PW063009-17

Glaval

2009 TRANSIT VEHICLE

CITY OF RAPID CITY
300 Sixth Street
Rapid City, South Dakota 57701

January 20, 2009

Alan Hanks, Mayor

Council Members

Malcom Chapman
Karen Gunderson-Olson
Patti Martinson
Aaron Costello
Deb Hadcock

Ron Kroeger
Bill Okrepkie
Lloyd LaCroix
Sam Kooiker
Ron Weifenbach

CONTACT PERSON

Rich Sagen
Rapid Transit System
(605) 394-6631

BID SHEET

ONE (1) 2009 ADA ACCESSIBLE RAISED FLOOR TRANSIT VEHICLE

	Unit Price	Extended Price
One (1) 2009 ADA ACCESSIBLE VEHICLE	$ 108,374.00	$ 108,374.00
Less trade in of three (3) 2002 vehicles	$ 7,500.00	$ 22,500.00
Total Bid price one (1) ADA transit vehicle	$ 100,874.00	$ 85,874.00

Brand Name of Vehicle, Chassis & Year 2009 GMC / Glaval Titan

Delivery Date Approx. 100 to 180 working days

Vehicle Warranty 3yr/36,000 miles Chassis 5yrs/100,000 miles

Proposed Facilities Local GMC dealer Warranty/Service (Letter must be attached)

EstimatedVehicle Life in Miles 250,000 miles

Estimated Vehicle Cost Per Mile, Including Gas, Oil and Maintenance Not available on this model

The within Bidder's Proposal is based upon the conditions and stipulations within the Contract Documents named in Section 7.2 and shall be considered a part of this contract as if written herein at length. The work to be performed under this contract shall be commenced upon award of contract and shall be completed within **ONE HUNDRED FIFTY (150) calendar days.**

The said Bidder further agrees and states that he has read the advertisement calling for bids, has studied the Contract Documents, is familiar with the terms and conditions stipulated therein, agrees to enter into the attached Contract and acknowledges receipt of the following Addenda.

Hartows Bus Sales Inc.
NAME OF COMPANY
(Party of the Second Part)

AUTHORIZED SIGNATURE AND TITLE

3800 East Century Ave
Bismarck, ND 58503
ADDRESS

1-6-09
DATE

ADDENDA NO. DATED

BIDDER MUST FILL IN ALL SPACES PROVIDED ABOVE

BIDDER'S PROPOSAL
FOR
ONE (1) 2009 ADA ACCESSIBLE RAISED FLOOR TRANSIT VEHICLE

PLACE: _____
DATE: 2-6-2009

TO: Common Council
Rapid City, South Dakota

Gentlemen:

In compliance with your invitation for bids to furnish ONE (1) 2009 ADA ACCESSIBLE RAISED FLOOR TRANSIT VEHICLE complete and ready for use, as shown by the detailed plans and specifications as prepared by the Rapid Transit System and now on file in the Office of the City Finance Officer, Rapid City, South Dakota, the undersigned Bidder:

(1). A Corporation originated and existing under the Laws of the State of North Dakota.

(2). A Partnership consisting of _____.

Having examined the detailed specifications and contract with bond hereto attached and being fully advised of the materials to be furnished and the work to be done in providing ONE (1) 2009 ADA ACCESSIBLE RAISED FLOOR TRANSIT VEHICLE, hereby proposes to furnish the equipment and do all the work as specified to fully complete said vehicles according to specifications at the following unit prices, to-wit:

CONTRACT BETWEEN CONTRACTOR AND CITY OF RAPID CITY

This Agreement, made the _____ day of _____, 2009, by and between _____, hereinafter called the "Party of the Second Part" (Contractor), and the CITY OF RAPID CITY, SOUTH DAKOTA, hereinafter called the "Party of the First Part," WITNESSETH:

That the "Party of the Second Part" (Contractor) and the "Party of the First Part" for the consideration hereinafter named agree as follows:

ARTICLE I. SCOPE OF WORK:

The "Party of the Second Part" (Contractor) shall furnish all of the materials, labor, and perform all of the work as described in the specifications (prepared by the Rapid Transit System, Rapid City, South Dakota) for providing ONE (1) 2009 ADA ACCESSIBLE RAISED FLOOR TRANSIT VEHICLE and shall be everything required by the Contract, Notice, General Conditions, Special Conditions, and Detailed Specifications, which are hereby made a part of the Contract, including the following Addenda:

ADDENDUM NO.	DATED

ARTICLE 2. TIME OF COMPLETION:

The work to be performed under this Contract shall be completed within **one hundred fifty (150) calendar days** from the date contract is awarded. If delivery is not made within the prescribed time frame, liquidated damages will be assessed at $300 per working day (M-F). Requests for time extensions shall be made in writing to the Rapid Transit System as soon as possible before the project completion date. All time extensions will be issued by the Owner through the Rapid Transit System and will be granted only for good cause beyond the control of the Contractor.

ARTICLE 3. THE CONTRACT SUM:

The "Party of the First Part" shall pay the "Party of the Second Part" (Contractor) for the performance of the Contract, subject to additions and deductions provided therein, in the current funds as follows:

Eighty Five Thousand Eight Hundred and Seventy Four Dollars and 00/100 Cents. ($ 85,874.00) DOLLARS

ARTICLE 4. ACCEPTANCE AND FINAL PAYMENT:

Upon completion of all work under this Contract, the individual or department specified in Article 2 for making time extensions shall satisfy itself by examination that the work has been finally and fully completed in accordance with the specifications and contract and report such completion to the Owner. The Contractor must complete and return a proper City Voucher, and payment will be made on said voucher as soon as possible after approval by the Common Council.

ARTICLE 5. THE CONTRACT DOCUMENTS:

The Notice for Bids, Bid/Performance Bond, General Conditions, Special Conditions, Addenda and the Specifications together with this Agreement, form the Contract and all are as fully a part of the Contract as if hereto attached or herein repeated.

The said "Party of the Second Part" further agrees and states that he has read the advertisement calling for bids and has studied the Detailed Specifications and that he is familiar with the terms and conditions stipulated therein.

IN WITNESS WHEREOF: The CITY OF RAPID CITY, SOUTH DAKOTA ("Party of the First Part"), its Common Council having duly approved this Contract, has caused this Contract to be executed in its behalf by its Mayor, thereunto duly authorized, attested thereto by its Finance Officer and has hereto attached its corporate seal this day of _____, 2009.

ATTEST:

THE CITY OF RAPID CITY, SOUTH DAKOTA

_____

Jim Preston,
City Finance Officer

_____

Alan Hanks, Mayor
Party of the First Part

(S E A L)

Date:_____

_____

NAME OF COMPANY
Party of the Second Part

(C O R P O R A T E S E A L)

By:_____

_____

Title

Address: _____

Date: _____

ARTICLE 6. PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that we _____ as "Principal," and _____ SURETY COMPANY with General Offices in _____, a Corporation organized under the Laws of the State of _____ and authorized to transact business in the State of South Dakota as "Surety," are held and firmly bound unto the CITY OF RAPID CITY, SOUTH DAKOTA, in the sum of ($_____) DOLLARS, lawful money of the United States, in payment of which sum well and truly to be made, the said "Principal" and "Surety" bind themselves, their successors and assigns, jointly and severally, firmly by these presents.

Signed, sealed and delivered this _____ day of _____, 2009.

WHEREAS said "Principal" has entered into a written contract with the "Obligee," dated _____,for _____in accordance with the detailed plans and specifications on file in the offices of the City Finance Officer of said City, a copy of which contract is attached hereto and made a part hereof. NOW, THEREFORE, if said "Principal" shall in all particulars, will, truly, and faithfully performed and abide by said Contract, and each and every covenant, condition and part thereof, and shall carry out all obligations resting upon said "Principal" by the terms of said Contract, Specifications, and Detailed Plans; and if the said "Principal" shall pay to said "City" all sums due or which may become due by the terms of said "Principal;" and if said "Principal" shall promptly pay, or cause to be paid for all labor bills, including the hire, rental or lease of equipment or machinery, or machinery and the operators thereof used on the work; and all bills for materials, lubricants, oils and gasoline used in or consumed in the construction of such work; and for all labor performed in such work, whether by subcontract or otherwise; and if said "Principal" shall protect and save harmless said "Principal" or his or its agents, servants, or employees in the construction of said work; or by or in the consequence of any negligence, carelessness or misconduct in guarding and protecting the same; or from any improper or defective materials used in its construction; or any act or omission of the said "Principal" or his agents, servants, or employees; and if the said "Principal" shall protect and save harmless said "City" from all suits and claims of infringement or alleged infringement of patent rights or processes; and if, for and during a period of one (1) year from and immediately following the completion of said Contract and the acceptance thereof by said "City," the said "Principal" shall pay, or cause to be paid to said "City" all damage, loss, and expense which may occur to the said "City" by reason of defective materials used, or by reason of defective workmanship done, in the furnishing of materials for and the construction of the said work and compliance with SDCL 5-21-3 and SDCL 10-46-5, if applicable; and if said "Principal" shall save and hold harmless said "City" from all damages, loss, and expense occasioned by any failure whatsoever of the said "Principal," then this obligation shall be null and void; otherwise to be and remain in full force and effect in law. If the "Principal" shall fail or neglect to pay any person, firm, or corporation for labor bills including the hire, rental, or lease of equipment or machinery and the operators thereof, issued on the work or materials employed or used by said "Principal" in carrying forward, performing the

completing of said Contract, within thirty (30) days after the same becomes due and payable, such persons, firms or corporations entitled to such pay may sue and recover on this bond from said sureties, or either of them, the amount so due and unpaid them.

And the said "Surety," for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed hereunder or the specifications accompanying the same shall in any way affect its obligations on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition by the terms of the Contract or to the work or to the specifications.

IN TESTIMONY WHEREOF, the said "Principal" has caused these presents to be executed in its name and its corporate seal to be hereunto affixed by its duly authorized officers, and the said "Surety" has caused these presents to be executed in its name and its corporate seal to be hereunder affixed by its attorney-in-fact, duly authorized thereunto so to do, the day and year first above written.

S E A L) _____

By: _____

_____
SURETY COMPANY

By: _____
(Attorney-in-fact)

(Accompanying this Bond with Attorney-in-fact's authority from the company.) This Bond and "Surety" herein approved this _____ day of _____, 2009.

CITY OF RAPID CITY, SOUTH DAKOTA

ATTEST:

By: _____

_____
Jim Preston, Finance Officer
(SEAL)

Alan Hanks, Mayor

ARTICLE 7. GENERAL CONDITIONS

7.1 SCOPE:

That the Contractor shall, in good and first-class workmanlike manner and at his own cost and expense, furnish all of the labor, tools, materials, and equipment necessary to complete ready for use all of the work as designated and as described by the Specifications, Contract Stipulation, Notice, Instruction to Bidders, Bid on file with the Finance Officer of the City of Rapid City, Rapid City, South Dakota, all of which Contract Documents form the Contract and are as fully a part thereof as if repeated verbatim herein, all the work done to be under the direct supervision and to the entire satisfaction of the Public Works Department and the Owner, and in accordance with the Laws of the State of South Dakota.

7.2 CONTRACT DOCUMENTS:

It is to be understood and agreed that the work shall be done fully in accordance with this Contract which includes: Notice, Instructions to Bidders, Bid, Bid/Performance Bond, General Conditions, Special Conditions, Detailed Specifications and Addenda. Detailed plans and/or specifications that are furnished by the Contractor to clarify or define the Owner's Contract must be approved by the Public Works Department. Upon approval, said plans and/or specifications shall be considered a part of this Contract.

7.3 DEFINITIONS:

That whenever any word or expression defined in this Article, or pronoun used in its stead, occurs in these documents, it shall have and is mutually understood to have the meaning herein given:

a. "Contract" or "Contract Documents" shall include all of the documents and plans enumerated in Section 7.2.

b. "Owner" or the words, "Party of the First Part," shall mean the City of Rapid City, acting through its Common Council.

c. "Contractor" or the words "Party of the Second Part," shall mean the party entering into contract for the performance of the work covered by this Contract and his duly authorized agents or legal representatives.

d. "Date of Signing of the Contract" or words equivalent thereto, shall mean the date upon which this Contract, executed by the Contractor, is signed by the Owner.

e. "Day" or "Days," unless herein otherwise expressly defined, shall mean a calendar day or days of twenty-four (24) hours each.

f. "Work" shall mean the furnishing of all labor, materials, equipment and other incidentals necessary to the successful completion for the project.

g. "Written Notice" shall be deemed to have been duly served if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered mail to the last business known to him who gives the "Notice."

h. All time limits stated in the Contract Documents are of the essence.

7.4 VERBAL STATEMENTS NOT BINDING:

It is understood and agreed that the written terms and provisions of this Agreement shall supersede all prior verbal statements of the Officials, Rapid Transit System, or other representatives of the City, and such statements shall not be effective or be construed as entering into, or forming a part of, or altering in any way whatsoever the written Agreement.

7.5 SUBHEADINGS AND TITLES:

The titles of subheadings used in this contract and on the specifications, are understood to be for convenience or reference only, and shall not be taken or considered as being a part thereof, or as having any bearing on the interpretation thereof.

7.6 COPIES OF CONTRACT:

Not less than four (4) copies (and as many more as may be required) of the bound volumes of the proposal, contract, and specifications shall be prepared, and each shall contain an exact copy of the Contract signed by both parties thereto. Additional copies shall be filed where and as may be required.

7.7 SCOPE, NATURE AND INTENT OF CONTRACT PLANS AND SPECIFICATIONS:

The said Specifications and Contract are intended to supplement, but not necessarily duplicate each other, and together constitute one complete set, so that any work covered in the one and not in the other shall be executed just as if it had been set forth in the Contract in order that the work shall be completed according to the specifications decided and determined by the Rapid Transit System. Should anything be omitted from the specifications, plans, and contract which are necessary to clear understanding of the work, or should it appear various instructions are in conflict, then the Contractor shall secure written instructions from the Rapid Transit System before proceeding with the construction affected by such omissions or discrepancies. It is understood and agreed that the work shall be performed and completed according to the true spirit, meaning, and intent of the contract and specifications.

7.8 RESPONSIBILITY OF CONTRACTOR:

General Responsibility - The Contractor shall furnish all transportation, ways, works, machinery, and plant and all suitable appliances required for the safe, proper, and lawful construction, maintenance, and use thereof. He shall cover and protect his work from damage and all injury to the same. Before the completion and acceptance of this contract he shall be solely answerable for all damage to the Owner, or the property of the Owner, to other contractors, or other employees of the Owner, to the neighboring premises, or to any private or personal property, due to improper, illegal, or negligent conduct of himself or his subcontractors, employees or agents in and about said work, or in the execution of the work covered by this Contract or any extra work undertaken herein provided, or to any defect in, or the improper use of, any scaffolding, shoring, apparatus, ways, works, machinery or plant), he shall indemnify and save harmless the Owner and its officers and agents from all claims relating to labor and materials furnished for the work.

7.9 CONTRACTOR LIABILITY INSURANCE:

The Contractor shall maintain insurance as will protect him from claims under workmen's compensation acts and from any other claims for damages for personal injury, including death, which may arise from or by any subcontractor or anyone directly or indirectly employed by either of them.

7.10 GUARANTEES:

The Contractor and any sureties under the Performance Bond guarantees to complete the project as specified and agree that loss as a result of any occurrence shall not relieve them of their obligation. If, for any reason (including but not limited to: bankruptcy, plant closure, or embargo), it becomes apparent to the City that delivery of the completed ADA ACCESSIBLE TRANSIT VEHICLE is not possible within thirty (30) days subsequent the ONE HUNDRED FIFTY (150) days after Contractor receives notice to proceed, the City reserves the right to deem the Contractor in default, terminate the contract, and forfeit the surety bond. Although the City may have the right to deem Contractor in default, it may, in its absolute discretion, waive such default.

7.11 CLAIMS AND DAMAGES:

Any claim for damage arising under this contract shall be made in writing to the party liable, within a reasonable time of the first observance of such damage, and not later than the time of final payment, except as expressly stipulated otherwise in the case of faulty work or materials, and shall be adjusted by agreement or by arbitration.

7.12 WAIVER OF RIGHTS:

Neither the inspection by the Owner or the Rapid Transit System or any of their employees, nor any order by the Owner for payment of money, nor any payment for, or acceptance of, the whole or any part of the equipment, material, or work by the Owner or the Rapid Transit System, nor any extension of time, nor any possession taken by

the Owner or its employees, shall operate as a waiver of any provision of this Contract, or of any power herein reserved to the Owner or any right to damages herein provided, nor shall any waiver or any breach in this Contract be held to be a waiver of any other or subsequent breach.

REQUEST FOR BID TIMEFRAMES

REQUEST FOR BID TIME FRAMES

DATE	DAY	TIME-MST	EVENT
1/21/09	Wednesday	_____	Legal Notice/Ad
1/28/09	Wednesday	_____	Legal Notice/Ad
1/30/09	Friday	4 p.m.	Request for Approved Equals Due
2/2/09	Monday	_____	Notification of Approved Equals
2/6/09	Friday	2:00 p.m.	Public Bid Opening

PLEASE SUBMIT TWO COPIES OF BID, PROPOSAL AND DOCUMENTATION.

EQUALS AND CLARIFICATIONS. Bidders and suppliers must submit to the City Finance office requests for approved equals and clarifications of specifications provided that such requests for approved equals and clarifications of specifications are:

(1) Submitted in writing and received by City of Rapid City Finance office no later than Friday, January 30, 2009, 4 p.m. MST as identified in the Timelines for **TRANSIT VEHICLE** request for bids and;

(2) Supported by evidence such as technical data, test results, or other pertinent information that demonstrates that the substitute offered is equal to or better than the specification requirement.

RAPID CITY

TECHINICAL SPECIFICATIONS

For

TRANSIT BUS

SCOPE:

The intent of this specification is to provide for one untitled model year 2009 diesel powered multipurpose transit passenger bus that shall seat not less than twenty (20) passengers, or not less than sixteen (16) passengers plus two (2) wheelchair positions. Time is of the essence for delivery of this vehicle specified herein.

Vehicle shall be used on generally flat terrain with frequent stops and operating in urban, suburban, and rural areas. The vehicle shall be capable of legal highway speeds, yet be able to negotiate grades of up to 15% with a standing load.

The vehicle shall meet all applicable FMVSS, American with Disabilities Act, (ADA), State of South Dakota and EPA requirements, and Society of Automotive Engineers (S.A.E.) recommended practices. The following design and construction requirements are the required minimums. A floor plan shall be submitted with the contractor's bid. The floor plan shall be to scale.

The Bidder shall present a detailed schedule for the vehicle to be built under this procurement to the City of Rapid City fifteen (15) days after the bid opening. This schedule at a minimum shall include the following: The chassis manufacturer's factory online date, expected chassis delivery to dealer/manufacturer, milestones in the production and completion of units per week, anticipated dates of inspection, delivery to City of Rapid City, and training dates. The schedule shall include names and telephone numbers of those responsible at the vendor location for completing the various phases and milestones of the project as described in the delivery schedule.

Prior to order of vehicle the successful bidder shall submit for approval a data sheet listing the major components of the vehicle with all optional equipment. This shall match the line setting sheet from the manufacturer that shall be submitted to City of Rapid City. Delivery, and acceptance of delivery by the City of Rapid City, shall be not more than 150 calendar days from date of award of bid.

The contractor shall comply with all applicable federal, state and local regulations. Local regulations are defined as those below the state level. These shall include, but not be limited to, Federal ADA as well as state and local accessibility, safety and security requirements.

The vehicles shall meet all applicable Federal Motor Vehicle Safety Standards (FMVSS) rules and regulations and shall accommodate all applicable Federal Motor Carrier Safety Regulations (FMCSR) in effect on the date of manufacture.

In the event of any conflict between the requirements of this Specification and any applicable legal requirement, the legal requirement shall prevail. Technical requirements that exceed the legal requirements are not considered to conflict.

The contractor shall ensure that the application and installation of major bus subcomponents and systems are compliant with all such subcomponent vendors' requirements and recommendations. Components used in the vehicle shall be of medium-duty design.

All equipment catalogued as standard is to be furnished with vehicle, whether or not it is listed in the specifications above.

The apparent silence of this specification as to any detail, or the apparent omission from it as to a detailed description concerning any point, shall be regarded as meaning that only the best commercial practice is to prevail, and that only materials and workmanship of the first quality are to be used.

Price is to be exclusive of Federal Excise Tax. An exemption certificate will be furnished when the bid is awarded.

DETAILED SPECIFICATIONS

		COMPLY
DIMENSIONS		
Overall Length:	29'-0"	
Maximum Overall Height:	123" Maximum	APS
Exterior Width (excluding mirrors)	96"	
Interior Width:	92"	
Interior Height:	78"	
Aisle Width:	18"	
Clear door opening:	30"	
Door Height:	84"	
Door Width:	30"	
Ground –to-step:	12 1/2" Maximum	
Wheel Base:	183.5"	196 wb

EXCEPTION: 196" wb

CAPACITY:
The vehicle shall be designed to carry twenty (20) ambulatory passengers, plus two (2) wheelchairs, plus (2) Freedman 34" three step foldaway mounted in wheelchair area on driver side. APS

EXCEPTION: _____

GVWR:
26,000 GVWR
FRONT: 8,000 LB.
REAR: 19,000 LB. APS

EXCEPTION: _____

ENGINE:
Engine shall be a minimum of 6.6L diesel 520-ft. lbs. of torque at 1800 rpm and 300 hp at 3000 rpm. Vehicle shall be equipped with soft, plug-type engine heater with a 400-watt minimum. APS

EXCEPTION: _____

FUEL SYSTEM:
Vehicle is equipped with a 60-gallon fuel tank located behind the rear axle.
The fuel fill will be near the rear of the vehicle on the street side. APS
Full at the time of delivery
Locking fuel cover to be provided

EXCEPTION:

_____

FUEL LINES:

Sequential port fuel injection fuel system, electronically controlled
32qt. cooling capacity
Dual 195 degree F thermostats
15 lb pressure cap

APS

EXCEPTION: _____

FRONT AXLE:
Front axle:
8,000lb gross axle rating
Constructed using an I-beam wide-trac
4-piston brake applied calipers

APS

EXCEPTION: _____

REAR SUSPENSION SPECIFICATIONS:
Single speed, 19,000lb, full floating axle
2-piston brake applied calipers

APS

EXCEPTION: _____

SUSPENSION:
Front suspension:
7,000 tapered leaf suspension
Coupled with 1.375" diameter front shock absorbers
2" x 2" front stabilizer bar

APS

Rear suspension:
MOR-RYDE suspension system
19,000 capacity
1.375" diameter shock absorbers
Rear stabilizer bar to increase load stabilization and improve handling

APS

EXCEPTION: _____

TRANSMISSION:
Transmission shall be an Allison 2200 or approved equal with gross input torque of 520 lb-ft. Transmission cooler and backup warning signal shall be included

APS

EXCEPTION: _____

ELECTRICAL:
Dual 700 CCA, Delphi heavy duty Freedom BS 31-700, 12V batteries (or equivalent) will be provided for the electrical system. Batteries will be mounted under the floor of the coach on a powder coated steel sliding tray. The battery compartment will be self-draining and vented. The battery cables will be color coded for positive and negative identification and be of sufficient size to meet S.A.E. standards.

