

# SUTPHEN CORPORATION

## SALES TECHNICAL BULLETIN

### FMVSS 121 BRAKE TESTING (SINGLE AXLE)

**What:** FMVSS 121 Testing

Link Commercial Vehicle Testing (LCVT) conducted FMVSS 121 braking tests on a Sutphen 4x2 Pumper fire truck with a wheelbase of 187 inches. The vehicle had a GVWR of 46,000 lbs (19,000 steer / 27,000 drive) and was equipped with Meritor 16½x6 Q-Plus s-cam drum brakes with R403 linings and Webb cast drums on the steer axle and Meritor 16½x7 Cast s-cam drum brakes with R403 linings and Gunite cast drums on the drive axle. The fire truck was equipped with a WABCO 4S4M ABS system

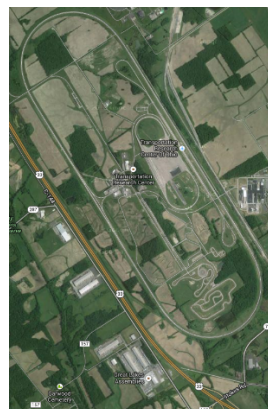


**Why:** Vehicle Verification

The purpose of the testing was to determine compliance with the current stopping distances required by the FMVSS 121. In addition to the stopping performance, the testing also evaluated parking brake performance, timing, and other pneumatic properties in accordance with the current version of FMVSS and CMVSS 121. The stability and control (brake-in-a-turn) test specified in FMVSS 121 was run on this vehicle empty to evaluate ABS performance.

**Where:** TRC

All testing was conducted at the LCVT and Transportation Research Center (TRC) facilities in East Liberty, Ohio. Burnishing was performed on the 7.5-Mile High Speed Track. Stopping distance tests were performed on the Skid Pad (dry concrete). Brake-in-a-turn stops were run on the Vehicle Dynamics Area (VDA) that is covered with Jennite driveway sealer (PFC=.40). A water truck was used to wet this surface. Parking brake performance was tested on the 20% grade and using a hydraulic winch drawbar test fixture at the LCVT garage.



**When:** November 2013

**Results:** Summary

The vehicle met all of the timing and pneumatic test requirements of FMVSS and CMVSS 121.

These tests verified service brake apply timing, service brake release timing, the park brake apply timing from first movement of park brake control, stop light activation occurred at less than 6 psi in the steer and drive pneumatic circuits, compressor cut-in pressure was above 100 psi and the compressor was able to charge reservoirs from 85 psi to 100 psi to meet the FMVSS 121 requirements.

The vehicle met the parking brake requirements of FMVSS 121 by holding the 20% grade in the loaded and unladen conditions.

In addition, the forces developed during the parking brake drawbar test exceeded the requirement of 28% of the drive axle GVWR (7,560 lbs for this vehicle) for all pulls in the forward and reverse directions.



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Based on the tests that were performed, the vehicle met the FMVSS / CMVSS 121 60 mph loaded full system stopping distance requirement of 310 feet with a best stop of 214 ft.

The vehicle met the FMVSS / CMVSS 121 60 mph unladen full system stopping distance of 335 feet with a best stop of 188 feet.

The vehicle also met the requirements of 20 mph loaded full system stopping distance requirements of 35 feet and 38 feet (unladen) with a best stop of 26 feet loaded and 23 feet unladen.

The vehicle met the 60 mph Emergency Braking stopping distance requirement of 613 feet for all failure modes (failed steer pneumatic reservoir, failed drive pneumatic reservoir and failed rear control line) in both the loaded and unladen configurations.

Click Video to Play



STB-0025 - FMVSS 121 BRAKE TESTING (SINGLE AXLE)

