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April 27, 2012

BY EMAIL AND BY OVERNIGHT DELIVERY

National Highway Traffic Safety Administration
1200 New Jersey Avenue, SE
Washington, D.C. 20590
Attention: Bruce York, Chief
Medium and Heavy Duty Vehicle Division
Office of Defects Investigation

INFORMATION Redacted PURSUANT TO THE FREEDOM OF INFORMATION ACT (FOIA), 5 U.S.C . 552(B)(6)

Re: NVS-214rw
PE12-007

Dear Mr. York:

This letter and enclosures will serve as Motor Coach Industries International, Inc.'s response to your March 28, 2012 letter in the above matter. Please note that this response has been redacted to remove MCI's confidential business information, which has been submitted to NHTSA's Office of Chief Counsel in accordance with your letter and applicable regulations.

1. State, by model, model year and transmission, how many subject and peer vehicles MCI has manufactured for sale or lease in the United States. For each vehicle provide the following:

   a. VIN;
   b. Model;
   c. Model Year;
   d. Engine;
   e. Transmission;
   f. Length of subject driveshaft;
   g. Date of vehicle manufacture;
   h. Date warranty coverage commenced;
   i. The purchaser (company name); and
   j. The part number(s) of subject driveshaft installed on the vehicle as original equipment.

   Provide the table in MS Access or a compatible format, entitled "PRODUCTION DATA_SUBJECT." A pre-formatted table that provides further details regarding this submission will be emailed to you.

   RESPONSE: The requested data constitutes MCI Confidential Business Information. MCI has therefore submitted to NHTSA's Office of Chief Counsel an unredacted

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version of the PRODUCTION DATA_SUBJECT worksheet in the attached Excel spreadsheet entitled "MCI DATA RESPONSE TO PE12-007 (REDACTED VERSION)". Attached hereto at Tab 1 is a copy of the redacted version of the PRODUCTION DATA_SUBJECT worksheet. The source of the data provided was MCI's MRP system, and the data were last gathered on or about April 20, 2012.

2. State the number and provide copies of each of the following, received by MCI, which relate to, or may relate to, the alleged defect or alleged failure mode in the subject vehicles and/or peer vehicles:

   a. Consumer / fleet complaints;
   b. Field reports;
   c. Reports involving a crash, injury, or fatality;
   d. Reports involving a fire;
   e. Property damage claims;
   f. Third-party arbitration proceedings where MCI is or was a party to the arbitration; and
   g. Lawsuits, both pending and closed, in which MCI is or was a defendant or codefendant.

   For subparts "a" through "g, " state the total number of each item (e.g., consumer complaints, field reports, etc.) separately. Multiple incidents involving the same unit are to be counted separately. Multiple reports of the same incident are also to be counted separately (i.e., a consumer complaint and a field report involving the same incident in which a crash occurred are to be counted as a crash report, a field report and a consumer complaint). For "f" and "g," provide a summary of the event.

   <u>RESPONSE:</u> A portion of the requested data, to the extent it's available to MCI, constitutes MCI Confidential Business Information. MCI has therefore submitted to NHTSA's Office of Chief Counsel an unredacted version of the RESPONSE TO REQUEST NUMBER TWO worksheet in the attached Excel spreadsheet entitled "MCI DATA RESPONSE TO PE12-007 (REDACTED VERSION)", as well as unredacted versions of the consumer complaints referenced therein. Attached hereto at Tab 2 is a copy of the redacted versions of the RESPONSE TO REQUEST NUMBER TWO worksheet and the consumer complaints referenced therein. The sources of the data provided were MCI's Service Tracking database, TREAD Act reports and supporting data, and lawsuit and incident files, and the data were last gathered on or about April 23, 2012.

3. Separately, for each item (complaint, report, claim, notice, or matter) within the scope of your response to Request No. 2, state the following information:

   a. VIN;

b. Vehicle's owner or fleet name (and fleet contact person), address, and telephone number;
c. Vehicle's model and model year;
d. Vehicle's transmission;
e. Vehicle's mileage at time of incident, if known;
f. Part numbers for each subject component involved;
g. Incident date;
h. Report date;
i. Date of manufacture;
j. Date warranty coverage commenced;
k. Concern stated by the customer; and
l. MCI's assessment of the incident.

Provide this information in MS Access or a compatible format, entitled "REQUEST NUMBER TWO DATA." A pre-formatted table that provides further details regarding this submission will be emailed to you.

RESPONSE: Please see MCI's response to the previous request, which contains the requested data to the extent it's available to MCI.

4. State, by model, model year, engine and transmission, a total count for all of the following categories of claims, collectively, that have been paid by MCI to date that relate to, or may relate to, the alleged defect or alleged failure mode in the subject and/or peer vehicles: warranty claims; extended warranty claims; claims for good will services that were provided; field, zone, or similar adjustments and reimbursements; and warranty claims or repairs made in accordance with a procedure specified in a technical service bulletin or customer satisfaction campaign.

   At a minimum please consider any such claim that involves the combination of a subject driveshaft and/or driveshaft universal joint and any other subject component to be related to the alleged defect or alleged failure mode.

   Separately, for each such claim, state the following information:

   a. MCI's claim number;
   b. VIN;
   c. Vehicle's owner or fleet name (and fleet contact person) and telephone number;
   d. Vehicle's model, and model year;
   e. Vehicle's transmission;
   f. Vehicle's engine;
   g. Vehicle's build date;
   h. Warranty start date;
   i. Incident date;

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j. Report date;
k. Part numbers for each subject component involved;
l. Vehicle's mileage at time of repair;
m. Repairing facility's name, telephone number, and address;
n. Labor operation number;
o. Problem code;
p. Replacement part number(s) and description(s);
q. Concern stated by customer; and
r. Comment, if any, by dealer/technician relating to claim and/or repair.

Provide this information in MS Access or a compatible format, entitled "WARRANTY DATA_SUBJECT." A pre-formatted table that provides further details regarding this submission will be emailed to you.

<u>RESPONSE:</u> The requested data, to the extent it's available to MCI, constitutes MCI Confidential Business Information. MCI has therefore submitted to NHTSA's Office of Chief Counsel an unredacted version of the WARRANTY DATA_SUBJECT worksheet in the attached Excel spreadsheet entitled "MCI DATA RESPONSE TO PE12-007 (REDACTED VERSION)". Attached hereto at Tab 3 is a copy of the redacted version of the WARRANTY DATA_SUBJECT worksheet. MCI further states that it conducted an expansive search of available data using several part numbers and word combinations (see MCI response to request 5). However, due to the lack of detail available with respect to older warranty claims, MCI has not been able to ascertain definitively whether the claims listed in the WARRANTY DATA_SUBJECT worksheet involved the alleged defect or alleged failure mode. The source of the data provided was MCI's warranty records, and the data was last gathered on or about April 26, 2012.

5. Describe in detail the search criteria used to identify the claims in response to Requests No 4.

   <u>RESPONSE:</u> MCI searched its available warranty records using the part numbers and words set forth in Tab 4 hereto.

