

A1.4: BUCKEYE/GSI-G70 FOR AMTRAK SUPERLINER II BI-LEVEL CAR

A1.4.1 Engineering Data

A1.4.1.1 Narrative Description of Truck Design

Truck Classification	32e
General Characteristics	This is an unpowered, rigid frame, outside journal bearing, equalizer beam design using a bolster with a center pin arrangement. Wheel alignment is provided by the pedestal guides for the journal bearing housings.
Frame	A cast steel H frame is used with a center hole and side bearing to accommodate the truck bolster.
Suspension System	
– Primary	The primary suspension is two coil spring packs between each equalizer and one side of the truck frame. Dampers are not used. Longitudinal and lateral wheelset restraint is provided by the pedestal guides.
– Secondary	The secondary suspension is two coil spring packs used between the truck bolster and the car underframe. At each side of the car a lateral shock absorber and a vertical shock absorber are connected between the end of the truck bolster and the car body for a total of four secondary shock absorbers per truck.
Propulsion System	N/A
Braking System	Two disks per axle plus one tread brake per wheel.

Exploded engineering and schematic drawings of this truck are provided in Figures A1.4.1 and A1.4.2.

**A1.4: BUCKEYE/GSI-G70 FOR AMTRAK SUPERLINER II BI-LEVEL CAR
(continued)**