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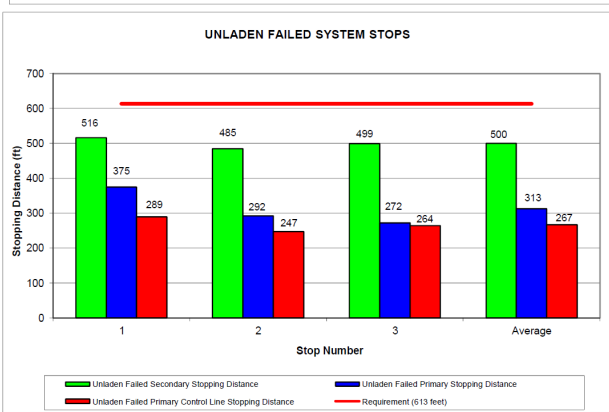
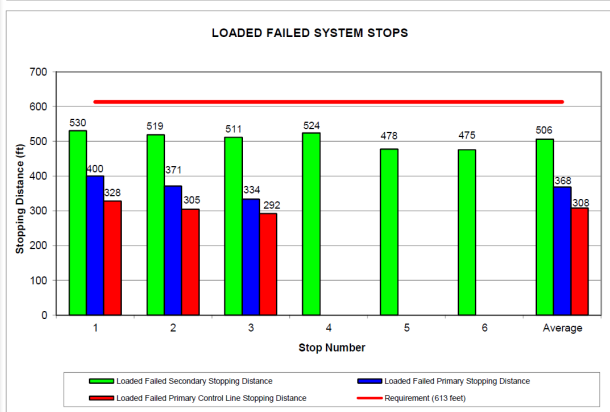
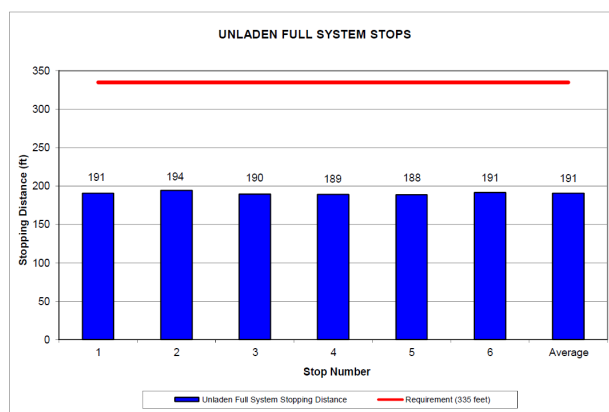
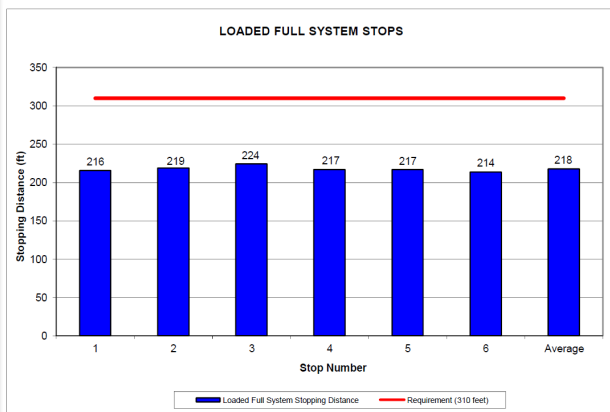


Figure 4 - Summary Results - 60 mph Loaded Stops

Figure 6 - Summary Results - 60 mph Unladen Stops

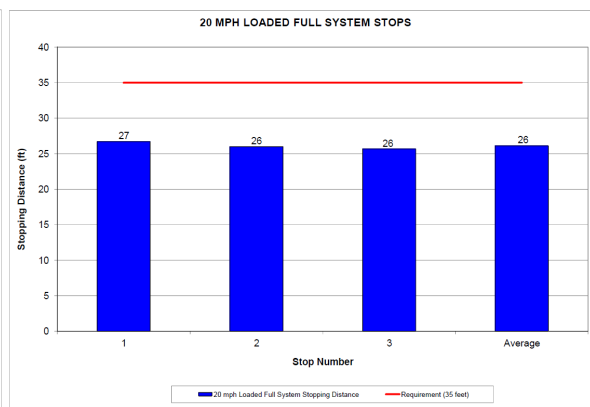
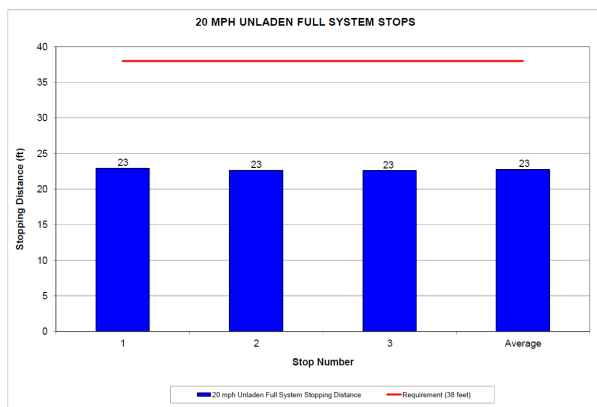


