Track Technology for High Speed Line in Japanese Railways

Railway Technical Research Institute

2. Track Technology Division

The track, one of the most important and fundamental railway structures, consists of rails, sleepers, ballast, road bed and other components. The quality of the design, components and construction of track greatly influences vehicle/track performance, maintenance cost of track and vehicles, running safety and riding comfort. It also governs the degree of noise, vibration and other environmental problems.

A key objective of the Division is the development of technologies and tools to evaluate and improve track structures and materials, often through advanced measurement, evaluation and maintenance of track geometry.

This Division is composed of the following four laboratories.

1) Track Structures and Components Laboratory
2) Track Structures and Geotechnology Laboratory
3) Track Geometry and Maintenance Laboratory
4) Rail Welding Laboratory

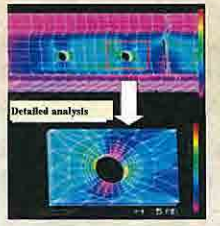
We also address advanced track technologies for railways in the future in cooperation with Track Dynamics Laboratory, Railway Dynamics Division.

Contents

Track Structures and Components Laboratory

Field: Research and development on rail, rail fastening, switch and crossing, expansion joint, mechanism of long welded rail

Products: Synthetic sleeper — Easy handling like wooden tie and high durability like concrete tie
Speed-up of split turnout — Application of curved crossing
Performance test of rail fastening — Confirmation of reliability
Estimation method of fatigue life of rail joint — Application of FEM analysis



4-axle fatigue test machine for rail fastening
FEM analysis for fatigue life around rail joint

Track Structures and Geotechnology Laboratory

Field: Research and development on low maintenance tracks for new and existing lines, reinforcement of ballast and roadbed and environmental friendliness.

Products: Type-D built-in track — Low noise and vibration track for newly constructed tracks
Paved track with asphalt injection — Low maintenance track for existing tracks
GEOCELL method — Improvement of poor roadbed and ballastbed
FWD method — Fast and simple estimation of the bearing index of roadbed

FWD method

Type-D built-in track

Rail Welding Laboratory

Field: Research and development on the method of welding for long welded rails, estimating method of welding quality aiming at the improvement of railway reliability.

Products: Small-size gas pressure welding machine — Highly mobile performance
New gas-pressure welding method — High reliability irrespective of the skill of welders
High performance ultrasonic rail flaw detector — Aiming at high accuracy
Trimming of reinforced bar — Improvement of reliability of gas pressure welding

Usual | Improved

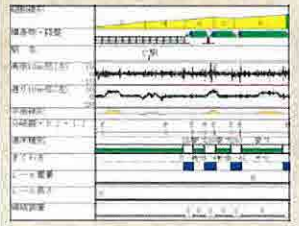
Gas burner for new gas pressure method

Welding by small-size welding machine

Track Geometry and Maintenance Laboratory

Field: Research and development on the track management method and track maintenance machines for safe and comfortable train operation

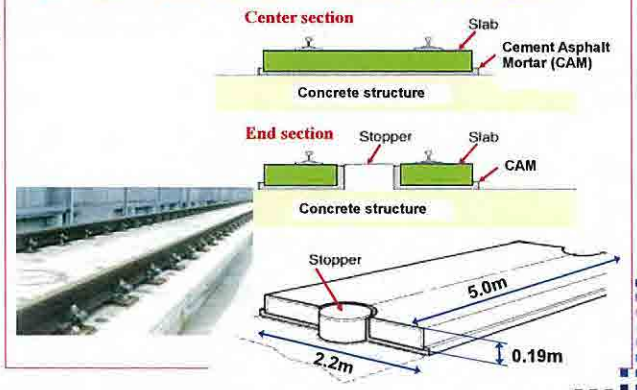
Products: Micro LABOCS database system for track maintenance — All-purpose system
Automated planning system for track tamping machines — Efficient repair
Track measuring system of a new concept — Low-cost and high performance
Track maintenance planning aid system — Effective track maintenance works



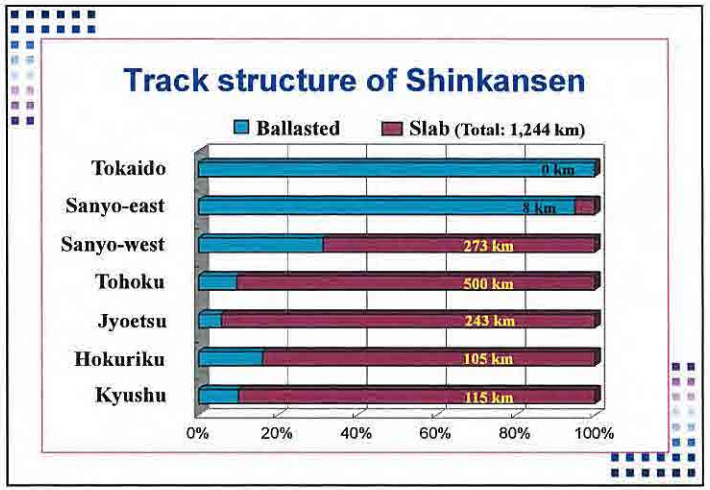
Prototype of inertia mid-chord system

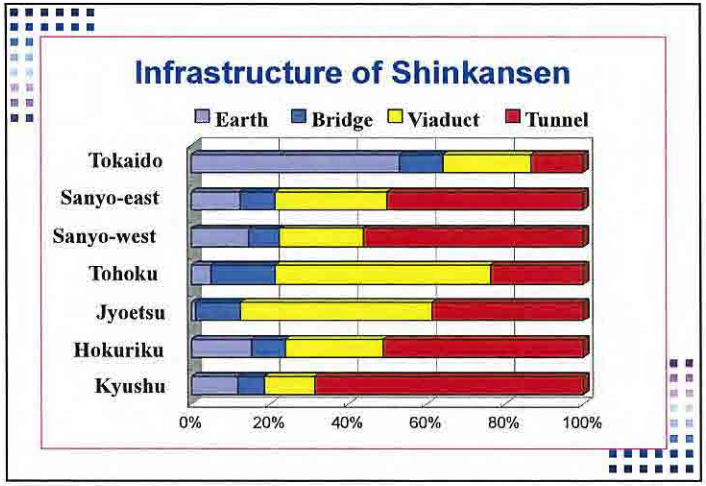
Track maintenance chart by LABOCS

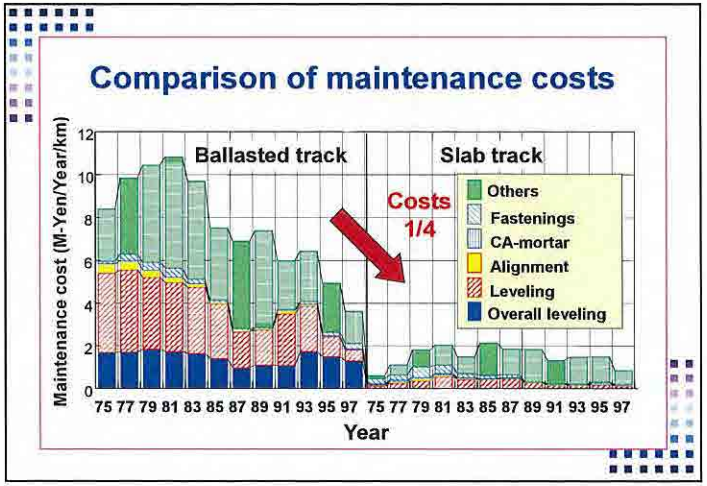
3. The "Slab track," ballast-less track




Slab tracks
1. Original Slab track
2. Frame-shaped slab track
3. Frame-shaped slab track on soil structure


