

## **APPENDIX 6**

### ***Design Data for Electric Multiple Units (EMU)***

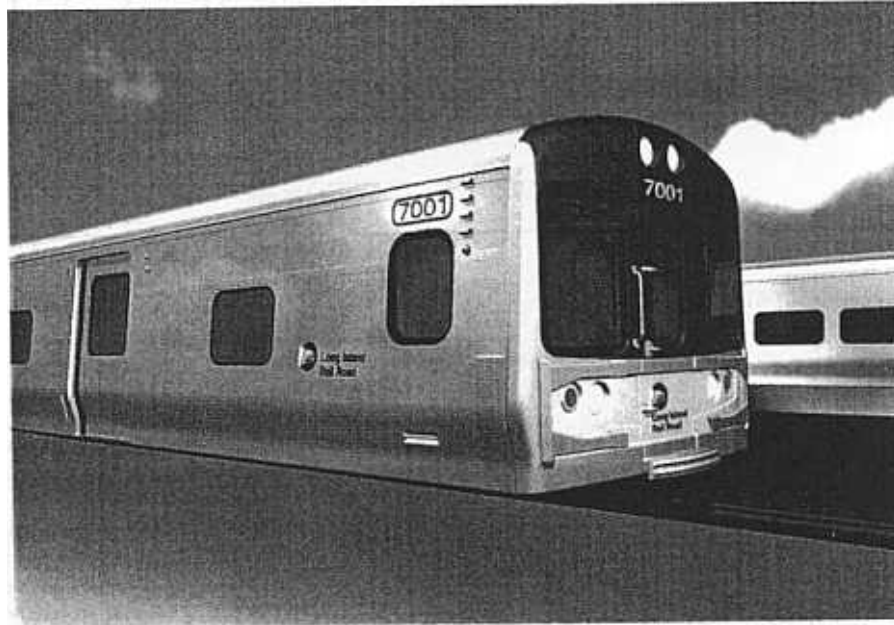
- ***M-7 Long Island Railroad***
  - ***Montreal EMU***
  - ***Gallery Car***

## Electric Multiple Unit — M-7 New York, USA

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 units are equipped with Bombardier's renowned stainless steel carbodies 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.

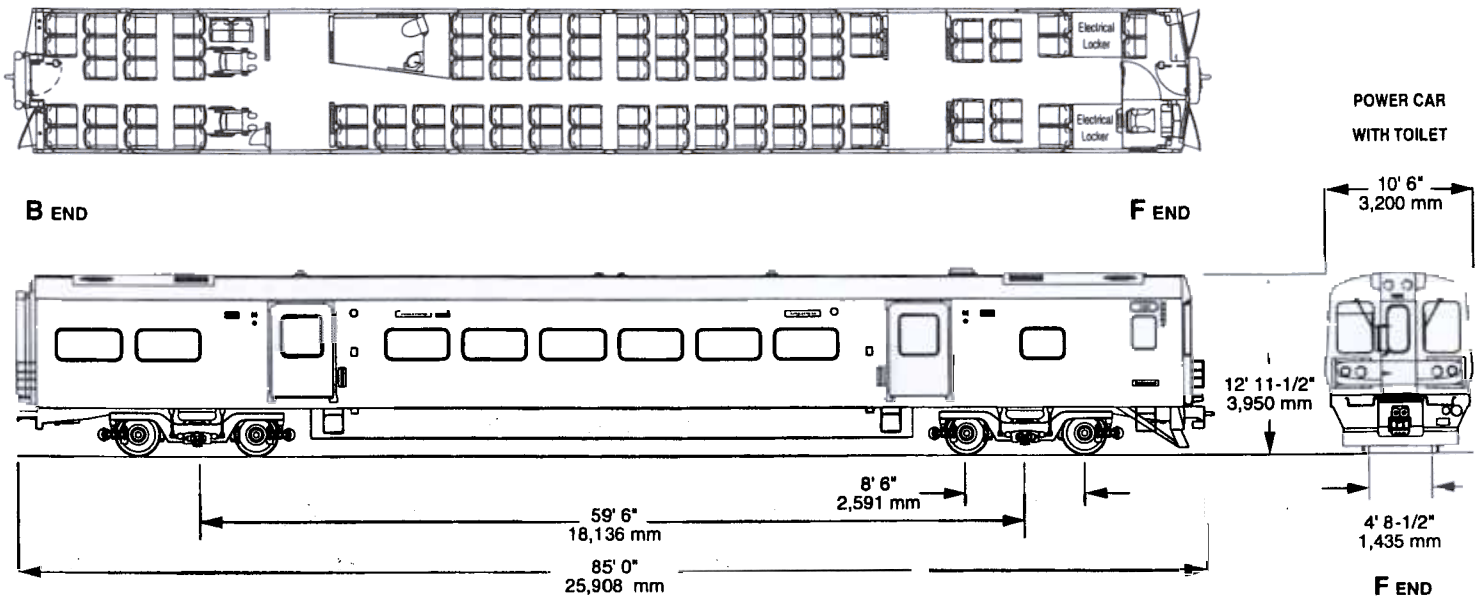
The interior of the LIRR "Car of the Future" was designed with the input of the passenger and employees and includes an ADA compliant toilet, cellular telephone and wide, single-leaved sliding doors for ease of entry and exit.