APS

Wiring: All wiring will be of the highest quality material according to the standards of the industry, and of sufficient capacity to carry the loads imposed upon them. All wiring

exposed to the elements must be suitably protected by waterproof loom or other approved material. All cable in the coach will be of sufficient size to carry the currents without excessive voltage drop. Wiring in the body will be adequately protected against passenger interference. Wiring will be color and function coded every 6" for easy identification of system functions. All wiring will meet all Federal Standards and S.A.E. recommended practices and standards. APS

The vehicle will be equipped with dual AD230, Delco Remy 105 amp alternators. APS

EXCEPTION: _____

WIRING:

All chassis relays, controllers, flashers, circuit breakers and other electrical components are to be of heavy-duty design. APS

There shall be an electrical panel with circuit breakers, fuses will not be acceptable. APS

Wiring to be color-coded and must meet SAE recommended practice J1127 and J1128 APS

EXCEPTION: _____

STEERING:

Shall be power with tilt feature and cruise control APS

EXCEPTION: _____

CONTROLS / INSTRUMENTATION:

Controls: (Driver area)

- Speedometer with odometer gauge
- Tachometer gauge
- Voltmeter gauge
- Oil Pressure gauge
- Water temperature gauge
- Fuel gauge
- Turn signal indicator lights
- Headlight high beam indicator light
- Parking brake light
- Low oil pressure light
- Low coolant warning light
- Interior light dial (located on the left near the headlight switch)
- Windshield wiper control (located on the turn signal indicator)
- Headlight switch
- Hazards button (located on the top of the steering column)
- Air conditioning, heater & defrost control switches

APS

EXCEPTION: _____

WHEELS:
Both front and rear wheels will be 19.5" x 6.75" 8 hole steel disc wheels
Front: 10,000lb capacity
Rear: 20,000lb capacity
All tires will be Goodyear 225/70R19.5 radial
Premium highway tread
Properly mounted and balanced
Valve Stem Extenders
Stainless Steel wheel inserts to be included

APS

EXCEPTION: _____

TIRES:
Goodyear 225/70R19.5 radial or Equal

APS

EXCEPTION: _____

BRAKES:
The braking consists of power, front, 4-wheel disc, 4 channel ABS brakes along with power, rear, 4-wheel disc, 4 channel ABS brakes. The parking brake is, a foot pedal operated, transmission mounted, drum brake.

APS

EXCEPTION: _____

WINDSHIELD WIPERS:
Variable speed operation, dual pulse washer system, 12V single motor, 22" arm & blade length.

APS

EXCEPTION: _____

BUMPERS:
Front bumper to be OEM.
Rear bumper is to be Romeo Rim energy absorbing type.

APS

EXCEPTION: _____

LIGHTING:
Exterior lighting is installed in accordance with the Federal Motor Carrier Safety Regulations. All lights, including marker, clearance, tail and brake lights shall be **LED** type. All lights are sealed from moisture and grounded to the body framing structure.

APS

Front Marker:	(5) Amber 12V 7.97Watt Incandescent Clearance Light, High Filament 2.2 amps, Low Filament .59amps
Rear Marker:	(5) Red 12V 7.97Watt Incandescent Clearance Light, High Filament 2.2amps, Low Filament .59amps
Side Marker:	Mid-Amber (1 each side), Rear-Amber (1 each side), 3.78Watt, .27amps

APS

Taillight: (2) 4" round amber 12V running lights
(2) 4" round red 12V brake lights
(2) 4" round clear 12V reverse lights APS

Vehicle shall have:
- Daytime running lights
- Dome light to be door activated
- Rear center brake light
- Entryway lighting

APS

EXCEPTION: _____

SAFETY EQUIPMENT:
There shall be provided Fire Extinguisher, First Aid Kit, Triangles and Back-up alarm APS

EXCEPTION: _____

ESCAPE HATCH:
Vehicle shall be equipped with a Transpec Model # 1100 Roof Hatch APS

EXCEPTION: _____

OUTSIDE MIRRORS:
Shall be **heated** with remote control mounted in console

Driver side: 8 ½" x 8 ½" Upper
4" x 8 ½" Lower Convex APS

Passenger Side: 8 ½" x 8 ½" Upper
4" x 8 ½" Lower Convex APS

EXCEPTION: _____

INTERIOR REARVIEW MIRROR:
A 6" x 16" interior rearview mirror shall be installed APS

EXCEPTION: _____

WINDOWS:
Shall be as follows:
Side passenger: Bonded 32" x 46" with tinted 20% light transmission. APS
Windows must be

Bonded coach type windows
Windshield: 9/32" Bent Laminated Glass APS
1/8" green tint annealed

.030 clear vinyl with 6" blue shade band
1/8" green tint annealed APS

Silkscreen pattern
AS1
Thickness: .258 - .300
SAE#4 edgework
Conforms to ANSI Z26.1 and FMVSS 205

APS

There shall be installed (1) egress window per side with an alarm APS

EXCEPTION: _____

ENTRANCE DOOR:
Shall be full view glass, 30" aluminum entry electric doors, they shall have a fully anodized 6063 -T6 aluminum extruded door frame, glass panel to be 1/8", AS-2 green tint APS

EXCEPTION: _____

REAR EMERGENCY WINDOW:
There shall be an egress window in rear wall with buzzer and alarm APS

EXCEPTION: _____

BODY:
The vehicle shall be a welded galvanized steel body frame. Exterior body panel skin to be .024 galvanized steel. APS

Vehicle shall have a fiberglass front with tilt forward hood, 5-piece ABS rear cap and rubber rear wheel well flares APS

EXCEPTION: _____

FLOOR:
The floor is to be constructed of 3/4" thick, 7-ply marine grade plywood and mechanically fastened and adhesive bonded to the chassis. APS

Floors are to have cove molding from the front of the rear wheelhouse up to the driver's island. APS

Floor to be covered in Rubber Solutions gray rubber or equal. APS

EXCEPTION: _____

SIDEWALLS:
Shall be 1-1/2" X 1-1/2" steel tubing on 24" centers attached to the chassis using 5/16'- 18 grade 5 bolts and weld. Interior panels to be 5.4mm gray vinyl covered lauan. Exterior panels are to be 5.4 mm lauan with .024 galvanized steel skins. There shall be 1 9/16" dense foam insulation fill in all cavities with exception of window location APS
No exception will be given on galvanized steel

EXCEPTION: _____

ROOF:
Shall be a fiberglass composite roof, it shall be on 24" centers and all to be attached to the walls using 5/16" – 18 grade 5 bolts through pre-punched holes in top wall angle into wall "C" channel. Inner panels are to be 5.4mm lauan. Foamed in-place roof insulation. APS

Roof Bows:	1 ½" x 1 ½" 16 gauge galvanized formed tubes
Outer Stringers:	1 ½" x 1 ½" 16 gauge galvanized "C" channel
Inner Stringers:	3" wide 11 gauge flat steel
	No exception will be granted on galvanized steel

APS

EXCEPTION: _____

INTERIOR:

Interior Wall Panels:	5.4mm gray vinyl-covered lauan
Roof Panels:	5.4mm gray vinyl-covered lauan
Floor Material:	5/8" marine grade plywood (7ply)
	1/8" smooth Gray rubber under seats
	3/16" ribbed Gray rubber flooring in aisles
Driver's Area:	1/8" smooth Gray rubber flooring
	ABS panels cover driver's area

APS

EXCEPTION: _____

PASSENGER SEATING:
Passenger seats shall be Freedman Mid-Hi double seats APS

Seats to be covered in heavy-duty, transit vinyl, Freedman Mor-Care or approved equal. APS

All seats are to have retractable seat belts APS

Seats shall have aisle side arm rests and top mounted grab handles APS

All bidder(s) shall submit in a copy of his proposed seat layout consistent with these specifications prior to bid for Procuring Agency review and approval. APS See Attached

EXCEPTION: _____

DRIVER SEAT:
Shall be a Bostrum driver seat with two arms and level five fabric to match color of passenger seats APS

EXCEPTION: _____

EXHAUST SYSTEM:
Shall consist of 16 gauge aluminized steel tubing with flanged and guillotine clamp connections, a Bosal heavy-duty aluminized in-line APS

muffler horizontally mounted to the right hand frame rail below the air tanks, with a square section tailpipe at the rear section of frame.

The exhaust system must meet all Federal and State regulations for exterior noise. APS

EXCEPTION: _____

AIR CONDITIONING:
Vehicle to have installed 93,000 BTU Free Blow Air Conditioning with EM-3 Eaporator; CM-2 & CM-3 Condensers **(roof mounted)**; Dual compressors. APS

EXCEPTION: _____

HEATER/DEFROSTER:
Auxiliary Heater: The vehicle shall be equipped with a hot-water, forced air re-circulating heater (s) of 70,000 BTU rating (minimum) located in the rear half of the passenger area. This heater or heaters, in combination with the standard factory dash unit, shall be capable of maintaining an interior temperature of 70 degrees Fahrenheit with an exterior temperature of 0 degrees Fahrenheit and no wind. APS

EXCEPTION: _____

MODESTY PANELS, STANCHIONS AND HANDRAILS:
There shall be a modesty panel and stanchion installed at the rear of the entrance, in front of the curbside row seats. Stanchion is to be constructed from the floor to the ceiling. The lower portion shall be constructed of 1 ¼" stainless steel tubing with Rontex covered 3/8" plywood panels with an aluminum frame. Upper portion to be Plexiglass Modesty panel is to be 5 ½" from floor. There shall be an entrance side (right hand) handrail APS

EXCEPTION: _____

ADDITIONAL EQUIPMENT:

- AM/FM Stereo CD with 8 speakers
- PA System with exterior speaker
- Two-way radio prep kit
- Sound barrier treatment around Driver's island, firewall, engine cover and rear wheels wells
- Defrost fan located above driver

APS

EXCEPTION: _____

OTHER TRANSIT EQUIPMENT:
The vehicle shall comply with all applicable Federal requirements defined in the Americans with Disabilities Act and all state and local regulations regarding mobility-impaired persons. Local regulations are defined as those below the state level. APS

There shall be installed ADA lighting, ADA signage, and a Park Interlock System as required by Americans with Disabilities Act APS

EXCEPTION: _____

WHEELCHAIR LIFT:
Shall be a Braun Model L919 or approved equal

Must meet all current ADA requirements APS

Double Lift Doors shall be included

EXCEPTION: _____

RESTRAINT SYSTEM:
Shall be **Q-Straint model QRT MAX DELUXE** or approved equal retractor system with belt storage pouches for belts when not in use. Shoulder and lap belt system to be non-retractable APS

EXCEPTION: _____

STOP REQUEST SYSTEM
Vehicle to be equipped with a pull cord style stop request system with audible chime and visual sign to indicate **STOP REQUESTED** APS

EXCEPTION: _____

DESTINATION SIGNS:
Vehicle to be equipped with front/side Luminator Vista destination signs (installed in a ***FRONT/SIDE*** configuration) or approved equal. APS

EXCEPTION: _____

BIKE RACK:
Sportworks two bike retention rack on front of bus. This receiver end should stick out 2 " beyond the front bumper to enable the bike rack to fit the front of the bus. APS

EXCEPTION: _____

ALTOONA TESTED:
Vehicle to be 10 year/350,000 mile Altoona tested. Altoona testing results to be submitted at time of bus order. APS

EXCEPTION: _____

WARRANTY:

GM Chassis:	3 year/36,000 miles bumper to bumper Floor Structure warranty is 5 years/ 60,000 miles	APS
Conversion:	5 years/100,000 miles	APS

Engine:	5 years/100,000 miles	APS
Transmission:	2 years/unlimited miles	APS
Air Conditioning:	2 years/limited warranty (loss of refrigerant only covered if caused by defective part)	APS

EXCEPTION: _____

PAINT:
Full body paint to include chassis and body. Paint shall be Dupont Imron F2573 (light silver metallic) APS

ADVERTISING FRAMES:
Three advertising frames will be provided, one on each side and one in the rear. Dimensions as follows: 20" high X 60" long. APS

FIRE SUPPRESSION:
Vehicle to be equipped with fire suppression system, Jomarr model # VT-6-FE-NAF or approved equal. APS

SURVEILLANCE SYSTEM: REI Bus-Watch R4001 MDVR four camera color surveillance system (160 GB hard drive) or approved equal. System shall include event marker. APS

WINTER FRONT: Shall be provided. APS

APPENDIX A

RAPID CITY, SOUTH DAKOTA
WRITTEN BID PROTEST PROCEDURES

PROTEST PROCEDURES

In accordance with the Federal Transit Authority (FTA), an agency of the United States Department of Transportation, the following are procedures which shall be used to protest a solicitation, contract, or procurement issued by the City of Rapid City.

Any proposer who is aggrieved in connection with any pre-award matters of a contract or procurement may protest such matters provided that ten (10) copies of a full and complete written statement specifying in detail the grounds of the protest and facts supporting the protest are received by the City Finance Officer no later than seven (7) calendar days prior to the award of the contract.

The City Attorney shall have the authority to settle and resolve a protest of any aggrieved proposer concerning the solicitation or award of a contract or procurement.

The City of Rapid City may, at its discretion, submit a response or reply to any material issues raised in the protests.

If the protest is not resolved by mutual agreement, the City Finance Officer or his designee with concurrence of the City Attorney shall, within fourteen (14) days of the protest, issue a decision in writing. The decision shall:

1) State the reason for the action taken; and
2) Inform the protestor of their right to administrative and judicial review.

A copy of an issued decision shall be mailed or otherwise furnished in a timely manner to the protestor and any other intervening party. The decision of the City Finance Officer shall be final and conclusive unless:

1) The decision is fraudulent, or
2) The person adversely affected by the decision has submitted an administrative appeal to the Rapid City Common Council within seven (7) days of the decision of the City Finance Officer.

In the event a timely protest is received under these regulations, the City of Rapid City shall not proceed further with the solicitation or with the awarding of the contract or

procurement unless the City Finance Officer, with concurrence of the City Attorney, makes a written determination that:

1) The items to be procured are urgently required;
2) Delivery or performance will be unduly delayed by failure to make the award promptly; or
3) Failure to make prompt award will otherwise cause undue harm to the Rapid Transit System or the Federal Government.

On any appeal of the decision of the City Finance Officer, the City of Rapid City's Common Council shall decide within fourteen (14) days whether the solicitation or award was made in accordance with applicable law and the terms and conditions of the solicitation award.

A copy of the City of Rapid City Common Council's decision shall be mailed or otherwise furnished in a timely manner to the protestor or any other intervening party.

The decision of the City of Rapid City Common Council shall be final and conclusive unless:

1) The decision is fraudulent; or

2) In accordance with UMTA Circular 4220.1B, the proposer adversely affected by the decision has a right appeal to the United States Department of Transportation, Federal Transit Authority (FTA), after having exhausted the local written protest procedures stated above. Any protest to FTA must be filed in accordance with UMTA Circular 4220.1B.

APPENDIX B
REQUIRED
FEDERAL CLAUSES

Buy America—Rolling Stock.

The Contractor agrees to comply with 49 USC 5323(j) and 49 CFR Part 661, which provide that Federal funds may not be obligated unless steel, iron, and manufactured products used in FTA-funded projects are produced in the United States, unless a waiver has been granted by FTA or the product is subject to a general waiver. General waivers are listed in 49 CFR 661.7, and include final assembly in the United States for 15 passenger vans and 15 passenger wagons produced by Chrysler Corporation, microcomputer equipment, software, and small purchases (currently less than $100,000) made with capital, operating, or planning funds. Separate requirements for rolling stock are set out at 5323(j)(2)(C) and 49 CFR 661.11. Rolling stock not subject to a general waiver must be manufactured in the United States and have a 60 percent domestic content.

A bidder or offeror must submit to the FTA recipient the appropriate Buy America certification (below) with all bids on FTA-funded contracts, except those subject to a general waiver. Bids or offers that are not accompanied by a completed Buy America certification must be rejected as nonresponsive. This requirement does not apply to lower tier subcontractors.

Certification requirement for procurement of buses, other rolling stock, and associated equipment.

Certificate of Compliance with 49 USC 5323(j)(2)(C)

The bidder or offeror hereby certifies that it will comply with the requirements of 49 USC 5323(j)(2)(C) and the regulations at 49 CFR Part 661.

Date 2-6-2009

Signature

Company Name Harlows Bus Sales Inc.

Title Sales Manager

Certificate of Non-Compliance with 49 USC 5323(j)(2)(C)

The bidder or offeror hereby certifies that it cannot comply with the requirements of 49 USC 5323(j)(2)(C), but may qualify for an exception pursuant to 49 USC 5323(j)(2)(B) or (j)(2)(D) and the regulations in 49 CFR 661.7.

Date _____

Signature _____

Company Name _____

Title _____

Bus Testing.

The Contractor [Manufacturer] agrees to comply with 49 USC A 5323(c) and FTA's implementing regulation at 49 CFR Part 665 and shall perform the following:

(1) A manufacturer of a new bus model or a bus produced with a major change in components or configuration shall provide a copy of the final test report to the recipient at a point in the procurement process specified by the recipient which will be prior to the recipient's final acceptance of the first vehicle.

(2) A manufacturer who releases a report under paragraph 1 above shall provide notice to the operator of the testing facility that the report is available to the public.

(3) If the manufacturer represents that the vehicle was previously tested, the vehicle being sold should have the identical configuration and major components as the vehicle in the test report, which must be provided to the recipient prior to recipient's final acceptance of the first vehicle. If the configuration or components are not identical, the manufacturer shall provide a description of the change and the manufacturer's basis for concluding that it is not a major change requiring additional testing.

(4) If the manufacturer represents that the vehicle is "grandfathered" (has been used in mass transit service in the United States before October 1, 1988, and is currently being produced without a major change in configuration or components), the manufacturer shall provide the name and address of the recipient of such a vehicle and the details of that vehicle's configuration and major components.

Certification of Compliance with FTA's Bus Testing Requirements

The undersigned [Contractor/Manufacturer] certifies that the vehicle offered in this procurement complies with 49 USC A 5323(c) and FTA's implementing regulation at 49 CFR Part 665. **The following certification must be completed and submitted with the bid. A bid, which does not include the certification, will not be considered.**

The undersigned understands that misrepresenting the testing status of a vehicle acquired with Federal financial assistance may subject the undersigned to civil penalties as outlined in the Department of Transportation's regulation on Program Fraud Civil Remedies, 49 CFR Part 31. In addition, the undersigned understands that FTA may suspend or debar a manufacturer under the procedures in 49 CFR Part 29.

Date: 2-6-2009

Signature: [signature]

Company Name: Harlows Bus Sales Inc.

Title: Sales Manager

Pre-Award and Post-Delivery Audit Requirements

The Contractor agrees to comply with 49 USC 5323(l) and FTA's implementing regulation at 49 CFR Part 663 and to submit the following certifications:

(1) Buy America Requirements: The Contractor shall complete and submit a declaration certifying either compliance or noncompliance with Buy America. If the Bidder certifies compliance with Buy America, it shall submit documentation which lists 1) component and subcomponent parts of the rolling stock to be purchased identified by manufacturer of the parts, their country of origin and costs; and 2) the location of final assembly point for the rolling stock, including a description of the activities that will take place at the final assembly point and the cost of final assembly.

(2) Solicitation Specification Requirements: The Contractor shall submit evidence that it will be capable of meeting the bid specifications.

(3) Federal Motor Vehicle Safety Standards (FMVSS): The Contractor shall submit 1) manufacturer's FMVSS self-certification sticker information that the vehicle complies with relevant FMVSS or 2) manufacturer's certified statement that the contracted buses will not be subject to FMVSS regulations.

Buy America Certificate of Compliance with FTA Requirements for Buses, Other Rolling Stock, or Associated Equipment

Certificate of Compliance

The bidder hereby certifies that it will comply with the requirements of 49 USC Section 5323(j)(2)(C), Section 165(b)(3) of the Surface Transportation Assistance Act of 1982, as amended, and the regulations of 49 CFR 661.11:

Date 2-6-2009

Signature

Company Name Harlows Bus Sales Inc.

Title Sales Manager

Certificate of Non-Compliance

The bidder hereby certifies that it cannot comply with the requirements of 49 USC Section 5323(j)(2)(C) and Section 165(b)(3) of the Surface Transportation Assistance Act of 1982, as amended, but may qualify for an exception to the requirements consistent with 49 USC Sections 5323(j)(2)(B) or (j)(2)(D), Sections 165(b)(2) or (b)(4) of the Surface Transportation Assistance Act, as amended, and regulations in 49 CFR 661.7.

Date _____

Signature _____

Company Name _____

Title _____

Certification Regarding Lobbying.

The undersigned [Contractor] certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for making lobbying contacts to an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Ford—LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions [as amended by "Government wide Guidance for New Restrictions on Lobbying," 61 Fed. Reg. 1413 (1/19/96). Note: Language in paragraph (2) herein has been modified in accordance with Section 10 of the Lobbying Disclosure Act of 1995 (P.L. 104-65, to be codified at 2 USC 1601, et seq.)]

(3) The undersigned shall require that the language of this certification be included in the award documents for all sub awards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31, USC §1352 (as amended by the Lobbying Disclosure Act of 1995). Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

[Note: Pursuant to 31 USC §1352(c)(1)-(2)(A), any person who makes a prohibited expenditure or fails to file or amend a required certification or disclosure form shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such expenditure or failure.]

The Contractor, Harlows Bus Sales, Inc., certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 USC A 3801, et seq., apply to this certification and disclosure, if any.

_____ Signature of Contractor's Authorized Official

Jason Hagenes, Sales Manager
Name and Title of Contractor's Authorized Official

2-6-2009 Date

Transit Vehicle Manufacturer's (TVM's) Certification of Compliance with Subpart D, 49 CFR Part 26.

This procurement is subject to the provisions of 49 CFR Part 26 as they apply to TVM's. Accordingly, as a condition, the following certification must be completed and submitted with the bid. A bid which does not include the certification will not be considered.

TVM Certification

Glaval Bus, Inc. a transit vehicle manufacturer, hereby certifies that it has
(Name of Firm)
complied with the requirements of 49 CFR Part 26 Section 49 by submitting a current annual disadvantaged business enterprise (DBE) goal to the Federal Transportation Administration (FTA). The goals apply to Federal Fiscal Year 2000 (October 1, 1999 to September 30, 2000), and have been approved or not disapproved by FTA.

Glaval Bus, Inc.
(Name of Firm)

hereby certifies that the manufacturer of the transit vehicle be supplied by:
Glaval Bus, Inc.
(Name of Manufacturer)

has complied with the above-referenced requirements of 49 CRF Part 26.49.