Track structure of Shinkansen
Ballasted
Slab (Total: 1,244 km)
Tokaido
Sanyo-east
Sanyo-west
Tohoku
Jyoetsu
Hokuriku
Kyushu
0 km
8 km
273 km
500 km
243 km
105 km
115 km
0%
20%
40%
60%
80%
100%

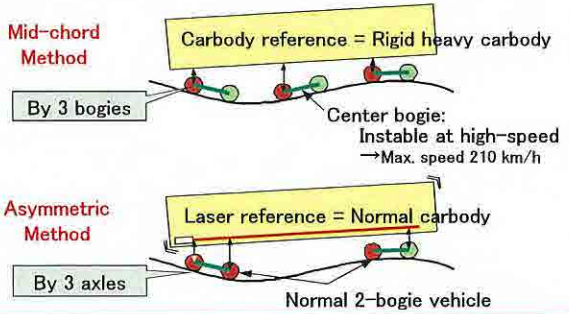

Infrastructure of Shinkansen
Earth
Bridge
Viaduct
Tunnel
Tokaido
Sanyo-east
Sanyo-west
Tohoku
Jyoetsu
Hokuriku
Kyushu
0%
20%
40%
60%
80%
100%


Comparison of maintenance costs
Ballasted track
Slab track
Costs 1/4
Others
Fastenings
CA-mortar
Alignment
Leveling
Overall leveling
Maintenance cost (M-Yen/Year/km)
0
2
4
6
8
10
12
75 77 79 81 83 85 87 89 91 93 95 97 75 77 79 81 83 85 87 89 91 93 95 97
Year

Comparison of performance

Items	Ballasted	Slab
Construction cost	Good	Poor
Construction speed	Even	Even
Construction precision	Even	Even
Durability	Poor	Good
Elasticity	Good	Poor
Maintainability	Even	Even
Maintenance Cost	Poor	Good

Difference between Mid-chord and Asymmetric-chord Measuring Method



3. Track inspection system

"Doctor Yellow," for the Shinkansen

Started to use in 1975.
Maximum speed was 210km/h.

2-bogie Track Inspection Cars

Same speed as commercial train (270, 275km/h)

JR-Central 923
"New Doctor Yellow"

JR-East E926 "East-i"
(For standard gauge lines)

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Inertia versine inspection device

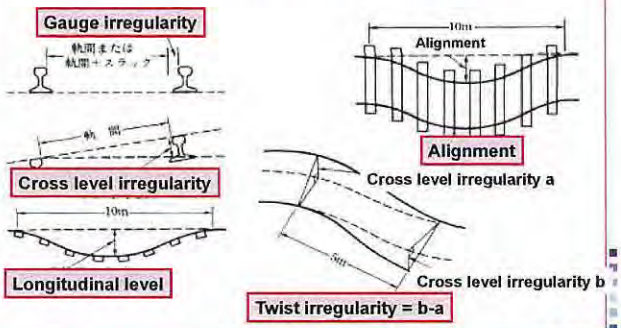
Kyushu Shinkansen 800 series

Track irregularity index for Meter gauge

Type / Rank / Category	Alert Limit 1st Rank	2nd Rank	3rd Rank	4th Rank	Immediately Action Limit 1st Rank	2nd Rank	3rd Rank	4th Rank
Gauge	+10 -5				15(9) 20(14)	200<=R<600 another		
Cross level	11 (7)	12 (8)	13 (9)	16 (11)				
Height	13 (7)	14 (8)	16 (9)	19 (11)	23 (15)	25 (17)	27 (19)	30 (22)
Street	13 (7)	14 (8)	16 (9)	19 (11)	23 (15)	25 (17)	27 (19)	30 (22)
Twist					23 (18)			

()In the inside, it is a unloaded value.

Definition of track irregularity



Track irregularity index for Shinkansen (JR-EAST)

Category	unit	Immediately Action Limit Above 275km/h	More than 245km/h	More than 210km/h	More than 160km/h	More than 110km/h	More than 70km/h	Less than 70km/h
Gauge	mm	+8 −6	+9 −6	+10 −7	+13 −8	+15 −9	+20 −9	+20 −9
Cross Level	mm	7	8	10	13	15	20	20
Longitudinal Level	mm/10m	10	12	14	16	21	24	30
Alignment	mm/10m	6	7	8	9	11	13	30
Twist	mm/2.5m	7	8	10	13	15	20	24

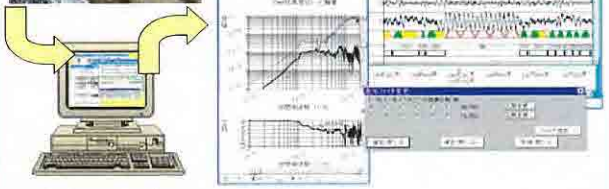
Track irregularity index for Shinkansen (JR-EAST)

Long chord versine (Alert Limit)

Category	20m	40m
Longitudinal level	8mm	7mm
Alignment	7mm	5mm

Track maintenance database system "LABOCS"

Track inspection car



Data processing

EN13848-5 (excerpt)

	Immidiately Action Limit[mm]			
	Longitudinal Level		Alignment	
Velocity[km/h]	3<λ≦25	25<λ≦70	3<λ≦25	25<λ≦70
V≦80	28	-	22	-
80<V≦120	26	-	17	-
120<V≦160	23	-	14	-
160<V≦230	20	33	12	24
230<V≦300	16	28	10	20

Amplitude of actual track irregularities

Track Maintenance Technology in Japanese Railways

Railway Technical Research Institute

16th December 2011

Exchange of Ideas with Private Companies

- Agenda
- Presentation by MOR Staff : Study Tour of HSR in Japan
- Sumitomo Metal : Sumitomo Railway Products
- Nabtesco Corporation : Railroad Products Company
- Nippon Signal : Signaling System for High Speed Rail
- Kawasaki : Technical Introductions of Kawasaki's High Speed EMU Trains

December 16, 2011
Japan International Cooperation Agency
Japan Overseas Rolling Stock Association

Exchange of Views with Japanese Private Companies Regarding High Speed Railway in India

~ JICA Needs Survey on High Speed Railway Technology and Skills in India ~

【Dec. 16 14:00~18:30 Placed: JICA Tokyo International Center】

1. First Session ··· Presentation & Discussion with Japanese Industries

№	Time				Contents	Speaker
1	14:00	~	14:05	5 min.	Opening Remarks	Mr. Mikio HATAEDA, Deputy Director General, South Asia Department, JICA
2	14:05	~	14:10	5 min.	Explanation of the High Speed Railway Survey Conducted by JICA	Mr. Motoyuki TAKAHASHI, Director (India, Bhutan), South Asia Department, JICA
3	14:10	~	14:40	30 min.	Presentation by the Delegation from India	Mr. XXX XXX, Ministry of Railways
4	14:40	~	14:55	15 min.	Q & A	—
5	14:55	~	15:15	20 min.	Presentation by Japanese Company 1	Mr. Kohei Suzuki Assistant Manager, Railway Products, Forging & Casting, Steel Logistics Equipment Dept., [illegible]
6	15:15	~	15:20	5 min.	Q & A	—
7	15:20	~	15:30	10 min.	Break	—
8	15:30	~	15:50	20 min.	Presentation by Japanese Company 2	Mr. Tsekin Lai Railroad Products Company, Nabtesco Corporation
9	15:50	~	15:55	5 min.	Q & A	—
10	15:55	~	16:15	20 min.	Presentation by Japanese Company 3	Mr. Yuta Nagashima Overseas Division, The Nippon Signal Co., Ltd.
11	16:15	~	16:20	5 min.	Q & A	—
12	16:20	~	16:40	20 min.	Presentation by Japanese Company 4	Mr. Masashi Ishizuka Associate Officer, Rolling Stock Company, [illegible]
13	16:40	~	16:45	5 min.	Q & A	—
14	16:45	~	16:55	10 min.	Q & A (for the whole progaram)	—
15	16:55	~	17:00	5 min.	Closing Remarks	Mr. Masataka NAKAHARA, Director General, South Asia Department, JICA

