High Speed Rail Seminar in Washington D.C.

Kawasaki's High Speed Train Technology and Contributions to the US Society

January 21, 2010

1.Kawasaki Company Profile

2.Kawasaki’s Contributions to the US Society

3.Efficient High Speed Train Design

4.Conclusion

1.Kawasaki Company Profile

1.1 Company Profile

Established: October 15, 1896

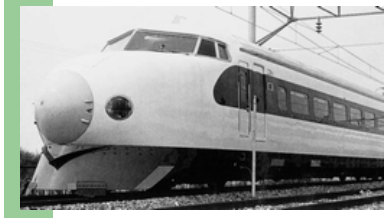
Capital: USD $839 million (as of March 31, 2009)

Net Sales: USD $13.6 billion (FY ending March 31, 2009)

Employees: 32,266 (as of March 31, 2009)

1.2 Chronicle of High Speed Train Development

Kawasaki‘s involvement in development of all Shinkansen trains



1964: 0 Series
(210km/h, 130mph)

1982: 200 Series
(220km/h, 137mph)

1985: 100 Series
(230km/h, 143mph)

1992: 300 Series
(270km/h, 168mph)

1992: 400 Series
(130 or 240km/h,81 or 149mph)

1994: E1 Series
(240km/h, 149mph)

1997: E2 Series
(275km/h, 171mph)

1997: E3 Series
(130 or 275km/h, 81 or 171mph)

1997: E4 Series
(240km/h, 149mph)

1997: 500 Series
(300km/h, 186mph)

1999: 700 Series
(285km/h, 177mph)

2000: 700-7000 Series
(285km/h, 177mph)

2004: 800 Series
Trucks and ventilation systems only
(260km/h, 162mph)

2007: N700 Series
(300km/h, 186mph)

E5 Series
(320km/h, 200mph,Scheduled)

Cumulative number of high speed train
Kawasaki supplied and is going to supply: 3,075(up to now)

1.3 Export Model High Speed Trains

Taiwan High Speed Rail Corp. 700T Series

- **Award/Service Commencement : 2000/2007**
- **Max. operating speed :186 mph(300km/h)**
- **Fully dedicated newly constructed track**
- **System-wide Contract**
- **Contractor: Taiwan Shinkansen Corporation**
- **Kawasaki supplied 360 cars**

Ministry of Railway,
People's Republic of China CRH2

- **Award/ Service Commencement : 2004/2007**
- **125mph(200km/h) EMU for upgraded existing lines with partially newly constructed tracks**
- **186mph(300km/h) class EMU for newly constructed dedicated passenger lines**
- **Kawasaki provided CRH2 with local partner Sifang:**
  - 125mph(200km/h) EMU 960 cars (including berth type)
  - 186mph(300km/h) class EMU 480 cars