Date 2-6-2009

Signature

Title Sales Manager

Firm Harlows Bus Sales Inc. - Glaval Bus

Cargo Preference.

The Contractor agrees: a. to use privately owned United Stated-Flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to the underlying contract to the extent such vessels are available at fair and reasonable rates for United Stated-Flag commercial vessels; b. to furnish within 20 working days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, "on-board" commercial ocean bill-of-lading in English for each shipment of cargo described in the preceding paragraph to the division of National Cargo, Office of Market Development, Maritime Administration, Washington, DC 20590 and to the FTA recipient (through the Contractor in the case of a subcontractor's bill-of-lading); c. to include these requirements in all subcontracts issued pursuant to this contract when the subcontract may involve the transport of equipment, material, or commodities by ocean vessel.

Energy Conservation.
The Contractor agrees to comply with mandatory standards and policies relating to energy efficiency, which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act.

Clean Water.
(1)The Contractor agrees to comply with all applicable standards, orders, or regulations issued pursuant to the Federal Water Pollution Control Act, as amended, 33 USC 1251 et seq. The Contractor agrees to report each violation to the purchaser and understands and agrees that the purchaser will, in turn, report each violation as required to assure notification to FTA and the appropriate EPA Regional Office. (2) The Contractor also agrees to include these requirements in each subcontract exceeding $100,000 financed in whole or in part with Federal assistance provided by FTA.

Access to Records and Reports.
The following access to records requirements apply to this contract:

(1) Where the Purchaser is not a State but a local government and is the FTA Recipient or a subgrantee of the FTA Recipient in accordance with 49 CFR 18.36(I), the Contractor agrees to provide the Purchaser, the FTA Administrator, the Comptroller General of the United States or any of their authorized representatives access to any books, documents, papers and records of the Contractor which are directly pertinent to this contract for the purposes of making audits, examinations, excerpts and transcriptions. Contractor also agrees, pursuant to 49 CFR 633.17 to provide the FTA Administrator or his authorized representatives including any PMO Contractor access to Contractor's records and construction sites pertaining to a major capital project, defined at 49 USC 5302(a)1, which is receiving federal financial assistance through the programs described at 49 USC 5307, 5309, or 5311.

(2) Where the Purchaser is a State and is the FTA Recipient or a subgrantee of the FTA Recipient in accordance with 49 CFR 633.17, Contractor agrees to provide the Purchaser, the FTA Administrator or his authorized representatives, including any PMO Contractor, access to the Contractor's records and construction sites pertaining to a major capital project, defined at 49 USC 5302(a)1, which is receiving federal financial assistance through the programs described at 49 USC 5307, 5309, or 5311. By definition, a major capital project excludes contracts of less than the simplified acquisition threshold currently set at $100,000.

(3) Where the Purchaser enters into a negotiated contract for other than a small purchase or under the simplified acquisition threshold and is an institution of higher education, a hospital or non-profit organization and is the FTA Recipient or a subgrantee of the FTA Recipient in accordance with 49 CFR 19.48, Contractor agrees to provide the Purchaser, FTA Administrator, the Comptroller General of the United States or any of their duly authorized representatives with access to any books, documents, papers and records of the Contractor which are directly pertinent to this contract for the purposes of making audits, examinations, excerpts, and transcriptions.

(4) Where any Purchaser which is the FTA Recipient or a subgrantee of the FTA Recipient in accordance with 49 USC 5325(a) enters into a contract for a capital project or improvement (defined at 49 USC 5302(a)1 through other than competitive bidding, the Contractor shall make available records related to the contract to the Purchaser, the Secretary of Transportation, and the Comptroller General or any authorized officer or employee of any of them for the purposes of conducting an audit and inspection.

(5) The Contractor agrees to permit any of the foregoing parties to reproduce by any means whatsoever or to copy excerpts and transcriptions as reasonably needed.

(6) The Contractor agrees to maintain all books, records, accounts, and reports required under this contract for a period of not less than three years after the date of termination or expiration of this contract, except in the event of litigation or settlement of claims arising from the performance of this contract, in which case Contractor agrees to maintain same until the Purchaser, the FTA Administrator, the comptroller General, or any of their duly authorized representatives, have disposed of all such litigation, appeals, claims, or exceptions related thereto. Reference 49 CFR 18.39(l)(11).

(7) FTA does not require the inclusion of these requirements in subcontracts.

Federal Changes.
Contractor shall at all times comply with all applicable FTA regulations, policies, procedures, and directives, including without limitation those listed directly or by reference in the Agreement (Form FTA MA(9) dated October 1, 2002) between Purchaser and FTA, as they may be amended or promulgated from time to time during the term of this contract. Contractor's failure to so comply shall constitute a material breach of this contract.

Clean Air.
(1) The Contractor agrees to comply with all applicable standards, orders, or regulations issued pursuant to the Clean Air Act, as amended, 42 USC 7401 et seq. The Contractor agrees to report each violation to the purchaser and understands and agrees that the purchaser will, in turn, report each violation as required to assure notification to FTA and the appropriate EPA Regional Office. (2) The Contractor also agrees to include these requirements in each subcontract exceeding $100,000 financed in whole or in part with Federal assistance provided by FTA.

Contract Work Hours and Safety Standards Act.

(1) Overtime requirements—No Contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages—In the event of any violation of the clause set forth in paragraph (1) of this section the Contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such Contractor and subcontractor shall be liable to the United States for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1) of this section.

(3) Withholding for unpaid wages and liquidated damages—The City of Rapid City shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the Contractor or subcontractor under any such contract or any other Federal contract with the same prime Contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime Contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2) of this section.

(4) Subcontracts—The Contractor or subcontractor shall insert in any subcontracts the clauses set forth in this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in this section.

(5) Payrolls and basic records—

(i) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social

security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentice and trainees, and the ratios and wage rates prescribed in the applicable programs.

No Government Obligation to Third Parties.

(1) The purchaser and Contractor acknowledge and agree that, notwithstanding any concurrence by the Federal Government in or approval of the solicitation or award of the underlying contract, absent the express written consent by the Federal Government, the Federal Government is not a party to this contract and shall not be subject to any obligations or liabilities to the purchaser, Contractor, or any other party (whether or not a party to that contract) pertaining to any matter resulting from the underlying contract.

(2) The Contractor agrees to include the above clause in each subcontract financed in whole or in part with Federal assistance provided by FTA. It is further agreed that the clause shall not be modified, except to identify the subcontractor who will be subject to its provisions.

Program Fraud and False or Fraudulent Statements and Related Acts.

(1) The Contractor acknowledges that the provisions of the Program Fraud Civil Remedies Act of 1986, as amended, 31 USC 3801 et seq. and US DOT regulations, "Program Fraud Civil Remedies," 49 CFR Part 31, apply to its actions pertaining to this project. Upon execution of the underlying contract, the Contractor certifies or affirms the truthfulness and accuracy of any statement it has made, it makes, it may make, or causes to be made, pertaining to the underlying contract or the FTA assisted project for which this contract work is being performed. In addition to other penalties that may be applicable, the Contractor further acknowledges that if it makes, or causes to be made, a false, fictitious, or fraudulent claim, statement, submission, or certification, the Federal Government reserves the right to impose the penalties of the Program Fraud Civil Remedies Act of 1986 on the Contractor to the extent the Federal Government deems appropriate.

(2) The Contractor also acknowledges that if it makes, or causes to be made, a false, fictitious or fraudulent claim, statement, submission, or certification to the Federal Government under a contract connected with a project that is financed in whole or in part with Federal assistance originally awarded by FTA under the authority of 49 USC 5307, the Government reserves the right to impose the penalties of 18 USC 1001 and 49 USC 5307(n)(1) on the Contractor, to the extent that the Federal Government deems appropriate.

(3) The Contractor agrees to include the above two clauses in each subcontract financed in whole or in part with Federal assistance provided by FTA. It is further agreed that the clauses shall not be modified, except to identify the subcontractor who will be subject to the provisions.

Termination.

a. Termination for Convenience (General Provision): The City of Rapid City may terminate this contract, in whole or in part, at any time by written notice to the Contractor when it is in the Government's best interest. The Contractor shall be paid its costs, including contract closeout costs, and profit on work performed up to the time of termination. The Contractor shall promptly submit its termination claim to (City of Rapid City) to be paid the Contractor. If the Contractor has any property in its possession belonging to the City of Rapid City, the Contractor will account for the same, and dispose of it in the manner the City of Rapid City directs.
b. Termination for Default [Breach or Cause] (General Provision): If the Contractor does not deliver supplies in accordance with the contract delivery schedule, or, if the contract is for services, the Contractor fails to perform in the manner called for in the contract, or if the Contractor fails to comply with any other provisions of the contract, the City of Rapid City may terminate this contract for default. Termination shall be effected by serving a notice of termination on the Contractor setting forth the manner in which the Contractor is in default. The Contractor will only be paid the contract price for supplies delivered and accepted, or services performed in accordance with the manner of performance set forth in the contract.

If it is later determined by the City of Rapid City that the Contractor had an excusable reason for not performing, such as a strike, fire, or flood, events which are not the fault of or are beyond the control of the Contractor, the City of Rapid City, after setting up a new delivery of performance schedule, may allow the Contractor to continue work, or treat the termination as a termination for convenience.

Government Debarment and Suspension (Nonprocurement).

(1) By signing and submitting this bid or proposal, the prospective lower tier participant is providing the signed certification set out below.

(2) The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, City of Rapid City may pursue available remedies, including suspension and/or debarment.

(3) The prospective lower tier participant shall provide immediate written notice to City of Rapid City if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(4) The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "persons," "lower tier covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549 [49 CFR Part 29]. You may contact City of Rapid City for assistance in obtaining a copy of those regulations.

(5) The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized in writing by City of Rapid City.

(6) The prospective lower tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion—Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

(7) A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that it is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the Nonprocurement List issued by U.S. General Service Administration.

(8) Nothing contained in the foregoing shall be construed to require establishment of system or records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(9) Except for transactions authorized under Paragraph 5 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to all remedies available to the Federal Government, City of Rapid City may pursue available remedies including suspension and/or debarment.

"Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion—Lower Tier Covered Transaction"

(1) The prospective lower tier participant certifies, by submission of this bid or proposal, that neither it nor its "principals" [as defined at 49 CFR §29.105(p)] is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

(2) When the prospective lower tier participant is unable to certify to the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Civil Rights Requirements.

The following requirements apply to the underlying contract:

(1) Nondiscrimination—In accordance with Title VI of the Civil Rights Act, as amended, 42 USC § 2000d, section 303 of the Age Discrimination Act of 1975, as amended, 42 USC § 6102, section 202 of the Americans with Disabilities Act of 1990, 42 USC § 12132, and Federal transit law at 49 USC § 5332, the Contractor agrees that it will not discriminate against any employee or applicant for employment because of race, color, creed, national origin, sex, age, or disability. In addition, the Contractor agrees to comply with applicable Federal implementing regulations and other implementing requirements FTA may issue.

(2) Equal Employment Opportunity—The following equal employment opportunity requirements apply to the underlying contract:

(a) Race, Color, Creed, National Origin, Sex—In accordance with Title VII of the Civil rights Act, as amended, 42 USC § 2000e, and Federal transit laws at 49 USC § 5332, the Contractor agrees to comply with all applicable equal employment opportunity requirements of U.S. Department of Labor (U.S. DOL) regulations, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor," 41 CFR Parts 60 et seq., (which implement Executive Order No. 11246, "Equal Employment Opportunity," as amended by Executive Order No. 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," 42 USC § 2000e note), and with any applicable Federal statutes, executive orders, regulations, and Federal policies that may in the future affect construction activities undertaken in the course of the Project. The Contractor agrees to take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, creed, national origin, sex, or age. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff of termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

(b) Age—In accordance with section 4 of the Age Discrimination in Employment Act of 1967, as amended, 29 USC § § 623 and Federal transit law at 49 USC § 5332, the Contractor agrees to refrain from discrimination against present and prospective employees for reason of age. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

(c) Disabilities—In accordance with section 102 of the Americans with Disabilities Act, as amended, 42 USC § 12112, the Contractor agrees that it will comply with the requirements of U.S. Equal Employment Opportunity Commission, "Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act," 29 CFR Part 1630, pertaining to employment of persons with disabilities. In addition, the Contractor agrees to comply with any implementing requirements FTA may issue.

(3) The Contractor also agrees to include these requirements in each subcontract financed in whole or in part with Federal assistance provided by FTA, modified only if necessary to identify the affected parties.

Breach of Contract and Dispute Resolution.

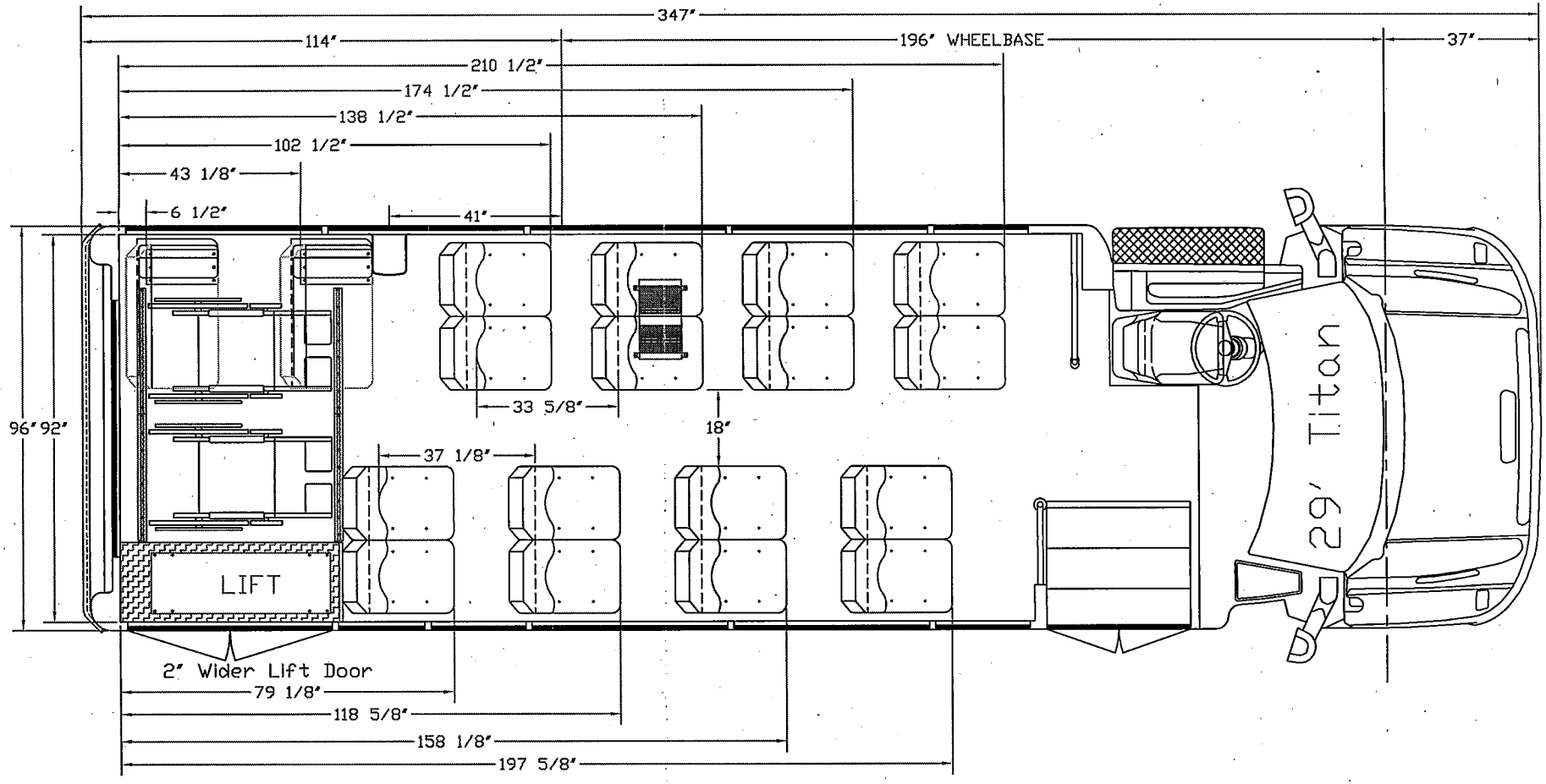
Disputes–Disputes arising in the performance of this Contract which are not resolved by agreement of the parties shall be decided in writing by the authorized representative of City of Rapid City Mayor. This decision shall be final and

conclusive unless within ten days from the date of receipt of its copy, the Contractor mails or otherwise furnishes a written appeal to the Mayor. In connection with any such appeal, the Contractor shall be afforded an opportunity to be heard and to offer evidence in support of its position. The decision of the Mayor shall be binding upon the Contractor and the Contractor shall abide by the decision.

Incorporation of FTA Terms.

The preceding provisions include, in part, certain Standard Terms and Conditions required by DOT, whether or not expressly set forth in the preceding contract provisions. All contractual provisions required by DOT, as set forth in FTA Circular 4220.1D, dated April 15, 1996, are hereby incorporated by reference. Anything to the contrary herein notwithstanding, all FTA mandated terms shall be deemed to control in the event of a conflict with other provisions contained in this agreement. The Contractor shall not perform any act, fail to perform any act, or refuse to comply with any City of Rapid City requests which would cause the City of Rapid City to be in violation of the FTA terms and conditions.

PW0063009-17



Drawn By:	Options:								Seating:	
Date:									Style:	Mid-Hi Back
Scale:	W/C Lift	W/C Pos	Ent Door	Foldaway	Handi-Flip	5-Place	DBL	Single	Ambulatory	
	Rear	2	30"	2 BV	0	0	8	0	16	

Dealer Approval:

GLAVAL BUS
Division of Forest River Inc.

29' Titan

Wheel Base 196"

DIN # T29RLWL16L03

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PW063009-17

STURAA TEST

10 YEAR

350,000 MILE BUS

from

GLAVAL BUS, A DIVISION of FOREST RIVER INC.

MODEL TITAN

MAY 2004

PTI-BT-R0318

PENNSTATE

The Pennsylvania Transportation Institute

201 Research Office Building
The Pennsylvania State University
University Park, PA 16802
(814) 865-1891

Bus Testing and Research Center

2237 Old Route 220 North
Duncansville, PA 16635
(814) 695-3404

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EXECUTIVE SUMMARY

Glaval Bus, A Division of Forest River Inc., submitted a model Titan (built on a GMC C5500 chassis), gasoline-powered, 34 seat (including the driver) 33-foot bus, for a 10 yr/350,000 mile STURAA test. The odometer reading at the time of delivery was 525.0 miles. Testing started on July 29, 2003 and was completed on May 3, 2004. The Check-In section of the report provides a description of the bus and specifies its major components.

The primary part of the test program is the Structural Durability Test, which also provides the information for the Maintainability and Reliability results. The Structural Durability Test was started on September 15, 2003 and was completed on April 7, 2004.

The interior of the bus is configured with seating for 34 passengers including the driver. Free floor space will accommodate 16 standing passengers resulting in a potential load of 50 persons. At 150 lbs per person, this load results in a measured gross vehicle weight of 21,650 lbs. In order to avoid exceeding the GAWR (13,500 lbs) of the rear axle, ballast for all 16 standing passengers was eliminated. This reduction from full capacity resulted in an adjusted measured gross vehicle weight of 19,425 lbs (same as SLW) and was used for all dynamic testing. The middle seated load weight segment was performed at the same 19,425 lbs and the final segment was performed at a curb weight of 14,250 lbs. Durability driving resulted in unscheduled maintenance and failures that involved a variety of subsystems. A description of failures, and a complete and detailed listing of scheduled and unscheduled maintenance is provided in the Maintainability section of this report.

Accessibility, in general, was adequate. Components covered in Section 1.3 (Repair and/or Replacement of Selected Subsystems) along with all other components encountered during testing, were found to be readily accessible and no restrictions were noted.

The Reliability section compiles failures that occurred during Structural Durability Testing. Breakdowns are classified according to subsystems. The data in this section are arranged so that those subsystems with more frequent problems are apparent. The problems are also listed by class as defined in Section 2. The test bus encountered no Class 1 or Class 2 failures. Of the 22 reported failures, 15 were Class 3 and seven were Class 4.

The Safety Test, (a double-lane change, obstacle avoidance test) was safely performed in both right-hand and left-hand directions up to a maximum test speed of 45 mph. The performance of the bus is illustrated by a speed vs. time plot. Acceleration and gradeability test data are provided in Section 4, Performance. The average time to obtain 50 mph was 23.09 seconds.

The Shakedown Test produced a maximum final loaded deflection of 0.269 inches with a permanent set ranging between 0.000 to 0.005 inches under a distributed static load of 18,750 lbs. The Distortion Test was completed with all subsystems, doors and escape mechanisms operating properly. No water leakage was observed throughout the test. All subsystems operated properly.

The bus submitted for testing was not equipped with any type of tow eyes or tow hooks; therefore, the Static Towing Test was not performed. The Dynamic Towing Test was performed by means of a front-lift tow. The towing interface was accomplished using a hydraulic under-lift wrecker. The bus was towed without incident and no damage resulted from the test. The manufacturer does not recommend towing the bus from the rear, therefore, a rear test was not performed. The Jacking and Hoisting Tests were also performed without incident. The bus was found to be stable on the jack stands, and the minimum jacking clearance observed with a tire deflated was 4.4 inches.

A Fuel Economy Test was run on simulated central business district, arterial, and commuter courses. The results were 4.23 mpg, 5.19 mpg, and 8.14 mpg respectively; with an overall average of 5.22 mpg.

A series of Interior and Exterior Noise Tests was performed. These data are listed in Section 7.1 and 7.2 respectively.

ABBREVIATIONS

ABTC	-	Altoona Bus Test Center
A/C	-	air conditioner
ADB	-	advance design bus
ATA-MC	-	The Maintenance Council of the American Trucking Association
CBD	-	central business district
CW	-	curb weight (bus weight including maximum fuel, oil, and coolant; but without passengers or driver)
dB(A)	-	decibels with reference to 0.0002 microbar as measured on the "A" scale
DIR	-	test director
DR	-	bus driver
EPA	-	Environmental Protection Agency
FFS	-	free floor space (floor area available to standees, excluding ingress/egress areas, area under seats, area occupied by feet of seated passengers, and the vestibule area)
GVL	-	gross vehicle load (150 lb for every designed passenger seating position, for the driver, and for each 1.5 sq ft of free floor space)
GVW	-	gross vehicle weight (curb weight plus gross vehicle load)
GVWR	-	gross vehicle weight rating
MECH	-	bus mechanic
mpg	-	miles per gallon
mph	-	miles per hour
PM	-	Preventive maintenance
PSBRTF	-	Penn State Bus Research and Testing Facility
PTI	-	Pennsylvania Transportation Institute
rpm	-	revolutions per minute
SAE	-	Society of Automotive Engineers
SCH	-	test scheduler
SEC	-	secretary
SLW	-	seated load weight (curb weight plus 150 lb for every designed passenger seating position and for the driver)
STURAA	-	Surface Transportation and Uniform Relocation Assistance Act
TD	-	test driver
TECH	-	test technician
TM	-	track manager
TP	-	test personnel

TEST BUS CHECK-IN

I. OBJECTIVE

The objective of this task is to log in the test bus, assign a bus number, complete the vehicle data form, and perform a safety check.