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**NONSTOP**

# Electric Multiple Unit — M-7



## GENERAL DATA

type of vehicle	electric multiple unit
operator	Metropolitan Transportation Authority Long Island Railroad
order date	May 1999
quantity	113 power cars without toilet 113 power cars with toilet
train consist	up to 14 cars

wheelchair locations	2
passenger per car (seated)	under design
passengers per car (standing) crush load	under design

## DIMENSIONS AND WEIGHT

	Metric	Imperial
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	89"
floor to low ceiling height	2,007 mm	79"
wheel diameter	914 mm	36"
truck wheelbase	2,591 mm	102"
truck 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

## PERFORMANCE AND CAPACITY

	Metric	Imperial
maximum service speed	160 km/h	100 mph
acceleration rate, initial (service)	0.9 m/s <sup>2</sup>	2.0 mphps
braking rate (service)	1.3 m/s <sup>2</sup>	3.0 mphps
braking rate, nominal (emergency)	1.4 m/s <sup>2</sup>	3.2 mphps
buff load	3,560 kN	800,000 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
- cab end: automatic coupler (mechanical, pneumatic and electrical type N-6A)
- non-cab end: semi-permanent drawbar
- four single-leaf doors
- hinged-end doors
- on-board computer-controlled diagnostic system

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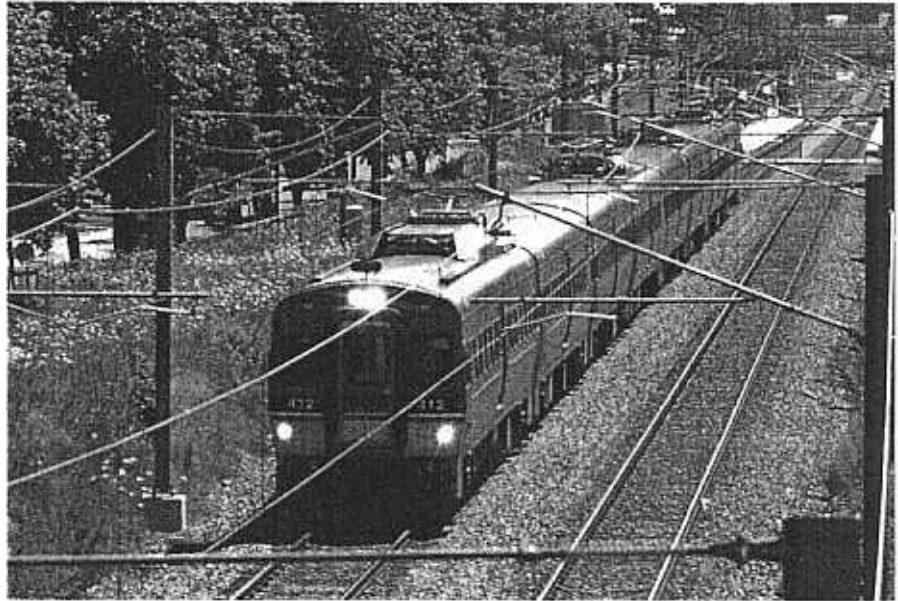
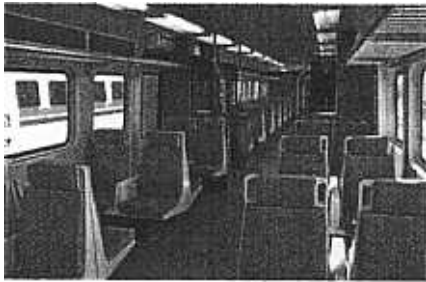
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## Electric Multiple Unit