2.Kawasaki's Contributions to the US Society

2.1 Kawasaki Built Rail Cars in the US

MTA New York City Transit R160

Port Authority Trans-Hudson Corp. PA-5

MTA Metro-North Railroad M-8

Port Authority Trans-Hudson Corp. PA-4

Massachusetts Bay Transportation Authority

MTA New York City Transit R142A

MTA Long Island Rail Road C-3

Maryland Mass Transit Administration MARCIII

2.2 Kawasaki New Car Orders Received in the US

3,549 Cars

Contract Award	Customer	City/Region in use – Vehicle Type	No. of vehicles	Final Delivery
1979	SEPTA	Philadelphia – Street Cars	141	1982
1980	SEPTA	Philadelphia – Broad Street Subway B-IV Cars	125	1983
1982	NYCT	New York – R62 Subway Cars	325	1985
1984	PATH	New York/New Jersey – PA-4 Rapid Transit Cars	95	1987
1987	NYCT	New York – R68A Subway Cars	200	1989
1989	MBTA	Boston – Bi-Level Passenger Coaches	75	1991
1990	NYCT	New York – R110A “New Generation” Subway Cars	10	1992
1990	DORTS	Taipei, Taiwan R.O.C. – C301 Rapid Transit Cars	132	1994
1990	NYCT	New York – R127/R134 Work Cars	18	1992
1995	LIRR	New York – C-3 Bi-Level Passenger Coaches	134	1998
1995	MTA	Maryland – MARCIII Bi-Level Passenger Coaches	50	1998
1996	MBTA	Boston – Bi-Level Passenger Coaches	17	1998
1997	NVTC (VRE)	Virginia – Bi-Level Passenger Coaches	13	1998
1997	NYCT	New York – R142A Subway Cars	520	2002
1999	NYCT	New York – R143 Subway Cars	212	2003
2000	MBTA	Boston – Bi-Level Passenger Coaches	15	2001
2002	NYCT	New York – R160B Subway Cars	660	2010
2003	MBTA	Boston – Bi-Level Passenger Coaches	33	2005
2003	NYCT	New York – R142S Subway Cars (Same as R142A car class)	80	2005
2005	PATH	New York/New Jersey – PA-5 Rapid Transit Cars	340	2011
2005	NYCT	New York – R157 Continuous Welded Rail Flat Cars	54	2009
2006	Metro-North	New York – M-8 MU Electric Passenger Car	300	2012

2.3 Kawasaki Rolling Stock Business Operation for the US

Organization	Rail Car Operation	Staff
Kawasaki Heavy Industries, Ltd., Hyogo Works	Since 1906	2,300
Kawasaki Rail Car, Inc., Yonkers Plant	Since 1986	502
Kawasaki Motors Manufacturing Corp., U.S.A., Lincoln Railcar Plant	Since 2001	440 (RC Plant only)

Kawasaki's basic philosophy is to provide "Made in the U.S.A." rail cars built by and for the American people.

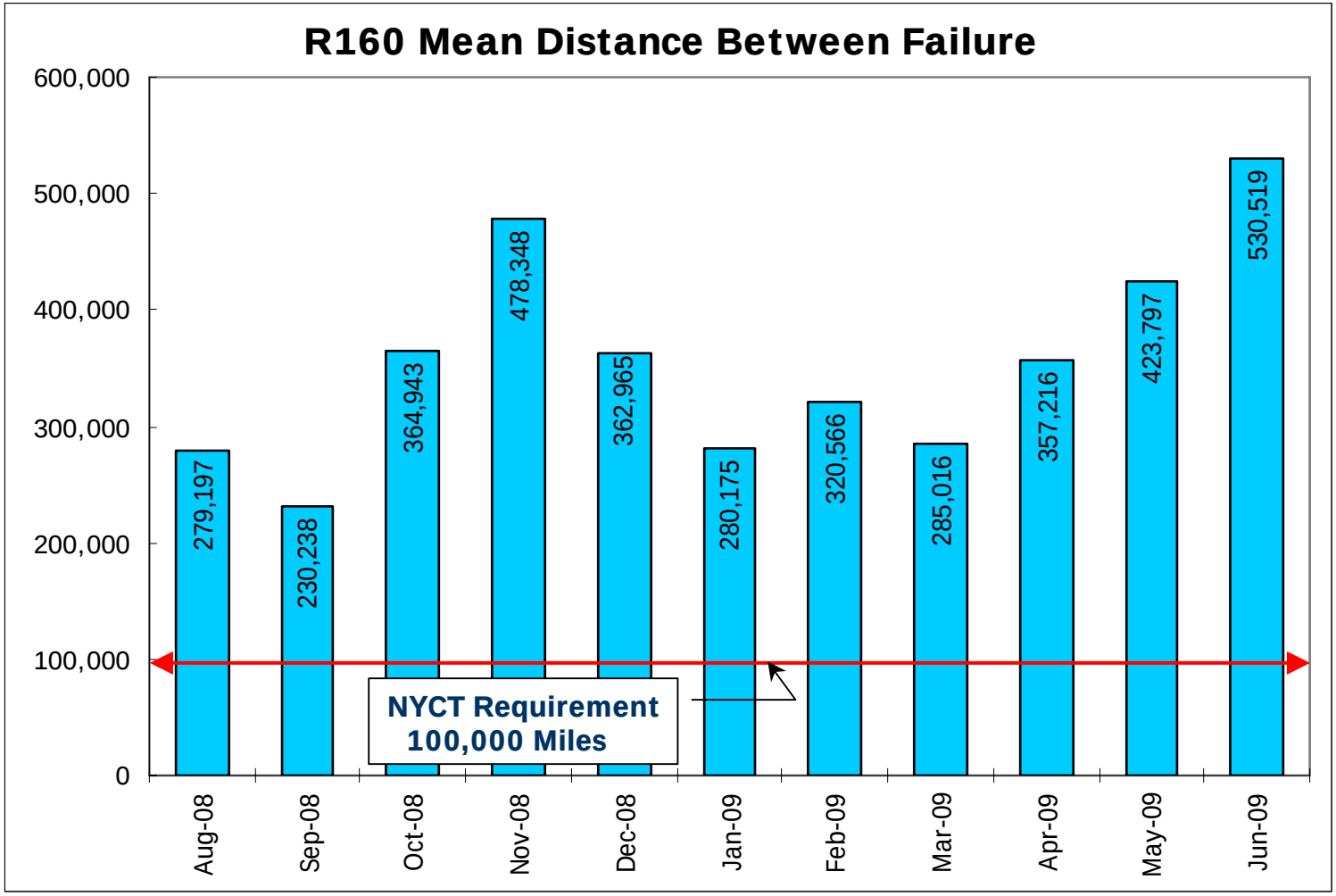
Kawasaki Heavy Industries, Ltd.
Kobe, JAPAN

