APPENDIX 6

Design Data for Electric Multiple Units (EMU)

- M-7 Long Island Railroad
- Montreal EMU
- Gallery Car
Under joint agreement to the Metropolitan Transportation Authority / Long Island Rail Road (LIRR) and the Metro-North Railroad (MNR), Bombardier Transportation is providing Electric Multiple Unit (EMU) M-7 commuter cars to LIRR to begin replacement of its Metropolitan M-1 commuter car fleet.

Chartered in 1834, the Long Island Rail Road is the largest Commuter Rail system in North America.

Bombardier's new Electric Multiple Units, its first railcar contract for the LIRR, will service the Long Island commuter lines, constituting 80% of the system. The interior of the LIRR "Car of the Future" was designed with the input of the passenger and employees and includes an ADA compliant toilet, cellula telephone and wide, single-leaf sliding doors for ease of entry and exit.

The units are equipped with Bombardier's renowned stainless steel car bodies for long life and low maintenance, and asynchronous AC motors featuring state-of-the-art IGBT (isolated gate bipolar transistors) inverters. Use of outboard-bearing bolsterless fabricated bogies offers considerable weight savings over cast bogies.
GENERAL DATA

type of vehicle: electric multiple unit
operator: Metropolitan Transportation Authority
Long Island Railroad

order date: May 1999

train consist:
- 113 power cars without toilet
- 113 power cars with toilet
- up to 14 cars

DIMENSIONS AND WEIGHT

length over coupler: 25,908 mm (85'0")
width over side sheets: 3,200 mm (10'6")
rail to roof height: 3,950 mm (12'11 1/2")
rail to top of floor height: 1,295 mm (51")
rail to top of height: 4,039 mm (13'3")
doorway width: 1,270 mm (50")
doorway height: 1,981 mm (6'6")
floor to high ceiling height: 2,261 mm (79")
floor to low ceiling height: 2,007 mm (79")
wheel diameter: 914 mm (36")
track gauge: 2,591 mm (102")
track centre distance: 18,136 mm (59'6")
track gauge: 1,435 mm (4'8 1/2")
car weight (empty):
- power car without toilet: 58,200 kg (125,300 lb)
- power car with toilet: 56,835 kg (128,300 lb)

TECHNICAL CHARACTERISTICS

- power fed by third rail: 400-900 Vdc
- auxiliary voltages: 230 Vac / 3 ph / 60 Hz
- 72 Vdc
- AC traction motor: 265 hp (200 kW)
- dynamic and pneumatic (tread & disc) braking system
- coil spring primary suspension
- air-bag secondary suspension
- stainless steel carbody
- fabricated steel frame trucks
- automatic parking brake
- forced-air ventilation
- air-conditioning capacity of 18 tons
- electric strip heaters
- ADA compliant toilet room (B car)
- vacuum sewage system (B car)
- communication system with visual signs
- cellular telephone (B car)
- event recorder
- cab signal / ATC
- non-cab end: semi-permanent drawbar
- four single-leaf doors
- hinged-end doors
- on-board computer-controlled diagnostic system

PERFORMANCE AND CAPACITY

maximum service speed: 160 km/h (100 mph)
acceleration rate, initial (service): 0.9 m/s² (2.0 mphps)
braking rate (service): 1.3 m/s² (3.0 mphps)
braking rate, nominal (emergency): 1.4 m/s² (3.2 mphps)

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- France - Tel.: (33-3) 27 23 53 00 • Germany - Tel.: (49 30) 6793-0 • Mexico - Tel.: 52 (5) 209-67-00 • People's Republic of China - Tel.: 8610-8529-9100
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www.transportation.bombardier.com
An impressive result of Bombardier’s ongoing research and development activities, the Electric Multiple Units (EMUs) delivered to the Société de transport de la Communauté urbaine de Montréal feature technological advances that make them safe, reliable, high-performing and economical. Technical innovations and improvements include:

- A propulsion system that uses asynchronous alternating current motors – requiring less maintenance than direct current motors.
- Outboard bearing bogies which are considerably lighter than casted bogies and provide a smoother ride at higher speeds.
- Wide side doors at both high and low platform levels to allow quick loading/unloading and to eliminate the need for stepwell trap operation.