6. Provide copies of any service or technical bulletins, product improvement campaigns, announcements, or advisories, and all other communications concerning the alleged defect or alleged failure mode in the subject or peer vehicles that MCI has issued or is considering issuing to fleets, dealers, zone offices, or field offices. If MCI has drafted any such communications, furnish a copy of the draft. For any such communication that have been issued, identify, by name, address, telephone number, and contact person, each entity to which it was sent, the date on which the communication was sent, and the specific equipment to which the communication pertained. For each such communication:

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a. Provide a complete chronology, listing all activities or events, including, but not limited to, incidents, which led MCI to issue the communication;
b. Provide a listing (in chronological order) of all testing through which the need for the communication was identified and/or assessed, even if the testing was being conducted for another purpose. Please provide a copy of all relevant information from each test listed; and
c. State the number of repairs and/or replacements paid for by MCI that resulted from the communication identified. List your response by repairing dealer (and include the dealer's name, address, and telephone number).

<u>RESPONSE:</u> None.

7. Provide a detailed chronology of all events regarding the alleged defect starting from the time MCI first became aware of this issue to present. Describe how MCI first became aware of the alleged defect and state the date on which MCI first became aware of the possibility of the alleged defect. Include all information including dates of both internal and external meetings, meetings with fleets, manufacturers, or any others involved in this issue and discuss the resolution, planned action, and/or the manner in which MCI plans to address this issue. Also separately, provide a copy of any/all document(s) and presentation materials that were used during the meeting(s) whether MCI generated the document(s) or the document(s) were generated by others.

<u>RESPONSE:</u> MCI first became aware of general allegations concerning the driveshaft on the coach involved in the Campbellton March 16, 2010 crash, when the first lawsuits were filed in or about April 2010. Please see MCI's response to request 10 for additional detail in response to this request. In addition, in a meeting on or about January 17, 2012, Greyhound Lines, Inc. ("GLI") asked if MCI could design a second "safety loop" for GLI to install on its coaches. Since then, MCI Engineering has worked on a design to accommodate this particular customer request. The documents pertaining to the request and MCI's design work constitute MCI Confidential Business Information. MCI has therefore submitted those documents to NHTSA's Office of Chief Counsel, as noted in Tab 5 hereto.

8. Describe all modifications or changes made by, or on behalf of, MCI in the design, material composition, manufacture, quality control, supply, or installation of the subject components, from the start of production to date, which relate to, or may relate to, the alleged defect in the subject or peer vehicles. For each such modification or change, provide the following information:

a. The date on which the change was incorporated into production;
b. A detailed description of the change;

c. The reason(s) for the change;
d. The part numbers (service and engineering) of the original component;
e. The part number (service and engineering) of the modified component;
f. Whether the original unmodified component was withdrawn from production, inventory(s) and/or sale, and if so, when;
g. When the modified component was made available as a service component; and
h. Whether the modified component can be interchanged with earlier production components.

RESPONSE: None.

9. Describe all assessments, analyses, tests, test results, studies, surveys, simulations, investigations, inquiries and/or evaluations (collectively, "actions") that relate to, or may relate to, the alleged defect in the subject vehicles that have been conducted, are being conducted, are planned, or are being planned by, or for, MCI. For each such action, provide the following information:

a. Action title or identifier;
b. The actual or planned start date;
c. The actual or expected end date;
d. Brief summary of the subject and objective of the action;
e. Engineering group(s)/supplier(s) responsible for designing and for conducting the action; and
f. A brief summary of the findings and/or conclusions resulting from the action.

RESPONSE:

A. Assessments, Analyses, Tests, Test Results, Studies, Surveys, Simulations, Investigations, Inquiries and/or Evaluations (Collectively, "Actions") Conducted

In connection with the investigation, analysis, and evaluation of Greyhound Lines/Americanos USA's (collectively, "GLI") contentions in the lawsuit related to the Campbellton, Texas accident, MCI had assessments, analyses, investigations, and evaluations conducted by MCI Vice President-Engineering, Virgil Hoogestraat, and by retained consultants in accident reconstruction, mechanical engineering, design evaluation, design performance, mechanical, transmission technology, and metallurgy, by Mr. Robert Rucoba, Mr. Kevan Granat, Mr. Gregory M. Wright, and Dr. David Coates. Their investigations, analyses, and evaluations continued from July 2010 through April 2012 and are thoroughly described in their reports and deposition testimony. Generally, the objectives of these assessments, analyses, tests, and evaluations were to determine what happened in the Campbellton, Texas accident as

accurately and as specifically as possible. The investigators were responsible for designing and for conducting the assessments, analyses, tests, and evaluations. The findings and conclusions of the above-listed investigators are well stated in the reports of the investigators and in their deposition testimony. A copy of the reports, deposition testimony, and other documents cited in this response is included in a CD found at Tab 6 hereto. More briefly summarized, the findings and conclusions of the investigators were that the driveshaft separation in the Campbellton coach did not cause or contribute to the accident that occurred. The actions of the driver of the coach, together with lack of maintenance (or nonexistent maintenance) of the coach, caused the accident. See Response to Inquiry No. 10, Section I.

B. Testing Conducted

Specifically, there are three (3) testing actions which have been conducted which should be referenced. Two of the testing actions are explained fully and in detail in "Full Vehicle Testing and Tag Axle Steering Analysis, 1995 MCI 102DL3, June 12-14, 2011," by Dynamic Analysis Group, with recorded data, vehicle photographs, weights, instrumentation, location, data plots, and video of testing. The third set of tests is described in the report of Kevan J. Granat, Dynamic Analysis Group, issued August 11, 2011 at "Laboratory Testing of a Tag Axle Assembly."

1. Track Tests of Performance of Subject Vehicles With Unlocked Tag Axle Steering at Highway Speeds up to Maximum Coach Speed

The first test is more fully described in Response to Inquiry No. 10, Section E. Performance of Subject Vehicles with Unlocked Tag Axle Steering. Dynamic Analysis Group was responsible for designing and conducting the testing and the testing was conducted on June 12-13, 2011 at the Continental Tire North America test track, Uvalde, Texas. The purpose of the testing was to determine the performance of the subject vehicles with unlocked tag axle steering in various conditions and maneuvers at highway speed up to maximum coach speed. Although more fully described in a report of Kevan Granat, Dynamic Analysis Group, issued August 8, 2011, and in his deposition testimony regarding the testing, the findings and conclusions from the testing action are discussed in Response to Inquiry No. 10, Section E and are set out below. Coach performance testing on a test track has shown the following performance effects of unlocked tag axle steering at slow speeds and at highway speeds up to maximum coach speeds:

a. The tag axle wheels and tires simply react to lateral forces imposed by turning as a trailing caster wheel under all tested conditions, including testing at highway speeds and at maximum coach speed.

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b. No oversteer conditions are created by unlocked tag axle steering under any conditions tested.

c. Through conventional steering tests such as step steers, frequency response testing, lane change testing, and aggressive lane change testing, the tested coach responded in an appropriate manner which was controllable and predictable with unlocked tag axle steering. The coach performed with no significant difference in controllability and handling from the performance of the coach with locked tag axle steering.

d. Various combinations of braking, braking and turning, braking and straight-ahead steering, braking and alternative right steering and left steering, hard braking, light braking, dry pavement, wet pavement, driving over roadway anomalies, lane changes, aggressive lane changes, and other conditions were tested, and all situations encountered with unlocked tag axle steering were controllable with appropriate and predictable steering responses. None of these tests even produced any difficult-to-control steering or handling of the tested coach.

e. For the testing, a specially-built and installed control was used to override the speed switch which is normally used to command "tag axle steering lock" or to command "tag axle steering unlock." The testing showed that, even with a command of "tag axle steering unlock" and cylinder air pressure attempting to unlock the tag axle steering lock mechanism, the tag axle steering lock mechanism will not actually unlock the tag axle steering unless the tag axle wheels reach a straight-ahead position. In other words, a tag axle steering unlock command does not initiate a tag axle steering unlock action if the coach is in even a slight turn. The tag axle steering lock cylinder does not have sufficient capacity to unlock the tag axle steering when the coach is in any turn. When the coach is no longer turning and is travelling straight, the pneumatic cylinder will initiate unlocking of the tag axle steering.

f. If properly maintained, the coach will provide to the driver a console light indication that tag axle steering is not locked when the speed switch has commanded "tag axle steering lock."