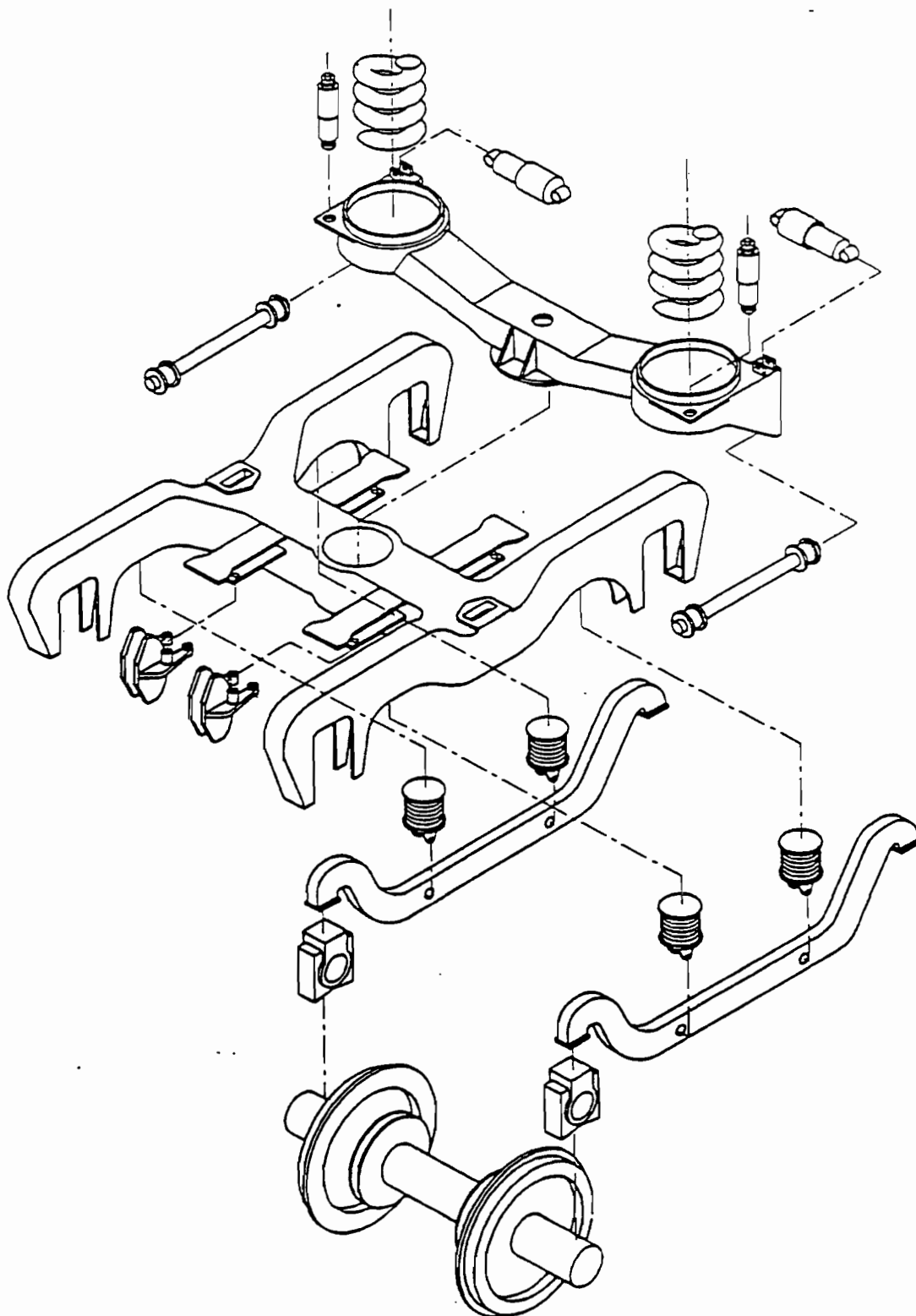


Figure A1.4.1 GSI Truck for Amtrak Superliner II - Exploded View

**A1.4: BUCKEYE/GSI-G70 FOR AMTRAK SUPERLINER II BI-LEVEL CAR
(continued)**

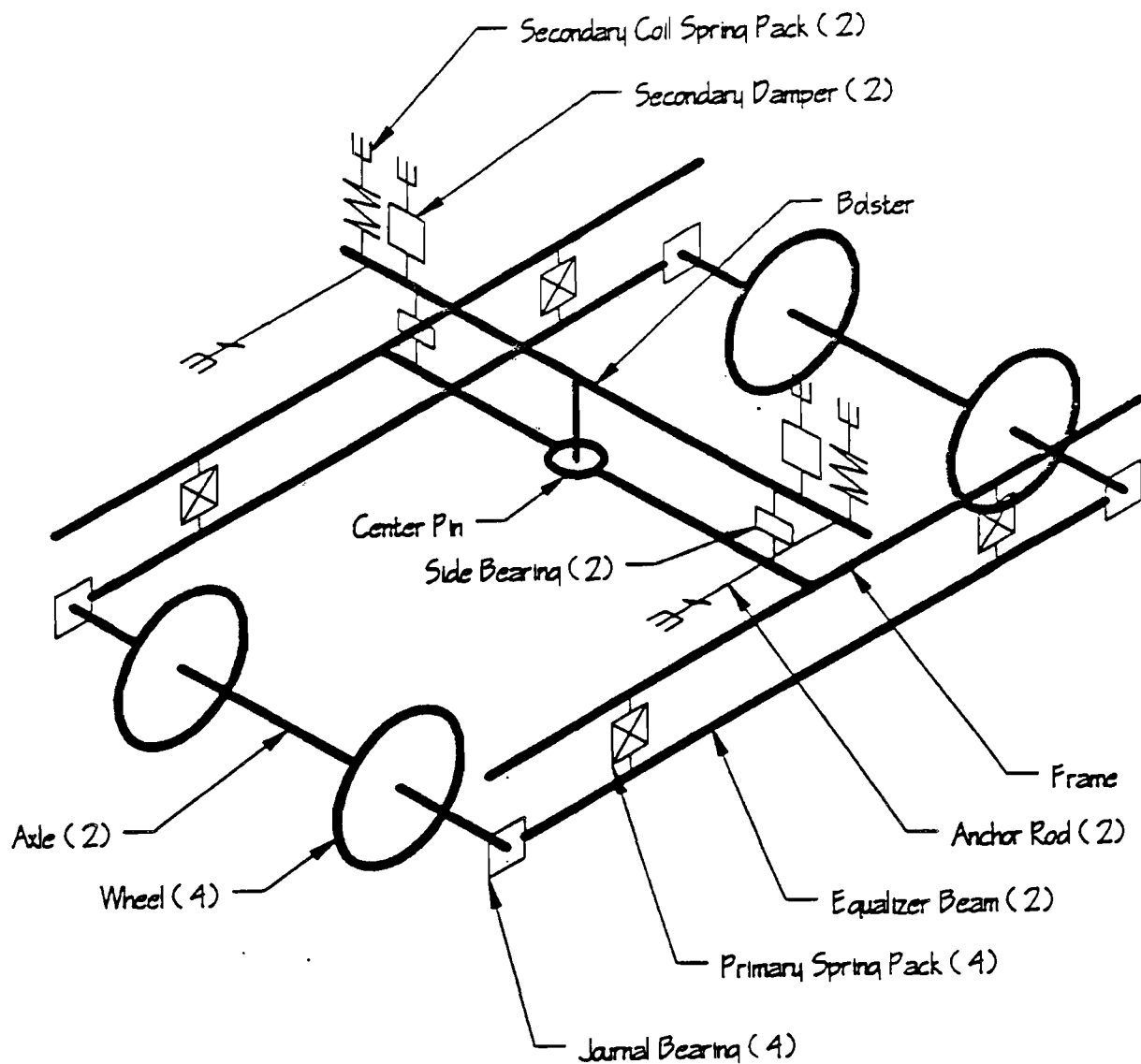


Figure A1.4.2 GSI Truck for Amtrak Superliner II - Schematic

**A1.4: BUCKEYE/GSI-G70 FOR AMTRAK SUPERLINER II BI-LEVEL CAR
(continued)**

A1.4.1.2 Basic Truck Data

Track Gauge	1435 mm (56.5 in)
Wheel Base	2591 mm (102 in)
Wheel Diameter	914 mm (36 in)
Bolster Bowl Diameter	Approximately 305 mm (12 in)
Truck Rotational Break Out Torque	Not Available
Design Load (Top of Bolster Bowl)	296 kN (66500 lb _f)
Total Truck Weight	Approximately 97.9 kN (22000 lb _f)
Brake Type	2 disk brakes per axle 1 tread brake per wheel
Motor	None
Gear Box	None

A1.4.1.3 Truck Center of Gravity, Mass and Moment of Inertia

Component Description	Number of Components	Mass of 1 Component kg (lb _f -sec ² /in)	Center of Gravity Location mm (in)			Moment of Inertia kg-m ² (lb _f -in-sec ²)		
			X	Y	Z	I _{xx}	I _{yy} *	I _{zz}
Wheel & Axle Set	2	1940.0 (11.0)	1295.4 (51.00)	0.0	456.2 (18.00)	944 (8330)	0.13 (116)	944 (8330)
Truck Frame	1	2223.2 (12.69)	0.0	0.0	708.4 (27.89)	15.3 (13520)	12.6 (11182)	26.9 (23794)
Bolster	1	907.5 (5.18)	0.0	0.0	673.1 (26.5)	4.97 (4396)	0.28 (249)	5.13 (4542)