These modern units are in revenue service on the Montréal Deux-Montagnes commuter line.
**GENERAL DATA**

- **type of vehicle**: electric multiple unit
- **operator**: Société de transport de la Communauté urbaine de Montréal
- **date of order**: June 1992
- **quantity**: 29 power cars, 25 trailer cars, 4 trailer cars with cab
- **train consist**: up to five married pairs

**DIMENSIONS AND WEIGHT**

- **length over coupler**: 26,010 mm (85' 4"), imperial: 85' 4"
- **width over side sheets**: 3,200 mm (10' 6"), imperial: 10' 6"
- **rail to roof height**: 3,937 mm (12' 11"), imperial: 12' 11"
- **rail to top of floor height**: 1,295 mm (51"), imperial: 51"
- **doorway width (side centre doors)**: 1,270 mm (4' 2"), imperial: 4' 2"
- **doorway width (side end doors)**: 1,219 mm (4' 0"), imperial: 4' 0"
- **doorway height over first step (side end doors)**: 2,413 mm (7' 11"), imperial: 7' 11"
- **floor to ceiling height (high ceiling)**: 2,006 mm (6' 7"), imperial: 6' 7"
- **wheel diametre**: 864 mm (34"), imperial: 34"
- **truck wheel base**: 2,642 mm (8' 8"), imperial: 8' 8"
- **truck centre distance**: 18,136 mm (59' 6"), imperial: 59' 6"
- **track gauge**: 1,435 mm (4' 8 1/2"), imperial: 4' 8 1/2"
- **car weight (empty)**:
  - power car: 57,169 kg (126,000 lb)
  - trailer car: 44,465 kg (98,000 lb)
  - trailer car with cab: 45,372 kg (100,000 lb)
- **dynamic and pneumatic (tread) braking system**
- **coil springs primary suspension**
- **air-bag secondary suspension**
- **stainless steel carbody**
- **fabricated steel frame trucks**
- **manual parking brake**
- **forced-air ventilation (trailer car and cab)**
- **air-conditioning capacity of 13 tons**
- **electric strip heaters**
- **type H tightlock coupler**
- **sliding side centre doors**
- **swing plug side end doors**
- **1 hinged end door (A end car with cab)**
- **on-board computer-controlled diagnostic for propulsion and braking systems**

**TECHNICAL CHARACTERISTICS**

- Power fed by catenary 25 kV / 1 ph / 60 Hz
- Auxiliary voltage 700 Vac / 1 ph / 60 Hz
- 480 Vac / 3ph 60 Hz - 120 Vac / 60 Hz - 37.5 Vdc
- AC traction motor 380 hp (continuous rating)

**PERFORMANCE AND CAPACITY**

- **maximum design speed**: 120 km/h (75 mph)
- **maximum service speed**: 109 km/h (68 mph)
- **acceleration rate, initial (service)**: 2.4 km/h/s, 1.5 mph/s
- **braking rate (service)**: 3.2 km/h/s, 2.0 mph/s
- **braking rate, nominal (emergency)**: 4 km/h/s, 2.5 mph/s
- **buff load**: 3,558 kN, 800,000 lb
- **wheelchair locations**:
  - power car: 2
  - trailer car with cab: 2
- **double bicycle racks (summer)**:
  - trailer car: 2
- **passengers per car (seated)**:
  - power car: 88
  - trailer car: 88
  - trailer car with cab: 88
- **passengers per car (standing)**:
  - crush load: 126

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www.transformation.bombardier.com
SELF PROPELLED GALLERY CAR

Operated by the Illinois Central Gulf Railroad

Bombardier Inc.
Transportation Equipment Group
SPECIFICATIONS

Type of Vehicle: Self-propelled gallery car
Operator: Illinois Central Gulf Railroad

DIMENSIONS

<table>
<thead>
<tr>
<th>Metric</th>
<th>Imperial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length, over coupler faces</td>
<td>25.908 m 85.0&quot;</td>
</tr>
<tr>
<td>Width, over threshold plates</td>
<td>3.200 m 10'6&quot;</td>
</tr>
<tr>
<td>Width, doorway</td>
<td>1.994 m 6'6&quot;</td>
</tr>
<tr>
<td>Height, rail to roof</td>
<td>4.826 m 15'10&quot;</td>
</tr>
<tr>
<td>Height, rail to floor</td>
<td>1.310 m 4'3½&quot;</td>
</tr>
<tr>
<td>Minimum pantograph operating height</td>
<td>4.978 m 16'4&quot;</td>
</tr>
<tr>
<td>Maximum pantograph operating height</td>
<td>7.518 m 24'6&quot;</td>
</tr>
<tr>
<td>Doorway height</td>
<td>2.032 m 6'8&quot;</td>
</tr>
<tr>
<td>Wheel diameter (new/ worn)</td>
<td>0.914 m/0.838 m 36'/33&quot;</td>
</tr>
<tr>
<td>Truck wheelbase</td>
<td>2.591 m 8'6&quot;</td>
</tr>
<tr>
<td>Truck centers</td>
<td>18.136 m 60'6½&quot;</td>
</tr>
<tr>
<td>Track gauge</td>
<td>1.435 m 4'8½&quot;</td>
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</table>