In summary, this testing shows that there is no dangerous, uncontrollable, unpredictable, or difficult-to-control condition created by an unintended unlocking of the tag axle steering in the subject vehicles. With unlocked tag axle steering, the steering and handling of the subject vehicles, assuming that they are properly maintained by the coach operator, will perform with no significant difference in steering, handling, and braking from the performance with locked tag axle steering. Experts retained by GLI for litigation in connection with the Campbellton, Texas case have given opinions that unlocked tag axle steering in the subject vehicles is not a dangerous condition. Former NTSB investigator, L. Yohe, has testified that he

"wouldn't be afraid to take a bus across [the] country with the tag axle unlocked." ***See*** **February 15, 2012 deposition of Lawrence Yohe, p. 307:9-20.**

2. <u>Track Tests of Degraded/Modified Universal Joint Performance</u>

Other testing performed on June 13-14, 2011 is also referenced in Tab 8 of "Full Vehicle Testing and Tag Axle Steering Analysis, 1995 MCI 102DL3, June 12-14, 2011," included testing of a degraded universal joint installed at the transmission end of the driveshaft of the tested coach to determine time to failure, pre-failure warnings, and susceptibility to failure of such a universal joint, and is listed as modified u-joint bearing tests 48 through 82 in full vehicle testing and tag axle steering analysis. The findings and conclusions from this testing were concluded in the report of Kevan Granat, Dynamic Analysis Group, issued August 11, 2011 and are summarized below:

> **"Additionally, I intentionally degraded the transmission end U-joint of the driveshaft of a 102DL3 and operated the coach at freeway speeds for an extended period of time. Degradation of the joint was achieved by removing more than half, and then subsequently all, of the needle bearings from both bearings on the transmission yoke and removing the grease from the bearing. The vehicle was driven over 250 miles at 70 miles per hour. The degraded bearing produced a vibration that was sensed when the throttle was released at speed that slowly grew more pronounced as the test progressed. Under these circumstances, significant degradation of U-joint bearings would likely occur over a much longer period than that of this test and would produce vibration that would be perceived by an alert operator." Report of Dynamic Analysis Group, Kevan J. Granat, issued August 11, 2011.**

Additionally, this testing showed that the universal joint body is filled with lubricant which reaches the needle bearings within the bearing caps by a combination of heat causing lower viscosity of the lubricant within the universal joint body, and centrifugal force of the turning driveline forcing the lubricant to the only moving parts of the universal joint (the needle bearings and universal joint shafts). The universal joint needle bearings and caps can be completely cleaned of all lubrication and driving with the universal joint in this condition will not produce universal joint failure because lubricant from the universal joint body will still reach the universal joint shafts, needle bearings, and caps. See Pre-Test and Post-Test Photographs in Tab 8 of "Full Vehicle Testing and Tag Axle Steering Analysis, 1995 MCI 102DL3, June 12-14, 2011" which show universal joint caps and needle bearings cleaned of all lubricant in pre-test photographs and well lubricated in post-test photographs without any action taken to add lubricant to universal joint caps and needle bearings between the pre-test

photographs and the post-test photographs. This makes the universal joint very unlikely to fail in a way that would produce de-coupling of the drive shaft from the transmission yoke end. In fact, testing conducted by MCI consultants has shown that the universal joint can be operated with all needle bearings removed, and all lubrication cleaned from the universal joint caps, for hundreds of miles without causing universal joint failure or even significant universal joint damage. The same testing showed that there is a vibration/noise produced by such a universal joint that should be noted by an alert driver and investigated before continuing travel.

3. Laboratory Testing of Effects of Ground Forces Created During Impact Furrowing of Right Tag Axle Tire

This testing was performed to determine whether ground forces created during the impact furrowing of the right tag axle tire as it approached its rest position were consistent with the deformation and damaged observed on the Campbellton, Texas coach. This instrumented testing and the test set-up are fully described in Laboratory Testing of a Tag Axle Assembly in the August 11, 2011 report of Dynamic Analysis Group, LLC, by Kevan J. Granat, and is depicted in photographs, video, and data plots in Exhibits 11, 12, and 13 of the October 14, 2011 deposition of Kevan Granat. Dynamic Analysis Group was responsible for designing and conducting the test. As reported by Kevan Granat, in his report of August 11, 2011:

This testing shows that ground forces created during the impact furrowing of the right tag axle tire as it approached its rest position are consistent with the deformation and damage observed on the subject coach, including gouges on the tie-rod-mounted locking plate, forward contact of the locking pin, and forward bending of the tie rod. The peak force levels observed during testing are consistent with the levels expected during such motion of the coach.

This testing shows that late-occurring events in the Campbellton, Texas accident sequence (events occurring after the Campbellton coach had skidded into the median and overturned) can and probably did cause the unlocking of the tag axle steering mechanism in the Campbellton coach.

C. Inspection/Testing Conducted

On June 30 – July 1, 2011, MCI Vice President-Engineering, Virgil Hoogestraat, together with mechanics/transmission and engine control module technology consultant, Gregory M. Wright, conducted an inspection and testing of the Campbellton coach with regard to the integrity and operability of electrical and pneumatic controls of the tag axle steering and tag axle castering cylinders. The

inspection/testing was designed and conducted by Virgil Hoogestraat and Gregory M. Wright. The inspection/testing as designed was described in a protocol prepared in advance of the inspection/testing. See Attachment C-1 (Protocol). Upon discovery of modifications to the Campbellton coach and its pneumatic system, the protocol was modified to determine whether air lines and solenoid valves controlling the tag axle steering lock cylinder and the tag axle castering cylinder were operative in supplying air pressure to the tag axle steering lock cylinder and the tag axle castering cylinder. It was determined that the pneumatic system had been modified by the coach operator, that air lines to the tag axle steering lock cylinder and the tag axle castering cylinder were incapable of supplying air pressure to operate the cylinders, and that solenoid valves which control air supply to the cylinders were inoperative. It was also determined that the tag axle warning lights on the Campbellton coach were burned out. Other findings from this inspection are detailed in the report of Virgil Hoogestraat, issued August 11, 2011. See Attachment C-2 (Report of Virgil Hoogestraat, issued August 11, 2011). This inspection/testing is further described in the deposition of Virgil Hoogestraat, dated September 23, 2011, and in the deposition of Gregory M. Wright, dated February 29, 2012.

10. Furnish MCI's assessment of the alleged defect in the subject vehicles, including:

   a. The causal or contributory factor(s);
   b. The failure mechanism(s);
   c. The failure mode(s);
   d. The risk to motor vehicle safety that it poses; and
   e. What warnings, if any, the operator and other people both inside and outside the vehicle would have that the alleged defect had occurred?