Kawasaki Rail Car, Inc.
Yonkers, NY

Kawasaki Motors Mfg Corp, USA
Lincoln, NE

2.4 Kawasaki's Advantages

-Delivers reliable cars, with quality built-in



2.5 Kawasaki's Advantages

- **Provides "Made in the USA" product**

  The only manufacturer in the US to mass produce heavy rail/subway cars from scratch.

- **Expertise and resource capability**

  Kawasaki, as a group, maintains its own technical research and development institute. Flexible mobilization according to the world market demands.

- **Customer oriented business philosophy**

  Problem solving is our first priority.

2.6 Kawasaki's Strategy to Enhance US Economy With HSR Projects

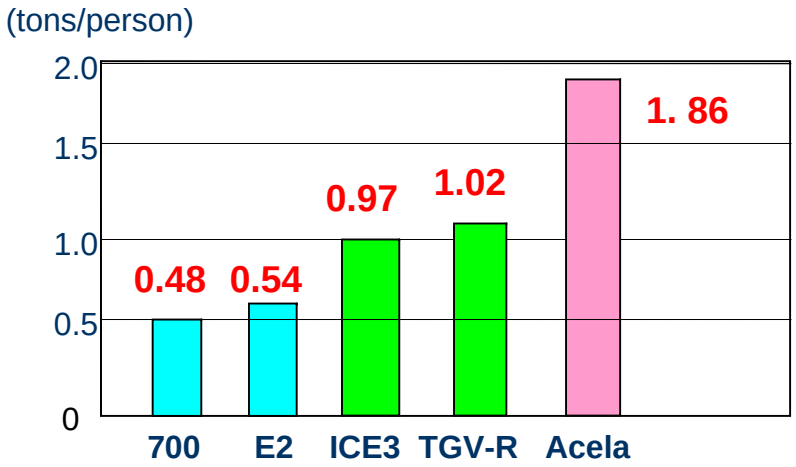
- **Increase of Production Line in KMM/KRC**
  - ➔Employment of additional people
- **Utilization of Automobile Parts Supplier**
  - ➔Restructuring of Automobile Industry
- **Promotion of Technology Transfer**
  - ➔Growing American Rolling Stock Business
  - ➔Compliance with "Buy American"
- **Final Assembly at HSR Site (Utilization of Depot facility)**
  - ➔Pre-training of Maintenance Staff

