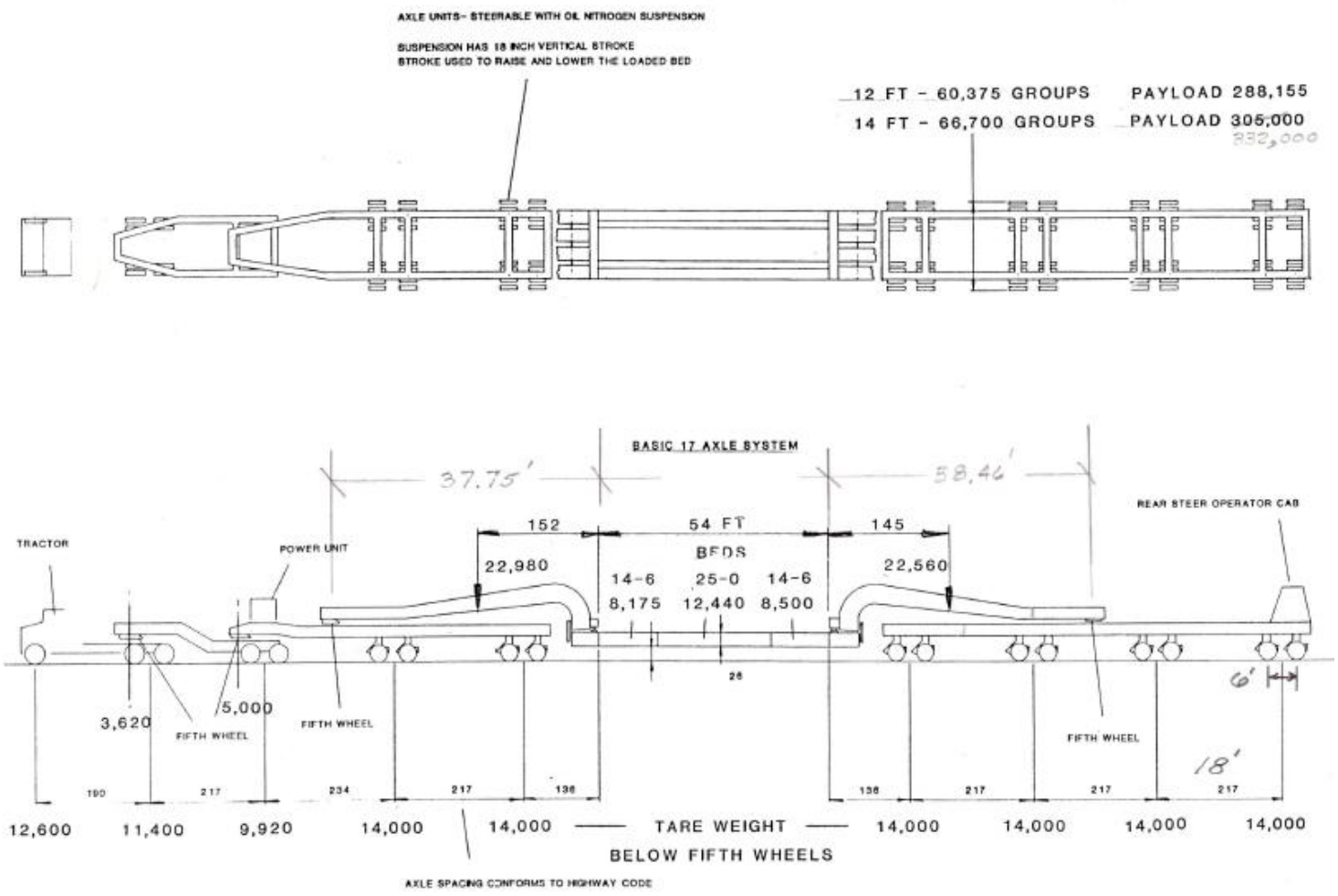
JAKE'S 17 AXLE TRAILER

For this move, we got a little more than $2.00 per mile for our trailer. We actually got $1,000 per mile or $275,000 for the total move. This transporter is a 14' wide 17 axle (not counting the push tractor's axles or the dollies under the autoclave) and has 132 tires. The four 50 ton dollies (two on either side of the autoclave) were required on the Interstate I-80. Note that they were removed when we reached the mine road. These trailers had a total of 30" of vertical stroke in the cylinders. After positioning the autoclave over the foundation, it was lowered down over the anchor bolts using the hydraulic cylinders. Most heavy haul trailers have this ability.