2. Second Session ··· Reception

№	Time				Contents	
1	17:00	~	18:30	90min	Reception	JORSA

[END]

STUDY TOUR OF HSR IN JAPAN

Presentation by the Indian Railways Delegation

16 Dec 2011

1

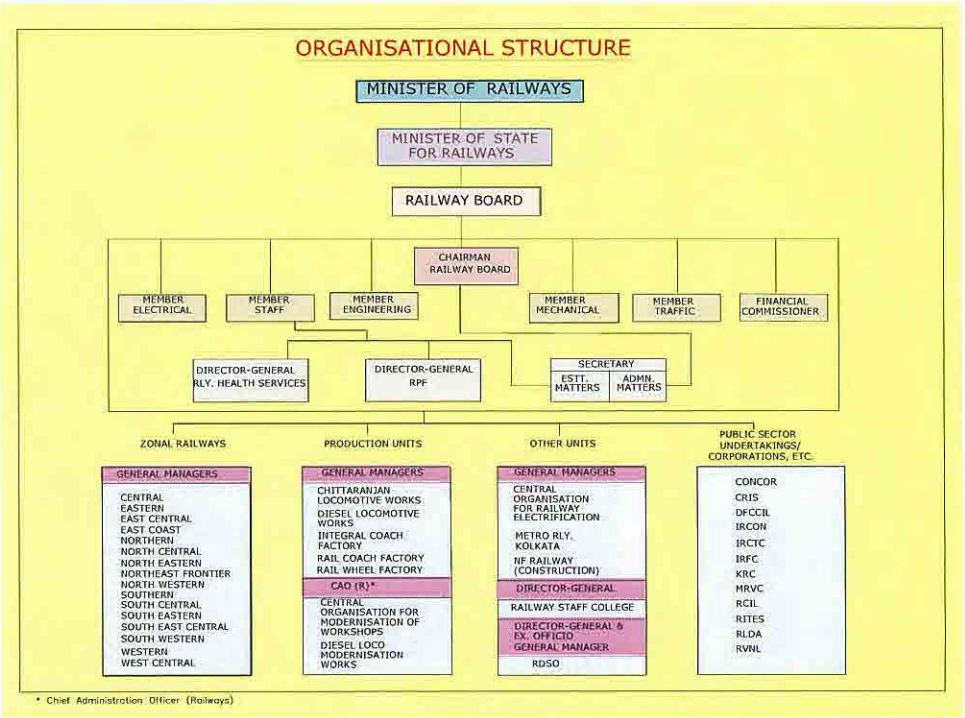
CONTENTS

- Overview of Indian Railways
- Proposal of HSR in India
- HSR Japan – The Study Tour Perspective
- Way Forward

2

Overview of Indian Railways

3



ORGANISATIONAL STRUCTURE

3 tier Management

- Apex –**Chairman and Members,** Railway board
- Middle -16 zones headed by **General Managers**
- Lower -68 divisions headed by **Division Railway Managers**

NETWORK AND RESOURCES*

- Predominantly 1676mm(BG) gauge
- 63,974 Route Km
- 18,893 Electrified Route Km(30% of total route km)
- 7,083 Stations
- 8,889 Locomotives
- 2,19,900 wagons & 57,500 passenger cars including EMU's
- 2 Passenger Car Manufacturing Units,2 Locomotive Manufacturing Units, 1 Wheel and Axle Plant and 1 Locomotive Rebuilding Plant
- 55 Workshops for Repair of Rolling Stock and Manufacture of Parts
- 124 hospitals & 586 Health Units (Includes 5 speciality hospitals)
- 1.4 Million Employees

* as on 1.4.2011

NETWORK AND RESOURCES

Production Units

- **Integral Coach Factory**, Perambur, (1400 coaches per annum)
- **Rail Coach Factory**, Kapurthala, (1500 coaches per annum)
- **Diesel Locomotive Works**, Varanasi, (250 diesel locomotives per annum)
- **Chittaranjan Locomotive Works**, Chittaranjan, (220 electric locomotives per annum)
- **Rail Wheel Factory**, Yelahanka (190000 wheel discs, 50000 axles per annum) and,
- **Diesel Loco Modernisation Workshop**, Patiala. (Rebuilding of 108 locomotives per annum)

NETWORK AND RESOURCES

Central Organisations under MoR

- Central Organisation for Railway Electrification, Allahabad
- Central Organisation for Modernisation of Workshop, New Delhi
- Research, Design and Standards Organisation, Lucknow

NETWORK AND RESOURCES

Public Sector Units/Corporations/Registered Societies

1. Bharat Wagon and Engineering Company Ltd.
2. Centre for Rail Information Systems.
3. Container Corporation of India Ltd.,
4. Dedicated Freight Corridor Corporation of India Ltd.,
5. Indian Railway Catering and Tourism Corporation Ltd.,
6. Indian Railway Finance Corporation Ltd.,
7. IRCON International Limited,
8. Konkan Railway Corporation,
9. Kutch Railway Corporation Ltd.
10. Mumbai Rail Vikas Corporation,
11. Pipavav Railway Corporation Ltd.,
12. Rail India Technical and Economic Services Ltd.,
13. Rail Land Development Authority,
14. Rail Vikas Nigam Ltd.,
15. Railtel Corporation of India Ltd.,

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NETWORK AND RESOURCES- CONSTRAINTS

- IR's main trunk routes viz., the GQ and the diagonals which form 16% of the network but carry 58% of the freight traffic and 52% of the passenger traffic are badly saturated
- Since 1950-51, freight output and passenger output have gone up by 11 times and 9 times while route kms have gone up by only 1.2 times
- Common infrastructure for passenger and freight traffic hampering resource optimisation
- Multigauge network causing bottlenecks and losses
- Inadequate capacity for production of required number of electric locomotives, diesel locomotives and passenger coaches
- Need for Resource Generation

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A3-89

INDIAN RAILWAYS: ROLE

- Lifeline of the nation carrying 40% of freight and 20% of passenger traffic of the country
- Carried 922 mt of freight traffic and transported more than 7 billion* originating passengers in 2010-11
- 11,000 + trains per day including 9,500 + passenger trains
- Carried 66% of all coal, 82% all fertilizers, 60% of all iron-ore, 45% of all cement, 22% of all POL and 17% of all Foodgrains transported in the country

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RESOURCE MOBILISATION & ALLOCATION FOR ANNUAL PLAN 2011-12 (BILLION US DOLLARS)

Plan Heads	Allocation
Rolling Stock	3.07
New Lines	2.12
Metro Transport	1.44
Doubling	1.20
Track Renewals	0.81
Lease Payment	0.77
Investment in PSUs	0.56
Gauge Conversion	0.55
Electrification	0.22
Road Safety	0.44
Workshops incldg. PUs	0.37
Passenger Amenities	0.24
Signalling & Tele	0.24
Traffic facilities	0.23
Others	0.54
Grand Total	12.81

XII PLAN (2012-17)

Railways XII Plan is under preparation

Government of Indian Proposes to Invest One Trillion Dollars in Infrastructure in the XII Plan

Proposal of HSR in India

VISION 2020 OF RAILWAYS

Broad category	Short Term Target (2010-11-2011-2012)	Long- term Target (2012-2013-2019-20)	Total Target
Doubling (including DFC)	1000 kms	11000 kms	12,000kms
Gauge conversion	2500kms	9,500kms	12,000kms
New line	1000kms	24,000kms	25,000kms
Electrification	2000kms	12,000kms	14,000kms
Procurement of wagons	33909	255227	289136
Procurement of diesel locomotives	690	4644	5334
Procurement of electric locomotives	555	3726	4281
Procurement of passenger coaches	6912	43968	50,880

HIGH SPEED CORRIDORS

- Development of high speed rail corridors has been proposed through PPP in the Railway Budget Speech of the Hon'ble Minister for Railways for the Financial Year 2010-11

- Vision 2020 of Indian Railways: Completion of High Speed Corridors of 2000 kms.

