



## **Spread Axle Field Report**

10/12/2016

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- On 5/16/16, Mr. Jeff Cook bought a 28ft Pace Shadow equipped with spread axles from Richmond Trailer Sales out of Geneva, Ohio. The trailer was built out of the Indiana facility on 4/13/2016. Trailer Serial Number 53BPTEB21HA028771.
- After picking the trailer up from Middlebury, Mr. Cook contacted Jerry Richmond (the owner of Richmond Trailer Sales) and complained about the towing characteristics.
- A complaint, in the form of a phone call, was filed with the LGS on 9/9/2016.
  - According to Mr. Richmond, the customer pulled the trailer to Detroit behind an F550 and had a difficult time keeping the trailer in his lane. The trailer was loaded at the time with (2) mini monster trucks weighing approximately 4,000lbs each. Mr. Cook tried to resolve the problem by readjusting the trailer hitch so that the trailer was pulling tongue up. At the same time, he also shifted the vehicles towards the rear. According to Mr. Cook, these changes helped the situation but didn't fix it.
- After reviewing the complaint and talking to the customer, LGS agreed to have the trailer brought back to the Indiana facility for inspection and evaluation.
- Once the trailer arrived on 9/21/2016, it was coupled to an F250 and taken down the road. While the trailer was nose down during the pull, it was apparent that the trailer was not properly tracking behind the tow vehicle. Leveling out the trailer did not seem to help the issue.
  - A visual inspection was conducted in order to eliminate the possible variables.
    - The axle centerline was measured and confirmed. LGS runs the industry standard 60/40 split based off of the trailers box length.
    - The axle spread was measured. LGS runs the spread axle option at 48" O/C. This design has been in effect since 10/31/2014. Axle spread on a standard Torsion Frame is 35" O/C.
    - Frame and assembly squareness was measured. Everything fell within the allowed tolerances. All measurements are included on a separate attachment.
    - Structural members were inspected for broken welds or components that could lead to instability. There were none.
    - Tongue weight measured at 680lbs on the LGS scale. On a 6500lb trailer, that yields a 10.5% tongue weight. While this is on the low end of the industry accepted 10-15%, it is still within the acceptable range.
    - Lug nuts and axle bolts were checked for proper torque.
  - Vendor supplied components directly related to the way the trailer tracks down the road were replaced.
    - The Dexter Torsion axles were unbolted and replaced with a new set of Dexter Torsion axles.
    - The existing wheels and tires were removed and replaced with a heavier duty version to eliminate the possibility of a blown cord or poor quality imported tires.

- The trailer was hooked up (level) to the same tow vehicle and pulled. The extra tongue weight provided a marginal improvement.
- Additional tests were conducted to rule out other possibilities.
  - 550lbs of dry weight was added to the front wall to help see if the extra tongue weight would resolve the issue. It did not.
  - The trailer was hooked to different tow vehicles (F250 Diesel and Ram 2500 diesel) to rule out any tow vehicle issues. There were none.
- Lippert was contacted to bring a 5-wheel scale system out to get more accurate readings on the axle and tongue weights (10/11/2016). This also gave us the opportunity to evaluate a couple of other spread axle trailers.
  - White spread axle in question. *\*\*\*Measured on jack stands without tires\*\*\**
    - (Front C/S = 1100lbs) + (Front R/S = 1400lbs) = 2690lbs: 42% trailer weight
    - (Rear C/S = 1660lbs) + (Rear R/S = 1100lbs) = 2960lbs: 45% trailer weight
    - Tongue = 860 lbs: 13% trailer weight
  - Black 28ft Spread Axle
    - (Front C/S = 1520lbs) + (Front R/S = 1560lbs) = 3080lbs: 51% trailer weight
    - (Rear C/S = 1080lbs) + (Rear R/S = 1040lbs) = 2120lbs: 35% trailer weight
    - Tongue = 860 lbs: 14% trailer weight
  - Black 24ft Spread Axle
    - (Front C/S = 1340lbs) + (Front R/S = 1440lbs) = 2780lbs: 65% trailer weight
    - (Rear C/S = 700lbs) + (Rear R/S = 640lbs) = 1340lbs: 30% trailer weight
    - Tongue = 220 lbs: 5% trailer weight
- After seeing the 5% tongue weight and not having a solid solution to Mr. Cook's towing problems, LGS suspended the shipment of spread axle trailers (out of the Indiana plant) indefinitely until we could better understand whether this was an isolated incident.
  - Phone calls were made to the General Manager's of the outlying plants to see if they had experienced any complaints. Arizona's GM pulled multiple trailers they had in the yard to see if they experienced the same issues. They did not. The same tests were performed in Indiana with no other issues.
  - We then contacted Richard Klein, the foremost expert in trailer dynamics. His thoughts and correspondence are attached to this document. He could not find any issues from a design standpoint.
  - Competitors offering the same option were contacted to see if they were modifying the axle centerlines or having similar issues. To the best of our knowledge, they all seem to be running the spread axle option in the same or similar configuration (with no issues)
- Aftermarket solutions were explored.
  - The trailer was equipped with an aftermarket Friction Sway Control Kit from Cequent. The trailer was taken up to 70mph unloaded. The kit eliminated any poor towing characteristics.
  - The trailer was then evaluated with a weight distribution kit (Equal-i-zer Model# 90-00-1400) without the sway control. This kit did NOT make the trailer track any better but it did a good job of evening out the load between the axles. Additional testing was performed to better understand the impact of a weight distribution kit. Results are in the tables below.