The drawing below shows a lowboy configuration for Jake's trailer instead of bridge beams like in the autoclave photo but the rest of the trailer is the same. Note that the spacing between tandem axles for the 14' wide trailer is 6' and the spacing from centerline to centerline of tandem axles is 18'-1". In the Western states, 18'mimimum spacing center to center of tandem axles is the magic number for the greatest allowable loading for highway transportation. At the top of the drawing, it shows the allowable loading for tandem axles in this configuration is 66,700 lbs. compared to 34,000 lbs. for the 10' wide, 9 axle lowboy above with 11' spacing. Also note that the tare weight for most of the tandem axles is 14,000 lbs.

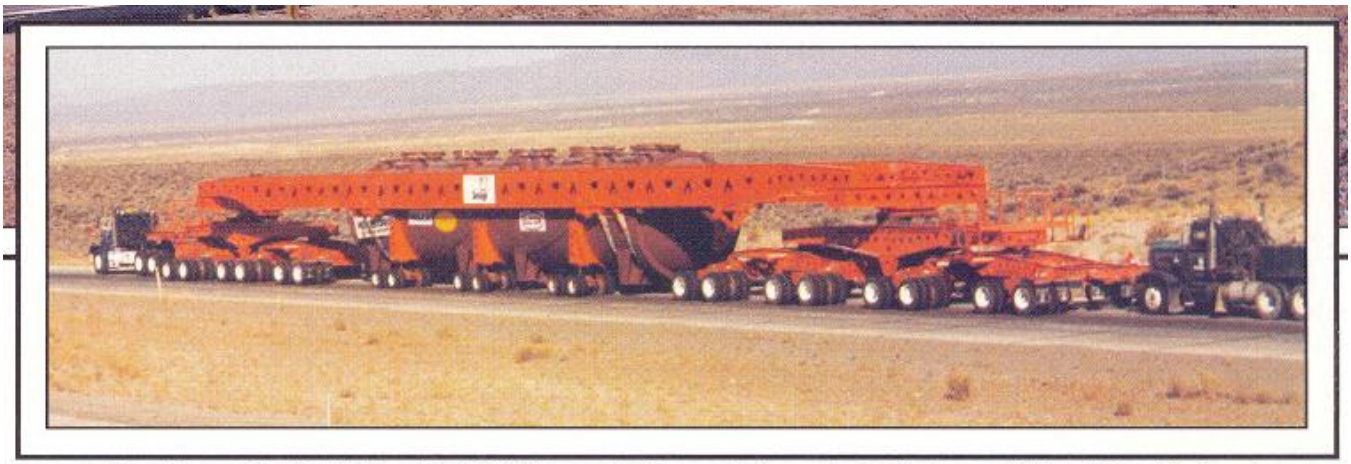
The load to each axle for the tractor and the two axle jeep was maintained by setting the positions of the fifth wheels of both the jeep and tractor. The load to each axle for the four axle trailer and the eight axle trailer was

maintained by the use of nitrogen accumulators, one for each cylinder. This way if the ram in one of the cylinders extended because the four tires fell down into a pothole in the road, the pressure in the cylinder remained the same at all times and the trailer stayed level or at the same gradient.



JAKE'S 17 AXLE LOWBOY TRAILER

The trailer shown in the photo below is a Trail King 17 axle trailer owned by Savage in Salt Lake City & is shown transporting the second autoclave from SLC to Carlin, NV.



Manufactured by Trail King, this 600,000 lb. payload capacity heavy hauler is shown with traditional deck and goosenecks *(top)*, with suspension beams *(middle)*, and with extended suspension beams *(bottom)*.

