

An Investigation of Container Chassis Brake Lining Maximum Wear Rates

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ABSTRACT

An experimental investigation of the minimum mileage between required brake adjustments is presented, for a particular vehicle configuration, fully loaded, on a defined route. To insure the results represented maximum brake lining wear, or minimum adjustment interval, for a container chassis, the operator followed a strict protocol requiring the use of chassis brakes only, except when safety dictated otherwise.

The data collected during the investigation have been tested against a proposed procedure for predicting brake adjustment frequency. This procedure should allow brake adjustment intervals to be predicted for other vehicle configurations and other service conditions.

INTRODUCTION

The appropriate period between brake adjustments for heavy vehicles equipped with air brakes and manual slack adjusters is a subject of interest to operators of trucking fleets. Although automatic slack adjusters are required on heavy vehicles produced after 1994, it is estimated that approximately 30 percent of the current fleet of trucks and trailers have manually adjusted brakes.

The period between brake adjustments is, of course, a function of brake lining wear. Brake lining wear depends on many variables, among them vehicle configuration and loading, the route traveled, lining formulation and operator technique.

Brake effectiveness of heavy vehicles is a major safety concern, and better brake adjustment maintenance can have a significant effect on safety. Brake adjustment

intervals for container chassis present a particular concern, in that these units typically are shared among various users, and the responsibility for maintenance shifts from user to user.

Data were collected on brake adjustment at approximately one-hundred mile increments over a well-documented route of approximately one-thousand miles.

METHODOLOGY

A detailed protocol was developed and a vehicle and load selected. A route was selected which was considered reasonably representative of eastern seaboard travel of overseas shipping containers, although, of course, routes can vary widely. The route employed is characterized as level driving and rolling hills driving. Most of it was in an urban environment.

INVESTIGATION PROTOCOL

Initially the push rod strokes of the clamp type 30 brake chambers of the chassis were adjusted to approximately 1.5 inches under an application pressure of 90 to 100 psi. Federally-mandated readjustment must occur at a maximum stroke of 2.0 inches [1]¹. No readjustment was to occur during the investigation, and if any push rod stroke reached 2.0 inches the investigation was to be terminated. This did not occur.

Push rod strokes were measured, during the route, only when the brake lining/drum temperature was less than 200 °F. Temperatures were measured with an infrared non-contact digital thermometer with a resolution of one

¹ Numbers in brackets refer to the references found at the end of the paper.

degree Fahrenheit. The actual temperature at the time of measurement was recorded. Push rod strokes were measured with a caliper to the nearest 0.01 inches.

The operator initially was instructed to maintain an application pressure of between 90 and 100 psi during the push rod stroke measurement. Evaluation of the first few sets of readings indicated rather large variations in stroke, even in some cases indicating a reduction after travel of approximately 100 miles. It was determined early on that more precision was required in application pressure, and more care was required in reading the air pressure dial, to avoid parallax errors. In fact, it has been reported that a 20 psi difference in pressure can account for approximately 3/16 inch difference in stroke [2]. Based upon that, a one psi change in application pressure could account for almost 0.01 inches difference in stroke. Thus, care in setting and reading the application pressure becomes important when stroke readings to the nearest 0.01 inch are made.

A significant requirement of the protocol was that the operator utilize only the chassis brakes, unless safety considerations dictated otherwise. Out of 376 recorded brake applications, only five applications of the full service brakes occurred. Also, no engine brake was used.

VEHICLE DESCRIPTION

The tractor employed was a three-axle conventional configuration, with a wheelbase of 238 inches. The chassis was a Bush Hog Loadcraft, 1985 model, with a kingpin to first axle dimension of 31 feet, $\frac{3}{4}$ inches, an axle separation of 48 inches, and an overall length of 41 feet, $\frac{3}{4}$ inches. The container had a nominal overall length of 40 feet, a width of 8 feet and a height of 9 feet, 5.5 inches. The overall maximum height, when loaded, was 13 feet, 3.25 inches.

The total loaded weight of the assembled rig was 74,140 pounds. The weight on the chassis axles totaled 30,240 pounds. The container was loaded with sand bags to achieve the desired total weight and weight distribution.

The assembled rig is shown in Figure 1. Figure 2 shows a view of a portion of the container load.



Figure 1

The two-axle chassis had clamp type 30/30 brake chambers at each wheel. The rear axle also had spring brakes. It has been reported that brake lining properties can vary significantly, even from batch to batch within a given formulation of a given manufacturer [3]; therefore no attempt was made to identify the brake lining material and manufacturer. Brake shoe thicknesses were measured to insure the "green" wear, or break-in period, was past.

ROUTE DESCRIPTION

The route began in Newark, New Jersey, and included circuits in the port area and then to Elizabeth, New Jersey, for a total of 19.8 miles. This was characterized as a level, urban area.



Figure 2