Equalizer Bar	2 outside 2 inside	192.7 (1.1) 192.7 (1.1)	0.0 0.0	1127.8 (44.4) 967.7 (38.1)	376.9 (14.84) 376.9 (14.84)	0.09 (78)	1.15 (1016)	1.06 (939)
Motor	---	---	---	---	---	---	---	---
Gear Box	---	---	---	---	---	---	---	---
Tread Brake Unit	4	67.9 (0.39)	***	***	***	***	***	***
Disk Brakes/ Brackets	4	192.7 (2.2)	***	***	***	***	***	***
Primary Spring	4	85.0 (0.485)	***	***	***	***	***	***
Secondary Vertical Damper	2	34.2 (0.195)	***	***	***	***	***	***
Secondary Lateral Damper	2	81.5 (0.465)	***	***	***	***	***	***
Anchor Rod	2	51.7 (0.295)	***	***	***	***	***	***
Coil Spring Assy Pack.	2	51.7 (0.295)	***	***	***	***	***	***

--- Not applicable to this truck, or value not relevant

* Non-rotating components only for wheel and axle set.

*** Value required, but not available or estimated

A1.4.1.4 Truck Suspension Parameters

A1.4.1.4.1 Primary Suspension

Component	Stiffness N/mm (lb/in)			Damping Rates N sec/mm(lb _f sec/in)			Clearance and Travel Tolerances mm (in)		
	Longi- tudinal	Lateral	Vertical	Longi- tudinal	Lateral	Vertical	Longi- tudinal	Lateral	Vertical
Individual Springs									
- Inside	---	---	---	---	---	---	---	---	---
- Outside	---	---	---	---	---	---	---	---	---
Double Coil Spring Set	---	---	---	---	---				
Total	***	***	1795 (10244) per Journal	---	---	---	***	***	***