TRAIL KING 17 AXLE TRAILER OWNED BY SAVAGE

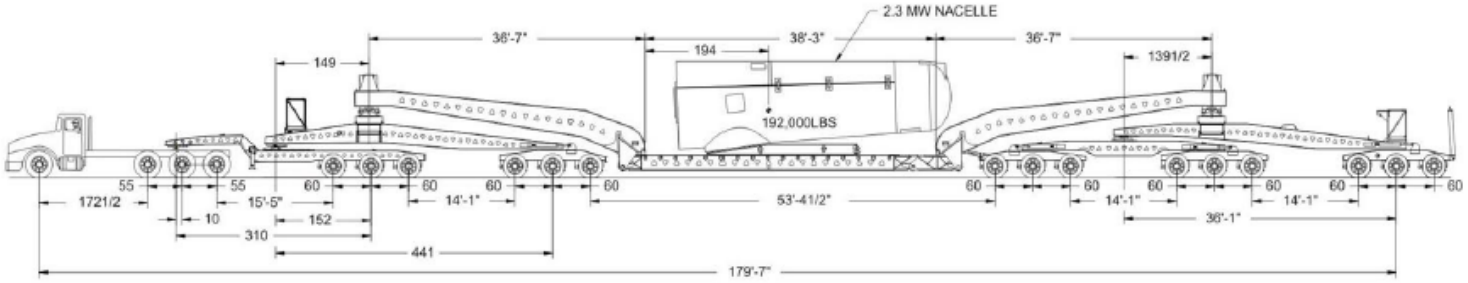
As the trailer is only 12’ wide with 13’ from center of tandem axles, note that Savage had to use six 50 ton dollies to make this load street legal.

The trailer shown below is a Trail Star 17 axle trailer, another version of Trail Kings 17 axle trailer. Note that this trailer uses a Schnabel hitch to carry the transformer, where in the photo above, a lowboy and bridge beams

were used. It just goes to show that there is more than one way to skin a cat. Note that the beams pin connect to the bottom of the transformer to carry the tension and have push pads at the top to carry the compression.

11' WIDE 17 AXLE TRAIL STAR TRAILER

The trailer shown below is a Trail King 19 axle trailer hauling a nacelle for a wind turbine. Note that this trailer has tridam axles (three axle group), and probably would not be used in the Western States. Note that the nacelle weighs 192,000 lbs.



12’ WIDE 19 AXLE TRAILER

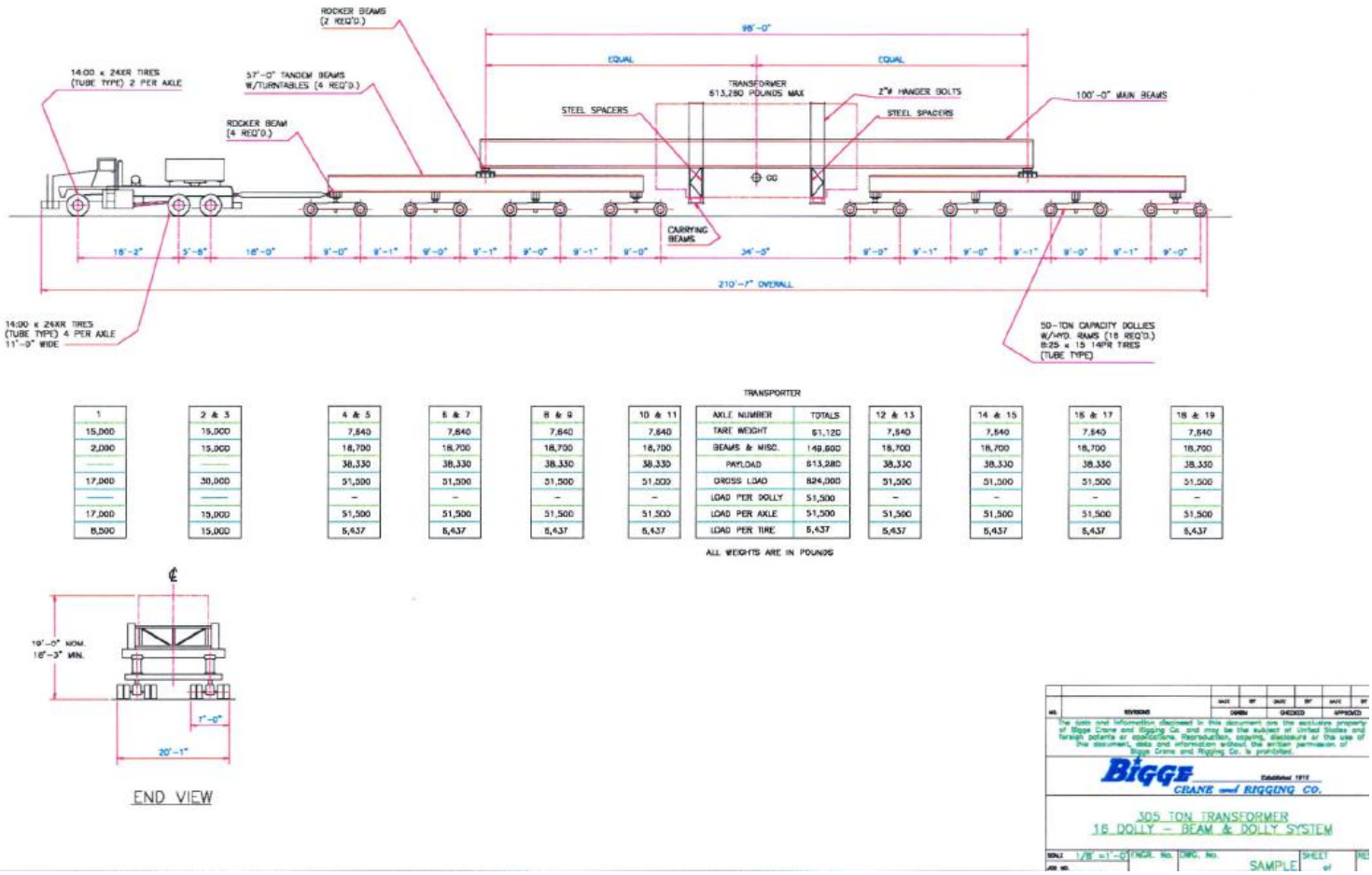
Another way to transport heavy loads is by using a series of 50 ton dollies configured under support beams. The trailer in the photo below (I apologize for it blurriness) shows how Bigge/Shaughnessy configured sixteen 50 ton dollies together with support beams to move a large transformer.