Montréal, Canada



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:

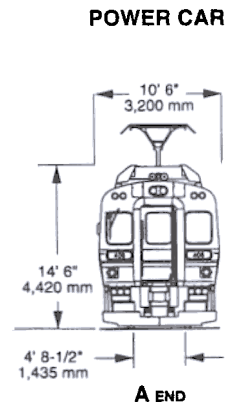
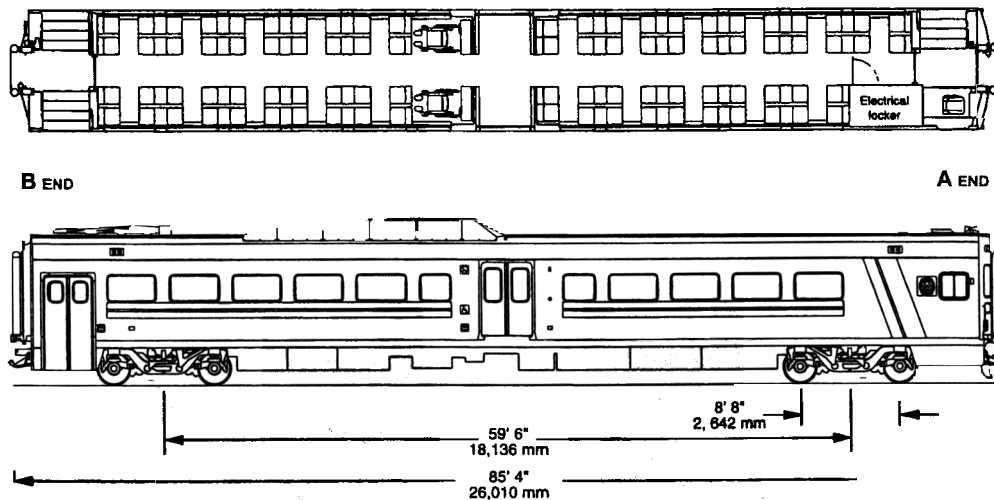
- A propulsion system that uses asynchronous alternating current motors – requiring less maintenance than direct current motors.
- Outboard bearing bogies which are considerably lighter than casted bogies and provide a smoother ride at higher speeds.
- Wide side doors at both high and low platform levels 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.

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## 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
train consist	4 trailer cars with cab up to five married pairs

## DIMENSIONS AND WEIGHT

	metric	imperial
length over coupler	26,010 mm	85' 4"
width over side sheets	3,200 mm	10' 6"
rail to roof height	3,937 mm	12' 11"
rail to top of floor height	1,295 mm	51"
rail to top of equipment height, except pantograph	4,420 mm	14' 6"
doorway width (side centre doors)	1,270 mm	50"
doorway height (side centre doors)	1,905 mm	6' 3"
doorway width (side end doors)	1,219 mm	48"
doorway height over first step (side end doors)	2,413 mm	7' 11"
floor to ceiling height (high ceiling)	2,159 mm	7' 1"
floor to ceiling height (low ceiling)	2,006 mm	6' 7"
wheel diameter	864 mm	34"
truck wheel base	2,642 mm	8' 8"
truck centre distance	18,136 mm	59' 6"
track gauge	1,435 mm	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