--- Not applicable to this truck, or value not relevant

*** Value required, but not available or estimated

A1.4.1.4.2 Secondary Suspension

Component	Stiffness N/mm(lb _f /in.)			Damping Rates N sec/mm(lb _f sec/in.)		
	Longitudinal	Lateral	Vertical	Longitudinal	Lateral	Vertical
Coil Spring	---	656 (3744)	***	---	---	---
Lateral Bumper (Bolster/Car)	---	***	---	---	---	---
Vertical Shock Absorber	---	---	---	---	---	***(†)
Lateral Shock Absorber	---	---	---	---	***(††)	---
Center Pivot	---	---	---	---	---	---
Anchor Assembly	***	---	---	---	---	---

Component	Clearance & Travel Tolerances mm(in.)			Torque or Friction Force		
	Longitudinal	Lateral	Vertical	Longitudinal	Lateral	Vertical
Coil Spring	---	---	***	---	---	---
Lateral Bumper (Bolster/Car)	---	12.7 (0.5)	---	---	---	---
Vertical Shock Absorber	---	---	***	---	---	---
Lateral Shock Absorber	---	***	---	---	---	---
Center Pivot	---	---	---	*** (Friction torque about vertical axis)		
Anchor Assembly	***	---	---	---	---	---

† Two Monroe 70148 450/truck

†† Two Monroe 70147 600/truck

--- Not applicable to this truck, or value not relevant

*** Value required, but not available or estimated

A1.4: BUCKEYE/GSI-G70 FOR AMTRAK SUPERLINER II BI-LEVEL CAR
(continued)

A1.4: BUCKEYE/GSI-G70 FOR AMTRAK SUPERLINER II BI-LEVEL CAR (continued)

A1.4.1.5 Narrative Description of Load Path

A1.4.1.5.1 Longitudinal

The longitudinal load path beginning at the car body bolster anchor rod supports goes through the anchor rods, then to the outer position of the truck bolster, then to the center pin location of the truck frame, then to the pedestal liners to the journal bearing housing.

A1.4.1.5.2 Lateral

The lateral load path beginning at the car body to secondary springs interface then goes to the truck bolster, to the frame center pin, to the frame, to the equalizer springs, to the equalizer and then to the journal bearing housing. Pedestal limits lateral movement between wheelset journal and truck frame.

A1.4.1.5.3 Vertical

The vertical load path beginning at the car body to secondary spring interface goes through the secondary springs to the truck bolster, then to the side bearings and through to the frame, then to the primary equalizer springs, then to the equalizer and then to the journal bearing housing.

A1.4.1.6 Wheel Profile

1/20 wheel conicity.

**A1.4: BUCKEYE/GSI-G70 FOR AMTRAK SUPERLINER II BI-LEVEL CAR
(continued)**

A1.4.2 Operating Environment and Operating Experience Data

A1.4.2.1 Background Information/Car Series

Operator	Amtrak
Type of Car	Long distance intercity car (transcontinental services)
Name of Car Series	Superliner II
Number in Service	128
Date(s) put into Service	1993-95
Manufacturer of Car	Bombardier
Type of Truck (Volpe/ADL Designation)	32e
Truck Manufacture and Model	GSI Arrangement G36500

A1.4.2.2 Operating and Route Data

Superliner II cars fitted with the GSI G70 outside frame truck are primarily used on Amtrak's long-distance western routes between the mid-west and west coast destinations. Most operations are limited to 79 mph by the lack of automatic train-control (ATC), but speeds of 90-100 mph are attained in some locations where train control is available.

Train Lengths Operated	Up to 20 cars, including Superliner bi-level and single-level equipment.
Braking Patterns (Friction/Dynamic)	Friction braking on train. Dynamic braking on locomotive for speed control. Long distance service with widely-spaced stops, typically 1-3 hours apart. Many routes have long downgrades where locomotive dynamic brakes are used with the train friction brakes to hold safe speed.