85x28TE5 Shadow Equipped with Weight Distribution & Sway Control Kit			
	Unloaded	Loaded with 6000lb Tahoe	Difference Front Unloaded to Loaded
Truck Front Axle	4560	4220	-340
Truck Front & Rear Axle	9120	10080	960
*Truck Rear Axle	4560	5860	1300
**Tongue Weight	900	1860	960
Truck Front/Rear & Trailer Front Axle	11740	15540	3800
Trailer Front & Rear Axle	5860	10700	4840
*Trailer Front Axle	3800	7400	3600
Trailer Rear Axle	2060	3300	1240
*Calculated Weights			
**Tow Vehicle weighed 8220lbs			

Impact of a Weight Distribution Kit on a Spread Axle Trailer				
	No Weight Distribution	Weight Distribution	Change in weight	Percentage Change
Truck Front Axle	3980	4160	180	4%
Truck Front & Rear Axle	10120	9640	-480	-5%
*Truck Rear Axle	6140	5480	-660	-12%
**Tongue Weight	1900	1420	-480	-34%
Truck Front/Rear & Trailer Front Axle	15560	14880	-680	-5%
Trailer Front & Rear Axle	5440	5240	-200	-4%
*Trailer Front Axle	2280	1600	-680	-43%
Trailer Rear Axle	3160	3640	480	13%

*\*The two experiments were conducted at separate times. The first table reflects values when the trailer was sitting perfectly level, while the second has the trailer sitting tongue up.*

A test was conducted to definitively prove what is happening when the axles are spread further from the axle centerline (with the centerline staying in the same position). Those results are recapped below as well as detailed in the attachments.

- Torsion Axles do not absorb the same percentage of the trailer's weight when sitting level. In order to evenly distribute the weight, the trailer's tongue needs to be raised higher.
- Spreading the axles further from the axle centerline removes weight from the tongue and shifts it to the rear axle. The front axle moves closer to the trailer's COG and lifts some of the tongue weight off of the coupler.

After all of the consulting, testing, and eliminating possibilities, LGS has reached the following conclusions regarding the construction of the spread axle option.

- Mr. Cook's poor trailer performance is an isolated occurrence. LGS has built over 100 spread axles over the past two years (at multiple locations) and Mr. Cook's trailer is the first documented complaint. The trailer is safe to tow to 55mph as stated in our owner's manual. Certain trailers, (in this case a 30ft Trailer with 12" extra height) need an aftermarket sway control kit to pull the trailer beyond those limits. LGS is outfitting the trailer with a sway control and weight distribution kit free of cost.
- Moving the axles back (in order to gain tongue weight) will continue to make the front axle absorb an even higher percentage of the trailer's weight. When we added artificial tongue weight, the towing characteristics did not improve.
- The axle vendor is not linked to the tow quality. The claim that a less costly axle must be inferior did not hold true in this scenario. Dexter and Lippert axles were evaluated with no measurable differences.

We feel that we have done our due diligence at ruling out all of the variables that could contribute to this problem. With that being said, LGS is laying forth the following recommendations...

1. The trailer MUST be 1-2" tongue high when hooked up to the tow vehicle.
  - a. With a perfectly level trailer, the front axle can be loaded 35% more than the rear axle. As the tongue drops, the theoretical axle centerline moves forward and the front axle absorbs an even higher percentage of the trailer weight. Moving the tongue higher has the opposite effect. It helps to lift weight off of the front axle (shifting it to the rear axle) and moves the theoretical axle centerline back.
2. LGS recommends that the tow vehicle and trailer equipped with spread axle use an Anti Sway Kit for speeds above 55 mph.
  - a. A wider wheelbase on a spread axle trailer lends itself to a trailer that is harder to turn and less receptive to lateral inputs from the tow vehicle and more receptive to external factors. The trailer can start to "wander" with imperfect road conditions, strong winds, alignment issues, and air underneath the trailer. Aftermarket solutions exist to combat these factors.

LGS will add a section to their owner's manual to further inform their customer's about the characteristics of a Spread Axle Trailer.