II. TEST DESCRIPTION

The test consists of assigning a bus test number to the bus, cleaning the bus, completing the vehicle data form, obtaining any special information and tools from the manufacturer, determining a testing schedule, performing an initial safety check, and performing the manufacturer's recommended preventive maintenance. The bus manufacturer must certify that the bus meets all Federal regulations.

III. DISCUSSION

The check-in procedure is used to identify in detail the major components and configuration of the bus.

The test bus consists of a Glaval Bus, model Titan. The bus is built on a GMC C5500 chassis. The bus has a front door, rear of the front axle, and a rear emergency door. Note: the test bus is not equipped with a handicap device. Power is provided by a gasoline-fueled, GMC model 8.1 L engine coupled to an Allison model 2200 Series transmission.

The measured curb weight is 5,450 lbs for the front axle and 8,800 lbs for the rear axle. These combined weights provide a total measured curb weight of 14,250 lbs. There are 34 seats including the driver and room for 16 standing passengers bringing the total passenger capacity to 50. Gross load is 150 lb x 50 = 7,500 lbs. At full capacity, the measured gross vehicle weight is 21,650 lbs. This value was used for all static testing. In order to avoid exceeding the GAWR (13,500 lbs) of the rear axle, ballast for all 16 standing passengers was eliminated. This reduction from full capacity resulted in an adjusted measured gross vehicle weight of 19,425 lbs and was used for all dynamic testing.

VEHICLE DATA FORM

Bus Number: 0318	Arrival Date: 7/29/03
Bus Manufacturer: Glaval Bus	Vehicle Identification Number (VIN): 1GDE5F1E03F517817
Model Number: Titan	Date: 7/29/03
Personnel: S.C.	Chassis: GMC C5500

WEIGHT: *Values in parenthesis indicates the adjusted weights necessary to avoid exceeding the GAWR. These values were used for all dynamic testing.

Individual Wheel Reactions:

Weights (lb)	Front Axle		Middle Axle		Rear Axle	
	Right	Left	Right	Left	Right	Left
CW	2,650	2,800	N/A	N/A	4,225	4,575
SLW	2,800	3,000	N/A	N/A	6,625	7,000
GVW	3,125 (2,800)	3,250 (3,000)	N/A	N/A	7,350 (6,625)	7,925 (7,000)

Total Weight Details:

Weight (lb)	CW	SLW	GVW	GAWR
Front Axle	5,450	5,800	6,375 (5,800)	7,000
Middle Axle	N/A	N/A	N/A	N/A
Rear Axle	8,800	13,625	15,275 (13,625)	13,500
Total	14,250	19,425	21,650 (19,425)	GVWR: 19,500

Dimensions:

Length (ft/in)	33 / 9.5
Width (in)	97.4
Height (in)	122.5
Front Overhang (in)	36.5
Rear Overhang (in)	135.5
Wheel Base (in)	233.5
Wheel Track (in)	Front: 80.5
	Rear: 73.0

Bus Number: 0318	Date: 7/29/03

CLEARANCES:

Lowest Point Outside Front Axle	Location: Sway bar	Clearance(in): 12.1
Lowest Point Outside Rear Axle	Location: Exhaust tail pipe	Clearance(in): 11.0
Lowest Point between Axles	Location: Muffler	Clearance(in): 10.7
Ground Clearance at the center (in)	13.0	
Front Approach Angle (deg)	24.7	
Rear Approach Angle (deg)	9.4	
Ramp Clearance Angle (deg)	7.3	
Aisle Width (in)	16.0	
Inside Standing Height at Center Aisle (in)	78.4	

BODY DETAILS:

Body Structural Type	Integral		
Frame Material	Steel rail		
Body Material	Steel / fiberglass		
Floor Material	Plywood		
Roof Material	Fiberglass		
Windows Type	☐ Fixed	■ Movable	
Window Mfg./Model No.	KTG / AS3 M7 DOT 620		
Number of Doors	1 Front	1 Rear	
Mfr. / Model No.	Glaval / Stainless Steel		
Dimension of Each Door (in)	Front-31.0 x 83.0	Rear – 36.0 x 65.0	
Passenger Seat Type	☐ Cantilever	■ Pedestal	☐ Other (explain)
Mfr. / Model No.	Freedman Seating / High Back Feather Weight		
Driver Seat Type	☐ Air	☐ Spring	■ Other (explain)
Mfr. / Model No.	OEM / Freedman seat cover over GM seat frame		
Number of Seats (including Driver)	34		

Bus Number: 0318	Date: 7/29/03

BODY DETAILS (Contd..)

Free Floor Space (ft^2)	24			
Height of Each Step at Normal Position (in)	Front	1. 12.7	2. 8.5	3. 8.4	4. 8.2
	Middle	1. N/A	2. N/A	3. N/A	4. N/A
	Rear	1. N/A	2. N/A	3. N/A	4. N/A
Step Elevation Change - Kneeling (in)	N/A			

ENGINE

Type	☐ C.I.	☐ Alternate Fuel	
	■ S.I.	☐ Other (explain)	
Mfr. / Model No.	General Motors Corp. / 8.1 L		
Location	■ Front	☐ Rear	☐ Other (explain)
Fuel Type	■ Gasoline	☐ CNG	☐ Methanol
	☐ Diesel	☐ LNG	☐ Other (explain)
Fuel Tank Capacity (indicate units)	40 gals		
Fuel Induction Type	■ Injected	☐ Carburetion	
Fuel Injector Mfr. / Model No.	General Motors Corp. / 8.1 L		
Carburetor Mfr. / Model No.	N/A		
Fuel Pump Mfr. / Model No.	General Motors Corp. / 8.1 L		
Alternator (Generator) Mfr. / Model No.	Penn Tex / PX-4		
Maximum Rated Output (Volts / Amps)	14 / 200		
Air Compressor Mfr. / Model No.	N/A		
Maximum Capacity (ft^3 / min)	N/A		
Starter Type	■ Electrical	☐ Pneumatic	☐ Other (explain)
Starter Mfr. / Model No.	Delco Remy of America / PG 2602		

Bus Number: 0318	Date: 7/29/03

TRANSMISSION

Transmission Type	☐ Manual	■ Automatic	
Mfr. / Model No.	Allison Transmission / 2200 Series		
Control Type	■ Mechanical	☐ Electrical	☐ Other
Torque Convertor Mfr. / Model No.	Allison Transmission / 2200 Series		
Integral Retarder Mfr. / Model No.	N/A		

SUSPENSION

Number of Axles	2		
Front Axle Type	☐ Independent	■ Beam Axle	
Mfr. / Model No.	Meritor / MFS07153CNN4		
Axle Ratio (if driven)	N/A		
Suspension Type	☐ Air	■ Spring	☐ Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	General Motors / 15174898		
Middle Axle Type	☐ Independent	☐ Beam Axle	
Mfr. / Model No.	N/A		
Axle Ratio (if driven)	N/A		
Suspension Type	☐ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	N/A		
Mfr. / Model No.	N/A		
Rear Axle Type	☐ Independent	■ Beam Axle	
Mfr. / Model No.	Dana / S135		
Axle Ratio (if driven)	Not available from manufacturer.		
Suspension Type	☐ Air	■ Spring	■ Other (Mor-Ryde)
No. of Shock Absorbers	2		
Mfr. / Model No.	General Motors / 1518564		

Bus Number: 0318	Date: 7/29/03

WHEELS & TIRES

Front	Wheel Mfr./ Model No.	Accuride / 19.5 x 6.75
	Tire Mfr./ Model No.	Goodyear G641 / RSA 225/70R 19.5
Rear	Wheel Mfr./ Model No.	Accuride / 19.5 x 6.75
	Tire Mfr./ Model No.	Goodyear G641 / RSA 225/70R 19.5

BRAKES

Front Axle Brakes Type	☐ Cam	■ Disc	☐ Other (explain)
Mfr. / Model No.	TRW Meritor-Dana / 66 mm, 4 Piston/wheel		
Middle Axle Brakes Type	☐ Cam	☐ Disc	☐ Other (explain)
Mfr. / Model No.	N/A		
Rear Axle Brakes Type	☐ Cam	■ Disc	☐ Other (explain)
Mfr. / Model No.	TRW Meritor-Dana / 66 mm, 2 Piston/wheel		
Retarder Type	N/A		
Mfr. / Model No.	N/A		

HVAC

Heating System Type	☐ Air	■ Water	☐ Other
Capacity (Btu/hr)	65,000 & 35,700		
Mfr. / Model No.	Pro Air / 65,000 Btu/hr and General Motors / 35,700 Btu/hr		
Air Conditioner	■ Yes	☐ No	
Location	Dash & rear ceiling interior		
Capacity (Btu/hr)	93,000 & 24,000		
A/C Compressor Mfr. / Model No.	A/C Industries / C-100632		

STEERING

Steering Gear Box Type	Hydraulic gear
Mfr. / Model No.	Not available from manufacturer.
Steering Wheel Diameter	15.0
Number of turns (lock to lock)	3.25

Bus Number: 0318	Date: 7/29/03

OTHERS

Wheel Chair Ramps	Location: N/A	Type: N/A
Wheel Chair Lifts	Location: N/A	Type: N/A
Mfr. / Model No.	N/A	
Emergency Exit	Location: Roof Windows Doors	Number: 1 3 2

CAPACITIES

Fuel Tank Capacity (units)	40 gals
Engine Crankcase Capacity (gallons)	1.6
Transmission Capacity (gallons)	4.4
Differential Capacity (pints)	26.0
Cooling System Capacity (quarts)	7.5
Power Steering Fluid Capacity (gallons)	Not available from manufacturer.

VEHICLE DATA FORM

Bus Number: 0318	Date: 7/29/03

List all spare parts, tools and manuals delivered with the bus.

Part Number	Description	Qty.
N/A	N/A	N/A

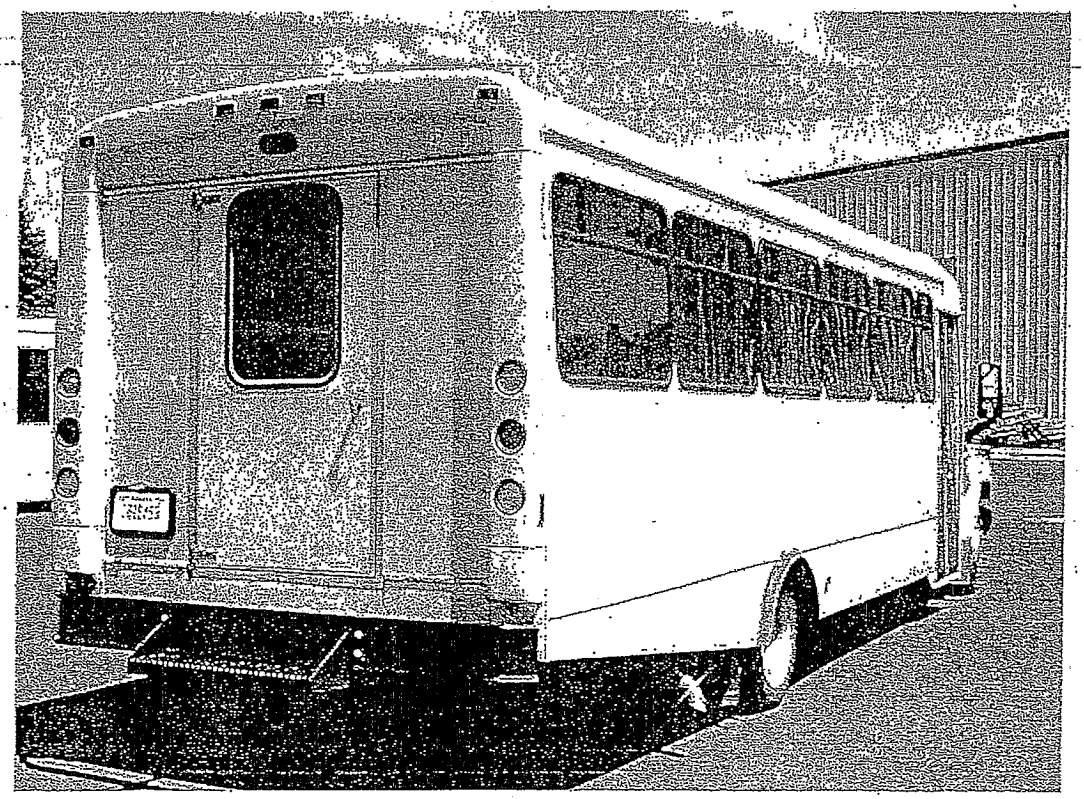
COMPONENT/SUBSYSTEM INSPECTION FORM

Bus Number: 0318	Date: 7/29/03

Subsystem	Checked	Comments
Air Conditioning Heating and Ventilation	✓	
Body and Sheet Metal	✓	
Frame	✓	
Steering	✓	
Suspension	✓	
Interior/Seating	✓	
Axles	✓	
Brakes	✓	
Tires/Wheels	✓	
Exhaust	✓	
Fuel System	✓	
Power Plant	✓	
Accessories	✓	
Lift System	N/A	
Interior Fasteners	✓	
Batteries	✓	

CHECK - IN

GLAVAL BUS
MODEL TITAN



1. MAINTAINABILITY

1.1 ACCESSIBILITY OF COMPONENTS AND SUBSYSTEMS

1.1-I. TEST OBJECTIVE

The objective of this test is to check the accessibility of components and subsystems.

1.1-II. TEST DESCRIPTION

Accessibility of components and subsystems is checked, and where accessibility is restricted the subsystem is noted along with the reason for the restriction.

1.1-III. DISCUSSION

Accessibility, in general, was adequate. Components covered in Section 1.3 (repair and/or replacement of selected subsystems), along with all other components encountered during testing, were found to be readily accessible and no restrictions were noted.

ACCESSIBILITY DATA FORM

Bus Number: 0318	Date: 5-3-04

Component	Checked	Comments
ENGINE :		
Oil Dipstick	✓	
Oil Filler Hole	✓	
Oil Drain Plug	✓	
Oil Filter	✓	
Fuel Filter	✓	
Air Filter	✓	
Belts	✓	
Coolant Level	✓	
Coolant Filler Hole	✓	
Coolant Drain	✓	
Spark / Glow Plugs	✓	
Alternator	✓	
Diagnostic Interface Connector	✓	
TRANSMISSION :		
Fluid Dip-Stick	✓	
Filler Hole	✓	
Drain Plug	✓	
SUSPENSION :		
Bushings	✓	
Shock Absorbers	✓	
Air Springs	N/A	
Leveling Valves	N/A	
Grease Fittings	✓	

ACCESSIBILITY DATA FORM

Bus Number: 0318	Date: 5-3-04

Component	Checked	Comments
HVAC :		
A/C Compressor	✓	
Filters	✓	
Fans	✓	
ELECTRICAL SYSTEM :		
Fuses	✓	
Batteries	✓	
Voltage regulator	✓	
Voltage Convertors	✓	
Lighting	✓	
MISCELLANEOUS :		
Brakes	✓	
Handicap Lifts/Ramps	N/A	
Instruments	✓	
Axles	✓	
Exhaust	✓	
Fuel System	✓	
OTHERS :		

1.2 SERVICING, PREVENTIVE MAINTENANCE, AND REPAIR AND MAINTENANCE DURING TESTING

1.2-I. TEST OBJECTIVE

The objective of this test is to collect maintenance data about the servicing, preventive maintenance, and repair.

1.2.-II. TEST DESCRIPTION

The test will be conducted by operating the NBM and collecting the following data on work order forms and a driver log.

1. Unscheduled Maintenance
   a. Bus number
   b. Date
   c. Mileage
   d. Description of malfunction
   e. Location of malfunction (e.g., in service or undergoing inspection)
   f. Repair action and parts used
   g. Man-hours required

2. Scheduled Maintenance
   a. Bus number
   b. Date
   c. Mileage
   d. Engine running time (if available)
   e. Results of scheduled inspections
   f. Description of malfunction (if any)
   g. Repair action and parts used (if any)
   h. Man-hours required

The buses will be operated in accelerated durability service. While typical items are given below, the specific service schedule will be that specified by the manufacturer.

A. Service
   1. Fueling
   2. Consumable checks
   3. Interior cleaning

B. Preventive Maintenance
   4. Brake adjustments
   5. Lubrication
   6. 3,000 mi (or equivalent) inspection

7. Oil and filter change inspection
8. Major inspection
9. Tune-up

C. Periodic Repairs
1. Brake reline
2. Transmission change
3. Engine change
4. Windshield wiper motor change
5. Stoplight bulb change
6. Towing operations
7. Hoisting operations

1.2-III. DISCUSSION

Servicing and preventive maintenance were performed at manufacturer-specified intervals. The following Scheduled Maintenance Form lists the mileage, items serviced, the service interval, and amount of time required to perform the maintenance. Table 1 is a list of the lubricating products used in servicing. Finally, the Unscheduled Maintenance List along with Unscheduled Maintenance related photographs is included in Section 5.7, Structural Durability. This list supplies information related to failures that occurred during the durability portion of testing. The Unscheduled Maintenance List includes the date and mileage at which the malfunction occurred, a description of the malfunction and repair, and the time required to perform the repair.

SCHEDULED MAINTENANCE

Glaval 0318

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
09-26-03	859	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
09-24-03	940	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
10-14-03	1,548	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-19-03	2,009	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
12-04-03	2,959	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
12-10-03	3,537	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
12-16-03	4,216	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00

SCHEDULED MAINTENANCE

Glaval 0318

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
02-04-04	5,322	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
03-08-04	6,642	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
03-11-04	7,395	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
03-24-04	8,973	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
04-02-04	10,414	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
04-21-04	Complete	P.M. / Inspection Fuel Economy Prep.	Linkage, tie rods, universals/u-joints all lubed. Oil changed. Oil, fuel, and air filters changed. Transmission oil and filter changed.	8.00	8.00

Table 1. STANDARD LUBRICANTS

The following is a list of Texaco lubricant products used in bus testing conducted by the Penn State University Altoona Bus Testing Center:

ITEM	PRODUCT CODE	TEXACO DESCRIPTION
Engine oil	#2112	URSA Super Plus SAE 30
Transmission oil	#1866	Automatic Trans Fluid Mercon/Dexron II Multipurpose
Gear oil	#2316	Multigear Lubricant EP SAE 80W90
Wheel bearing & Chassis grease	#1935	Starplex II

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS

1.3-I. TEST OBJECTIVE

The objective of this test is to establish the time required to replace and/or repair selected subsystems.

1.3-II. TEST DESCRIPTION

The test will involve components that may be expected to fail or require replacement during the service life of the bus. In addition, any component that fails during the NBM testing is added to this list. Components to be included are:

1. Transmission
2. Alternator
3. Starter
4. Batteries
5. Windshield wiper motor

1.3-III. DISCUSSION

During the test, several additional components were removed for repair or replacement. Following is a list of components and total repair/replacement time.

	MAN HOURS
Left front shock.	1.00
Transmission fluid cooler seal.	0.50
Right front shock.	0.50
Right rear inside tire.	0.50
Left rear inside tire.	0.50
Left low beam lamp.	0.50

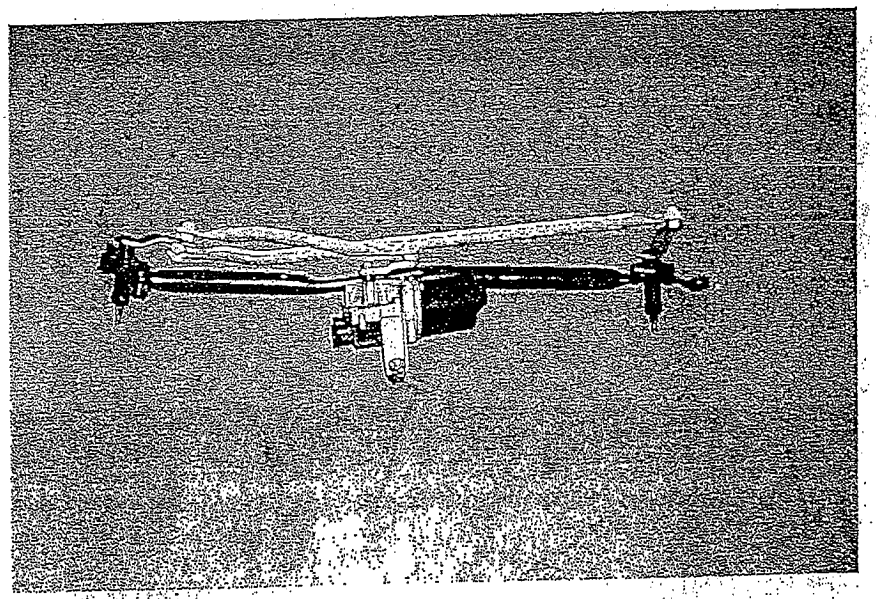
At the end of the test, the remaining items on the list were removed and replaced. The transmission assembly took 14.0 man-hours (two men 7.0 hrs) to remove and replace. The time required for repair/replacement of the four remaining components is given on the following Repair and/or Replacement Form.