<u>RESPONSE:</u> MCI's assessment of the alleged defect in the subject vehicles is that the alleged defect is not a defect at all. There is essentially no risk to motor vehicle safety presented by the alleged defect.

A. <u>Decoupling of Drive Shaft from Transmission During Highway Travel is a Low Probability Event</u>

Because of the design, configuration, and geometry of the driveline and surrounding structures and equipment in the subject vehicles, a decoupling of the driveshaft from the transmission during highway travel is unlikely and requires:

1. **Improper installation of the transmission universal joint in its attachment to the driveshaft (the universal joint is very simple to install in the transmission end of the**

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driveshaft, and any mis-installation should be readily apparent and is unlikely to allow the coach to ever reach highway speeds before the connection fails);

2. **Improper installation of the transmission universal joint in its attachment to the transmission yoke end (in driveshaft tests conducted by GLI it is believed that (a) universal joint straps intentionally were cut almost all the way through the strap body and bolt shanks were cut down to a greatly decreased shank diameter to produce a driveshaft de-coupling of the transmission universal joint from the transmission yoke end, or (b) bolts were intentionally left out of the universal joint strap connections to the transmission yoke end). See Attachment A-1 (IMG_033); Pre-Test Photograph from Americanos/GLI expert A. Jones Geometric Load Testing (drive shaft test);**

3. **Improper installation of the transmission yoke end (the transmission yoke end is usually installed by the transmission vendor and improper installation should be prevented by quality control procedures; such an improper installation is likely to be discovered upon installation of the transmission universal joint in its attachment to the transmission yoke end);**

4. **Improper lubrication (or, more likely, complete lack of lubrication) of the universal joint for a long period of time by the coach operator. The universal joint body is filled with lubricant that reaches the needle bearings within the bearing caps by a combination of heat causing lower viscosity of the lubricant within the universal joint body, and centrifugal force of the turning driveline forcing the lubricant to the only moving parts of the universal joint (the needle bearings and universal joint shafts). The universal joint needle bearings and caps can be completely cleaned of all lubrication and driving with the universal joint in this condition will not produce universal joint failure, because lubricant from the universal joint body will still reach the universal joint shafts, needle bearings, and caps. See Attachment A-2 (Granat Report Excerpts). This makes the universal joint very unlikely to fail in a way that would produce de-coupling of the driveshaft from the transmission yoke end. In fact, testing conducted by MCI consultants has shown that the universal joint can be operated, with all needle bearings removed and all lubrication cleaned from the universal joint caps, for hundreds of miles without causing universal joint failure or even significant universal joint damage. See Attachment A-3 (Granat Report Excerpts). The same testing showed that there is a vibration/noise produced by such a universal joint that should be noted by an alert driver and investigated before continuing travel. See Attachment A-3 (Granat Report Excerpts).**

5. **Excessive wear or damage to the universal joint which decreases the strength of the body or shafts of the universal joint from the designed strength. Such a condition should be observable by the installing mechanic during any installation or re-**

installation of the universal joint. Universal joints must be removed and replaced many times during the life of a coach. Replacement of a driveshaft, any transmission replacement, and universal joint replacement are examples of occasions where driveline universal joints are required to be removed and replaced or reinstalled. Such a condition should be noted and resolved (by replacement of the universal joint) during any such operation. Further, any such condition should be noted during periodic inspections of the driveline. See Attachment A-3 (Maintenance Manual Excerpts).

None of these conditions should exist in a well-maintained coach driveline. None will exist unless a coach is improperly maintained and/or improperly prepared for return to service.

B. <u>Escape of Decoupled Driveshaft Is Unlikely Because Multiple Near-Simultaneous Failures Are Required</u>

Because of the design, configuration, and geometry of the driveline and surrounding structures and equipment in the subject vehicles, even with a decoupling of the driveshaft from the transmission during highway travel, an escape of the driveshaft from the latch arm assembly is unlikely because multiple failures must occur almost simultaneously for an escape of the driveshaft from the surrounding latch arm assembly. The probability of such multiple failures occurring simultaneously or almost simultaneously is very low. When the coach is on the road and the driveshaft is intact, the geometry of the driveline and surrounding structures is such that the transmission-end of the driveshaft cannot escape the latch arm assembly and guard unless it also detaches from the differential half-round yoke. Even fully collapsed on its splined, telescoping slip joint, the intact driveshaft is too long to escape the latch arm assembly while it is intact and still attached to the differential. See Attachment B-1 (CAD Drawings). In the Campbellton crash, it is believed that the driveshaft did not escape the latch arm assembly until <u>after</u> the driveshaft had become detached from both the differential and the transmission. See Attachment B-2 (Report Excerpts).

In the driveshaft testing submitted by GLI to NHTSA, it is apparent that the driveshaft escapes from the latch arm assembly after an intentionally-induced failure at the transmission half-round yoke end. However, close examination reveals that this occurs with a driveshaft where strikes of the still-attached and intact universal joint on the latch arm assembly have produced fractures of both sides of the driveshaft's rear full-round yoke end. See Attachment B-3 (IMG_0116). Without these double fractures to both sides of the driveshaft's rear full-round yoke end, the driveshaft's length is still too long to escape the latch arm assembly. See Attachment B-4 (CAD Diagram). Even if one side of the driveshaft's rear full-round yoke end remains intact (as it did in the

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Campbellton crash; see Attachment B-5 (DSCN0629)), the driveshaft is too long to escape the latch arm assembly while still connected to the differential and surrounded by the original equipment guard.

The failures that must occur simultaneously or almost simultaneously are:

1. **Any of the unlikely conditions listed in A.1-5 above leading to breakage of universal joint straps, strap-holding bolts, universal joint body, or universal joint shafts at the transmission end of the driveshaft; AND**
2. **Compression of the driveshaft length to its minimum length; AND**
3. **Loss of the universal joint body and shafts from the driveshaft's rear full-round yoke end; AND**
4. **Breakage of BOTH sides of the driveshaft's rear full-round yoke end.**

It also must be remembered that any coach experiencing a transmission-detached driveshaft striking the latch arm assembly will be slowing because the drive wheels are no longer powered, and the coach driver will be alerted to the problem as a result of the noise. Moderate braking and maneuvering to the side of the road are also to be expected from a prudent coach driver. Braking and natural slowing of an unpowered coach will decrease the rotational speed of the transmission-detached driveshaft rapidly, since the transmission-detached driveshaft is only being driven by the rolling speed of the drive wheels. The impacts of the transmission-detached driveshaft on the latch arm assembly will also decrease the kinetic energy of the driveshaft. The probability of all these things (1-4 above) occurring within the seconds before the coach is brought to a stop on the roadside is very low, assuming properly operating brakes and prudent operator actions. The Campbellton coach did not have properly operating brakes due to maintenance issues, and the coach driver failed to moderately apply the brakes and attempt to coast the coach to the road side.

There is an even lower probability of all these things (1 – 4 above) occurring within the very few seconds before the coach is brought to a speed where its kinetic energy could no longer result in any handling difficulties. As the coach is slowing and being braked moderately, the driveshaft rotational speed will be decreasing and the energy with which it can strike any coach structures or equipment is decreasing.