CORRIDORS SELECTED

1. Delhi-Chandigarh-Amritsar (450 km approx.)
2. Pune-Mumbai-Ahmedabad (650 km approx.)
3. Hyderabad-Dornakal-Vijyawada-Chennai (664 km approx.)
4. Howrah-Haldia (135 km approx.)
5. Chennai-Bangalore-Coimbatore-Ernakulum (649 km approx.)
6. Delhi -Agra-Lucknow -Varanasi – Patna (991 km approx.)

As a first step pre-feasibility studies for the above projects are being carried out. Some studies have been started and rest are in the process of award.

Present Status of Pre-Feasibility Studies

SN	Name of the Corridor	Status of tender	Remarks
1	Pune-Mumbai-Ahmedabad	Awarded to M/s Systra, M/s Italffer and M/s RITES Limited.	Report submitted to the Ministry of Railways. State Govt. of Gujarat has paid their share for the pre-feasibility study.
2	Delhi-Chandigarh-Amritsar	Offer under finalisation	-
3	Delhi-Agra-Lucknow-Varanasi-Patna	Awarded to M/s McDonald.	Inception report and Interim Report No. I & II submitted.

WAY FORWARD

- Constitution of National High Speed Rail Authority

1. An autonomous body for implementation of High Speed Rail Corridor projects.

2. Planning, standard setting, implementing and monitoring these projects.

.

4	Howrah-Haldia	Awarded to Consortium of M/s INECO, M/s PROINTEC, M/s Ayesa.	Inception report and Interim Report No. I & II submitted.
5	Hyderabad-Dornakal-Vijaywada-Chennai	Awarded to Consortium of M/s Parsons Brinkerhoff India Pvt. Ltd. And two other Japanese firms.	Tender awarded on 2.12.2011.
6	Chennai-Bangalore-Coimbatore-Ernakulam-Thiruvanantpuram	Tenders opened on 31.10.2011 and are under evaluation.	-

HSR Japan
A Study Tour Perspective

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Shinkansen - A Study Tour Perspective

- Dedicated Network
- Dedicated Organisation
- Infrastructure and Operations
- Integrated Supply Chain
- Creating value for customers
- Continuous Innovation

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The Network & Organisation

- "Shinkansen" – The Brand
  - Many entities, One Brand
- The Organisation – Public & Private – alignment of Objectives and Goal
  - (Manufacture, Operations, Maintenance & Research)
  - Customer Focus – Safety, Punctuality, Comfort, Speed and Capacity
  - Environment friendly – Emissions, Noise
- Central & Local Government Support

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Infrastructure and Operations

- Creating Infrastructure – JRTT
- Separation of Operations
  - Privatisation and division into six private companies of the Japanese National Railway thus fostering efficiency in operations
  - Focused and lean structure for Operations through region based Organisations (East, Central, West, Kyushu)
  - Creating Mini Brands within "Sinkansen" to foster efficiency and dedication in operation
    (Tokaido, Sanyo, Tohuku, Joetsu)

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INTEGRATED SUPPLY CHAIN

- Backward
  - Specialised Manufacturers, Suppliers (Hitachi, Kawasaki, Toshiba, Nippon… et al.)
  - Robust Maintenance Organisations aligned towards efficient operations
- Forward
  - Creating value beyond travel – The Life style Business

(retail, restaurants, vending machines, shopping centers, hotel chains, advertisement, sports and leisure…)

INNOVATION – THE HALLMARK

- Sinkansen Series – creating new milestones
- New Technology – scaling new heights
  - Construction
  - Rolling stock Manufacture (eg. FSW, PMSM, Bolsterless Bogie, Wt Reduction)
  - Operations and Control (COSMOS)
  - Maintenance
  - Passsenger services – Suika
- Innovative Operation
  - Coupling and de-coupling
  - Mini Shinkansen

Way Forward

WAY FORWARD …

- Financing Model – The crux
  - The core business?, Extent of Government Support, private participation? Profitability of Business Units, Revenue from exports? Etc.
  - Viability of different business units, Transportation Vs. Lifestyle Business
- Maintenance aligned towards operations – details
  - Frequency of 4 mins, upto 14 trains per hour, less than 1 min average delay….
- Adopting technology to Indian Conditions: Cost/Benefit of state of art technology.
- Government policies
  - Competition
  - Land acquisition
- Choice of Speed (200, 300, 400 kmph etc.)

Arigato Gozaimasu

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SUMITOMO RAILWAY PRODUCTS

SUMITOMO METAL INDUSTRIES,LTD.

Railway, Automotive and Machinery parts Company

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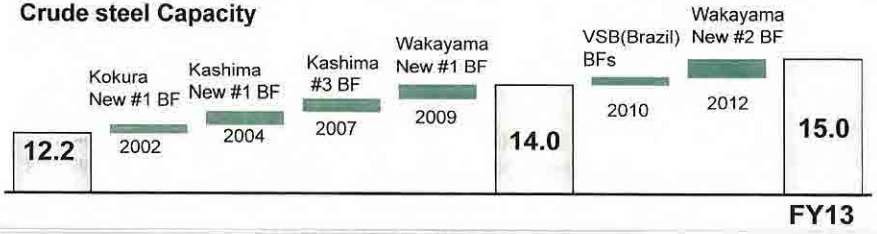
Sumitomo presentation contents

1. Sumitomo Metals Company Profile
2. Sumitomo Railway Products
3. Advantages of Sumitomo wheelsets
4. Supply records to global market including India

Sumitomo Metals Company Profile

- Foundation : 1897
- Number of employees : 22,597
- Sales : $14.0 billion (FY2010)
- Crude steel Capacity : 14.0 million tons (Consolidated base)

Crude steel Capacity



Sumitomo Metals Portrait

- Kashima 8.0 million tons (Steel sheets, plates, structural steels, welded pipes)
- Wakayama 4.5 million tons (Seamless pipes, slabs)
- Kokura 1.5 million tons (Specialty steel)
- Osaka (Railway parts, crankshafts)
- Steel tube works (Seamless pipes)
- Naoetsu (Titanium, stainless)
- Brazil (VSB : Seamless pipes start up 2010)
- Vietnam (CSVC : Steel sheets start up 2012)

Global market share 40%
Super high-end seamless pipes for oil & gas

Customer penetration ratio 80%
High-end Steel sheets

Global market share 30%
Steel wheels for high-speed railways

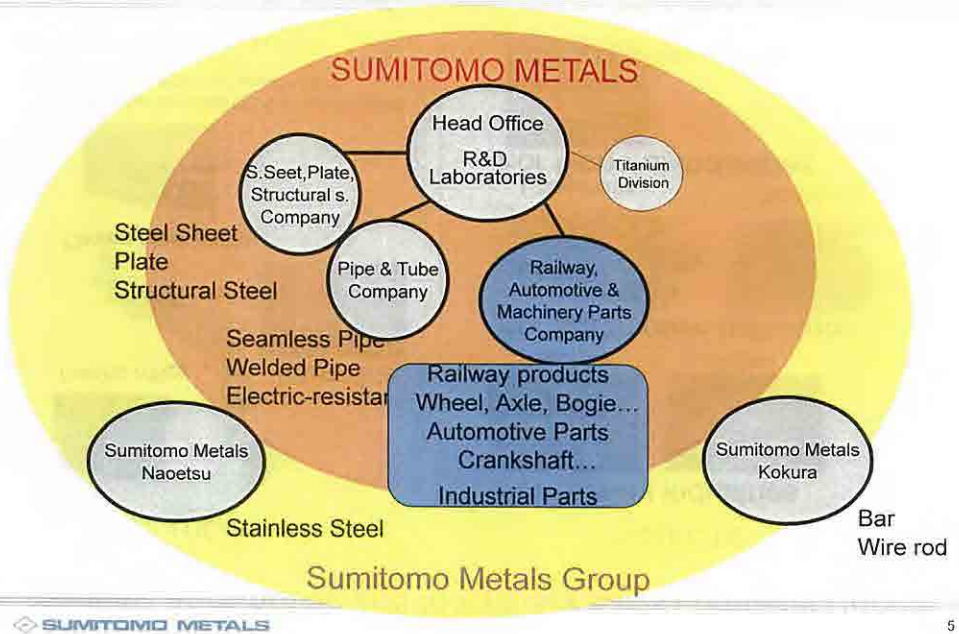
Global market share 33%
Steam generator tubes for nuclear power plant

Global market share 50%
Steel plates for penstocks

Global market share 8%
Forged crankshafts for automobiles

Customer penetration ratio: The percentage of sales tonnage of products where we are the number one or number two supplier to customers.