## 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)

- 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

## PERFORMANCE AND CAPACITY

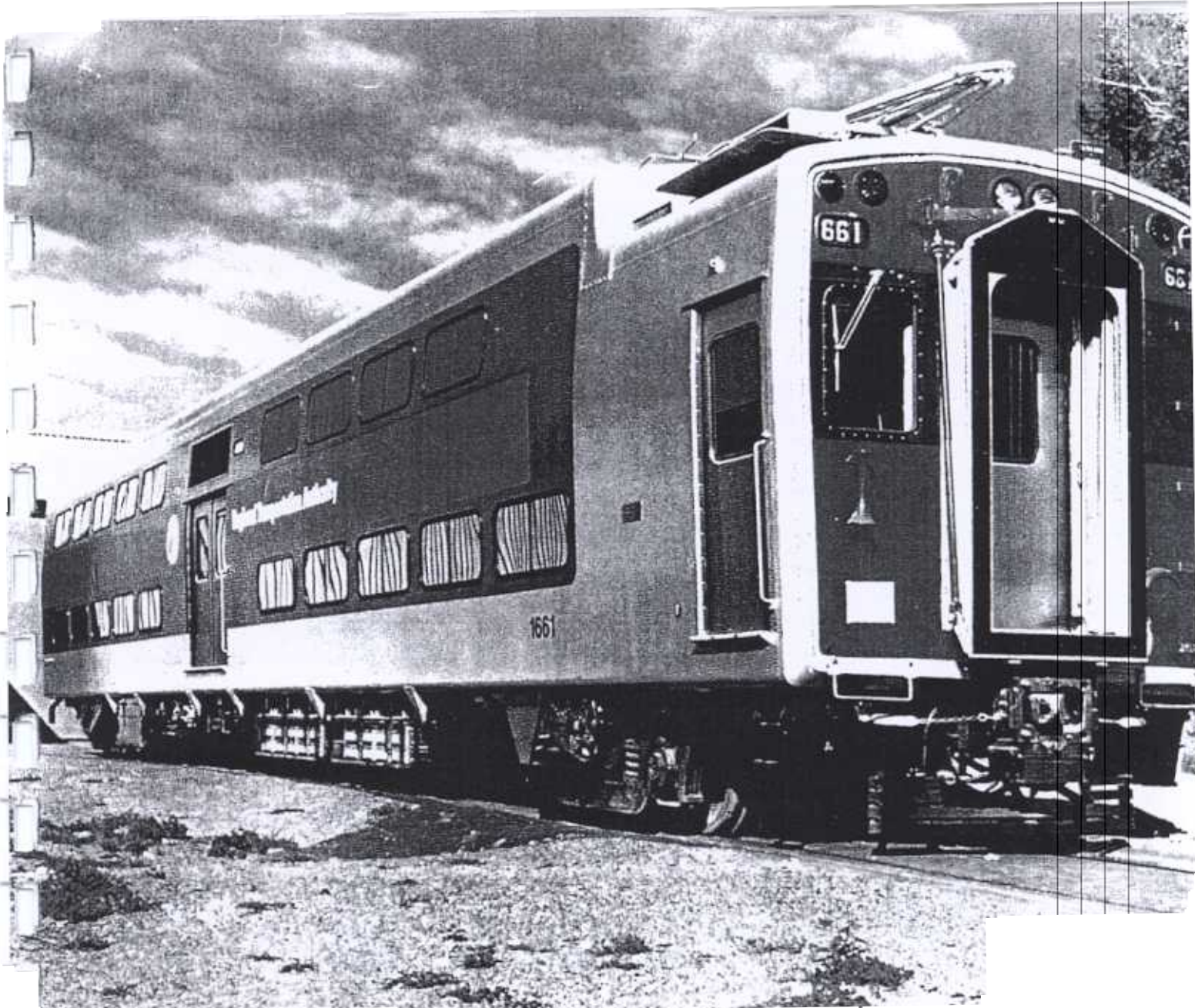
	metric	imperial
maximum design speed	120 km/h	75 mph
maximum service speed	109 km/h	68 mph
acceleration rate, initial (service)	2.4 km/h/s	1.5 mph/s
braking rate (service)	3.2 km/h/s	2.0 mph/s
braking rate, nominal (emergency)	4 km/h/s	2.5 mph/s
buff load	3,558 kN	800,000 lb
wheelchair locations		
- power car	2	
- trailer car with cab	2	
double bicycle racks (summer)		
- trailer car		
- trailer car with cab	2	
passengers per car (seated)		
- power car	summer 88	winter 88
- trailer car	88	92
- trailer car with cab	80	88
passengers per car (standing) crush load	126	126

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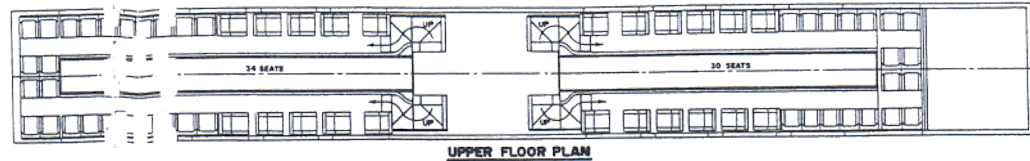