What actually should occur in the event of a transmission-detached driveshaft is quite different than the driveshaft testing that GLI has submitted to NHTSA. In those tests, the coach drive wheels were not allowed to coast down unpowered as would be expected in such an event occurring on the road. See Attachment B-1. Instead, the tests show

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elevated drive wheels (and driveshaft) that were powered by the engine, transmission, and elevated drive wheels of an adjacent "power coach." See Attachment B-2. Not only do those tests show powered drive wheels on the tested coach, they also show that efforts were made to increase the drive wheel speed and the rotational speed of the driveshaft as soon as a transmission detachment occurred. See Attachment B-1.

C. <u>A Driveshaft Which Escapes the Latch Arm Assembly Has No Significant Effect on Steering or Handling</u>

In the event that (a) a coach is improperly maintained and/or improperly prepared for return to service; and (b) multiple near-simultaneous failures occur with the driveshaft and the transmission end of the driveshaft; and (c) the driveshaft escapes from the latch arm assembly while still rotating and still attached to the differential, it is possible that the transmission end of a rotating driveshaft can strike some structures or equipment near the latch arm assembly. The center portion of the tag axle tie rod is perhaps the most exposed to driveshaft strikes. If the transmission-detached driveshaft escapes the latch arm assembly but is still attached to the differential and still enclosed by the driveshaft guard, it is possible that the tie rod will incur driveshaft strikes. Because the driveshaft guard limits the downward travel of the rotating driveshaft, there are limits on the amount of deformation of the tag axle tie rod that can be caused by the rotating driveshaft. See Attachment C-1 (CAD Drawing). The kinetic energy of the rotating driveshaft, in such an unlikely event, should be limited by a slower rotational speed produced by the slowing, unpowered drive wheels as the coach is brought to a roadside position and to a stop.

The driveshaft testing produced to NHTSA by GLI has shown that powered drive wheels, powering a driveshaft that has escaped from the latch arm assembly, can significantly deform the center portion of the tie rod and cause unlocking of the tag axle steering lock. However, this testing also shows that when this occurred, significant gouges on the tag axle tie rod of the tested coach were produced. See Attachment C-2 (Photo). No such gouges were found on the tie rod of the Campbellton coach. See Attachment C-3 (Photos). It is believed that the driveshaft did not escape from the latch arm assembly in that incident until the coach was on its side in the median and the differential connection to the driveshaft failed. See Attachment C-4 (Excerpt from Granat Report).

The testing submitted by GLI to NHTSA showed that deformation of the tag axle tie rod resulted in unlocking of the tag axle steering lock mechanism, but this has no significant effect on steering or handling of the coach. Testing conducted for MCI shows this clearly. See Attachment C-5.

For full understanding of the testing and its results, a clear understanding of the tag axle steering lock mechanism of the subject vehicles is required.

D. <u>Description of Tag Axle Steering Lock Mechanism</u>

Control of the tag axle steering lock mechanism is by a speed switch which is set to lock the tag axle steering at 20 MPH and set to unlock the tag axle steering at 15 MPH. The tag axle steering lock mechanism is operated by a pneumatic cylinder which actuates an attached pin up or down (up to unlock; down to lock). The pin is spring-loaded to lock the tag axle steering even with no air pressure to the cylinder or to the solenoid valves which control air pressure to the cylinder.

Mechanically, tag axle steering is locked by a spring-loaded and pneumatic-cylinder-actuated pin positioned within three mating slots in two stationary lock plates and one sliding lock plate. The stationary lock plates are affixed to the tag axle structure and the sliding lock plate is affixed to the tag axle tie rod. The tag axle tie rod is attached to the tag axle steering knuckles through ball joint tie rod ends. Locking of the tie rod locks the tag axle steering knuckles in a straight-ahead position.

With pneumatic pressure to the solenoid valves which operate the pneumatic cylinder, air pressure can be directed to either side of the cylinder, depending on which solenoid valve is electrically actuated. When a command of "tag axle steering lock" is received by the proper solenoid valve, the pneumatic cylinder acts, utilizing air pressure plus spring force, to push the pin down through three mating slots in the tag axle steering lock mechanism. When a command of "tag axle steering unlock" is received by the proper solenoid valve, the pneumatic cylinder acts, utilizing air pressure to overcome the spring force, to pull the pin up and out of the three mating slots in the tag axle steering lock mechanism.

When the pin is in place in the three mating slots of the three plates, the tag axle tie rod is fixed in place and keeps the tag axle wheels and tires from pivoting on the tag axle king pins. Additionally, bosses on the steering knuckles for each tag axle wheel align with adjustable tag axle steering stops to limit the travel of the tag axle wheels to 11 degrees of pivot about the king pin, left or right. When tag axle steering is unlocked, secondary limitation on the travel of the tie rod is provided by a steering damper that is affixed to the tag axle structure and to the tag axle tie rod.

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E. <u>Performance of Subject Vehicles with Unlocked Tag Axle Steering</u>

Coach performance testing on a test track has shown the following performance effects of unlocked tag axle steering at slow speeds and at highway speeds up to maximum coach speeds:

1. **The tag axle wheels and tires simply react to lateral forces imposed by turning as a trailing caster wheel under all tested conditions, including testing at highway speeds and at maximum coach speed.**

2. **No oversteer conditions are created by unlocked tag axle steering under any conditions tested.**

3. **Through conventional steering tests such as step steers, frequency response testing, lane change testing, and aggressive lane change testing, the tested coach responded in an appropriate manner which was controllable and predictable with unlocked tag axle steering. The coach performed with no significant difference in controllability and handling from the performance of the coach with locked tag axle steering.**

4. **Various combinations of braking, braking and turning, braking and straight-ahead steering, braking and alternative right steering and left steering, hard braking, light braking, dry pavement, wet pavement, driving over roadway anomalies, lane changes, aggressive lane changes, and other conditions were tested, and all situations encountered with unlocked tag axle steering were controllable with appropriate and predictable steering responses. None of these tests even produced any difficult-to-control steering or handling of the tested coach.**

5. **For the testing, a specially-built and installed control was used to override the speed switch which is normally used to command "tag axle steering lock" or to command "tag axle steering unlock." The testing showed that, even with a command of "tag axle steering unlock" and cylinder air pressure attempting to unlock the tag axle steering lock mechanism, the tag axle steering lock mechanism will not actually unlock the tag axle steering unless the tag axle wheels reach a straight-ahead position. In other words, a tag axle steering unlock command does not initiate a tag axle steering unlock action if the coach is in even a slight turn. The tag axle steering lock cylinder does not have sufficient capacity to unlock the tag axle steering when the coach is in any turn. When the coach is no longer turning and is travelling straight, the pneumatic cylinder will initiate unlocking of the tag axle steering.**

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6. **If properly maintained, the coach will provide to the driver a console light indication that tag axle steering is not locked when the speed switch has commanded "tag axle steering lock."**

In summary, this testing shows that there is no dangerous, uncontrollable, unpredictable, or difficult-to-control condition created by an unintended unlocking of the tag axle steering in the subject vehicles. With unlocked tag axle steering, the steering and handling of the subject vehicles, assuming that they are properly maintained by the coach operator, will perform with no significant difference in steering, handling, and braking from the performance with locked tag axle steering.