Companies of Sumitomo Metals



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Railway, Automotive and Machinery parts Company Outline

LOCATION

Osaka office

Tokyo office

Osaka steel works

Sumitomo has acquired USA wheel and axle manufacturer, "Standard steel" in 2011

STANDARD STEEL

PRODUCTS

For railway industries

Wheelsets

Bogies

For automotive industries

Crankshafts

Retarders

For General Industries

Functional rolls

Osaka Steel Works Summary

History	OSW was founded in 1901. Railroad products have been manufactured since 1920
Area	560,000 m²
Employee	approx. 1,100 persons
Certification	ISO9001, ISO14001, AAR, RSSB,DB

HIGH PERFORMANCE FACILITIES FOR FORGING

High speed forging presses for crankshafts

Precise forging presses for wheels and axles

Railway Products Business

Exclusive supplier of Railway wheels, higher market shares of components such as Bogies, Driving Gear Unit in Japan

Products	Domestic Share
Wheels & Axles	**100%**
Gear Unit	**60%**
Bogie Truck	**25%**
Coupler	**80%**

Products	World Share
High-speed railway wheels	**30%**

Wheelsets and components for conventional speed train

A3-97

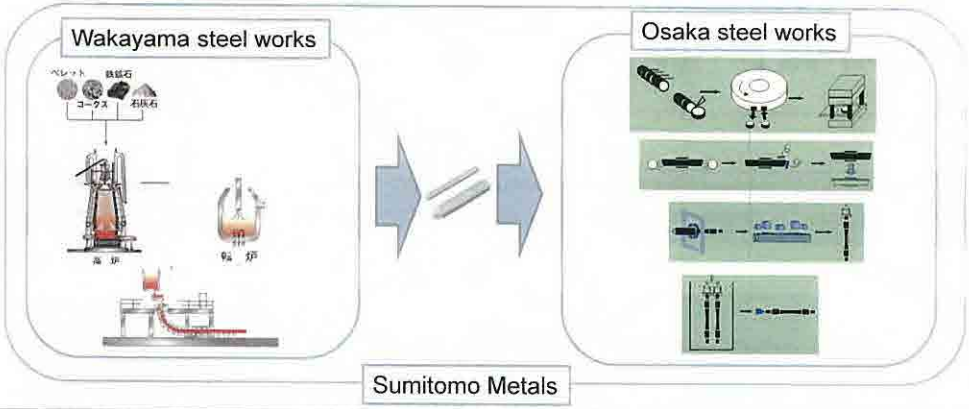
Wheelsets and components for high speed train

Advantages of Sumitomo wheels and axles

- High quality materials for wheels and axles manufactured in house
- Rigorous quality control

→

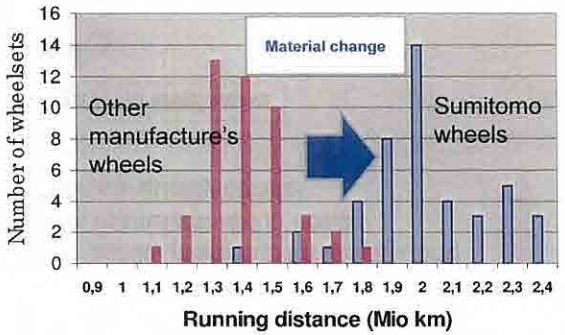
- High quality products
- Stable supply



Sumitomo Wheel advantages - A best practice by our high level expertise

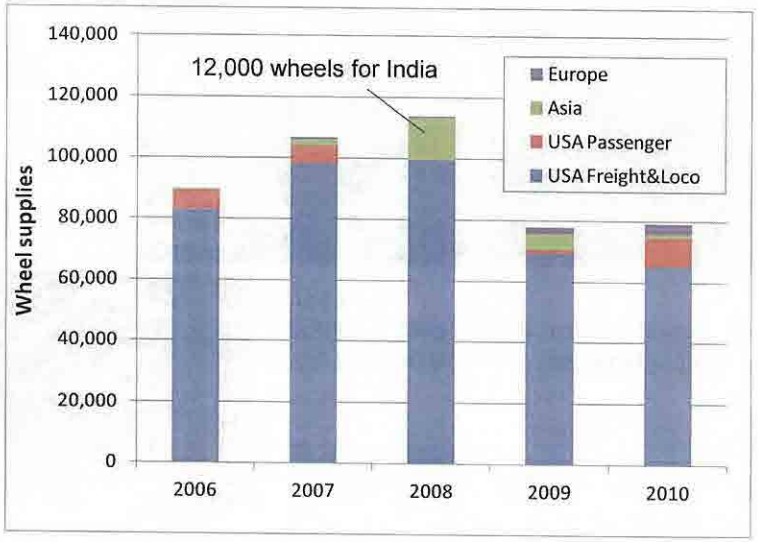
A customer had an issue of uncomfortable vibration of cars caused by un-roundness of railway wheels.

Sumitomo has investigated the reason and proposed a solution by changing material of wheels. As a result, the customer obtained successful benefits !!



Wheel lifetime increases 1.5 times

Supply records of wheels to global market

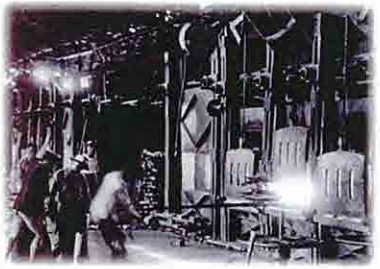


A3-98

Our relationship with India

300,000 wheelsets were supplied to India around 1950's.

We had the honor of receiving India's Prime Minister Nehlu to our manufacturing plant in 1957.



1901: Sumitomo started production of cast steel at Sumitomo Steel Foundry.

2010: Steel converter at the Kashima Steel Works

Thank you for your attention.

SUMITOMO METAL INDUSTRIES,LTD.