# SELF PROPELLED GALLERY CAR

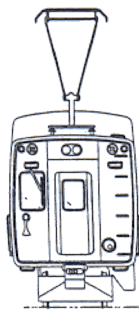
Operated by the Illinois Central Gulf Railroad



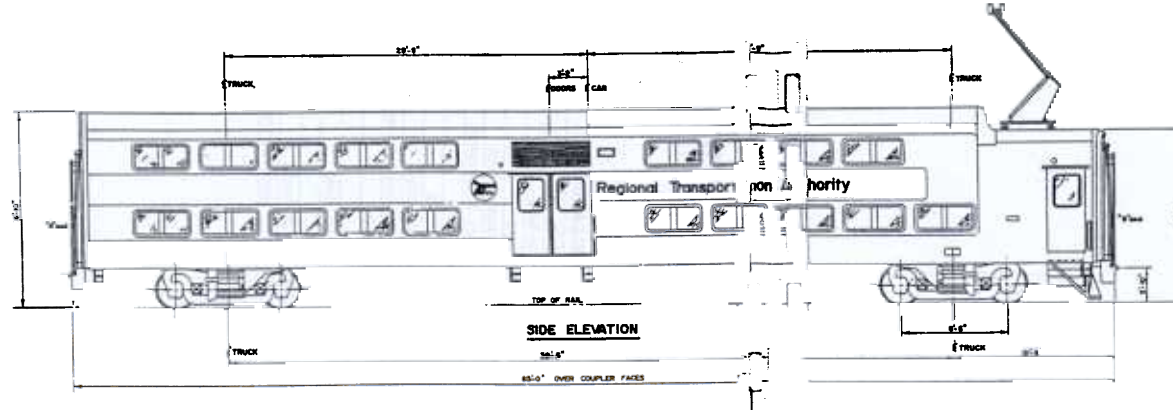
**Bombardier Inc.**  
Transportation Equipment Group



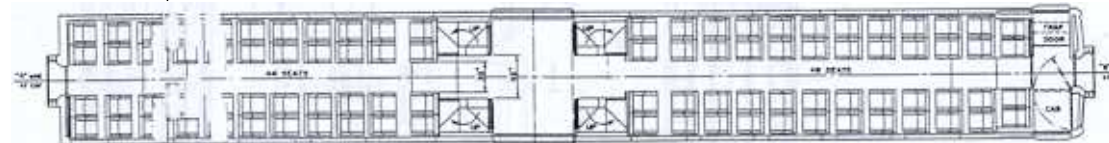
UPPER FLOOR PLAN



FRONT VIEW



SIDE ELEVATION



LOWER FLOOR PLAN

**SPECIFICATIONS**

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

DIMENSIONS	Metric	Imperial
Length, over coupler faces	25.908 m	85' 0"
Width, over threshold plates	3.200 m	10' 6"
Width, doorway	1.994 m	6' 6½"
Height, rail to roof	4.826 m	15' 10"
Height, rail to floor	1.310 m	4' 3⅜"
Minimum pantograph operating height	4.978 m	16' 4"
Maximum pantograph operating height	7.518 m	24' 8"
Doorway height	2.032 m	6' 8"
Wheel diameter (new / worn)	0.914 m / 0.838 m	36" / 33"
Truck wheelbase	2.591 m	8' 6"
Truck centers	18.136 m	59' 6"
Track gauge	1.435 m	4' 8½"

WEIGHT AND CAPACITY	Metric	Imperial
Empty weight	63500 kg	140 000 lb
Gross weight (normal)	74470 kg	164 180 lb
Crush load weight	81500 kg	179 680 lb