REPLACEMENT AND/OR REPAIR FORM

Subsystem	Replacement Time
Transmission	14.00 man hours
Wiper Motor	0.50 man hours
Starter	0.75 man hours
Alternator	1.00 man hours
Batteries	0.50 man hours

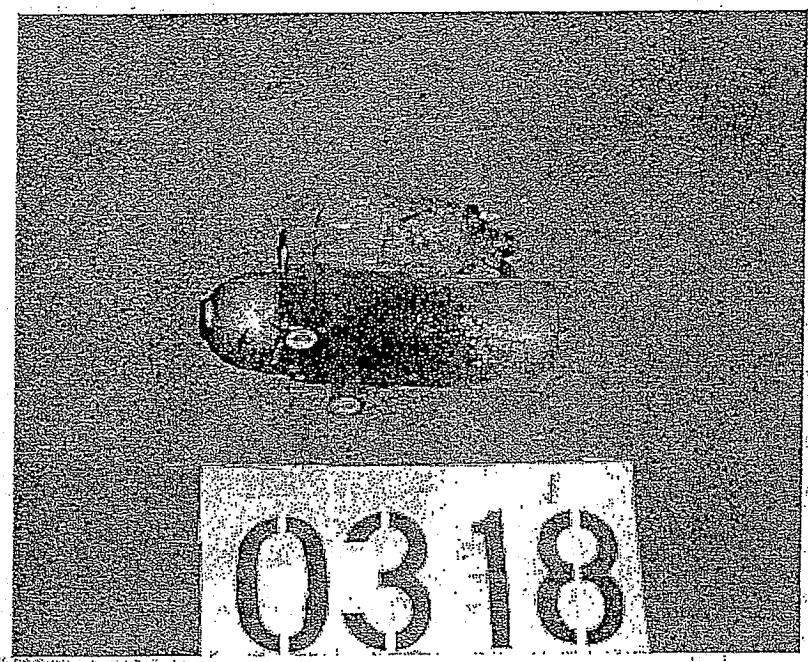
1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS

TRANSMISSION REMOVAL AND REPLACEMENT
(14.00 MAN HOURS)

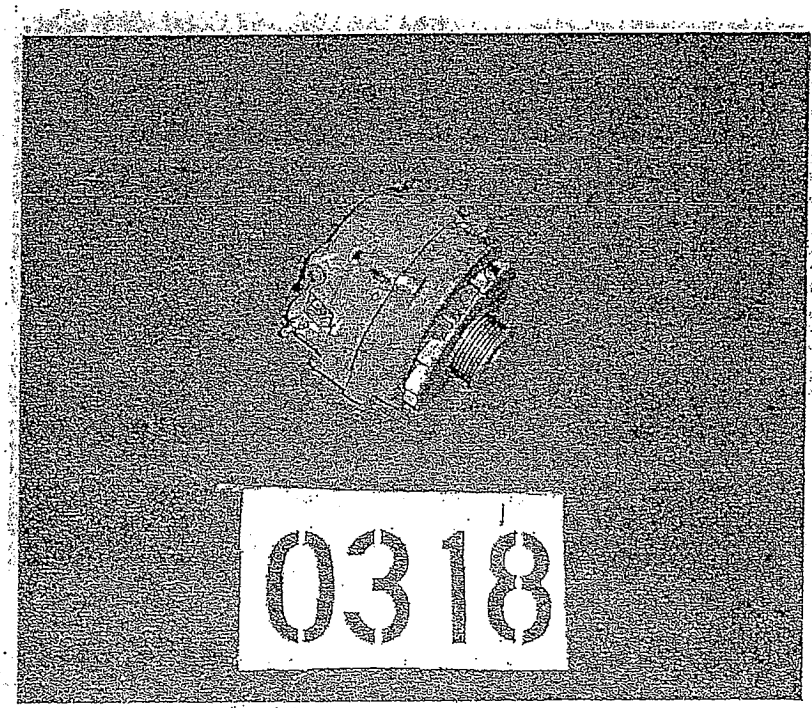


WIPER MOTOR REMOVAL AND REPLACEMENT
(0.50 MAN HOURS)

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS CONT.



STARTER REMOVAL AND REPLACEMENT
(0.75 MAN HOURS)



ALTERNATOR REMOVAL AND REPLACEMENT
(1.00 MAN HOURS)

2. RELIABILITY - DOCUMENTATION OF BREAKDOWN AND REPAIR TIMES DURING TESTING

2-I. TEST OBJECTIVE

The objective of this test is to document unscheduled breakdowns, repairs, down time, and repair time that occur during testing.

2-II. TEST DESCRIPTION

Using the driver log and unscheduled work order forms, all significant breakdowns, repairs, man-hours to repair, and hours out of service are recorded on the Reliability Data Form.

CLASS OF FAILURES

Classes of failures are described below:

(a) Class 1: Physical Safety. A failure that could lead directly to passenger or driver injury and represents a severe crash situation.

(b) Class 2: Road Call. A failure resulting in an enroute interruption of revenue service. Service is discontinued until the bus is replaced or repaired at the point of failure.

(c) Class 3: Bus Change. A failure that requires removal of the bus from service during its assignments. The bus is operable to a rendezvous point with a replacement bus.

(d) Class 4: Bad Order. A failure that does not require removal of the bus from service during its assignments but does degrade coach operation. The failure shall be reported by driver, inspector, or hostler.

2-III. DISCUSSION

A listing of breakdowns and unscheduled repairs is accumulated during the Structural Durability Test. The following Reliability Data Form lists all unscheduled repairs under classes as defined above. These classifications are somewhat subjective as the test is performed on a test track with careful inspections every two hours. However, even on the road, there is considerable latitude on deciding how to handle many failures.

The Unscheduled Repair List is also attached to provide a reference for the repairs that are included in the Reliability Data Forms.

The classification of repairs according to subsystem is intended to emphasize those systems which had persistent minor or more serious problems. There were no Class 1 or 2 failures. Of the 15 Class 3 failures, seven involved the engine/transmission, six occurred in the suspension, and one each with the electrical, wheels/tires and body/framework. These, and the remaining seven Class 4 failures are available for review in the Unscheduled Maintenance List, located in Section 5.7 Structural Durability.

RELIABILITY DATA FORMS

Bus Number: 0318	Date: 04-07-04
Personnel: Bob Reifsteck	

Failure Type			
Class 4 Bad Order	Class 3 Bus Change	Class 2 Road Call	Class 1 Physical Safety

Subsystems	Mileage	Mileage	Mileage	Mileage	Man Hours	Down Time
Suspension	890				1.50	8.00
	1,089				1.00	104.00
	1,324				1.00	8.00
		1,873			1.00	16.00
		4,218			1.00	4.00
		5,003			4.00	448.00
		5,322			0.50	16.00
	7,447				4.00	8.00
		8,973			1.50	24.00
		10,414			0.50	4.00
Engine/Transmission		1,548			4.00	272.00
		2,958			1.00	112.00
		3,538			1.00	10.00
		5,322			3.00	32.00
		7,314			0.50	8.00
		9,532			0.50	8.00
		10,414			0.50	2.00
Electrical		890			0.50	0.50
	8,849				0.25	0.25

RELIABILITY DATA FORMS

Bus Number: 0318	Date: 04-07-04
Personnel: Bob Reifsteck	

Failure Type			
Class 4 Bad Order	Class 3 Bus Change	Class 2 Road Call	Class 1 Physical Safety

Subsystems	Mileage	Mileage	Mileage	Mileage	Man Hours	Down Time
Wheels/Tires	5,322				0.50	0.50
		6,336			0.50	2.00
Body/Framework	6,130				1.00	1.00

3. SAFETY - A DOUBLE-LANE CHANGE (OBSTACLE AVOIDANCE)

3-I. TEST OBJECTIVE

The objective of this test is to determine handling and stability of the bus by measuring speed through a double lane change test.

3-II. TEST DESCRIPTION

The Safety Test is a vehicle handling and stability test. The bus will be operated at SLW on a smooth and level test track. The bus will be driven through a double lane change course at increasing speed until the test is considered unsafe or a speed of 45 mph is reached. The lane change course will be set up using pylons to mark off two 12 foot center to center lanes with two 100 foot lane change areas 100 feet apart. The bus will begin in one lane, change to the other lane in a 100 foot span, travel 100 feet, and return to the original lane in another 100 foot span. This procedure will be repeated, starting first in the right-hand and then in the left-hand lane.

3-III. DISCUSSION

The double-lane change was performed in both right-hand and left-hand directions. The bus was able to safely negotiate the test course in both the right-hand and left-hand directions up to the maximum test speed of 45 mph.

SAFETY DATA FORM

Bus Number: 0318	Date: 4-22-04
Personnel: G.M., T.S. & S.C.	

Temperature (°F): 68	Humidity (%): 64
Wind Direction: W	Wind Speed (mph): 8
Barometric Pressure (in.Hg): 30.06	

SAFETY TEST: DOUBLE LANE CHANGE	
Maximum safe speed tested for double-lane change to left	45 mph
Maximum safe speed tested for double-lane change to right	45 mph
Comments of the position of the bus during the lane change: A safe profile was maintained through all portions of testing.	
Comments of the tire/ground contact patch: Tire/ground contact was maintained through all portions of testing.	

3. SAFETY

RIGHT - HAND APPROACH

LEFT - HAND APPROACH

4. PERFORMANCE - AN ACCELERATION, GRADEABILITY, AND TOP SPEED TEST

4-I. TEST OBJECTIVE

The objective of this test is to determine the acceleration, gradeability, and top speed capabilities of the bus.

4-II. TEST DESCRIPTION

In this test, the bus will be operated at SLW on the skid pad at the PSBRTF. The bus will be accelerated at full throttle from a standstill to a maximum "geared" or "safe" speed as determined by the test driver. The vehicle speed is measured using a Correvit non-contacting speed sensor. The times to reach speed between ten mile per hour increments are measured and recorded using a stopwatch with a lap timer. The time to speed data will be recorded on the Performance Data Form and later used to generate a speed vs time plot and gradeability calculations.

4-III. DISCUSSION

This test consists of three runs in both the clockwise and counterclockwise directions on the Test Track. Velocity versus time data is obtained for each run and results are averaged together to minimize any test variability which might be introduced by wind or other external factors. The test was performed up to a maximum speed of 50 mph. The fitted curve of velocity vs time is attached, followed by the calculated gradeability results. The average time to obtain 50 mph was 23.09 seconds.

PERFORMANCE DATA FORM

PW063009-17

Bus Number: 0318	Date: 4-22-04
Personnel: G.M., T.S. & S.C.	

Temperature (°F): 68	Humidity (%):
Wind Direction: W	Wind Speed (mph): 8
Barometric Pressure (in.Hg): 30.06	

Air Conditioning compressor-OFF	✓ Checked
Ventilation fans-ON HIGH	✓ Checked
Heater pump motor-Off	✓ Checked
Defroster-OFF	✓ Checked
Exterior and interior lights-ON	✓ Checked
Windows and doors-CLOSED	✓ Checked

ACCELERATION, GRADEABILITY, TOP SPEED

Counter Clockwise Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	3.02	3.05	2.80
20 mph	5.62	5.71	5.58
30 mph	9.77	10.11	10.08
40 mph	15.52	15.65	16.21
Top Test Speed(mph) 50	23.40	23.21	23.05

Clockwise Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	2.80	3.18	2.96
20 mph	5.33	5.68	5.65
30 mph	9.17	9.83	9.27
40 mph	14.52	14.93	14.74
Top Test Speed(mph) 50	23.46	22.68	22.74

0318.ACC

PERFORMANCE SUMMARY SHEET

BUS MANUFACTURER : Glaval
BUS MODEL : Titan

BUS NUMBER : 0318
TEST DATE : 4/22/04

TEST CONDITIONS :

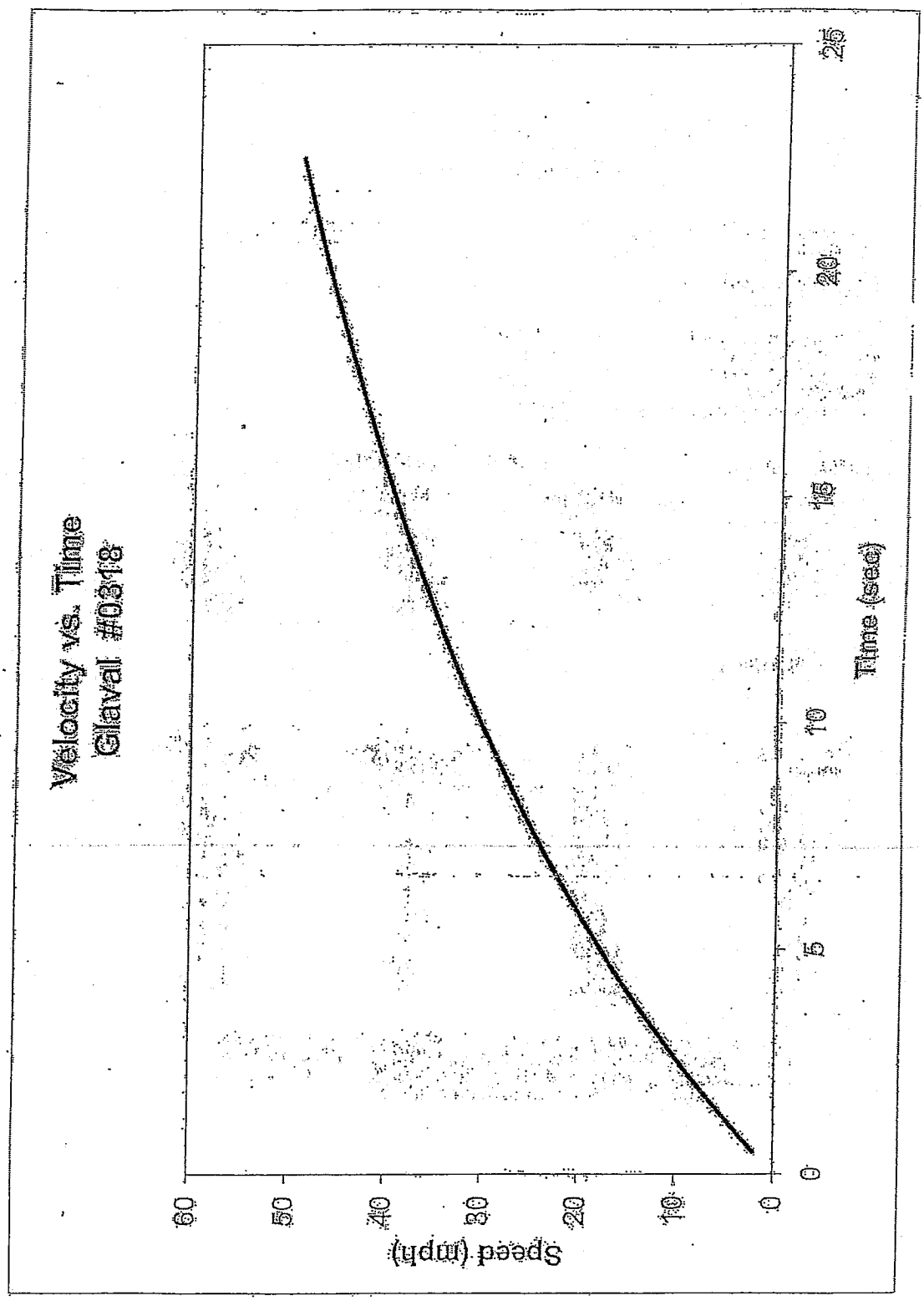
TEMPERATURE (DEG F) : 68.0
WIND DIRECTION : W
WIND SPEED (MPH) : 8.0
HUMIDITY (%) : 25
BAROMETRIC PRESSURE (IN. HG) : 30.1

VEHICLE SPEED (MPH)	AVERAGE TIME (SEC) CCW DIRECTION	CW DIRECTION	TOTAL
10.0	2.96	2.98	5.97
20.0	5.64	5.55	11.60
30.0	9.29	9.42	18.71
40.0	15.79	14.73	30.26
50.0	26.22	22.96	49.09

TEST SUMMARY :

VEHICLE SPEED (MPH)	TIME (SEC)	ACCELERATION (FT/SEC^2)	MAX. GRADE (%)
1.0	.24	6.1	19.4
5.0	1.23	5.7	18.0
10.0	2.58	5.2	16.2
15.0	4.08	4.6	14.5
20.0	5.76	4.1	12.9
25.0	7.66	3.6	11.3
30.0	9.83	3.2	9.8
35.0	12.33	2.7	8.5
40.0	15.27	2.3	7.2
45.0	18.77	1.9	5.9
50.0	23.03	1.6	4.8

NOTE : Gradeability results were calculated from performance test data. Actual sustained gradeability performance for vehicles equipped with auto transmission may be lower than the values indicated here.


Velocity vs. Time
Glaval #03-18
Speed (mph)
60
50
40
30
20
10
0
0
5
10
15
20
25
Time (sec)

5. STRUCTURAL INTEGRITY

5.1 STRUCTURAL STRENGTH AND DISTORTION TESTS - STRUCTURAL SHAKEDOWN TEST

5.1-I. DISCUSSION

The objective of this test is to determine certain static characteristics (e.g., bus floor deflection, permanent structural deformation, etc.) under static loading conditions.

5.1-II. TEST DESCRIPTION

In this test, the bus will be isolated from the suspension by blocking the vehicle under the suspension points. The bus will then be loaded and unloaded up to a maximum of three times with a distributed load equal to 2.5 times gross load. Gross load is 150 lb for every designed passenger seating position, for the driver, and for each 1.5 sq ft of free floor space. For a distributed load equal to 2.5 times gross load, place a 375-lb load on each seat and on every 1.5 sq ft of free floor space. The first loading and unloading sequence will "settle" the structure. Bus deflection will be measured at several locations during the loading sequences.

5.1-III. DISCUSSION

This test was performed based on a maximum passenger capacity of 50 people including the driver. The resulting test load is (50 x 375 lb) = 18,750 lb. The load is distributed evenly over the passenger space. Deflection data before and after each loading and unloading sequence is provided on the Structural Shakedown Data Form.

The unloaded height after each test becomes the original height for the next test. Some initial settling is expected due to undercoat compression, etc. After each loading cycle, the deflection of each reference point is determined. The bus is then unloaded and the residual (permanent) deflection is recorded. On the final test, the maximum loaded deflection was 0.269 inches at reference point 7. The maximum permanent deflection after the final loading sequence ranged from 0.000 inches at reference points 2, 5, 8, 9, and 11 to 0.005 inches at reference point 1.

STRUCTURAL SHAKEDOWN DATA FORM

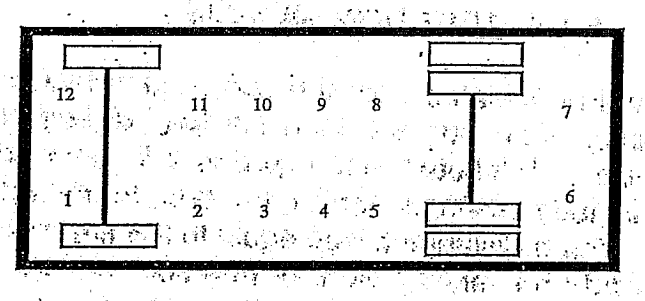
Bus Number: 0318	Date: 9-11-03
Personnel: E.D., E.L., D.L. & T.S.	Temperature (°F): 71
Loading Sequence: ■ 1 ☐ 2 ☐ 3 (check one) Test Load (lbs): 18,750	

Indicate Approximate Location of Each Reference Point

Right

Front of Bus

Left



Top View

Reference Point No.	A (in) Original Height	B (in) Loaded Height	B-A (in) Loaded Deflection	C (in) Unloaded Height	C-A (in) Permanent Deflection
1	0	-.007	-.007	.037	.037
2	0	.020	.020	.000	.000
3	0	.039	.039	.003	.003
4	0	.041	.041	.000	.000
5	0	.020	.020	.004	.004
6	0	.201	.201	.056	.056
7	0	.192	.192	.017	.017
8	0	.040	.040	.005	.005
9	0	.058	.058	.000	.000
10	0	.059	.059	.000	.000
11	0	.061	.061	-.003	.003
12	0	-.006	-.006	.027	.027

STRUCTURAL SHAKEDOWN DATA FORM

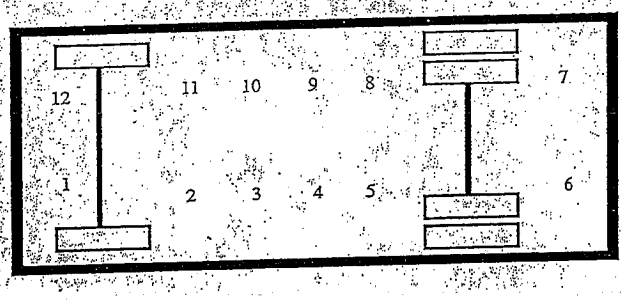
Bus Number: 0318	Date: 9-11-03
Personnel: E.L., T.S., D.L. & S.C.	Temperature (°F): 75
Loading Sequence: ☐ 1 ■ 2 ☐ 3 (check one) Test Load (lbs): 18,750	

Indicate Approximate Location of Each Reference Point

Right

Front of Bus

Left



Top View

Reference Point No.	A (in) Original Height	B (in) Loaded Height	B-A (in) Loaded Deflection	C (in) Unloaded Height	C-A (in) Permanent Deflection
1	.037	.000	-.037	.042	.005
2	.000	.018	.018	.000	.000
3	.003	.031	.028	.004	.001
4	.000	.035	.035	.001	.001
5	.004	.019	.015	.004	.000
6	.056	.238	.182	.057	.001
7	.017	.286	.269	.019	.002
8	.005	.040	.035	.005	.000
9	.000	.058	.058	.000	.000
10	-.003	.052	.055	-.004	.001
11	-.002	.027	.029	-.002	.000
12	.027	-.001	-.028	.031	.004

5.1 STRUCTURAL SHAKEDOWN TEST

BUS LOADED TO 2.5 TIMES GVL
(18,750 LBS)

5.2 STRUCTURAL STRENGTH AND DISTORTION TESTS - STRUCTURAL DISTORTION

5.2-I. TEST OBJECTIVE

The objective of this test is to observe the operation of the bus subsystems when the bus is placed in a longitudinal twist simulating operation over a curb or through a pothole.

5.2-II. TEST DESCRIPTION

With the bus loaded to GVWR, each wheel of the bus will be raised (one at a time) to simulate operation over a curb and the following will be inspected:

1. Body
2. Windows
3. Doors
4. Roof vents
5. Special seating
6. Undercarriage
7. Engine
8. Service doors
9. Escape hatches
10. Steering mechanism

Each wheel will then be lowered (one at a time) to simulate operation through a pothole and the same items inspected.

5.2-III. DISCUSSION

The test sequence was repeated ten times. The first and last test is with all wheels level. The other eight tests are with each wheel 6 inches higher and 6 inches lower than the other three wheels.

All doors, windows, escape mechanisms, engine, and steering operated normally throughout the test. The undercarriage and body indicated no deficiencies. No water leakage was observed during the test. The results of this test are indicated on the following data forms.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 0318	Date: 9-15-03
Personnel: E.D., E.L., D.L., T.S., & S.C.,	Temperature(°F): 73

Wheel Position : (check one)		
All wheels level	☒ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	No deficiencies.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	N/A
☒ Undercarriage	No deficiencies.
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	No deficiencies.
☒ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 0318	Date: 9-15-03
Personnel: E.D., E.L., D.L., T.S., & S.C.,	Temperature(°F): 73

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☒ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	No deficiencies.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	N/A
☒ Undercarriage	No deficiencies.
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	No deficiencies.
☒ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 0318	Date: 9-15-03
Personnel: E.D., E.L., D.L., T.S., & S.C.,	Temperature(°F): 73

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☒ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	No deficiencies.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	N/A
☒ Undercarriage	No deficiencies.
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	No deficiencies.
☒ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 0318	Date: 9-15-03
Personnel: E.D., E.L., D.L., T.S., & S.C.,	Temperature(°F): 73

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☒ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	No deficiencies.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	N/A
☒ Undercarriage	No deficiencies.
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	No deficiencies.
☒ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 0318	Date: 9-15-03
Personnel: E.D., E.L., D.L., T.S., & S.C.,	Temperature(°F): 73

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☒ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	No deficiencies.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	N/A
☒ Undercarriage	No deficiencies.
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	No deficiencies.
☒ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 0318	Date: 9-15-03
Personnel: E.D., E.L., D.L., T.S., & S.C.,	Temperature(°F): 73

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☒ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	No deficiencies.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	N/A
☒ Undercarriage	No deficiencies.
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	No deficiencies.
☒ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 0318	Date: 9-15-03
Personnel: E.D., E.L., D.L., T.S., & S.C.,	Temperature(°F): 73

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☒ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	No deficiencies.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	N/A
☒ Undercarriage	No deficiencies.
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	No deficiencies.
☒ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 0318	Date: 9-15-03
Personnel: E.D., E.L., D.L., T.S., & S.C.,	Temperature(°F): 73

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
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Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	No deficiencies.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	N/A
☒ Undercarriage	No deficiencies.
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	No deficiencies.
☒ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 0318	Date: 9-15-03
Personnel: E.D., E.L., D.L., T.S., & S.C.,	Temperature(°F): 73

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☒ 6 in lower
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Left center	☐ 6 in higher	☐ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	No deficiencies.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	N/A
☒ Undercarriage	No deficiencies.
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	No deficiencies.
☒ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 0318	Date: 9-15-03
Personnel: E.D., E.L., D.L., T.S., & S.C.,	Temperature(°F): 73

Wheel Position : (check one)		
All wheels level	☐ before	☒ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
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	Comments
☒ Windows	No deficiencies.
☒ Front Doors	No deficiencies.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	N/A
☒ Undercarriage	No deficiencies.
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	No deficiencies.
☒ Steering Mechanism	No deficiencies.