Railway, Automotive and Machinery parts Company

Nabtesco Corporation

RailRoad Products Company

The Nabtesco Group, with our unique motion control technology, will provide safety, comfort and a sense of security in daily lives as well as any form of transportation

Agenda

1. Corporate Profile
2. Company Profile
3. SHINKANSEN with Nabtesco Products
4. Supply Record

1-1. Corporate Profile

- Company Name Nabtesco Corporation
- Established September 29, 2003
- Address 7-9, Hirakawacho 2-chome, Chiyoda-ku, Tokyo 102-0093, Japan
- Capital 10 billion yen
- Representatives President & CEO: Kazuaki KOTANI
- Employees* Consolidated 4,057
- Consolidated subsidiaries*
  Japan: 14 (other 6 equity-method affiliates)
  International: 27 (other 2 equity-method affiliates)

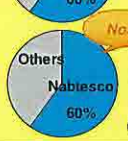
(*as of September 2011)

1-2. Precision Equipment

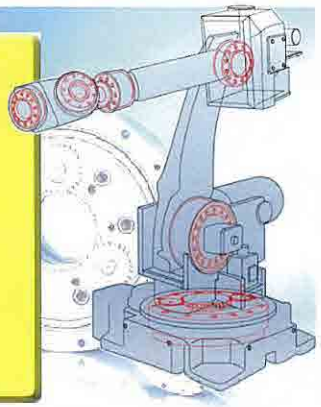
Precision Reduction Gears

Features
high positioning accuracy, high rigidity

Approx. 60% world market share for joints of industrial robots



Approx. 60% domestic market share for machine tool ATCs
(ATC = Automatic Tool Changer)



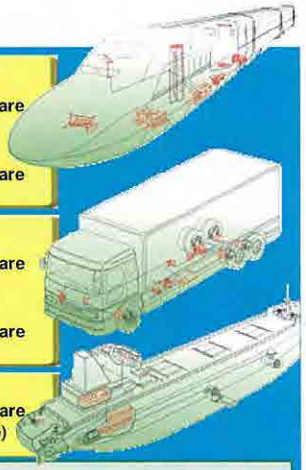

Servo actuator


Wafer transfer unit


Rapid prototyping machine


Vacuum gauge

1-3. Transport Equipment



Railroad vehicle

Brake Systems	Approx. 50% domestic market share
Door Operating Systems	Approx. 70% domestic market share

Commercial vehicle

Wedge Chambers	Approx. 70% domestic market share
Air Dryers	Approx. 85% domestic market share

Marine vessel

2-stroke Main Engine Control Systems	Approx. 60% domestic market share (Approx. 40% world market share)

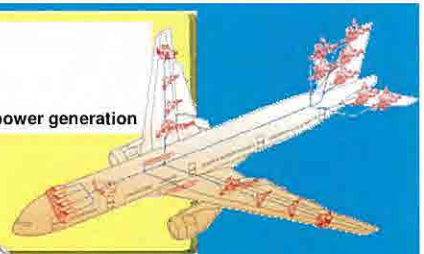
Brake Operating Unit | Door operating system for railroad vehicle | Anti-lock brake system for railroad vehicle | Wedge chamber for commercial vehicle | Air dryer for commercial vehicle | Main engine remote control system for marine vessel | Main engine digital governor for marine vessel | Main engine control simulator for marine vessel

1-4. Aircraft and Hydraulic Equipment

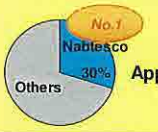
Flight Control Actuation Systems (FCA)

- One of the four major world players of FCA manufacturing (major FCA supplier to Boeing Company)
- Expanding business into engine accessories and electric power generation

100% market share for domestically-produced aircrafts



Traveling Motors for hydraulic excavators



Approx. 30% world market share

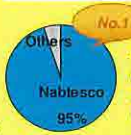
B777 Aileron | B777 Flaperon | B787 High-Voltage Electric Power Unit | Traveling motor for small to mid size excavator | Traveling motor for large size excavator | Control valve | Drive unit for wind turbine generator

1-5. Industrial Equipment

Automatic doors

Approx. 50% domestic market share for building automatic doors (top share in the world)

Platform Screen Doors



Approx. 95% domestic market share (accumulated total)

Packaging Machines

Approx. 85% domestic market share for automatic filler/sealer machines for retort pouch foods

Control velocity joint processing machine | Forming machine | Stair Climber for Wheel Chair | Electrically assisted wheel chair | Intelligent prosthesis knee joint

Agenda

1. Corporate Profile
2. Company Profile
3. SHINKANSEN with Nabtesco Products
4. Supply Record

2-1. Railroad Product Company Profile

- Established : March 5, 1925
- President : Tsutomu (Ben) Sakamoto
- Number of Employees : 548 (as of September 2011)

2-2. Railroad Product Company Profile (history)

- 1925 : Establishment of Nippon Air Brake Co.,Ltd.
  Got the first order from Ministry of Railways for Brake System
- 1953 : Developed Door Engine and Window Wiping Device
- 1955 : Exported Brake System and Door Engine to Argentina
- 1958 : Developed synthetic Brake Shoe
- 1960 : Developed Brake System for the Shinkansen
  Start manufacturing synthetic Brake Shoe
- 1964 : Developed Door Engine for the Shinkansen
- 1992 : Name changed to NABCO, Ltd.
- 1995 : Hanshin Earthquake caused extensive damage to Kobe Plant
- 1998 : Start operating current Kobe Plant
- 1999 : Acquisition of ISO9001
- 2002 : Establishment of branch office in Beijing
- 2003 : Establishment of Nabtesco Corporation
- 2004 : Acquisition of ISO14000
- 2005 : Establishment of Nabtesco Railroad Products (Beijing) Co.,Ltd.
- 2011 : Establishment of Jiangsu Nabtesco KTK Railroad Products Co.,Ltd.

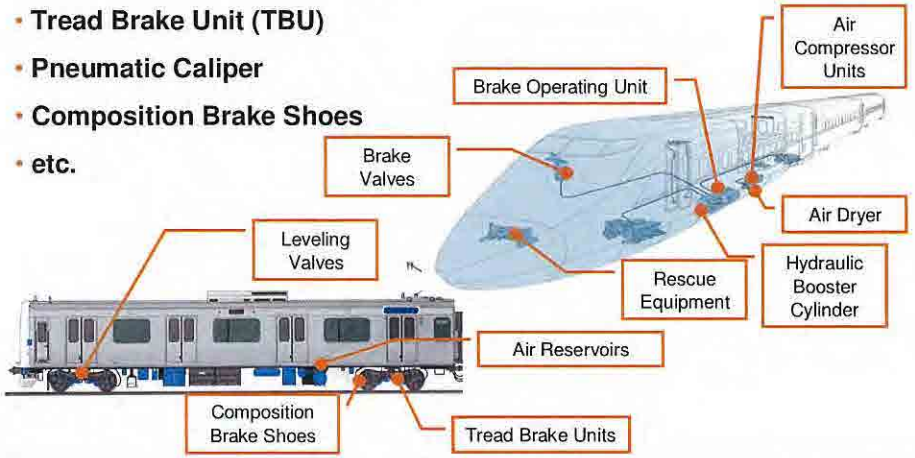
2-3. Kobe Plant

- Location : Kobe, Japan
- Products : All kinds of Equipments related to Brake and Door Systems for all types of Rolling Stocks
- Established : April , 1998
- Land Area : 27,000 m^2
- Total Floor Area : Approx. 23,000 m^2
- Number of Employees : Total 634 (as of September 2011)
  147 (Engineering, R&D)
  487 (Others)

2-4. Main Products of Nabtesco

Brake System:

- Brake Operating Unit
- Air Compressor and Air Dryer
- Tread Brake Unit (TBU)
- Pneumatic Caliper
- Composition Brake Shoes
- etc.