Experts retained by GLI for litigation in connection with the Campbellton, Texas case have given opinions that unlocked tag axle steering in the subject vehicles is not a dangerous condition. Former NTSB investigator, [redacted] has testified that he "wouldn't be afraid to take a bus across [the] country with the tag axle unlocked." ***See*** **February 15, 2012 deposition of [redacted] p. 307:9-20.**

F. GLI Contentions Regarding Unlocked Tag Axle Steering and Unlatched Tag Axle Castering in the Campbellton, Texas Case

In connection with the Campbellton case, GLI first contended that unlocking of tag axle steering caused the driver to oversteer and yaw across the roadway and into the center median of the roadway. Later, after observing the testing discussed above and after performing testing with experts retained for the litigation, GLI changed its contentions. The new contentions combined the old contention with a new one. The later contention was that unlocked tag axle steering combined with unlatched tag axle castering caused a difficult-to-control yaw to the right followed by a driver response that was an excusable over-correction to the left, with the over-correction to the left producing the yaw across the roadway and into the center median of the roadway. To support this new contention, GLI retained experts who performed track tests with highly questionable methods and equipment. See Attachment F-1 (Caster Change Estimation & Drawings/Campbellton Coach Photograph & Test Photograph). Rather than present this to a jury with MCI and MCI retained experts present and questioning these tests, GLI dismissed all claims against MCI on the Friday before trial was to commence. See Attachment F-2 (Order NonSuit MCI).

This highly questionable testing (some of which may well have been presented to NHTSA) will be discussed below after a description of the tag axle castering mechanism and the castering latch mechanism.

G. Description of Tag Axle Castering Mechanism and Tag Axle Castering Latch

In order to provide for a shorter turning radius for the subject vehicles at low speeds and less tag axle tire scrub, tag axle steering was developed. Tag axle steering was enabled at coach speeds less than 15-20 mph in both forward and reverse travel. Tag axle steering in the subject vehicles is not powered or actuated by a piston and cylinder arrangement. Tag axle steering in the subject vehicles is "self-steering" only, with a "pivoting (variable caster) truss design." MCI 102D Series Maintenance Manual, Section 12D Trailing Axle Suspension. When tag axle steering is enabled, the self-steering tag axle wheels are intended to be trailing castered wheels.

If tag axle steering were enabled only for forward travel of the coach, there would be no need for a variable caster design, but greater maneuverability is desirable in both forward travel and reverse travel at low speeds in parking lots, in traffic-congested areas, and in parking maneuvers. Operation of the castering mechanism assures positive castering of the tag axle wheels for either forward travel or reverse travel. Actuation of the castering mechanism is controlled by transmission gear selection (a transmission "reverse switch" signals the castering mechanism to reverse the caster of the tag axle wheels). The transmission gear selection of "reverse" causes the tag axle castering mechanism to tilt the king pins of the steerable tag axle steering knuckles to provide for negative caster during reverse travel.

Assuming a coach has a working air system and operating castering pneumatic cylinder, the tag axle castering mechanism is latched in one of two indexed positions:

1. **Latched for forward travel: latch arm assembly horns retracted against tag axle structure, rear horn within rear hole of latch plate and forward horn within forward hole of latch plate. In this position the king pin axes are inclined so that their intersection with the road surface is forward of the contact patch of the tag axle tires.**

2. **Latched for rearward travel: latch arm assembly horns extended forward of tag axle structure (pivoted 6 degrees), rear horn within forward hole of latch plate and forward horn forward of forward edge of latch plate (but still within the travel-limiting strap). In this position the king pin axes are inclined so that their intersection with the road surface is to the rear of the contact patch of the tag axle tires.**

The tag axle castering mechanism is indexed between its two latched positions by a pneumatic castering cylinder. A castering latch mechanism is used to assure that braking loads are not transmitted through the latch arm assembly to the castering

cylinder. When latched in either of its indexed positions, braking loads are transmitted to the latch assembly and the tag axle structure rather than to the castering cylinder.

Transmission gear selection of "reverse" signals solenoid valves which admit compressed air to the double-acting castering cylinder to extend the piston and attached clevis and rollers of the castering latch mechanism. This action causes the clevis mounted rollers to ride under the latch plate ramps, forcing the latch plate up and unlatching the castering mechanism, and sequentially pushes the castering horns and latch arm assembly forward.

Transmission gear selection of any gear except "reverse" signals solenoid valves which admit compressed air to the double-acting castering cylinder to retract the piston and attached clevis and rollers of the castering latch mechanism. This action causes the clevis mounted rollers to ride under the latch plate ramps as the clevis is retracted, forcing the latch plate up and unlatching the castering mechanism and sequentially retracting the castering horns and latch arm assembly back to a position against the tag axle structure.

If the controls are not functioning or if there is no compressed air supply to the pneumatic castering cylinder, the clevis–mounted rollers will not ride under the latch plate ramps and lift the latch plate for unlatching the latch arm assembly. Action of the pneumatic castering cylinder is also required to retract the latch arm assembly horns back against the tag axle structure (the proper position for latching in the forward travel position). Without action of the pneumatic castering cylinder to retract the latch arm assembly horns, the latch plate cannot come down with its front and rear holes over the front and rear horns of the latch arm assembly and the castering mechanism will not be latched in the position for forward travel.

The castering mechanism and the castering latch mechanism require inspection and maintenance and can be inspected with its operation observed from outside the coach (looking in between drive axle wheels/tires and tag axle wheels/tire), with coach air pressure utilized to operate the castering cylinder (controlled by transmission gear selection). The operation of the castering cylinder and castering mechanism can also be observed from a pit position, with coach air pressure utilized to operate the castering cylinder (controlled by transmission gear selection).
The latch plate of the tag axle castering latch is fitted with replaceable wear plates on the forward edges of the two latch plate holes. The rear horn of the latch arm assembly is fitted with a replaceable wear plate (horn plate) on the forward edge of the horn. These surfaces can wear and should be inspected and maintained.

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The tag axle castering latch mechanism of the subject vehicles is also equipped with a travel-limiting strap welded to the tag axle structure. This strap is positioned and configured so that it limits the forward excursion of the latch arm assembly and horns to just beyond the indexed position of the horns for rearward travel. Once the forward horn is in contact with this strap, no further forward pivoting of the latch arm assembly can occur.

H. Questionable Track Testing by GLI

As referenced above, there are some potentially significant differences in the condition of the tag axle castering latch mechanism in the GLI test coach, as compared to the tag axle castering latch mechanism in the Campbellton coach and as compared to a well-maintained or original equipment coach.

First, the GLI test coach has a working castering cylinder, whereas the Campbellton coach had no air pressure to the castering cylinder and the solenoid valves that operate this cylinder were not working (the cylinder could not be operated on the Campbellton coach). The castering cylinder operates the attached clevis and rollers. The clevis and rollers are used to push the latch plate up by the rollers acting on the latch ramps. This action of the rollers acting on the ramps pushes the latch plate up, compressing the rubber bushings on the top and, when the rollers are no longer on the ramps, allows the resilience of the compressed bushings, together with gravity, to return the latch plate to its "down position", where it latches if a "horn" or "horns" are in the correct position. In the proper latched position for forward travel of the coach, both "horns" are engaged in the latch plate holes (forward "horn" in the forward hole and rear "horn" in the rear hole), with the latch plate in the down position. In the proper latched position for reverse travel of the coach, only the rearmost "horn" is engaged in the forward latch plate hole, with the latch plate in the down position. The forward "horn" is not engaged by the latch plate in this position, but it is still within the strap that is part of the castering latch assembly.