5.2 STRUCTURAL DISTORTION TEST

RIGHT REAR WHEEL SIX INCHES HIGHER

LEFT FRONT WHEEL SIX INCHES HIGHER

5.3 STRUCTURAL STRENGTH AND DISTORTION TESTS - STATIC TOWING TEST

5.3-I. TEST OBJECTIVE

The objective of this test is to determine the characteristics of the bus towing mechanisms under static loading conditions.

5.3-II. TEST DESCRIPTION

Utilizing a load-distributing yoke, a hydraulic cylinder is used to apply a static tension load equal to 1.2 times the bus curb weight. The load will be applied to both the front and rear, if applicable, towing fixtures at an angle of 20 degrees with the longitudinal axis of the bus, first to one side then the other in the horizontal plane, and then upward and downward in the vertical plane. Any permanent deformation or damage to the tow eyes or adjoining structure will be recorded.

5.3-III. DISCUSSION

The test bus submitted for testing was not equipped with any type of tow eyes or tow hooks, therefore, the Static Towing Test was not performed.

5.4 STRUCTURAL STRENGTH AND DISTORTION TESTS - DYNAMIC TOWING TEST

5.4-I. TEST OBJECTIVE

The objective of this test is to verify the integrity of the towing fixtures and determine the feasibility of towing the bus under manufacturer specified procedures.

5.4-II. TEST DESCRIPTION

This test requires the bus be towed at curb weight using the specified equipment and instructions provided by the manufacturer and a heavy-duty wrecker. The bus will be towed for 5 miles at a speed of 20 mph for each recommended towing configuration. After releasing the bus from the wrecker, the bus will be visually inspected for any structural damage or permanent deformation. All doors, windows and passenger escape mechanisms will be inspected for proper operation.

5.4-III. DISCUSSION

The bus was towed using a heavy-duty wrecker. The towing interface was accomplished by incorporating a hydraulic under lift. A front lift tow was performed. Rear towing is not recommended. No problems, deformation, or damage was noted during testing.

DYNAMIC TOWING TEST DATA FORM

Bus Number: 0318	Date: 4-29-04
Personnel: D.L., E.L. & K.D.	

Temperature (°F): 70	Humidity (%): 30
Wind Direction: W	Wind Speed (mph): 7
Barometric Pressure (in.Hg): 30.06	

Inspect tow equipment-bus interface.

Comments: A safe and adequate connection was made between the tow equipment and the bus.

Inspect tow equipment-wrecker interface.

Comments: A safe and adequate connection was made between the tow equipment and the wrecker.

Towing Comments: A front lift tow was performed incorporating a hydraulic under lift wrecker.

Description and location of any structural damage: None noted

General Comments: No problems were encountered with the towing interface.

5.4 DYNAMIC TOWING TEST

TOWING INTERFACE

5.5 STRUCTURAL STRENGTH AND DISTORTION TESTS – JACKING TEST

5.5-I. TEST OBJECTIVE

The objective of this test is to inspect for damage due to the deflated tire, and determine the feasibility of jacking the bus with a portable hydraulic jack to a height sufficient to replace a deflated tire.

5.5-II. TEST DESCRIPTION

With the bus at curb weight, the tire(s) at one corner of the bus are replaced with deflated tire(s) of the appropriate type. A portable hydraulic floor jack is then positioned in a manner and location specified by the manufacturer and used to raise the bus to a height sufficient to provide 3-in clearance between the floor and an inflated tire. The deflated tire(s) are replaced with the original tire(s) and the jack is lowered. Any structural damage or permanent deformation is recorded on the test data sheet. This procedure is repeated for each corner of the bus.

5.5-III. DISCUSSION

The jack used for this test has a minimum height of 8.75 inches. During the deflated portion of the test, the jacking point clearances ranged from 4.4 inches to 19.0 inches. No deformation or damage was observed during testing. A complete listing of jacking point clearances is provided in the Jacking Test Data Form.

JACKING CLEARANCE SUMMARY

Condition	Frame Point Clearance
Front axle – one tire flat	18.9"
Rear axle – one tire flat	16.3"
Rear axle – two tires flat	14.5"

JACKING TEST DATA FORM

Bus Number: 0318	Date: 7-30-03
Personnel: T.S. & M.H.	Temperature: 80

Record any permanent deformation or damage to bus as well as any difficulty encountered during jacking procedure.

Deflated Tire	Jacking Pad Clearance Body/Frame (in)	Jacking Pad Clearance Axle/Suspension (in)	Comments
Right front	21.1 " I 18.9 " D	7.0 " I 4.5 " D	
Left front	21.0 " I 19.0 " D	6.9 " I 4.4 " D	
Right rear—outside	16.8 " I 16.4 " D	10.6 " I 10.4 " D	
Right rear—both	16.8 " I 14.7 " D	10.6 " I 9.2 " D	
Left rear—outside	16.7 " I 16.3 " D	10.5 " I 10.3 " D	
Left rear—both	16.7 " I 14.5 " D	10.5 " I 9.1 " D	
Right middle or tag—outside	NA	NA	
Right middle or tag—both	NA	NA	
Left middle or tag—outside	NA	NA	
Left middle or tag—both	NA	NA	

Additional comments of any deformation or difficulty during jacking:

None noted.

5.6 STRUCTURAL STRENGTH AND DISTORTION TESTS - HOISTING TEST

5.6-I. TEST OBJECTIVE

The objective of this test is to determine possible damage or deformation caused by the jack/stands.

5.6-II. TEST DESCRIPTION

With the bus at curb weight, the front end of the bus is raised to a height sufficient to allow manufacturer-specified placement of jack stands under the axles or jacking pads independent of the hoist system. The bus will be checked for stability on the jack stands and for any damage to the jacking pads or bulkheads. The procedure is repeated for the rear end of the bus. The procedure is then repeated for the front and rear simultaneously.

5.6-III. DISCUSSION

The test was conducted using four posts of a six-post electric lift and standard 19 inch jack stands. The bus was hoisted from the front wheel, rear wheel, and then the front and rear wheels simultaneously and placed on jack stands.

The bus easily accommodated the placement of the vehicle lifts and jack stands and the procedure was performed without any instability noted.

HOISTING TEST DATA FORM

Bus Number: 0318	Date: 7-30-03
Personnel: T.S. & M.H.	Temperature (°F): 80

Comments of any structural damage to the jacking pads or axles while both the front wheels are supported by the jack stands:

None noted.

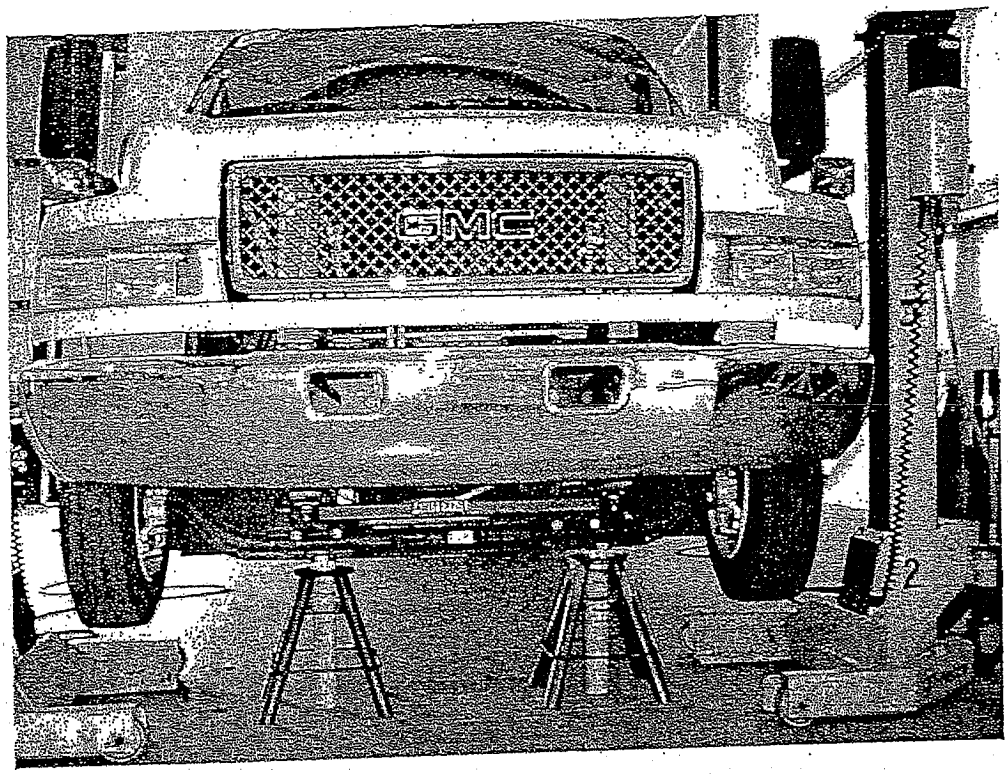
Comments of any structural damage to the jacking pads or axles while both the rear wheels are supported by the jack stands:

None noted.

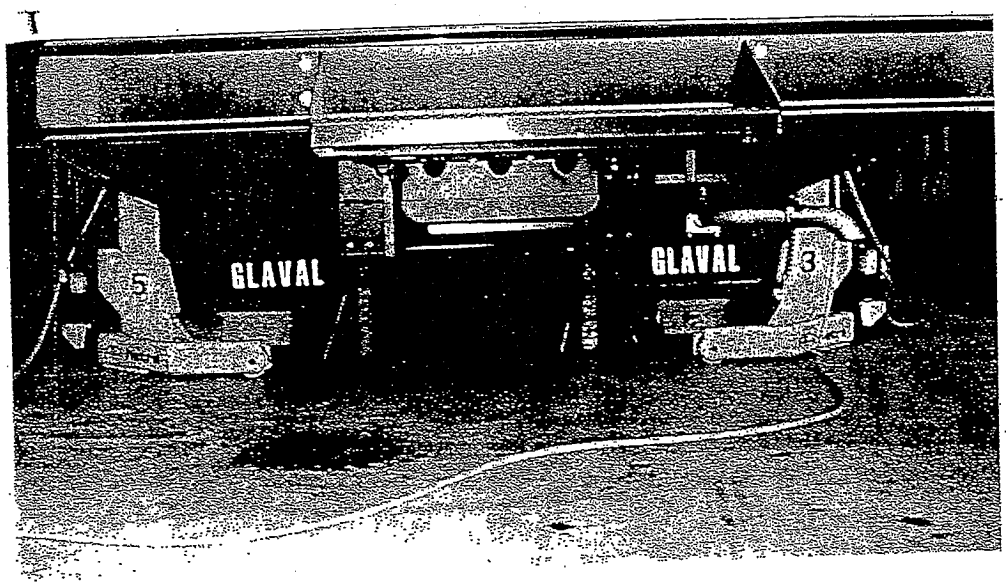
Comments of any structural damage to the jacking pads or axles while both the front and rear wheels are supported by the jack stands:

None noted.

5.6 HOISTING TEST



TEST BUS STABLE ON JACK STANDS



5.7 STRUCTURAL DURABILITY TEST

5.7-I. TEST OBJECTIVE

The objective of this test is to perform an accelerated durability test that approximates up to 25 percent of the service life of the vehicle.

5.7-II. TEST DESCRIPTION

The test vehicle is driven a total of 11,250 miles; approximately 8,750 miles on the PSBRTF Durability Test Track and approximately 2,500 miscellaneous other miles. The test will be conducted with the bus operated under three different loading conditions. The first segment will consist of approximately 4,625 miles with the bus operated at GVW. The second segment will consist of approximately 2,000 miles with the bus operated at SLW. The remainder of the test, approximately 4,625 miles, will be conducted with the bus loaded to CW. If GVW exceeds the axle design weights, then the load will be adjusted to the axle design weights and the change will be recorded. All subsystems are run during these tests in their normal operating modes. All recommended manufacturers servicing is to be followed and noted on the vehicle maintainability log. Servicing items accelerated by the durability tests will be compressed by 10:1; all others will be done on a 1:1 mi/mi basis. Unscheduled breakdowns and repairs are recorded on the same log as are any unusual occurrences as noted by the driver. Once a week the test vehicle shall be washed down and thoroughly inspected for any signs of failure.

5.7-III. DISCUSSION

The Structural Durability Test was started on September 15, 2003 and was conducted until April 7, 2004. ~~The first 4,625 miles were performed at a GVW~~ of 19,425 lbs. The number of standing passengers was reduced from 16 to 0. The ballast for all 16 standing passengers was eliminated. This reduction in passenger weight was necessary to avoid exceeding the GAWR (13,500 lbs) of the rear axle. The GVW segment was completed on December 17, 2003. The next 2,000 mile SLW segment was performed at the same 19,425 lbs and completed on March 8, 2004, and the final 4,625 mile segment was performed at a CW of 14,250 lbs and completed on April 7, 2004.

The following mileage summary presents the accumulation of miles during the Structural Durability Test. The driving schedule is included, showing the operating duty cycle. A detailed plan view of the Test Track Facility and Durability Test Track are attached for reference. Also, a durability element profile detail shows all the measurement of the different conditions. Finally, photographs illustrating some of the failures that were encountered during the Structural Durability Test are included.

GLAVAL - TEST BUS #0318
MILEAGE DRIVEN/RECORDED FROM DRIVERS' LOGS

DATE	TOTAL DURABILITY TRACK	TOTAL OTHER MILES	TOTAL
09/15/03 TO 09/21/03	229.00	63.00	292.00
09/22/03 TO 09/28/03	572.00	26.00	598.00
09/29/03 TO 10/05/03	182.00	17.00	199.00
10/06/034 TO 10/12/03	348.00	17.00	365.00
10/13/03 TO 10/19/03	41.00	53.00	94.00
10/20/03 TO 10/26/03	0.00	0.00	0.00
10/27/03 TO 11/02/03	62.00	192.00	254.00
11/03/03 TO 11/09/03	148.00	7.00	155.00
11/10/03 TO 11/16/03	0.00	52.00	52.00
11/17/03 TO 11/23/03	69.00	54.00	123.00
11/24/03 TO 11/30/03	708.00	68.00	776.00
12/01/03 TO 12/07/03	157.00	112.00	269.00
12/08/03 TO 12/14/03	595.00	131.00	726.00
12/15/03 TO 12/21/03	802.00	247.00	1049.00
12/22/03 TO 12/28/03	0.00	0.00	0.00
12/29/03 TO 01/04/04	0.00	0.00	0.00
01/05/04 TO 01/11/04	0.00	51.00	51.00

DATE	TOTAL DURABILITY TRACK	TOTAL OTHER MILES	TOTAL
01/12/04 TO 01/18/04	0.00	0.00	0.00
01/19/04 TO 01/25/04	0.00	0.00	0.00
01/26/04 TO 02/01/04	86.00	71.00	157.00
02/02/04 TO 02/08/04	401.00	121.00	522.00
02/09/04 TO 02/15/04	213.00	10.00	223.00
02/16/04 TO 02/22/04	0.00	0.00	0.00
02/23/04 TO 02/29/04	0.00	0.00	0.00
03/01/04 TO 03/07/04	468.00	127.00	595.00
03/08/04 TO 03/14/04	849.00	250.00	1099.00
03/15/04 TO 03/21/04	1117.00	52.00	1169.00
03/22/04 TO 03/28/04	632.00	132.00	764.00
03/29/04 TO 04/04/04	899.00	141.00	1040.00
04/05/04 TO 04/11/04	172.00	508.00	680.00
TOTAL	8750.00	2502.00	11252.00

Table 4. Driving Schedule for Bus Operation on the Durability Test Track.

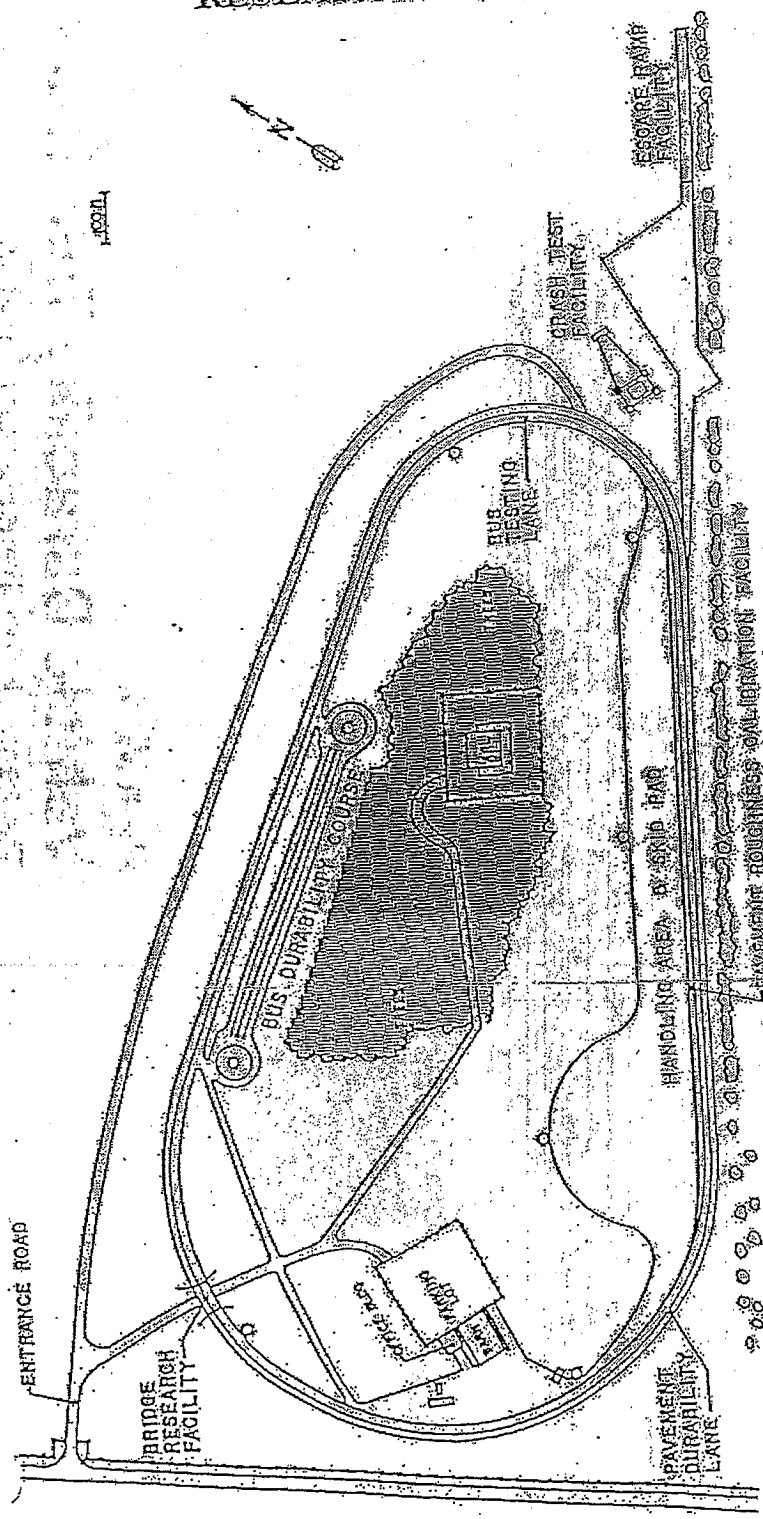
STANDARD OPERATING SCHEDULE

Monday through Friday

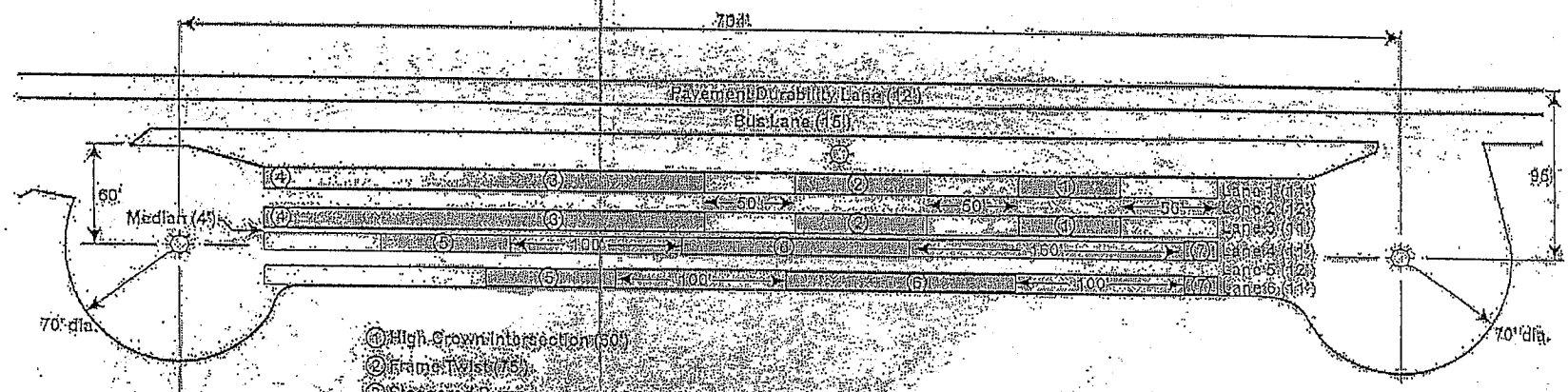
	HOUR	ACTION
Shift 1	midnight	D
	1:40 am	C
	1:50 am	B
	2:00 am	D
	3:35 am	C
	3:45 am	B
	4:05 am	D
	5:40 am	C
	5:50 am	B
	6:00 am	D
	7:40 am	C
	7:50 am	F
Shift 2	8:00 am	D
	9:40 am	C
	9:50 am	B
	10:00 am	D
	11:35 am	C
	11:45 am	B
	12:05 pm	D
	1:40 pm	C
	1:50 pm	B
	2:00 pm	D
	3:40 pm	C
	3:50 pm	F
Shift 3	4:00 pm	D
	5:40 pm	C
	5:50 pm	B
	6:00 pm	D
	7:40 pm	C
	7:50 pm	B
	8:05 pm	D
	9:40 pm	C
	9:50 pm	B
	10:00 pm	D
	11:40 pm	C
	11:50 pm	F