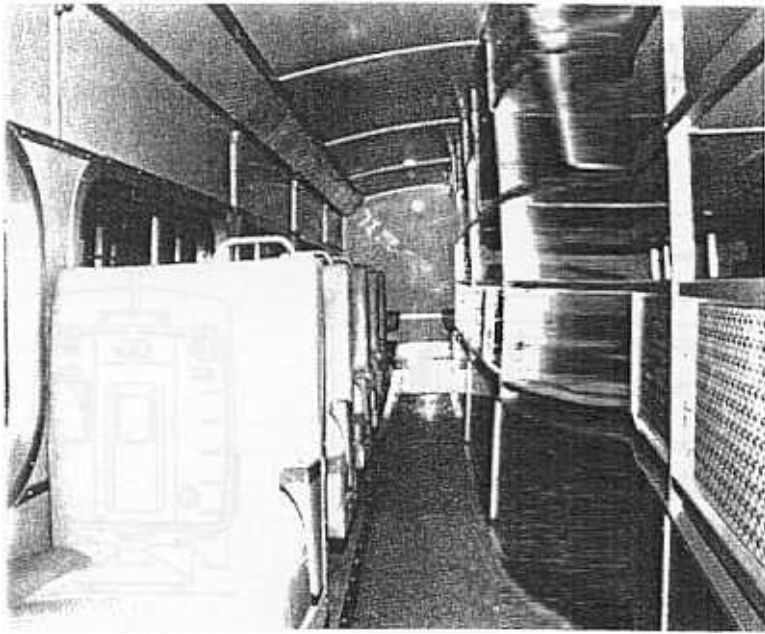
Buff load	363 000 kg	800 000 lb
Number of seats (upper / lower)	64/92	64/92
Total number of passengers (normal)	156	156
Total number of passengers (crush)	256	256

PERFORMANCE CHARACTERISTICS	Metric	Imperial
Maximum speed	120 kmh	75 mph
Acceleration rate (from 0 mph to 30 mph)	0.61 m/s²	1.36 mph/s
Braking rate — service (from 50 mph to 0 mph)	0.67 m/s²	1.50 mph/s
Braking rate — emergency (from 60 mph to 0 mph)	1.01 m/s²	2.25 mph/s
Jerk limit	0.89 m/s³	2 mph/sps
Minimum radius horizontal	97.5 m	320'
Minimum radius vertical (crest)	610 m	2000'
Minimum radius vertical (sag)	610 m	2000'

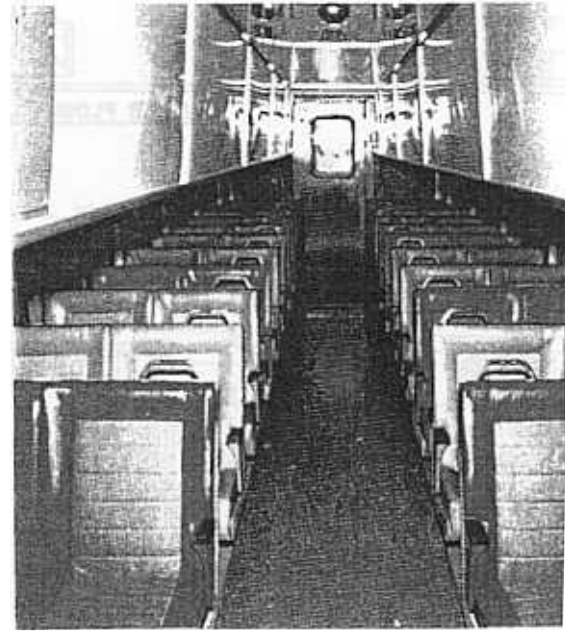
ELECTRICAL SYSTEM	
Nominal line voltage	1500 VDC
Low voltage power supply	MA set 3Ø, 208 VAC and 72 VDC
Traction motor, cont. rating	GE#1258, 150 hp (112 kw) at 750 VDC
Traction motor, 1-hr rating	160 hp (119 kw) at 750 VDC
Number of motors / truck	Two

**MISCELLANEOUS**

Gear ratio	4.07:1
Gearbox type	GE#GA66, parallel drive
Truck type	GSI, cast steel frame
Primary suspension	Steel coil springs
Secondary suspension	Air
Brakes	Hydraulic and electro-dynamic
Motor control	Motor driven cam
Power collection	Pantograph
Low / high level loading	High
Ventilation	Yes
Heating	Yes
Air conditioning	Yes
Carbody	LAHT steel
Number of trucks	Two
Number of powered trucks	Two



Upper level interior



Lower level interior

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, an additional 36 cars were ordered from Bombardier in 1976 and placed into service beginning in 1978. The cars not only offer a low weight-to-passenger 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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