3.Efficient High Speed Train Design

3.1 Light Weight Design

Weight Comparison of High Speed Trains

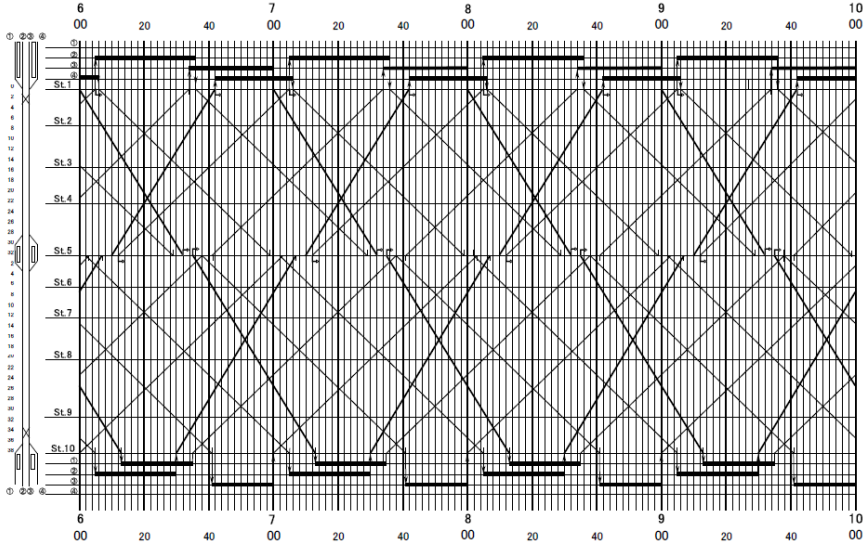
Series		700	E2-1000	ICE 3	TGV-R	Acela
Train Weight [A]	(tons)	638	443	409	383	566
Train Length	(m)	405	251	200	200	203
Train Weight / m	(tons/m)	1.58	1.76	2.05	1.91	2.79
Passenger Capacity [B]	(persons)	1323	814	422	377	304
Train Weight / Passenger[A/B] (tons/person)		0.48	0.54	0.97	1.02	1.86
Max. Axle Load	(tons)	11.3	12.9	16.0	17.0	23.0

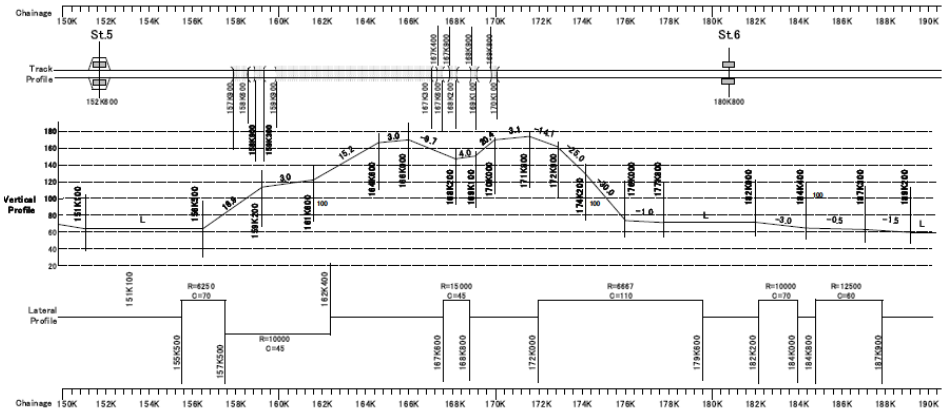


3.2 Effect of Light Weight HSR Train

Computer Simulation to substantiate the effect of Light Weight HSR Train.

- Comparison: Axle Load 14 ton & 17 ton with same running curve
- Line Length: 330 km (Equivalent to high speed section of Taiwan High Speed Rail)
- Train operation: 1 express + 1 local per hour/16 hours per day