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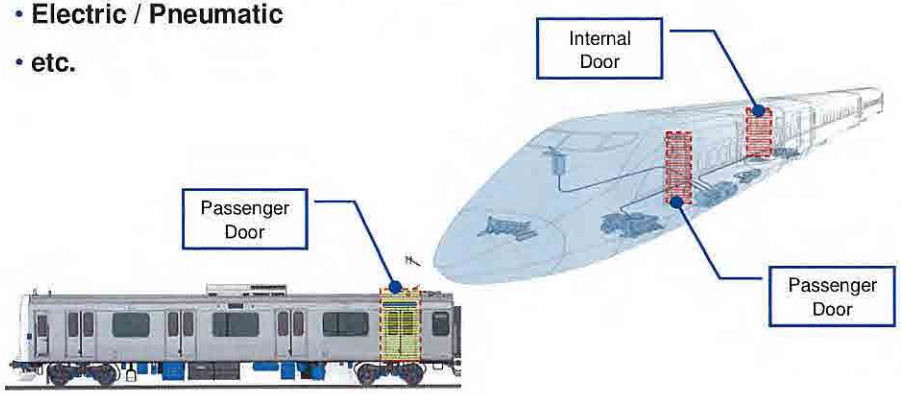
2-5. Main Products of Nabtesco

Door System:

- **Internal Door / Passenger Door**
- **Pocket Sliding Type / Plug Type**
- **Electric / Pneumatic**
- **etc.**



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2-6. Main Products of Nabtesco

Other Products for High Speed Train:

- **Tilting Control Unit (For N700)**
  - **By tilting train with air suspension, tilting control unit allows faster and more comfort for curves.**

- **Air Tightness Device**
  - **To minimize noise, vibration and change of air pressure near passenger doors, air tightness devices are applied to high speed trains.**

Agenda

1. Corporate Profile
2. Company Profile
3. SHINKANSEN with Nabtesco Products
4. Supply Record

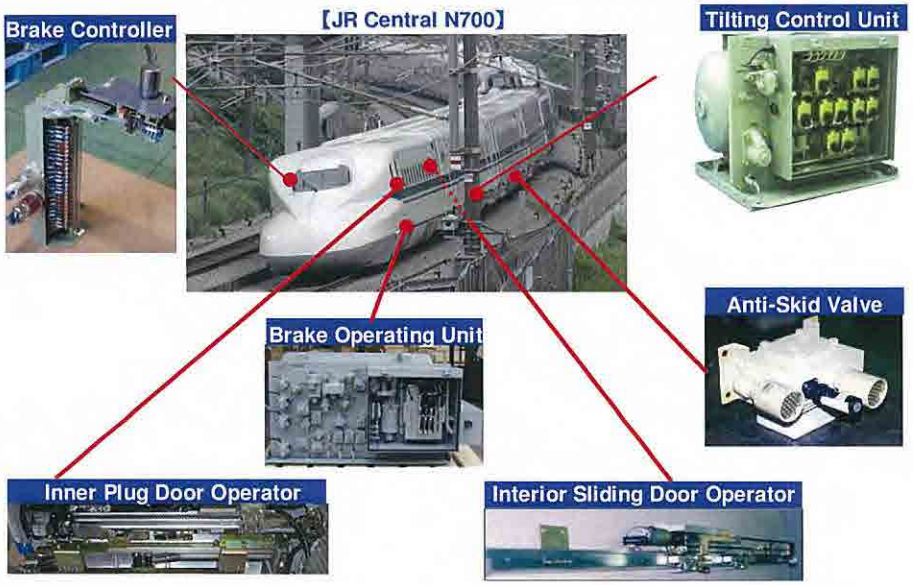
3-1. SHINKANSEN with Nabtesco Product

【JR Central 300】 【JR West 500】 【JR Central 700】

【JR West 700】 【JR East E2】 【JR East E4】 【JR Kyusyu 800】

3-2. SHINKANSEN with Nabtesco Product

【JR Central N700】



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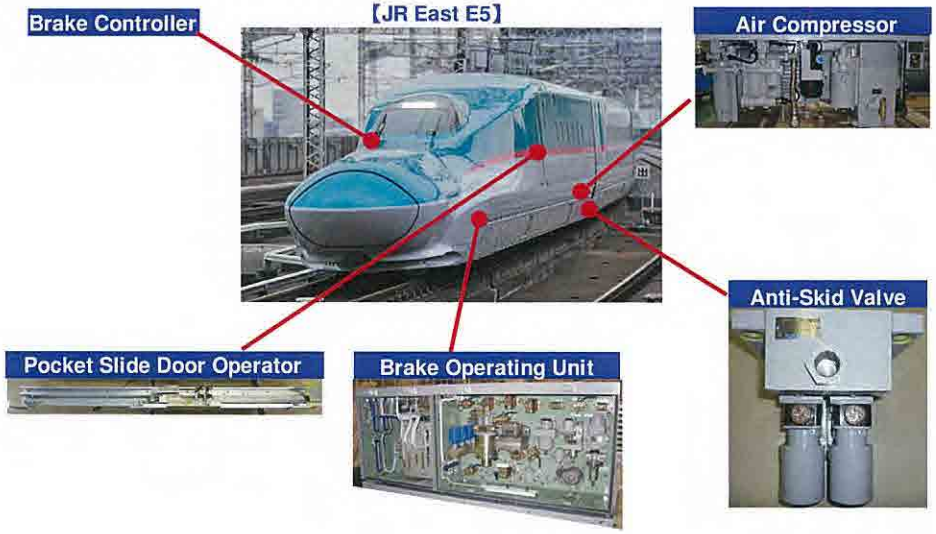
3-3. SHINKANSEN with Nabtesco Product

【JR East E5】



Agenda

4-1. Supply Record in China

Nabtesco is the official BRAKE & DOOR supplier for 200~350 km/h semi-high and high speed EMU, known as China SHINKANSEN "CRH2"

Door
Brake

2006 - 2007: 480 cars
2007 - 2010: 480 cars
2008 - 2010: 480 cars
2009 - 2011:1,920 cars

For City Transit market such as Beijing, Wuhan, Chongqing and Changdu, Nabtesco supplied BRAKE for over 2,200 cars.

4-2. Supply Record in Taiwan-Korea

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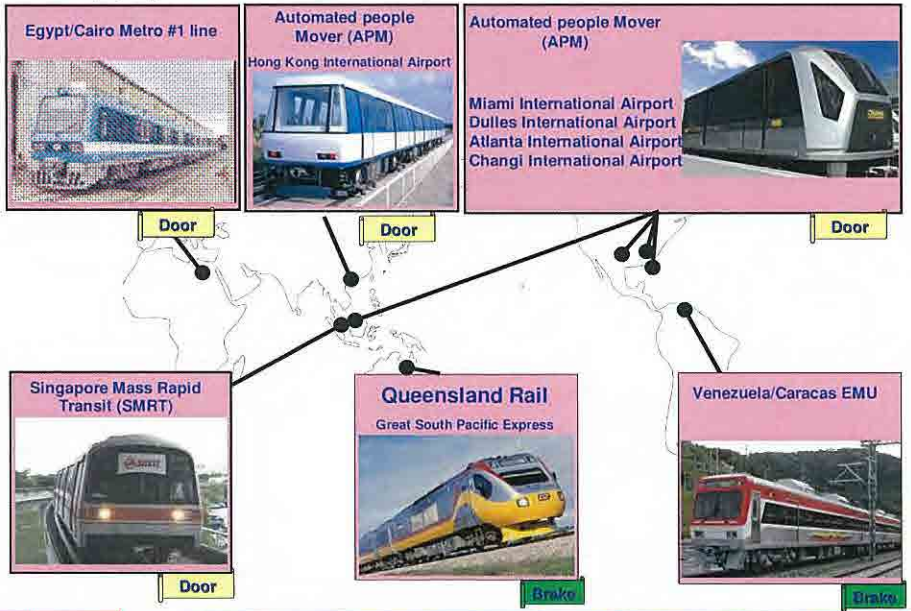
4-3. Supply Record in Others



Nabtesco will keep making progress by searching local partners, and get prepared for business chances in India.

Thank you for your attention !

Railroad Products Company

Nabtesco

SIGNALING SYSTEM FOR HIGH SPEED RAIL

December 2011

THE NIPPON SIGNAL CO., LTD.