Second, the GLI test coach had the castering latch strap, which limits the forward motion of the latch arm assembly, cut off from the castering latch assembly. In the Campbellton coach, the strap was present and not significantly disfigured (meaning that it would have done its job of limiting the forward travel of the latch arm assembly if the latching mechanism had somehow become unlatched).

Third, during GLI's most significant tests on the track, the GLI experts used the castering cylinder (operated from a specially-mounted switch on the driver's LH panel) to unlatch the castering mechanism from the proper position for forward travel and move the latch arm assembly to the position for rearward travel and "latch" it there.

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In this position, the rearmost "horn" of the latch arm assembly is in the forward hole of the latch plate. However, while the latch plate is in its down position at this point in the tests, the rearmost "horn" of the latch arm assembly is not truly latched and held by the latch plate. The reason for this is discussed below.

Finally, the rearmost "horn" on the tag axle latch arm assembly of the GLI test coach is significantly damaged/rounded over in the area where it is supposed to contact the wear surface part of the castering latch plate. In addition, the horn plate, a stainless steel plate that is held by a screw to the latching face of the rearmost horn, is completely missing from the damaged/rounded-over rear horn on the GLI test coach. This horn plate is the protective plate that protects the rear horn of the latch arm assembly from wear. Without the horn plate, the horn itself does not match up with the latch plate latching surfaces (which are also replaceable wear surfaces).

The result of this is that, in the track testing performed by GLI's experts, the latch plate does not hold the castering mechanism (latch arm assembly) latched when brakes are heavily applied during forward travel. With brakes heavily applied in forward travel (brakes locked and the coach in a locked-wheel skid), the rearmost "horn" slips past the contact point on the forward edge of the forward hole of the latch plate and past the roller shaft on the castering-cylinder-operated clevis.

The braking forces in the GLI tests push the latch arm assembly past (more forward of) the normal point where the horns of the latch arm assembly could go (more than the intended 3 degrees of negative caster angle), creating more castering in the wrong direction than the castering latch mechanism would normally allow and even more negative castering than the travel-limiting strap would allow.

This creates instability in the tag axle wheels where none would normally exist. Even if the tag axle wheels were castered for reverse travel while the coach was traveling forward, pneumatic trail of the tag axle tires/wheels keeps the total trail of the tag axle tires/wheels positive. When positive trail exists, the wheels act as trailing castered wheels.

This extreme forward excursion of the latch arm assembly during heavy braking in the GLI testing (approximately three times the designed castering excursion for reverse travel) creates greater instability in the tag axle wheels than could exist if the travel-limiting strap were still present on the tested coach. Calculations of total trail existing with the tag axle wheels/tires show that if the tag axle wheels were castered for reverse travel, the total trail is still positive. Likewise, if the castering mechanism were allowed to go to its travel limit (travel limited by the strap), the total trail remains positive.

Accordingly, the tag axle wheels/tires can only trail as castered wheels if castering is limited to this extent.

Of course, there would be no instability in the tag axle wheels if the latch arm assembly were latched and remained latched in the proper position for forward travel. In this position, the total trail of the tag axle wheels/tires is highly positive; the tag axle wheels would just trail as they were intended to do.

GLI's testing does confirm that negative castering of the tag axle within the limits of the castering latch mechanism still results in positive trail. The tag axle wheels, with tag axle steering unlocked, continue to trail as castered self-steering wheels during the portions of the testing before brakes are heavily applied (while the castering is within the designed limits of the castering and castering latch mechanism). Once brakes are heavily applied, braking forces on the unlatched and unlimited (because of GLI's modifications to the test coach) cause the castering mechanism to make extreme excursions from its designed limits. Only from that point forward are the results of the tests invalid as to the performance of a coach with unlocked tag axle steering and unlatched and mispositioned tag axle castering.

It should be noted, however, that the mispositioning of the tag axle castering mechanism in the test coach could not have occurred with the Campbellton coach. The Campbellton coach had no working air supply to the tag axle castering cylinder, and the solenoid valves for that cylinder were not operative (all due to lack of maintenance of the Campbellton coach). The mispositioning of the test coach castering mechanism was performed with a working castering cylinder and working solenoid valves and with compressed air supplied to the cylinder. This mispositioning could not have been performed on the Campbellton coach as it was with the test coach.

GLI's testing is wholly unreliable and unsuccessful in showing that the coach equipment (even with unlocked tag axle steering and unlatched tag axle castering) produced steering of the coach by the tag axle wheels alone (without driver steering input). This testing cannot and does not show that the GLI driver played no role in causing this accident or that she played only an excusable role in trying to overcome an "uncontrollable condition." The testing does not show that unlocked tag axle steering plus unlatched tag axle castering causes an uncontrollable situation, and it doesn't even begin to show what caused the overcorrection to the left which directly caused the Campbellton coach to yaw across the roadway and into the median where it overturned. See February 15, 2012 Report of Dynamic Analysis Group, [redacted] February 15, 2012 Report of Carr Engineering, R. Rucoba; March 22, 2012 Deposition of [redacted] Pgs. 6, 18-19, 41-43, 139-141, 178-182, 186-204, 213; September 21,

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2011 Deposition of [redacted] Pgs. 81-91, 128-132, 153-157, 180-181; March 23, 2012 Deposition of [redacted] Pgs. 13-16, 79-83, 84-89, 94-104, 118-120.

I. Cause of the Campbellton, Texas Bus Accident

Even a marginally less-panicked, more experienced, and better trained driver would have brought the Campbellton coach to a stop on the road side and waited for a replacement bus to come and transport her passengers to their destinations. The driver of the Campbellton coach was a school bus driver who drove for Americanos on weekends and school holidays, who did not have the proper license for the trip she was on, who had no record of having ever been trained on the type of coach she was driving, who did not know the schedule and was late in appearing at the terminal, who was late starting the trip and who drove at full coach speed in the rain. She also reacted to the noise of the driveshaft universal joint failure by slamming on the brakes, skidding, and then greatly over correcting to the left. This latter action is what turned the Campbellton incident from a routine coach breakdown into a fatal accident.

Because the Campbellton coach had no working castering cylinder (no air supply and non-operative solenoid valves), the castering mechanism had likely not been operative for months or years. This was the direct result of poor or non-existent maintenance by the coach owner/operator. An inoperative castering cylinder cannot retract the castering mechanism into a position where it can be latched in the proper position for forward travel. The castering mechanism was found at the accident scene in an intermediate position (neither retracted rearward to the "latched for forward travel" position nor extended forward to the "latched for reverse travel" position). It is unknown whether this positioning was caused by the layover and slide rearward which was experienced by the Campbellton coach in this accident, but this is the position that the castering mechanism would have been in without a working castering cylinder to retract the castering mechanism back to the "latched for forward travel" position. There is simply no evidence to indicate that the castering mechanism of the Campbellton coach was unlatched by a driveshaft strike from a driveshaft that escaped from the latch arm assembly while the coach was still on the road. There is no evident mark on the castering latch mechanism that indicates a driveshaft strike on the latch plate or strap of that mechanism.