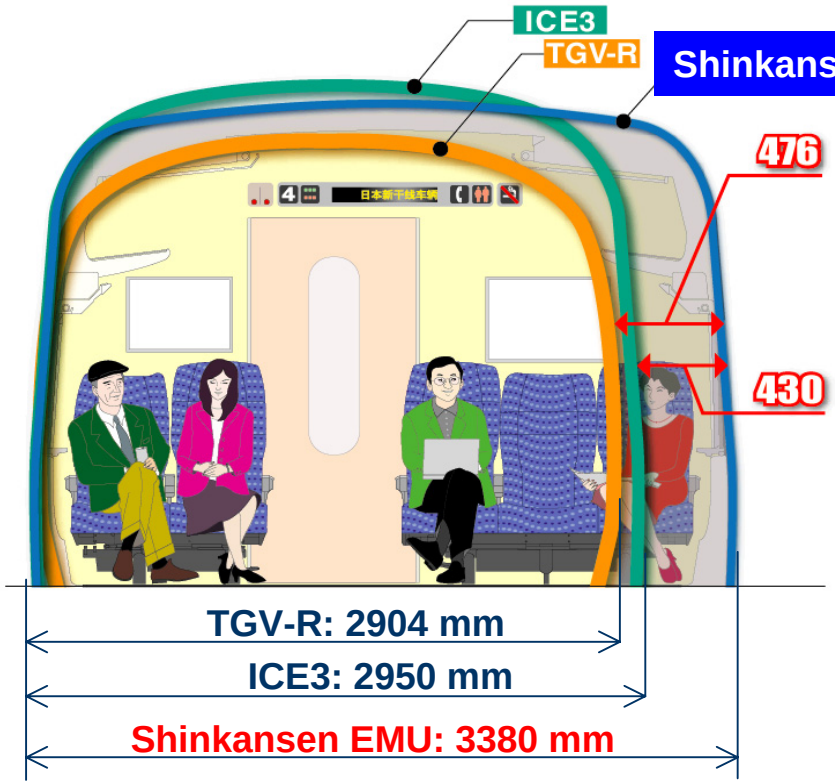


Result (Effect of weight difference only)

- Reduction of Power Consumption = 10%
- Reduction of Greenhouse Gas Emission = 16,000 ton/year
  (at CO2 emission rate of 0.56 ton/MWh)

3.3 Light Weight Design

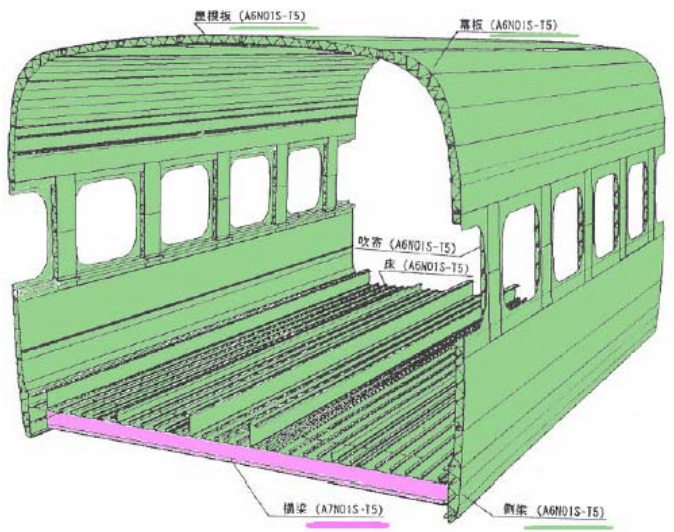
Wide-body Design Contributes to Weight / Capacity Ratio.

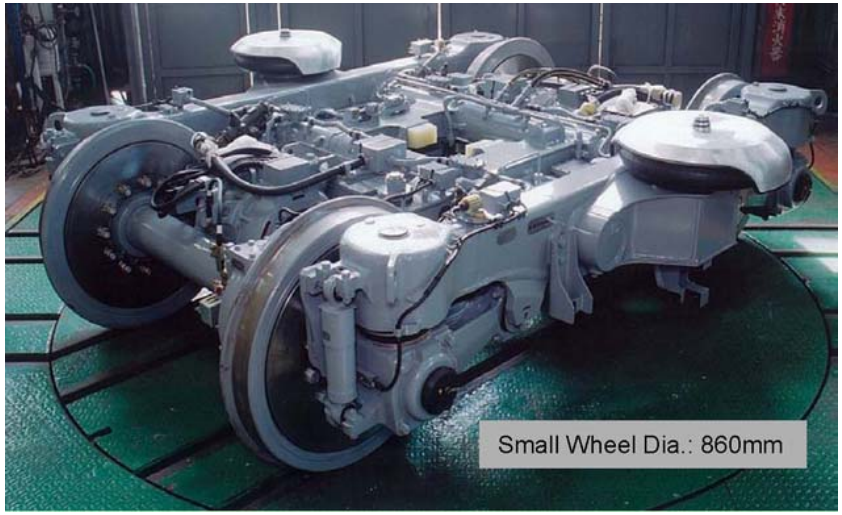


Standard Class	Seat pitch (mm)	Aisle width (mm)
Series 300,700 (*)	1040	570･600
Series E3,E2 (*)	980	550･600
TGV-D	920	450
TGV-R	900	450
ICE3	920	554

Note
(*) Rotation seat

3.4 Light Weight Design





Carbody – Aluminum Double Skin

Bolster-less Truck

Lightweight train contributes not only to energy saving but also to reduced noise and vibration. It also reduces track maintenance needs.

