27 February, 2007

George Person
Chief, Recall Management Division
National Highway Traffic Safety Administration (NHTSA)
400 7th St. SW
Washington, DC 20590

Subject: Recall 04V-042 – New Flyer D60HF Center Axle Lock-up
Proposed Resolution

Dear Mr. Person:

The prolonged evaluation and testing for the subject recall between New Flyer (NFIL) and Arvin Meritor (ARM) is nearing a workable solution, here is a brief synopsis of the issue.

Problem Synopsis & Review:

The subject recall involves a non-drive, non-steer axle on a 60 foot long heavy duty transit bus, which has had reports of the center axle park brakes not releasing after the vehicle had been parked for an extended period of time, typically more than 24 hours. This resulted in the wheel sliding and causing control issues during cornering. All the occurrences happened at the bus depot level immediately after trying to initially move a bus which had been parked for an extended period, with a professional driver at the controls. There has not been a recorded event of this nature once the vehicle is on the road or in revenue service.

This recall was declared as a result of a Preliminary Evaluation PE04-003. At the time that New Flyer declared recall status, the root cause factor(s) for this issue had not been fully determined.

We have since determined that the cause of the issue was not a defect of any one of the brake system components, but was determined to be a combination of factors (described below and in the attached report from Arvin Meritor) which, individually, would not have resulted in wheel lock-up, but when in concert with a low tire-to-road surface friction coefficient, created a potential for lock-up which we were able to duplicate during testing.

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Leading theories for potential cause as determined by the 8D process:

1. The automatic slack adjusters have an internal #2 notch on the clutch mechanism, this relates to a narrower shoe to drum clearance. This arrangement is more susceptible to lock-up due to thermal expansion and contraction of the brake drum. (refer to attachment #2, ARM report page 9).

2. The automatic slack adjusters with a #2 notch and tighter shoe to drum clearance are also affected by the higher debris levels found in Salt Belt States (refer to attachment #3). The result is that higher air pressure is required to fully release the parking brake. (refer to attachment #2, ARM report page 10).

3. An adhesion of the brake shoe material to the brake drums that cannot normally be overcome by the brake return springs. This adhesion is the result of a combination of salt, brake dust, moisture and temperature which causes corrosion to occur between the metallic particles in the brake lining material and the surface of the brake drum when the brake are left applied for an extended period. Normal function of the air system and foundation brake components to release the (parking) brake, results in the shoes remaining in contact with the drums. (refer to attachment #2, ARM report page 11).

4. A fourth potential cause was due to insufficient air system pressure and slow release of the park brake timing at time of brake release, resulting in an incomplete parking brake release before transmission engagement. (refer to attachment #2, ARM report page 12)

Several engineering attempts followed by field testing have been conducted over the last few years to try to overcome these potential causes.

Recent Testing:

Our most recent salt spray testing, incorporated the following modifications to the vehicle:

On the center non-steer, non-drive axle;

- dual return springs - to aid in overcoming shoe to drum adhesion;

- redesigned brake shoe - brake shoe was narrowed from 10” to 8” in width to reduce surface area of shoe to drum contact and allow rolling torque to overcome attractive forces;

- improved brake lining materials - R301/R602 combination linings determined as result of 600 hrs of testing with materials from 3 different suppliers;

- non-vented brake drums - incorporated to reduce ingress of road salt, debris and moisture;

- backing plates - incorporated to reduce ingress of road salt, debris and moisture;

- an additional R14 valve - incorporated to reduce park brake release times;

- a slack adjuster with a #4 notch and a longer moment arm (6.5”) - to increase the shoe to drum clearance, to reduce friction due to foreign material, and require less air pressure to release the brakes; and

- 36/30 long stroke brake chambers - to change the brake system output force, this requirement was done to meet the 121 Dynamometer testing and allowed for less input pressure to the chamber to create the same force output. Long stoke feature was incorporated to ensure the push rod did not exceed maximum stroke due to the new slack adjusters.

On the rear drive axle;

- new slack adjusters with a #4 notch and a longer moment arm (6.5”); and

- 36/30 long stroke brake chambers.

The on-board PLC system was reprogrammed to;

- keep the “Low Air” dash indication ON after initial start-up, until the vehicle main air system was just above the air compressor cut-in pressure of 105 psi.; and

- prevent transmission gear selection until main system air pressure was above 105 psi.

The above described configuration was installed on a bus and was tested for FMVSS 121 compliance at the Radlinski Test Facility in Ohio last fall. After successful completion of the test, this bus has run in winter service operation in New York City for a period of over two months. A further in-service test was then conducted with an additional four vehicles modified in the same configuration, followed by spray testing with a salt solution. The spray test was also conducted on an additional five unmodified buses as a control group.