A1.4: BUCKEYE/GSI-G70 FOR AMTRAK SUPERLINER II BI-LEVEL CAR (continued)

A1.4.2.3 Track System Data

FRA Track Class

- | | |
|--------------------|-----------------------------|
| - Main | Class 4 or 5 on most routes |
| - Sidings and Yard | Class 1 or 2 |

Approximate Percentage of Welded & Jointed Rail

Variable mix of welded and jointed rail

Rail-Tie Fastener System

Principally cut spikes on wood ties

Curvature Data

- | | |
|---|--|
| - Average/Typical
Curvature on Main
Track | Typically in the range 1-4° |
| - Maximum Curvature on
Track | 10° on main line |
| - Approximate Percentage
of Curved and Tangent
Main Track | Highly variable by route, especially between
plains and mountains |
| - Typical Spiral Length
Relative to AREA
Recommendations | Variable |
| - Typical Curve Radius
in Yard and Siding
Tracks | Down to 76 m (250 ft) |
| - Minimum Curve Radius
in Yards and Sidings | 76 m (250 ft) |
| - Typical Turnout Size
(AREA Number) | |
| Main line | AREA Nos. 8, 10 and above |
| Yard | AREA No. 6 |

**A1.4: BUCKEYE/GSI-G70 FOR AMTRAK SUPERLINER II BI-LEVEL CAR
(continued)**

A1.4.2.4 Maintenance and Service Experience

Regular Servicing and Inspection Schedules	Routine servicing done for wheels, brakes, shims, lubrication, etc.
Rationale for Maintenance Schedules	Expect excellent service life with six year overhaul period to be established by FRA rules for friction brake system.
Average or Typical Intervals (time or miles) Between Maintenance Action or Component Replacement	Overhaul expected at about one million miles.
Information on any Unusual Problems with Truck	None. This design is based on similar designs used on earlier single-level Amtrak cars.
Information on the Maintainability of the Truck	Maintenance is routine as it is the same as that required for other similar GSI or Buckeye designs.
Information on the Operator's Experience with the Truck	Good experience on Superliner II with very minimum wear shown.

A1.4: BUCKEYE/GSI-G70 FOR AMTRAK SUPERLINER II BI-LEVEL CAR (continued)

A1.4.3. Engineering Data on Railroad Passenger Cars and Car-Truck Interface

A1.4.3.1 General Description of Car

The Rockwell G70 outside frame truck is applied to Amtrak's Superliner II bi-level long-distance cars. The cars have a full length upper level and a shorter lower level between the trucks. Miscellaneous equipment such as braking, HVAC and toilet systems are housed in the space above the trucks and below the upper level. The cars are being built over the period 1993-1995, for use in long-distance services in the western part of the U.S., and between Washington DC and Florida. The G70 outside frame truck is also applied to the Horizon and Viewliner series of Amtrak single-level cars, and to bi-level cars being purchased by the California Department of Transportation.

A1.4.3.2 Car and Body Data

Overall Dimensions

Car Length (over coupler faces)	25.91 m (85.0 ft)
Width	3.10 m (10.2 ft)
Height (from top of rail)	4.92 m (16.1 ft)

Truck Center Spacing

18.14 m (59.5 ft)

Car Weight

Ready to Run	672 to 719 kN (151000 to 161500 lb _f)
With Maximum Load	719 to 757 kN (161500 to 170200 lb _f)

Note: the weight range covers the different versions of this car: sleepers, diners and coach cars.

Mass of Car Body

(without trucks) (ready to run) 48535-53298 kg (3323-3741 lb-sec²/ft)

Radius of gyration about center of gravity

Roll	2.00 m (6.7 ft) Est
Pitch	7.57 m (24.8 ft) Est
Yaw	7.57 m (24.8 ft) Est

Center of Gravity of Car Body (from top of rail)

2.20 m (7.5 ft) Est

Car Body Natural Frequency (first vertical bending mode)

8.0-8.5 Hz (Est)

A1.4: BUCKEYE/GSI-G70 FOR AMTRAK SUPERLINER II BI-LEVEL CAR (continued)

A1.4.3.3 Car Body to Truck Interface

The car body rests on two steel coil springs at each truck which rest on the truck bolster. The longitudinal connection between the truck and the car body is via two laterally spaced longitudinal anchor rods between the car body and the truck bolster. Secondary vertical dampers are provided in parallel with the cant springs.

Specific dimensions are as follows:

Lateral spacing of coil spring	2.18 m (7.17 ft)
Lateral spacing of anchor rods	2.72 m (8.92 ft)
Height of anchor rods above top of rail	0.48 m (1.58 ft)