Skin Thickness: Minimum 2.0mm

3.5 Total System Safety

Series	Japanese HSR	ICE3	TGV-R	Acela
Train Weight / Passenger (tons / person)	0.48-0.54	0.97	1.02	1.86
Required Compression Load (tons)	Japanese Standard 100tons	UIC 200tons		49CFR Tier Ⅱ 360tons (Coach) 945tons(Power Car)
Safety	Unsafe → Safe			
Track	Fully Dedicated Track	High Speed Section-Dedicated Track Low speed Section-Conventional Track		Conventional Track

Safety in high speed rail operation is of paramount importance and can be ensured through the total system design including positive train control and other wayside systems.

Provides an energy efficient and safe high-speed rail system.

3.6 Efficient Regenerative Brake System

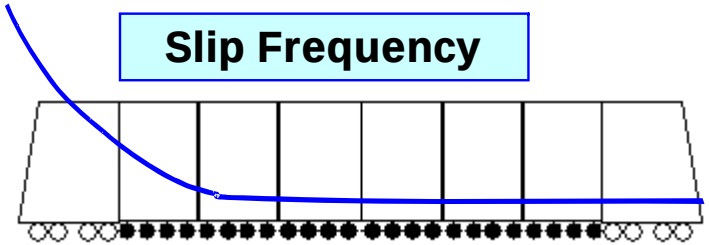
1) High Ratio of Motor Cars in a Train
2) Both Ends are Trailer Cars

→ **Stable and Efficient Regenerative Brake Under Rainy Conditions**

Train Formation

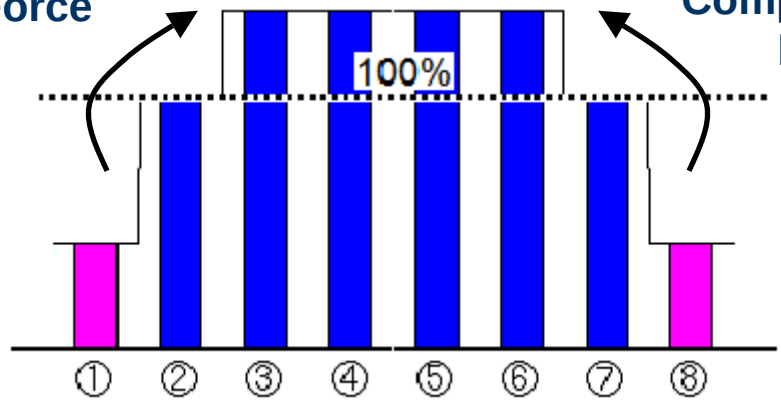
● Motor Axle
○ Trailer Axle

ahead



Leading car tends to slip.
The cars after car No. 3 are unlikely to slip/slide.

Distribution of Brake Force



Compensated by regenerative brake of intermediate cars

Regenerative Brake
Mechanical Brake

Reduction of Total Power Consumption and Wear of Brake Pad

3.7 Kawasaki's Solution

1995: Maryland Mass Transit Administration (MarcⅢ)
Qualified by FRA for 125mph operation

High Speed Train

"efSET"
(Environmentally Friendly Super Express Train)
Max. Operating Speed:220mph(350km/h)

Medium High Speed Train

"K-Star Express"
Push-Pull Coaches
Max. Operating Speed:125mph(200km/h)

The principle designs of two new trains will be ready by the end of March 2010.

4.Conclusion

4.1 Response to Expectations in the US

Job Creation and Reduction of Greenhouse Gas Emission

1.By Kawasaki's Strategy

Revive railway related industry and encourage new job opportunities in the United States.

2.By Kawasaki's Technology

Contribute to the significant reduction of greenhouse gas emission in the United States.

Kawasaki can contribute to the US society through the high speed rail projects!

Thank You Very Much for Your Attention