20’ WIDE, 16 AXLE DOLLY TRAILER

If you enlarge the view below, you will see that the trailer is 20’ wide, with 9’ between tandem axles and 13.5’ from center of tandem to center of tandem axles. The payload is 613,280 lbs. The trailer was street legal.

Each dolly has a 50 ton cylinder with an 18” stroke that is located between the two axles. The front axle of each dolly is castered so that tongues are not required to keep the dolly’s tracking with the frames and following the prime mover. It is very much like pulling your office chair around and watching the castered rollers follow the path of the chair. The rear trailer is steered by a tiller man where the front four dolly’s have a horizontal hydraulic ram that steers them and the others just follow in suite.

The only real problem is that a dolly trailer cannot be backed up. To change the direction of travel, all of the dolly’s ram’s must be extended and cribbing placed under the support beams. The rams can then be retracted and the dolly’s turned 180 degrees and reinstalled under the support beams. So the transportation superintendent must plan his route very carefully so that he can enter the site and stage the payload under the offloading equipment the first time. The beauty of this system is that it can be transported to the load out site on floats and quickly assembled into the hauling configuration with a relative small assist crane.



1	2 & 3	4 & 5	6 & 7	8 & 9	10 & 11	AXLE NUMBER	TOTALS	12 & 13	14 & 15	16 & 17	18 & 19
15,000	15,000	7,640	7,640	7,640	7,640	TARE WEIGHT	61,120	7,640	7,640	7,640	7,640
2,000	15,000	18,700	18,700	18,700	18,700	BEAMS & MISC.	149,600	18,700	18,700	18,700	18,700
——	——	38,330	38,330	38,330	38,330	PAYLOAD	613,280	38,330	38,330	38,330	38,330
17,000	30,000	51,500	51,500	51,500	51,500	GROSS LOAD	824,000	51,500	51,500	51,500	51,500
——	——	–	–	–	–	LOAD PER DOLLY	51,500	–	–	–	–
17,000	15,000	51,500	51,500	51,500	51,500	LOAD PER AXLE	51,500	51,500	51,500	51,500	51,500
8,500	15,000	5,437	5,437	5,437	5,437	LOAD PER TIRE	5,437	5,437	5,437	5,437	5,437

20' WIDE 16 AXLE DOLLY TRAILER

The photo below shows a 14' wide x 10 axle dolly trailer hauling a 150 ton refinery vessel. Note that there are actually five 50 ton dolly's under each side beam. Two cross beams were bolted between the side beams and the saddles of the vessel rested on them for transportation.

14’ WIDE, 10 AXLE DOLLY TRAILER

END OF PART 1

PULL TYPE MODULAR TRAILERS And SELF PROPELLED MODULAR TRAILERS

will be covered in Part 2 of 2.