B—Break
C—Cycle all systems five times, visual inspection, driver's log entries
D—Drive bus as specified by procedure
F—Fuel bus, complete driver's log shift entries

"PLAN VIEW OF PENN STATE BUS TESTING AND RESEARCH FACILITY"



BUS TESTING AND RESEARCH TEST TRACK
UNIVERSITY PARK, PA

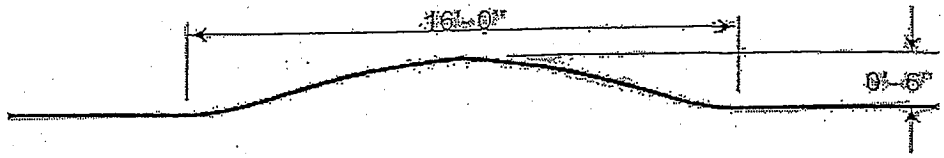


Plan View

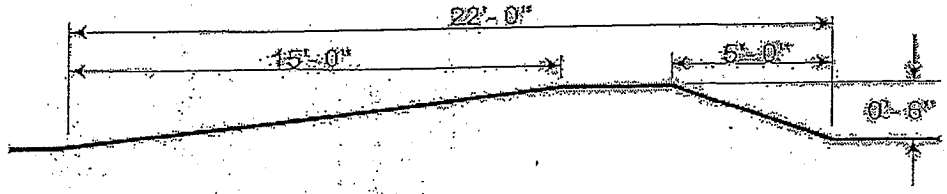
Vehicle Durability Test Track

The Pennsylvania Transportation Institute
Penn State

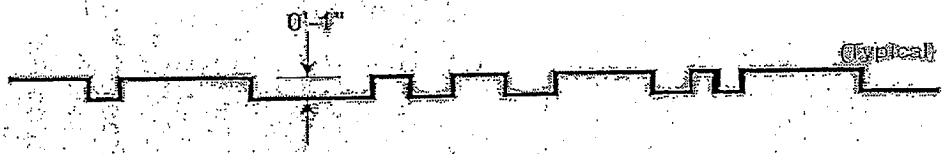
Staggered Bumps (10 mph)



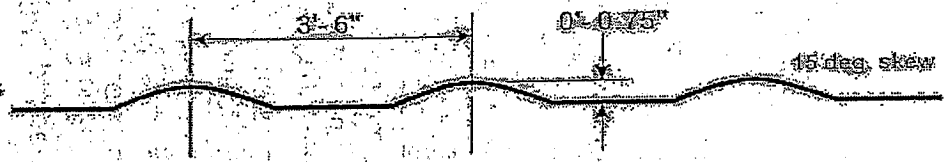
Railroad Crossing (8 mph)



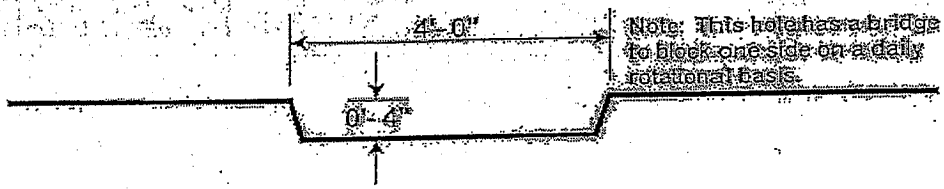
1" Random Chuck Holes (20 mph)



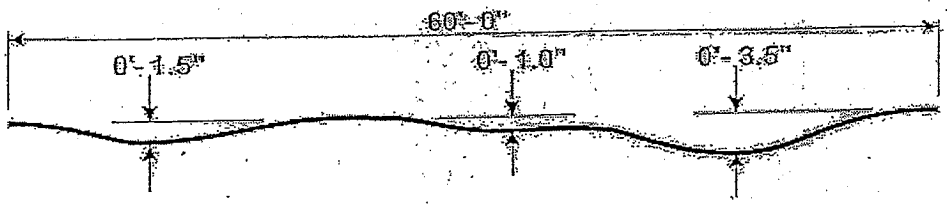
Chatter Bumps (20 mph)



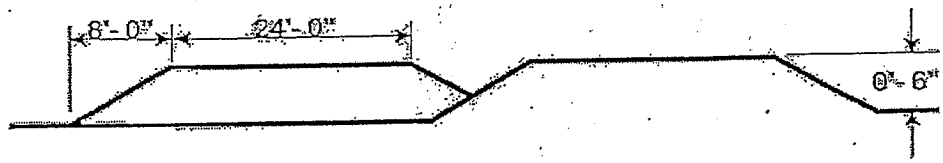
4" Chuck Hole (5 mph)



High Crown Intersection (20 mph)



Frame Twist (10 mph)



Durability Element Profiles

The Pennsylvania Transportation Institute
Penn State

UNSCHEDULED MAINTENANCE

Glaval 0318

DATE	TEST MILES	SERVICE	ACTIVITY	HOURS	DOWN TIME
09-29-03	890	Suspension too low.	Adjusted Mor/Ryde suspension system. Raised suspension to next hole.	1.50	8.00
09-29-03	890	The front clearance light will not work.	Repaired loose ground.	0.50	0.50
10-07-03	1,089	The left front shock is leaking oil.	Left front shock replaced.	1.00	104.00
10-09-03	1,324	The left front shock is leaking oil.	Left front shock replaced.	1.00	8.00
10-29-03	1,548	"Check Transmission" light is on, transmission comes out of gear.	Bus sent to Allison Warranty dealer. Dealer road-tested and checked linkage. Installed lap top and inspected unit for codes--no codes present. Road tested unit; could not duplicate problem. Moved wires and linkage around from transmission to ECU to shifter--no problem found. Checked motor mounts and transmission mounts--ok. Checked linkage on column and at the transmission--no problem found. Replaced N.S.B.U. switch. Road tested and checked operation—ok.	4.00	272.00
11-03-03	1,873	The left front shock is broken.	Left front shock replaced.	1.00	16.00

UNSCHEDULED MAINTENANCE

Glaval 0318

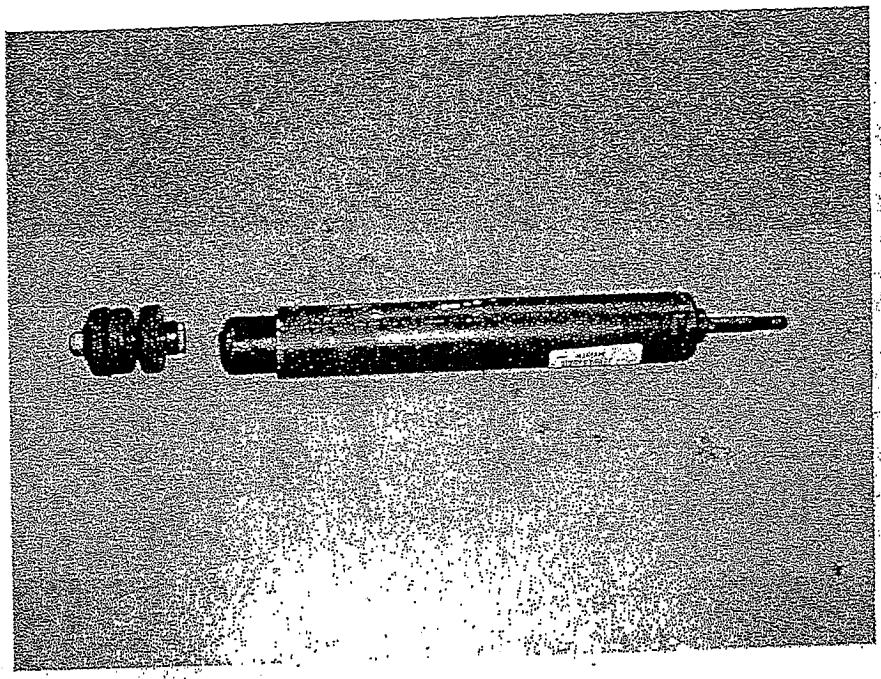
DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
12-04-03	2,958	The manifold exhaust crossover pipe is broken at the weld.	Pipe realigned and welded/repaired.	1.00	112.00
12-10-03	3,538	Transmission fluid is leaking at the connection between the fluid line and the cooler.	Worn O-ring replaced.	1.00	10.00
12-16-03	4,214	The left front shock is broken.	Left front shock replaced.	1.00	4.00
01-30-04	5,003	The right rear spring beam has a broken ply.	Broken ply replaced by GMC dealer.	4.00	448.00
02-03-04	5,322	Transmission locks in 2nd gear.	Detroit rep. installed laptop. Found incorrect 2nd ratio and TCM power interrupt. Ratio reset.	3.00	32.00
02-04-04	5,322	The right front shock is broken.	Right front shock replaced.	0.50	16.00
02-04-04	5,322	The right rear inside tire has a slow leak.	Found screw in tire, removed screw and plugged tire.	0.50	0.50
03-04-04	6,130	The battery box is loose.	Battery box fasteners tightened.	1.00	1.00
03-05-04	6,336	The left, rear inside tire is flat.	Leak found and hole plugged.	0.50	2.00
03-11-04	7,314	The transmission oil cooler is leaking at the seal.	Worn seal replaced and P-clips added for additional support.	0.50	8.00

UNSCHEDULED MAINTENANCE

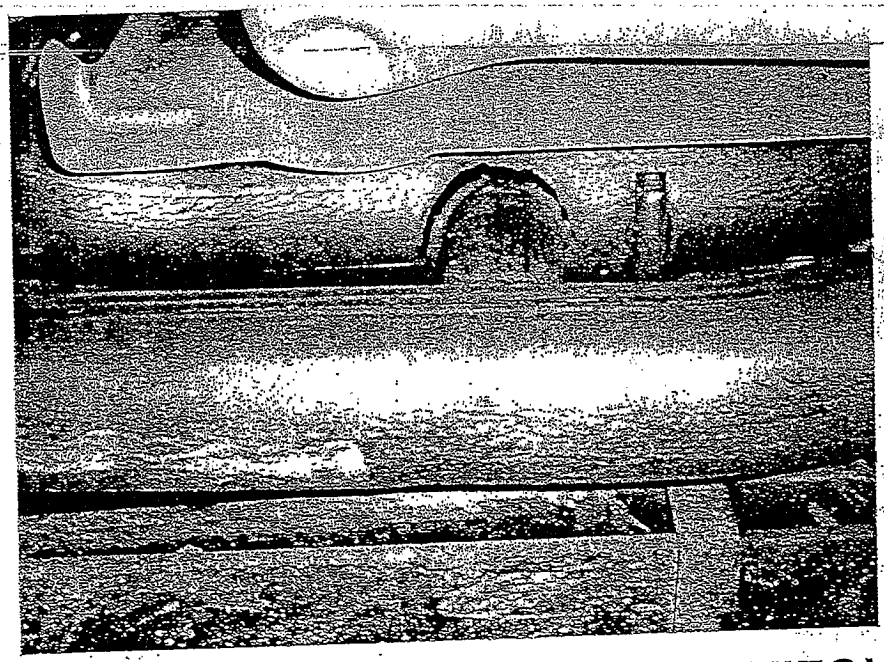
Glaval 0318

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
03-12-04	7,447	The left rear, spring beam bolt is not properly seated in hex hole.	Suspensions system removed, spring beam lowered and hex hold reworked. Suspension and spring beam installed.	4.00	8.00
03-22-04	8,849	The left low beam lamp is burned out.	Left low beam lamp replaced.	0.25	0.25
03-24-03	8,973	The rear sway bar, left side mounting bracket is broken.	Mounting bracket welded/repaired.	1.50	24.00
03-29-04	9,532	The transmission oil cooler seal is leaking.	Transmission oil cooler seal replaced.	0.50	8.00
04-02-04	10,414	The transmission oil cooler seal is leaking. Transmission oil cooler seal replaced.	Transmission oil cooler seal replaced.	0.50	2.00
04-02-04	10,414	The torque tube between the front springs is broken.	Broken tube replaced with used tube. New part ordered.	0.50	4.00

UNSCHEDULED MAINTENANCE

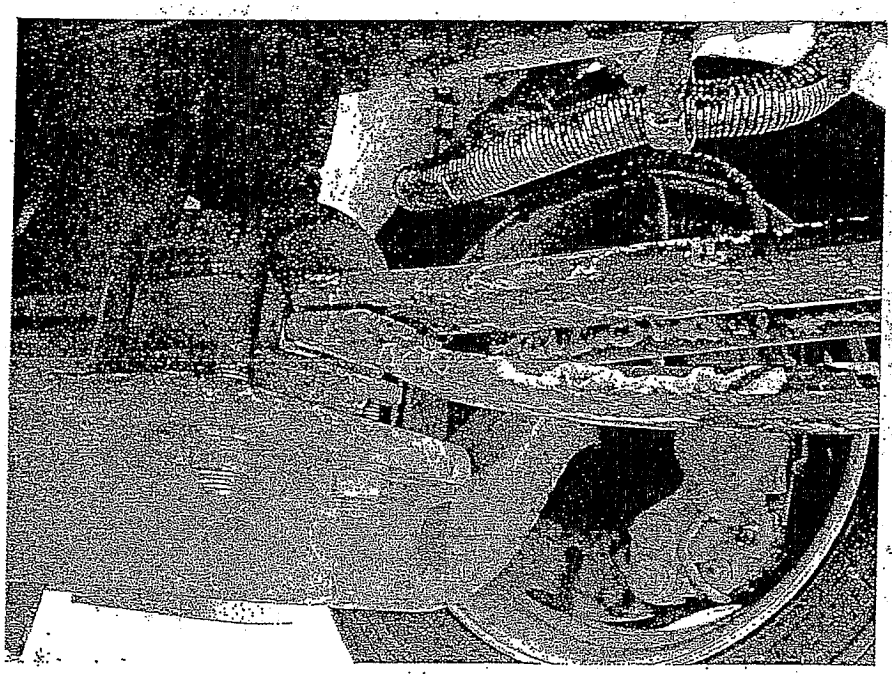


BROKEN LEFT FRONT SHOCK
(1,873 TEST MILES)

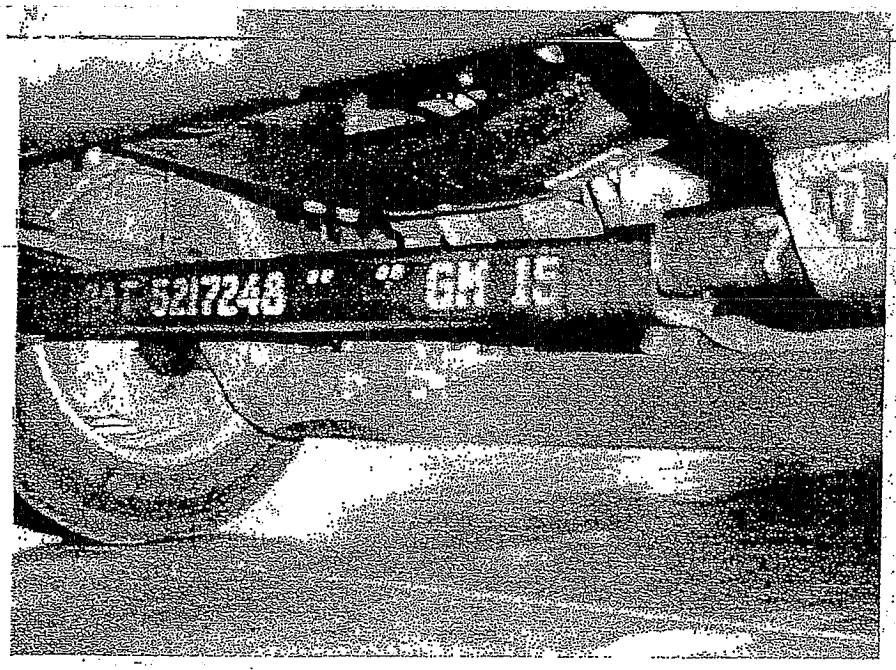


BROKEN WELD ON EXHAUST MANIFOLD
CROSSOVER PIPE
(2,958 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.



BROKEN PLY IN RIGHT REAR SPRING BEAM
(5,003 TEST MILES)



BROKEN RIGHT FRONT SPRING BEAM
(6,534 TEST MILES)

6. FUEL ECONOMY TEST - A FUEL CONSUMPTION TEST USING AN APPROPRIATE OPERATING CYCLE

6-I. TEST OBJECTIVE

The objective of this test is to provide accurate comparable fuel consumption data on transit buses produced by different manufacturers. This fuel economy test bears no relation to the calculations done by the Environmental Protection Agency (EPA) to determine levels for the Corporate Average Fuel Economy Program. EPA's calculations are based on tests conducted under laboratory conditions intended to simulate city and highway driving. This fuel economy test, as designated here, is a measurement of the fuel expended by a vehicle traveling a specified test loop under specified operating conditions. The results of this test will not represent actual mileage but will provide data that can be used by recipients to compare buses tested by this procedure.

6-II. TEST DESCRIPTION

This test requires operation of the bus over a course based on the Transit Coach Operating Duty Cycle (ADB Cycle) at seated load weight using a procedure based on the Fuel Economy Measurement Test (Engineering Type) For Trucks and Buses: SAE 1376 July 82. The procedure has been modified by elimination of the control vehicle and by modifications as described below. The inherent uncertainty and expense of utilizing a control vehicle over the operating life of the facility is impractical.

The fuel economy test will be performed as soon as possible (weather permitting) after the completion of the GVW portion of the structural durability test. It will be conducted on the bus test lane at the Penn State Test Facility. Signs are erected at carefully measured points which delineate the test course. A test run will comprise 3 CBD phases, 2 Arterial phases, and 1 Commuter phase. An electronic fuel measuring system will indicate the amount of fuel consumed during each phase of the test. The test runs will be repeated until there are at least two runs in both the clockwise and counterclockwise directions in which the fuel consumed for each run is within ± 4 percent of the average total fuel used over the 4 runs. A 20-minute idle consumption test is performed just prior to and immediately after the driven portion of the fuel economy test. The amount of fuel consumed while operating at normal/low idle is recorded on the Fuel Economy Data Form. This set of four valid runs along with idle consumption data comprise a valid test.

The test procedure is the ADB cycle with the following four modifications:

1. The ADB cycle is structured as a set number of miles in a fixed time in the following order: CBD, Arterial, CBD, Arterial, CBD, Commuter. A separate idle fuel consumption measurement is performed at the beginning and end of the fuel economy test. This phase sequence permits the reporting of fuel consumption for each of these phases separately, making the data more useful to bus manufacturers and transit properties.

2. The operating profile for testing purposes shall consist of simulated transit type service at seated load weight. The three test phases (figure 6-1) are: a central business district (CBD) phase of 2 miles with 7 stops per mile and a top speed of 20 mph; an arterial phase of 2 miles with 2 stops per mile and a top speed of 40 mph; and a commuter phase of 4 miles with 1 stop and a maximum speed of 40 mph. At each designated stop the bus will remain stationary for seven seconds. During this time, the passenger doors shall be opened and closed.

3. The individual ADB phases remain unaltered with the exception that 1 mile has been changed to 1 lap on the Penn State Test Track track. One lap is equal to 5,042 feet. This change is accommodated by adjusting the cruise distance and time.

4. The acceleration profile, for practical purposes and to achieve better repeatability, has been changed to "full throttle acceleration to cruise speed".

Several changes were made to the Fuel Economy Measurement Test (Engineering Type) For Trucks and Buses; SAE 1376 July 82:

1. Sections 1.1, and 1.2 only apply to diesel, gasoline, methanol, and any other fuel in the liquid state (excluding cryogenic fuels).

1.1 SAE 1376 July 82 requires the use of at least a 16-gal fuel tank. Such a fuel tank when full would weigh approximately 160 lb. It is judged that a 12-gal tank weighing approximately 120 lb will be sufficient for this test and much easier for the technician and test personnel to handle.

1.2 SAE 1376 July 82 mentions the use of a mechanical scale or a flowmeter system. This test procedure uses a load cell readout combination that provides an accuracy of 0.5 percent in weight and permits on-board weighing of the gravimetric tanks at the end of each phase. This modification permits the determination of a fuel economy value for each phase as well as the overall cycle.

2. Section 2.1 applies to compressed natural gas (CNG), liquified natural gas (LNG), cryogenic fuels, and other fuels in the vapor state.

2.1 A laminar type flowmeter will be used to determine the fuel consumption. The pressure and temperature across the flow element will be monitored by the flow computer. The flow computer will use this data to calculate the gas flow rate. The flow computer will also display the flow rate (scfm) as well as the total fuel used (scf). The total fuel used (scf) for each phase will be recorded on the Fuel Economy Data Form.

3. Use both Sections 1 and 2 for dual fuel systems.

FUEL ECONOMY CALCULATION PROCEDURE

A. For diesel, gasoline, methanol and fuels in the liquid state.

The reported fuel economy is based on the following: measured test quantities--distance traveled (miles) and fuel consumed (pounds); standard reference values--density of water at 60°F (8.3373 lbs/gal) and volumetric heating value of standard fuel; and test fuel specific gravity (unitless) and volumetric heating value (BTU/gal). These combine to give a fuel economy in miles per gallon (mpg) which is corrected to a standard gallon of fuel referenced to water at 60°F. This eliminates fluctuations in fuel economy due to fluctuations in fuel quality. This calculation has been programmed into a computer and the data processing is performed automatically.

The fuel economy correction consists of three steps:

1.) Divide the number of miles of the phase by the number of pounds of fuel consumed

phase	miles per phase	total miles per run
CBD	1.9097	5.7291
ART	1.9097	3.8193
COM	3.8193	3.8193

$$FEo_{mi/lb} = \text{Observed fuel economy} = \frac{\text{miles}}{\text{lb of fuel}}$$

2.) Convert the observed fuel economy to miles per gallon [mpg] by multiplying by the specific gravity of the test fuel Gs (referred to water) at 60°F and multiply by the density of water at 60°F

$$FEo_{mpg} = FEc_{ml/lb} \times Gs \times Gw$$

where **Gs** = Specific gravity of test fuel at 60°F (referred to water)
Gw = 8.3373 lb/gal

3.) Correct to a standard gallon of fuel by dividing by the volumetric heating value of the test fuel (H) and multiplying by the volumetric heating value of standard reference fuel (Q). Both heating values must have the same units.

$$FEc = FEo_{mpg} \times \frac{Q}{H}$$

where

H = Volumetric heating value of test fuel [BTU/gal]
Q = Volumetric heating value of standard reference fuel

Combining steps 1-3 yields

$$\Longrightarrow FEc = \frac{miles}{lbs} \times (Gs \times Gw) \times \frac{Q}{H}$$

4.) Covert the fuel economy from mpg to an energy equivalent of miles per BTU. Since the number would be extremely small in magnitude, the energy equivalent will be represented as miles/BTUx10^6.