The results of the salt spray testing on the test group, indicated that although lock-up could be recreated in the depot setting, it could not be consistently overcome by just driving forward from the parked position. On only 60% of the test group did the linings “break free” during initial movement of the bus. All buses (including the control group) were able to get the linings to break free once the vehicle was put in reverse and moved backwards less than the distance of the tire patch.

This testing indicates that the engineering modifications to the brake and air systems alone, would not be sufficient to overcome brake shoe lock-up for all possible combinations or concentrations of salt, dust and moisture under all possible temperature ranges. Nor can we control the friction coefficient between the tires on the

center axle and the road surface, as accumulations of ice and/or water, grease and oil in the vehicle storage areas, can effect the ability of the wheel to break free from a brake lock-up condition.

Proposed Intentions:

Because of these limitations it is our intention to fine tune the braking system in order to reduce the potential for lock-up to occur, and incorporate a Lock-up Prevention System to supplement the correction. To accomplish this end we propose the following:

1. First, to modify the original recall population identified in the initial 573 Report issued in 2004, to include only those vehicles operating in the "Salt Belt" States (see attachment 3 which is part of a NHTSA presentation, based on information from a 1991 Transportation Research Board report). Many of the vehicles included in the original recall population are located outside this region and have not had a single reported instance of center axle lock-up. Additionally the report would include those vehicles manufactured since the original report was submitted and to discount those vehicles which have since been retired or scrapped.

2. To incorporate those mechanical components which reduced the likelihood of lock-up, as determined in the ARM engineering presentation to New Flyer from November of 2006 (see attachment 2). This will be done by replacing the existing slack adjuster (with #2 notch) to one with a #4 notch in the clutch mechanism to increase shoe to drum clearance (for reasons previously described). Also, the standard 30/30 brake chambers will be replaced with 30/30 long stroke chambers to ensure maximum stroke is not exceeded with the new slack adjusters.

3. To speed up the parking brake release timing by the incorporation of an additional R14 relay valve at the center axle. The incorporation of this valve improved the total release time on the parking brake from an average of six seconds to well under three seconds.

4. To modify the PLC programming on the vehicle to prevent transmission gear selection prior to a minimum main air system pressure of 105 psi being available, and to keep the operators dash mounted "Low Air" indicator and audible warning on (after initial start-up only) until that pressure is achieved. Also a 60 psi service brake application will now be required to enable the transmission shift, this allows the anti-compounding features of the braking system to ensure that the parking brake is fully released.

5. To incorporate a Lock-up Prevention System for warning/indication developed and tested two years ago, for those instances where the engineering modifications could not overcome a lock-up condition due to low tire-to-road surface friction coefficient or adhesion of brake shoes to drums caused by higher than average levels of debris and moisture.

The operation of the Lock-up Prevention System is fairly basic. A new electronic control module will be incorporated, which monitors wheel-rotation speeds of the Anti-lock Braking System (ABS). When a wheel rotation anomaly occurs on the center axle within the first few minutes of initial gear selection, this system would automatically apply the vehicle brakes (via the electrically controlled brake interlock solenoid valve) and stop the vehicle (typically in less than 5 feet from its originally parked position). It would simultaneously trigger both visual and audible alarms to alert the driver. The vehicle would then require a maintenance action (a system reset) before attempting to move the vehicle again. Future modifications to the programming are possible to make the Lock-up Prevention System available to react to other brake related abnormalities.

A small portion of the recall population was built prior to ABS being a mandatory requirement for vehicles of this classification. These vehicles will also be outfitted with the necessary ABS components required for the Lock-up Prevention System.

In order to move forth with implementing this proposed solution, I am submitting a revision to the original 573 Defect Report for this recall, which reduces the original recall population from 1081 vehicles, to 807 vehicles (see attachment 1). This new total includes only those buses located within the Salt Belt area, and includes all new production of D60HF buses for that area since time recall was originally declared.

I look forward to your response to our proposal so that we can begin incorporating a solution to this long standing issue.

Sincerely

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Enclosures:
1. Revised 573 Defect Report
2. Arvin Meritor Project Review Presentation - Nov 9, 2006
3. Basis for “Salt Belt” States* NHTSA presentation 1991
4. Sample Customer Letter

cc: **NFIL** Hans Peper, Cliff Murray, Scott Halbesma, Don Bean, Todd Sutherland, Bernie Hedja, John Elder
ARM Donn Knight, Dale Eschenburg, Mike Doles, Niran Audimoolan.

* **”Salt Belt” States** as also referred to in the following documents:
- 49CFR Part 571 Docket No. NHTSA-00-8248 RIN 2127-AF26 – FMVSS; Fuel System Integrity, Para IV, C; and
- NHTSA Cases EA06-018 and PE06-007