At the end of the Campbellton crash, there is evidence that the tag axle steering was unlocked, but there is no reliable evidence that this occurred while the coach was still on the road and being driven. The layover and rearward slide of the coach in the median could have produced this unlocking of the tag axle as shown by testing of MCI's expert, [redacted] Sliding rearward on the curbside of the coach produces forces on the face of the tag axle wheel rim which stress the tag axle steering lock mechanism through the tag axle tie rod in the direction shown by the evidence on the tie rod and

tag axle steering lock mechanism. It is believed that this effect, rather than driveshaft strikes on the tie rod, is what produced the failure of the tag axle steering lock in the Campbellton coach. This effect produced by the laid over sliding is long after the driver had any opportunity to control the coach on the road.
Driveshaft strikes on the tie rod as a cause of the tag axle steering unlocking are not likely because:

1. **The type of marks on the tie rod are not consistent with those seen on the tie rods of the tested coaches. The GLI driveshaft tests produced much deeper gouges than those on the Campbellton coach tag axle tie rod.**

2. **The driveshaft tests conducted by GLI each resulted in driveshafts with both sides of the driveshaft yoke end broken off. As a result, the driveshafts in those tests can escape the latch arm assembly while still rotating. In the Campbellton coach, only one side of the drive shaft yoke end was broken. The configuration of the driveline and surrounding equipment when a coach is on the road preclude escape of the driveshaft from the latch arm assembly when only one side of the drive shaft yoke end is broken.**

3. **The driveshaft tests by GLI were conducted with an artificial geometry (jacking up the drive axle while allowing the tag axle to hang below its normal on-the-road position) which allowed easier escape of the driveshaft from the latch arm assembly. These tests should not be viewed as reliable or an indication of the likelihood of a driveshaft escaping from the latch arm assembly of the subject vehicles.**

4. **It is also unknown whether the driveshaft tests by GLI were conducted with air pressure to the tag axle lock cylinder. The tag axle lock pin is spring-loaded to maintain locking of tag axle steering even without air pressure or cylinder actuation. The Campbellton coach had its tag axle steering locked with spring loading only. Due to GLI modifications to the air system in the Campbellton coach and due to lack of maintenance, there was no air supply to the tag axle steering lock cylinder as result of clogged air lines and inoperative solenoid valves. The tag axle steering lock design is for both spring loading and air cylinder forces to hold the locking pin within the mating slots of the tag axle steering lock. The susceptibility of the tag axle steering lock to disengagement from driveshaft strikes on the tie rod should be tested only with the designed locking measures in place to maintain the steering lock.**

5. **Driveshaft tests by GLI were also conducted with powered drive wheels which did not allow the driveshaft to "coast down" as would occur in an actual on-the-road driveshaft separation at the transmission. It is apparent that this produces driveshaft strikes that are of higher energy and more frequent than would occur**

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with a coasting-down, unpowered driveshaft. This effect is exacerbated by the speeding up the driveshaft when the first evidence of failure or impending failure is detected, as was done in the driveshaft tests by GLI.

6. **There is a more likely explanation for accident scene findings of unlocked tag axle steering which better fits the evidence or lack thereof on the Campbellton coach. Sliding rearward on the curbside of the coach produces forces on the face of the tag axle wheel rim which stress the tag axle steering lock mechanism through the tag axle tie rod in the direction shown by the evidence on the tie rod and tag axle steering lock mechanism.**

For all these reasons, it is unlikely that the Campbellton, Texas accident should be considered as an example of the risk of a transmission-detached driveshaft escaping from the latch arm assembly of the tag axle and causing damage to the tag axle steering lock mechanism.

J. The [redacted] Pennsylvania Bus Accident is Completely Unrelated to the Alleged Defect Because the Driveshaft Separation in that Accident Occurred During and as a Result of the Accident Rather than Before and as a Cause of the Accident

The [redacted], Pennsylvania bus accident was initiated when the GLI driver steered into or allowed the left front corner of the coach (GLI unit 6352) to strike the median jersey barrier at highway speed. There is no evidence of a prior driveshaft connection failure. The first scene evidence demonstrates this left front corner collision with the median jersey barrier, to the left of the travel lane. No evidence of a failed universal joint or a failed driveshaft were found in or near the path of the coach before this left front corner strike on the jersey barrier.

The initial strike on the jersey barrier (preceded by a veer or drift to the left of the travel lane) resulted in a rebound of the front of the coach to the right (clockwise yaw, viewed from above), with the left rear of the coach striking the median jersey barrier next. This second strike of the jersey barrier was very significant and caused significant damage to the left side of the coach at the rear, including body damage and damage to the tag axle suspension and radius rod supports. The entire tag axle structure was forced toward the right side of the coach such that the left side of the latch arm assembly impacted, impinged upon, and then stopped the rotation of the driveshaft and transmission universal joint, causing the driveshaft to be torn away from its connections to the still-rotating differential and the still-powered transmission. The driveshaft of the [redacted] coach did not flail, still connected to the differential, as evidenced by the lack of marks on the forward circumference of the driveshaft. A flailing driveshaft still connected to the differential will contact the original equipment

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guard loop and show circumferential marks left by its rotating contact with the guard loop.

Following the collision of the coach's left side (rear) with the jersey barrier, the coach traveled diagonally forward and across the travel lanes to the right (as directed by the clockwise yaw discussed above), then collided with an earthen embankment off the right side of the roadway, front end leading. The impact forces from the front end collision with the sloping embankment (sloping up to the right) caused the coach to enter into a sudden counterclockwise rotation (counterclockwise, viewed from the rear of the coach), overcoming the roll stability of the coach. The coach overturned onto its left side as a result of the front-end leading impact with the sloping embankment.

It is important to understand when, in the [redacted] accident sequence, the driveshaft separation occurred. The driveshaft separated from its transmission connection and likely also its differential connection following (a) the veer or drift to the left of the travel lane, (b) the initial collision of the coach's left front corner with the jersey barrier, (c) the impact-induced clockwise yaw of the coach which produced the second collision of the coach's left side (rear) with the jersey barrier, and (d) the second collision of the coach's left side (rear) with the jersey barrier, which forced the entire tag axle structure to the right by a significant amount (4.5 – 5 inches of residual deformation and likely more, dynamically). There is no evidence the separated driveshaft caused any interference with steering or handling of the coach after its mid-accident separation. There is no evidence and no logic that could suggest that it played any role in causing the accident, since the driveshaft separation occurred well into the accident sequence.

The separation of the driveshaft in the [redacted] accident occurred as a result of the accident events rather than as a cause of the accident events. The [redacted] accident cannot even be cited as an example of a failed driveshaft connection that causes difficulty with steering or handling of a coach, happening as it did during the course of an accident rather than as a prelude to an accident. The differences between the [redacted] crash and the Campbellton, Texas crash are well reported by experienced accident reconstructionist, [redacted] who investigated both crashes. See Attachment J-1 ([redacted] Supplemental Report Excerpts and [redacted] Second Deposition Excerpts). Mr. [redacted] examined both scenes and both vehicles (over GLI objections after GLI was ordered by the Texas court to allow inspections of certain GLI coaches, including the [redacted] coach). See Attachment J-2 (Order).

A copy of the reports, deposition testimony, and other documents cited in this response is included in a CD found at Tab 7 hereto.

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Please let me know if you should need any additional information.

Sincerely,
Motor Coach Industries International, Inc.

By: Timothy J. Nalepka

Attachments

c: NHTSA Office of the Chief Counsel
(by overnight delivery, w/ two copies of attachments)