Eq = Energy equivalent of converting mpg to mile/BTUx10^6.

$$Eq = ((mpg)/(H))\times 10^6$$

B. CNG, LNG, cryogenic and other fuels in the vapor state.

The reported fuel economy is based on the following: measured test quantities--distance traveled (miles) and fuel consumed (scf); density of test fuel, and volumetric heating value (BTU/lb) of test fuel at standard conditions (P=14.73 psia and T=60 °F).

These combine to give a fuel economy in miles per lb. The energy equivalent (mile/BTUx10^6) will also be provided so that the results can be compared to buses that use other fuels.

1.) Divide the number of miles of the phase by the number of standard cubic feet (scf) of fuel consumed.

phase	miles per phase	total miles per run
CBD	1.9097	5.7291
ART	1.9097	3.8193
COM	3.8193	3.8193

$$FEo_{mi/scf} = \text{Observed fuel economy} = \frac{\text{miles}}{\text{scf of fuel}}$$

2.) Convert the observed fuel economy to miles per lb by dividing FEo by the density of the test fuel at standard conditions (Lb/ft^3).

Note: The density of test fuel must be determined at standard conditions as described above. If the density is not defined at the above standard conditions, then a correction will be needed before the fuel economy can be calculated.

$$FEo_{mi/lb} = FEo / Gm$$

where Gm = Density of test fuel at standard conditions

3.) Convert the observed fuel economy (FEomi/lb) to an energy equivalent of (miles/BTUx10^6) by dividing the observed fuel economy (FEomi/lb) by the heating value of the test fuel at standard conditions.

$$Eq = ((FEomi/lb)/H)x10^6$$

where

Eq = Energy equivalent of miles/lb to mile/BTUx10^6
H = Volumetric heating value of test fuel at standard conditions

6-III. DISCUSSION

This is a comparative test of fuel economy using gasoline fuel with a heating value of 20,025.0 btu/lb. The driving cycle consists of Central Business District (CBD), Arterial (ART), and Commuter (COM) phases as described in 6-II. The fuel consumption for each driving cycle and for idle is measured separately. The results are corrected to a reference fuel with a volumetric heating value of 127,700.0 btu/gal.

An extensive pretest maintenance check is made including the replacement of all lubrication fluids. The details of the pretest maintenance are given in the first three Pretest Maintenance Forms. The fourth sheet shows the Pretest Inspection. The next sheet shows the correction calculation for the test fuel. The next four Fuel Economy Forms provide the data from the four test runs. Finally, the summary sheet provides the average fuel consumption. The overall average is based on total fuel and total mileage for each phase. The overall average fuel consumption values were; CBD – 4.23 mpg, ART – 5.19 mpg, and COM – 8.14 mpg. Average fuel consumption at idle was 4.29 lb/hr (0.68 gph).

FUEL ECONOMY PRE-TEST MAINTENANCE FORM

Bus Number: 0318	Date: 3-12-04	SLW (lbs): 19,425
Personnel: S.C. & T.S.		

FUEL SYSTEM	OK	Date	Initials
Install fuel measurement system	✓	3/12/04	S.C.
Replace fuel filter	✓	3/12/04	S.C.
Check for fuel leaks	✓	3/12/04	S.C.
Specify fuel type (refer to fuel analysis)	Gasoline		
Remarks: None			

BRAKES/TIRES	OK	Date	Initials
Inspect hoses	✓	3/12/04	S.C.
Inspect brakes	✓	3/12/04	S.C.
Relube wheel bearings	✓	3/12/04	T.S.
Check tire inflation pressures (mfg. specs.)	✓	3/12/04	T.S.
Remarks: None			

COOLING SYSTEM	OK	Date	Initials
Check hoses and connections	✓	3/12/04	S.C.
Check system for coolant leaks	✓	3/12/04	S.C.
Remarks: None			

FUEL ECONOMY PRE-TEST MAINTENANCE FORM (page 2)

Bus Number: 0318	Date: 3-12-04
Personnel: S.C. & T.S.	

ELECTRICAL SYSTEMS	OK	Date	Initials
Check battery	✓	3/12/04	S.C.
Inspect wiring	✓	3/12/04	S.C.
Inspect terminals	✓	3/12/04	S.C.
Check lighting	✓	3/12/04	S.C.
Remarks: None			

DRIVE SYSTEM	OK	Date	Initials
Drain transmission fluid	✓	3/12/04	T.S.
Replace filter/gasket	✓	3/12/04	T.S.
Check hoses and connections	✓	3/12/04	T.S.
Replace transmission fluid	✓	3/12/04	T.S.
Check for fluid leaks	✓	3/12/04	T.S.
Remarks: None			

LUBRICATION	OK	Date	Initials
Drain crankcase oil	✓	3/12/04	T.S.
Replace filters	✓	3/12/04	T.S.
Replace crankcase oil	✓	3/12/04	T.S.
Check for oil leaks	✓	3/12/04	T.S.
Check oil level	✓	3/12/04	T.S.
Lube all chassis grease fittings	✓	3/12/04	T.S.
Lube universal joints	✓	3/12/04	T.S.
Replace differential lube including axles	✓	3/12/04	T.S.
Remarks: None			

FUEL ECONOMY PRE-TEST MAINTENANCE FORM (page 3)

Bus Number: 0318	Date: 3-12-04
Personnel: S.C. & T.S.	

EXHAUST/EMISSION SYSTEM	OK	Date	Initials
Check for exhaust leaks	✓	3/12/04	S.C.
Remarks: None			

ENGINE	OK	Date	Initials
Replace air filter	✓	3/12/04	T.S.
Inspect air compressor and air system	N/A	3/12/04	T.S.
Inspect vacuum system, if applicable	✓	3/12/04	T.S.
Check and adjust all drive belts	✓	3/12/04	T.S.
Check cold start assist, if applicable	N/A	3/12/04	T.S.
Remarks: None			

STEERING SYSTEM	OK	Date	Initials
Check power steering hoses and connectors	✓	3/12/04	T.S.
Service fluid level	✓	3/12/04	T.S.
Check power steering operation	✓	3/12/04	T.S.
Remarks: None			

	OK	Date	Initials
Ballast bus to seated load weight	✓	3/12/04	S.C.

TEST DRIVE	OK	Date	Initials
Check brake operation	✓	3/12/04	S.C.
Check transmission operation	✓	3/12/04	S.C.
Remarks: None			

FUEL ECONOMY PRE-TEST INSPECTION FORM

Bus Number: 0318	Date: 4-21-04
Personnel: S.C.	

PRE WARM-UP	If OK, Initial
Fuel Economy Pre-Test Maintenance Form is complete	S.C.
Cold tire pressure (psi): Front 95 Middle N/A Rear 95	S.C.
Tire wear:	S.C.
Engine oil level	S.C.
Engine coolant level	S.C.
Interior and exterior lights on, evaporator fan on	S.C.
Fuel economy instrumentation installed and working properly.	S.C.
Fuel line -- no leaks or kinks	S.C.
Speed measuring system installed on bus. Speed indicator installed in front of bus and accessible to TECH and Driver.	S.C.
Bus is loaded to SLW	S.C.
WARM-UP	**If OK, Initial**
Bus driven for at least one hour warm-up	S.C.
No extensive or black smoke from exhaust	S.C.
POST WARM-UP	**If OK, Initial**
Warm tire pressure (psi): Front 96 Middle N/A Rear 98	S.C.
Environmental conditions Average wind speed <12 mph and maximum gusts <15 mph Ambient temperature between 30°(-1°) and 90°F(32°C) Track surface is dry Track is free of extraneous material and clear of interfering traffic	S.C.

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 0318	Manufacturer: Glaval	Date: 4-21-04
Run Number: 1	Personnel: G.M., T.S. & S.C.	
Test Direction: □CW or ■CCW	Temperature (°F): 70	Humidity (%): 52
SLW (lbs): 19,425	Wind Speed (mph) & Direction: 10 / S	Barometric Pressure (in.Hg): 29.91

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	8:45	8:45	27.5	0	2.85	2.85
ART #1	0	4:04	4:04	28.5	0	2.32	2.32
CBD #2	0	8:36	8:36	28.5	0	2.88	2.88
ART #2	0	4:06	4:06	29.0	0	2.34	2.34
CBD #3	0	8:43	8:43	29.0	0	2.89	2.89
COMMUTER	0	6:16	6:16	29.5	0	2.98	2.98
							Total Fuel = 16.26 lbs

20 minute idle : Total Fuel Used = 1.44 lbs

Heating Value = 20,025.0 BTU/LB

Comments: None

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 0318	Manufacturer: Glaval	Date: 4-21-04
Run Number: 2	Personnel: G.M., T.S. & S.C.	
Test Direction: ■CW or □CCW	Temperature (°F): 70	Humidity (%): 52
SLW (lbs): 19,425	Wind Speed (mph) & Direction: 10 / S	Barometric Pressure (in.Hg): 29.91

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	8:42	8:42	29.0	0	2.77	2.77
ART #1	0	4:11	4:11	29.0	0	2.25	2.25
CBD #2	0	8:44	8:44	29.0	0	2.78	2.78
ART #2	0	4:12	4:12	29.5	0	2.28	2.28
CBD #3	0	8:34	8:34	29.5	0	2.84	2.84
COMMUTER	0	6:17	6:17	31.0	0	2.91	2.91
							Total Fuel = 15.83 lbs

20 minute idle : Total Fuel Used = N/A lbs

Heating Value = 20,025.0 BTU/LB

Comments: None

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 0318	Manufacturer: Glaval	Date: 4-21-04
Run Number: 3	Personnel: G.M., T.S. & S.C.	
Test Direction: ☐CW or ■CCW	Temperature (°F): 72	Humidity (%): 52
SLW (lbs): 19,425	Wind Speed (mph) & Direction: 10 / S	Barometric Pressure (in.Hg): 29.91

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	8:35	8:35	35.0	0	2.87	2.87
ART #1	0	4:05	4:05	34.5	0	2.36	2.36
CBD #2	0	8:43	8:43	27.5	0	2.92	2.92
ART #2	0	4:09	4:09	27.5	0	2.34	2.34
CBD #3	0	8:48	8:48	34.0	0	2.87	2.87
COMMUTER	0	6:16	6:16	33.5	0	2.99	2.99
							Total Fuel = 16.35 lbs

20 minute idle : Total Fuel Used = N/A lbs

Heating Value = 20,025.0 BTU/LB

Comments: None

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 0318	Manufacturer: Glaval	Date: 4-21-04
Run Number: 4	Personnel: G.M., T.S. & S.C.	
Test Direction: ■CW or □CCW	Temperature (°F): 75	Humidity (%): 48
SLW (lbs): 19,425	Wind Speed (mph) & Direction: 8 / SW	Barometric Pressure (in.Hg): 29.91

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	8:52	8:52	27.5	0	2.83	2.83
ART #1	0	4:03	4:03	30.0	0	2.42	2.42
CBD #2	0	8:45	8:45	30.5	0	2.90	2.90
ART #2	0	4:09	4:09	31.5	0	2.33	2.33
CBD #3	0	8:50	8:50	30.5	0	2.87	2.87
COMMUTER	0	6:15	6:15	31.0	0	3.00	3.00
							Total Fuel = 16.35 lbs

20 minute idle : Total Fuel Used = 1.42 lbs

Heating Value = 20,025.0 BTU/LB

Comments: None

0318.FUL
FUEL ECONOMY SUMMARY SHEET

BUS MANUFACTURER : Glaval
BUS MODEL : Titan

BUS NUMBER : 0318
TEST DATE : 4/21/04

FUEL TYPE : GASOLINE
SP. GRAVITY : .7512
HEATING VALUE : 20025.00 BTU/Lb
Standard Conditions : 60 deg F and 14.7 psi
Density of Water : 8.3373 lb/gallon at 60 deg F

CYCLE	TOTAL FUEL USED (Lb)	TOTAL MILES	FUEL ECONOMY M/Lb (Measured)	FUEL ECONOMY MPG (Corrected)
Run # : 1, CCW				
CBD	8.62	5.73	.66	4.21
ART	4.66	3.82	.82	5.19
COM	2.98	3.82	1.28	8.11
TOTAL	16.26	13.37	.82	5.20
Run # : 2, CW				
CBD	8.39	5.73	.68	4.32
ART	4.53	3.82	.84	5.34
COM	2.91	3.82	1.31	8.31
TOTAL	15.83	13.37	.84	5.34
Run # : 3, CCW				
CBD	8.66	5.73	.66	4.19
ART	4.70	3.82	.81	5.14
COM	2.99	3.82	1.28	8.08
TOTAL	16.35	13.37	.82	5.17
Run # : 4, CW				
CBD	8.60	5.73	.67	4.22
ART	4.75	3.82	.80	5.09
COM	3.00	3.82	1.27	8.06
TOTAL	16.35	13.37	.82	5.17

IDLE CONSUMPTION

First 20 Minutes Data : 1.44 Lb Last 20 Minutes Data : 1.42 Lb
Average Idle Consumption : 4.29 Lb/Hr

RUN CONSISTENCY: % Difference from overall average of total fuel used

Run 1 : -.4 Run 2 : 2.3 Run 3 : -.9 Run 4 : -.9

SUMMARY

Average Idle Consumption	.68	G/Hr
Average CBD Phase Consumption	4.23	MPG
Average Arterial Phase Consumption	5.19	MPG
Average Commuter Phase Consumption	8.14	MPG
Overall Average Fuel Consumption	5.22	MPG
Overall Average Fuel Consumption	41.65	Miles/ Million BTU

7. NOISE

7.1 INTERIOR NOISE AND VIBRATION TESTS

7.1-I. TEST OBJECTIVE

The objective of these tests is to measure and record interior noise levels and check for audible vibration under various operating conditions.

7.1-II. TEST DESCRIPTION

During this series of tests, the interior noise level will be measured at several locations with the bus operating under the following three conditions:

1. With the bus stationary, a white noise generating system shall provide a uniform sound pressure level equal to 80 dB(A) on the left, exterior side of the bus. The engine and all accessories will be switched off and all openings including doors and windows will be closed. This test will be performed at the ABTC.

2. The bus accelerating at full throttle from a standing start to 35 mph on a level pavement. All openings will be closed and all accessories will be operating during the test. This test will be performed on the track at the Test Track Facility.

3. The bus will be operated at various speeds from 0 to 55 mph with and without the air conditioning and accessories on. Any audible vibration or rattles will be noted. This test will be performed on the test segment between the Test Track and the Bus Testing Center.

All tests will be performed in an area free from extraneous sound-making sources or reflecting surfaces. The ambient sound level as well as the surrounding weather conditions will be recorded in the test data.

7.1-III. DISCUSSION

This test is performed in three parts. The first part exposes the exterior of the vehicle to 80.0 dB(A) on the left side of the bus and the noise transmitted to the interior is measured. The overall average of the six measurements was 47.3 dB(A); ranging from 45.5 dB(A) at the driver's seat to 48.4 dB(A) at the front passenger seats. The interior ambient noise level for this test was 35.4 dB(A).

The second test measures interior noise during acceleration from 0 to 35 mph. This noise level ranged from 68.5 dB(A) at the middle passenger seats to 72.3 dB(A) at the front passenger seats. The overall average was 70.5 dB(A). The interior ambient noise level for this test was 39.7 dB(A).

The third part of the test is to listen for resonant vibrations, rattles, and other noise sources while operating over the road. No vibrations or rattles were noted.

INTERIOR NOISE TEST DATA FORM
Test Condition 1: 80 dB(A) Stationary White Noise

Bus Number: 0318	Date: 9-10-03
Personnel: T.S. & S.C.	
Temperature (°F): 68	Humidity (%): 78
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.03	
Initial Sound Level Meter Calibration: ☒ checked by: S.C.	
Interior Ambient Noise Level dB(A): 35.4	Exterior Ambient Noise Level dB(A): 45.1
Microphone Height During Testing (in): 45.0	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	45.5
Front Passenger Seats	48.4
In Line with Front Speaker	45.8
In Line with Middle Speaker	48.3
In Line with Rear Speaker	47.9
Rear Passenger Seats	47.6

Final Sound Level Meter Calibration: ☒ checked by: S.C.

Comments: All readings taken in the center aisle.

INTERIOR NOISE TEST DATA FORM
Test Condition 2: 0 to 35 mph Acceleration Test

Bus Number: 0318	Date: 4-22-04
Personnel: G.M., T.S. & S.C.	
Temperature (°F): 79	Humidity (%): 25
Wind Speed (mph): 10	Wind Direction: SW
Barometric Pressure (in.Hg): 30.09	
Initial Sound Level Meter Calibration: ☒ checked by: S.C.	
Interior Ambient Noise Level dB(A): 39.7	Exterior Ambient Noise Level dB(A): 45.5
Microphone Height During Testing (in): 48.0	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	72.0
Front Passenger Seats	72.3
Middle Passenger Seats	69.6
Rear Passenger Seats	69.0

Final Sound Level Meter Calibration: ☒ checked by: S.C.

Comments: All readings taken in the center aisle.

INTERIOR NOISE TEST DATA FORM
Test Condition 3: Audible Vibration Test

Bus Number: 0318	Date: 4-22-04
Personnel: G.M., T.S. & S.C.	
Temperature (°F): 79	Humidity (%): 25
Wind Speed (mph): 10	Wind Direction: SW
Barometric Pressure (in.Hg): 30.09	

Describe the following possible sources of noise and give the relative location on the bus.

Source of Noise	Location
Engine and Accessories	None noted
Windows and Doors	None noted
Seats and Wheel Chair lifts	None noted

Comment on any other vibration or noise source which may have occurred
that is not described above:

7.1 INTERIOR NOISE TEST

TEST BUS SET-UP FOR 80 dB(A)
INTERIOR NOISE TEST

7.2 EXTERIOR NOISE TESTS

7.2-I. TEST OBJECTIVE

The objective of this test is to record exterior noise levels when a bus is operated under various conditions.

7.2-II. TEST DESCRIPTION

In the exterior noise tests, the bus will be operated at a SLW in three different conditions using a smooth, straight and level roadway:

1. Accelerating at full throttle from a constant speed at or below 35 mph and just prior to transmission upshift.
2. Accelerating at full throttle from standstill.
3. Stationary, with the engine at low idle, high idle, and wide open throttle.

In addition, the buses will be tested with and without the air conditioning and all accessories operating. The exterior noise levels will be recorded.

The test site is at the PSBRTF and the test procedures will be in accordance with SAE Standards SAE J366b, Exterior Sound Level for Heavy Trucks and Buses. The test site is an open space free of large reflecting surfaces. A noise meter placed at a specified location outside the bus will measure the noise level.

During the test, special attention should be paid to:

1. The test site characteristics regarding parked vehicles, signboards, buildings, or other sound-reflecting surfaces
2. Proper usage of all test equipment including set-up and calibration
3. The ambient sound level

7.2-III. DISCUSSION

The Exterior Noise Test determines the noise level generated by the vehicle under different driving conditions and at stationary low and high idle, with and without air conditioning and accessories operating. The test site is a large, level, bituminous paved area with no reflecting surfaces nearby.

With an exterior ambient noise level of 52.1 dB(A), the average test result obtained while accelerating from a constant speed was 77.3 dB(A) on the right side and 75.1 dB(A) on the left side.

When accelerating from a standstill with an exterior ambient noise level of 49.8 dB(A), the average of the results obtained were 74.0 dB(A) on the right side and 73.5 dB(A) on the left side.

With the vehicle stationary and the engine, accessories, and air conditioning on, the measurements averaged 56.0 dB(A) at low idle and 70.3 dB(A) at wide open throttle. With the accessories and air conditioning off, the readings averaged 2.3 dB(A) lower at low idle and 1.4 dB(A) lower at wide open throttle. The exterior ambient noise level measured during this test was 49.9 dB(A). Note; the test bus was not equipped with a high idle mode, therefore, data for that condition is not available.

EXTERIOR NOISE TEST DATA FORM
Accelerating from Constant Speed

Bus Number: 0318	Date: 4-22-04
Personnel: G.M., T.S. & S.C.	
Temperature (°F): 81	Humidity (%): 21
Wind Speed (mph): 10	Wind Direction: SW
Barometric Pressure (in.Hg): 30.06	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ☒ checked by: S.C.	
Initial Sound Level Meter Calibration: ☒ checked by: S.C.	
Exterior Ambient Noise Level dB(A): 52.1	

Accelerating from Constant Speed Curb (Right) Side		Accelerating from Constant Speed Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	76.7	1	72.5
2	77.4	2	75.4
3	76.1	3	74.7
4	75.8	4	73.8
5	77.1	5	74.1
Average of two highest actual noise levels = 77.3 dB(A)		Average of two highest actual noise levels = 75.1 dB(A)	

Final Sound Level Meter Calibration Check: ☒ checked by: S.C.
Comments: None

EXTERIOR NOISE TEST DATA FORM
Accelerating from Standstill

Bus Number: 0318	Date: 4-22-04
Personnel: G.M., T.S. & S.C.	
Temperature (°F): 81	Humidity (%): 21
Wind Speed (mph): 10	Wind Direction: SW
Barometric Pressure (in.Hg): 30.06	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ☒ checked by: S.C.	
Initial Sound Level Meter Calibration: ☒ checked by: S.C.	
Exterior Ambient Noise Level dB(A): 49.8	

Accelerating from Standstill Curb (Right) Side		Accelerating from Standstill Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	73.5	1	73.1
2	73.4	2	73.5
3	74.1	3	73.5
4	73.5	4	72.6
5	73.9	5	72.9
Average of two highest actual noise levels = 74.0 dB(A)		Average of two highest actual noise levels = 73.5 dB(A)	

Final Sound Level Meter Calibration Check: ☒ checked by: S.C.
Comments: None

EXTERIOR NOISE TEST DATA FORM
Stationary

Bus Number: 0318	Date: 4-22-04
Personnel: G.M., T.S. & S.C.	
Temperature (°F): 81	Humidity (%): 21
Wind Speed (mph): 10	Wind Direction: SW
Barometric Pressure (in.Hg): 30.06	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ☒ checked by: S.C.	
Initial Sound Level Meter Calibration: ☒ checked by: S.C.	
Exterior Ambient Noise Level dB(A): 49.9	

Accessories and Air Conditioning ON

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	550	56.0	55.9
High Idle	N/A	N/A	N/A
Wide Open Throttle	2,975	70.8	69.8

Accessories and Air Conditioning OFF

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	500	52.9	54.5
High Idle	N/A	N/A	N/A
Wide Open Throttle	3,000	69.5	68.3

Final Sound Level Meter Calibration Check: ☒ checked by: S.C.

Comments: None

7.2 EXTERIOR NOISE TEST

TEST BUS UNDERGOING
EXTERNAL NOISE TESTING