Figure 5 - Summary Results - 20 mph Unladen Stops

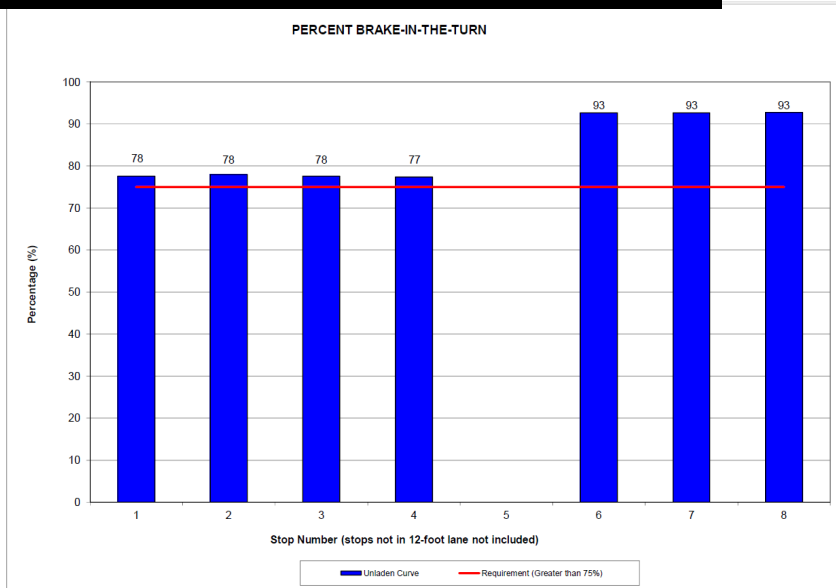
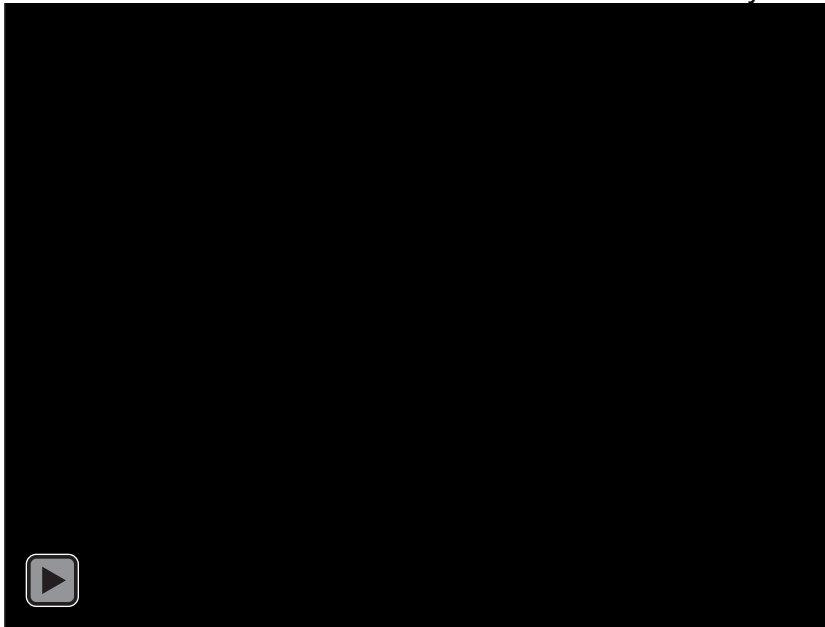
Figure 3 - Summary Results - 20 mph Loaded Stops

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The vehicle also met the stability and control requirements. The test specified in FMVSS 121 is performed on a low co-efficient surface. A 12-foot wide lane is configured to follow a 500-foot radius curve on the low co-efficient surface. The test starts with driver finding the "maximum drive through speed" he is able to drive the vehicle maintaining the curved 12-foot lane. Once the maximum drive through speed is obtained, the driver performs full treadle stops in the lane at 75% of the maximum drive through speed. The FMVSS 121 requirement is that four of five stops at 75% be in the 12-foot lane. The vehicle met these requirement as well as three stops in lane at 93% of maximum drive through speed ("maximum brake speed"). [Click Video to Play](#)



For any questions or concerns, please contact your designated SAE.

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