WEIGHT AND CAPACITY

<table>
<thead>
<tr>
<th>Metric</th>
<th>Imperial</th>
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<tbody>
<tr>
<td>Empty weight</td>
<td>63500 kg 140 000 lbs</td>
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<tr>
<td>Gross weight (normal)</td>
<td>74470 kg 164 180 lbs</td>
</tr>
<tr>
<td>Crush load weight</td>
<td>81500 kg 179 680 lbs</td>
</tr>
</tbody>
</table>

Bull load | 363 000 kg 800 000 lb
Number of seats (upper/lower) | 84/92 84/92
Total number of passengers (normal) | 156 156
Total number of passengers (crowd) | 254 264

PERFORMANCE CHARACTERISTICS

<table>
<thead>
<tr>
<th>Metric</th>
<th>Imperial</th>
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<tbody>
<tr>
<td>Maximum speed</td>
<td>120 km/h 75 mph</td>
</tr>
<tr>
<td>Acceleration rate (from 0 mph to 30 mph)</td>
<td>0.61 m/s² 1.30 mps²</td>
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<tr>
<td>Braking rate — service (from 30 mph to 15 mph)</td>
<td>0.67 m/s² 1.45 mps²</td>
</tr>
<tr>
<td>Braking rate — emergency (from 60 mph to 0 mph)</td>
<td>1.01 m/s² 2.25 mps²</td>
</tr>
<tr>
<td>Jerk limit</td>
<td>0.09 m/s² 2 mfps²</td>
</tr>
<tr>
<td>Minimum radius horizontal</td>
<td>97.5 m 320'</td>
</tr>
<tr>
<td>Minimum radius vertical (clearance)</td>
<td>610 m 2000'</td>
</tr>
<tr>
<td>Minimum radius vertical (clear)</td>
<td>610 m 2000'</td>
</tr>
</tbody>
</table>

ELECTRICAL SYSTEM

Nominal line voltage | 1500 VDC
Low voltage power supply | 240 VAC
Tractive motor, cont. rating | GE/FTX25B 150 hp (112 kw) at 750 VDC
Grindon motor, 1-hr rating | 160 hp (119 kw) at 750 VDC
Number of motors/truck | Two

MISCELLANEOUS

<table>
<thead>
<tr>
<th>Metric</th>
<th>Imperial</th>
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<tbody>
<tr>
<td>Gear ratio</td>
<td>4.07:1</td>
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<tr>
<td>Gearbox type</td>
<td>GER/BA66, parallel drive</td>
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<tr>
<td>Truck type</td>
<td>GSI, cast steel frame</td>
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<tr>
<td>Primary suspension</td>
<td>Steel coil springs</td>
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<tr>
<td>Secondary suspension</td>
<td>Air</td>
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<tr>
<td>Brakes</td>
<td>Hydraulic and electo-dynamic</td>
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<td>Motor control</td>
<td>Motor driven cam</td>
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<td>Power collection</td>
<td>Pantograph</td>
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<td>Low/ high level loading</td>
<td>High</td>
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<td>Ventilation</td>
<td>Yes</td>
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<tr>
<td>Heating</td>
<td>Yes</td>
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<tr>
<td>Air conditioning</td>
<td>Yes</td>
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<tr>
<td>Car body</td>
<td>LAHT steel</td>
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<tr>
<td>Number of trucks</td>
<td>Two</td>
</tr>
<tr>
<td>Number of powered trucks</td>
<td>Two</td>
</tr>
</tbody>
</table>
The Highliners were designed by the St. Louis Car Company for operation on the Illinois Central Gulf Railroad’s commuter lines in the Chicago area. Following the initial order of 131 such cars in 1970, another 36 cars were ordered from Bombardier in 1976 and placed into service beginning in 1978. The cars not only offer a low weight-to-pas.senger ratio, but make more efficient use of manpower than conventional single level cars.

The car bodies, constructed of low alloy-high tensile steel, feature two levels for seated passengers, both of which may be monitored by railroad personnel from the first level for ticket taking, etc. Access to the upper level is via stairwells located at the center of the car.

Used in commuter service, the cars serve numerous communities to the south of Chicago. One route, South Chicago, operates on a boulevard median strip while another, to Blue Island, operates for a considerable distance on single track.

The cars have been designed and built to operate in the severe winters experienced in Chicago, with temperatures of -20°F and snowfalls of 20 inches and more.

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