A3-105

Table of Contents

Designed	Checked	Approved
M.Takahashi	H.Ogihara	H.Ogihara

1. Company Introduction

Founded	1928
Headquarter	Tokyo, Japan
President and COO	Yohei Furuhata
Capital	US$ 82,482,000 *
Annual sales	US$ 1,005,605,000 *
Employees	3,079
Main Business Field	- Railway Signaling Systems - AFC Systems - Traffic Information Systems - Information Systems
Major Overseas Projects	- Taiwan High Speed Rail (Signal) -Chennai Metro (AFC) -etc..

*At the rate of ¥83 to US$1, the approximate exchange rate at March 31, 2011.

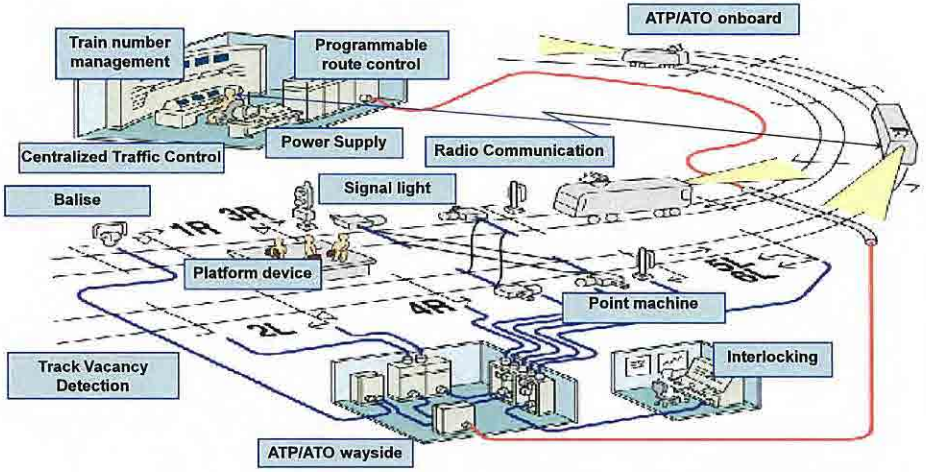
Headquarter

Kuki Plant

Utsunomiya Plant

1. Company Introduction

Nippon Signal Total Signaling System



1. Company Introduction

日本信号 THE NIPPON SIGNAL CO., LTD.

Domestic Activity:

Nippon Signal technology is widely used in Japan

- Shinkansen
- Main line
- Metro / Subway
- Monorail
- LRT

1. Company Introduction

日本信号 THE NIPPON SIGNAL CO., LTD.

Overseas Activity: Taiwan High Speed Rail

- Commercial operation since 2007
- Based on Japanese High Speed Rail Technology
- Nippon Signal contributes to its successful operation by advanced Signaling technology.

1. Company Introduction

日本信号 THE NIPPON SIGNAL CO., LTD.

Overseas Activity: Others

Beijing Subway line 15

Dubai monorail

Beijing Subway line 13

Chongqing monorail

1. Company Introduction

日本信号 THE NIPPON SIGNAL CO., LTD.

Activity in India: Chennai Metro

- Awarded on AFC contract in March 2011
- Commercial operation to be started from 2014
- First Japanese contractor in India for AFC project

2. Signaling Technology for HSR

日本信号 THE NIPPON SIGNAL CO., LTD.

2.1 General

Safe and reliable operation at 300km/h (83m/sec)

Fatal accident record is ZERO

Average Delay per train is shorter than 1 minute

2. Signaling Technology for HSR

日本信号 THE NIPPON SIGNAL CO., LTD.

2.2 Overview

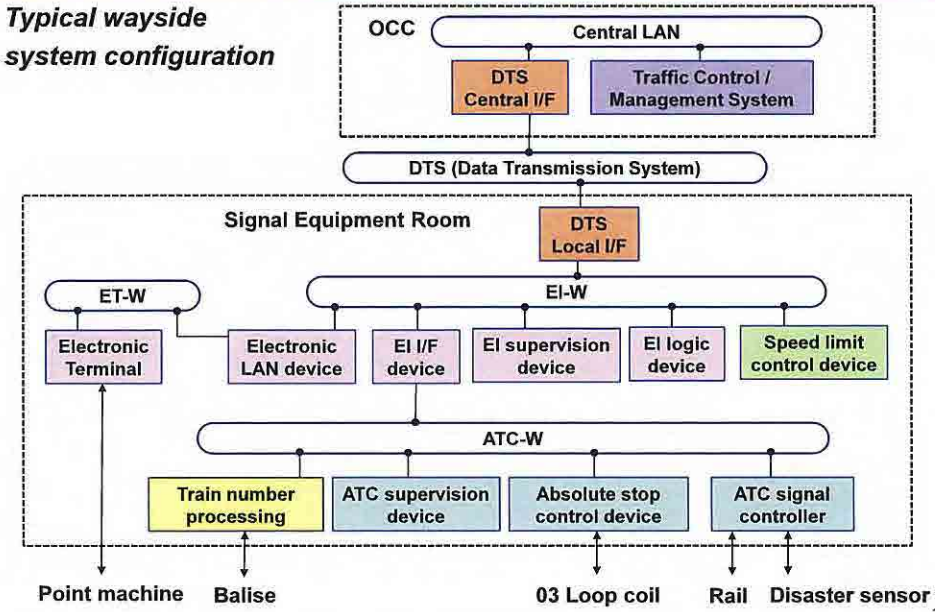
Signaling system is mainly composed of the following sub-systems.

- Traffic Control/Management System
- Electronic Interlocking system
- Digital ATC system with cab signal
- Track Vacancy Detection system by digital coded ATC signal

2. Signaling Technology for HSR

日本信号 THE NIPPON SIGNAL CO., LTD.

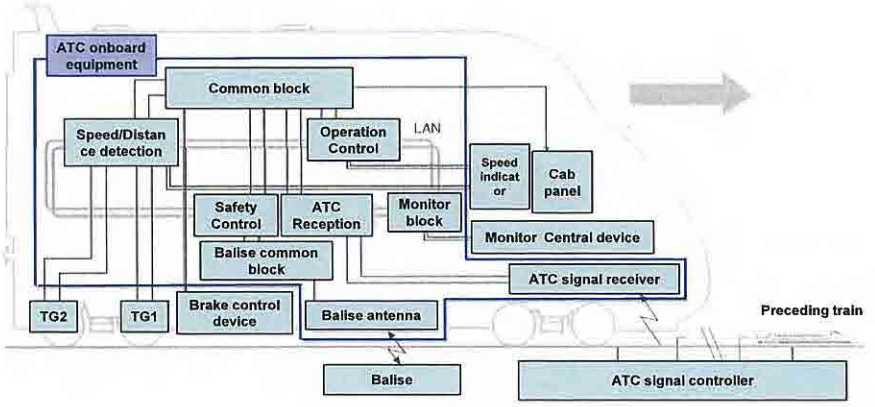
Typical wayside system configuration



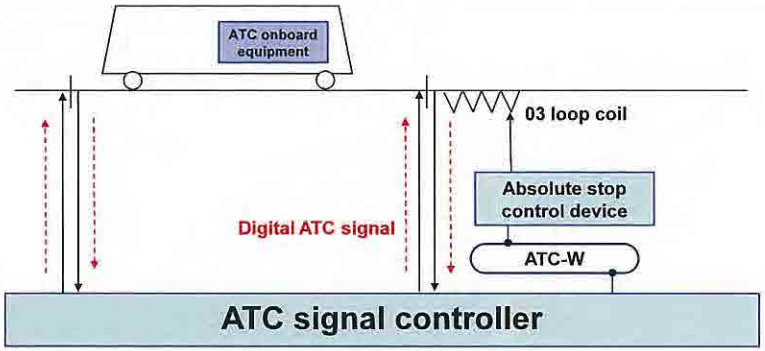
2. Signaling Technology for HSR

日本信号 THE NIPPON SIGNAL CO., LTD.

Typical onboard system configuration



2.3 Automatic Train Control



Process:

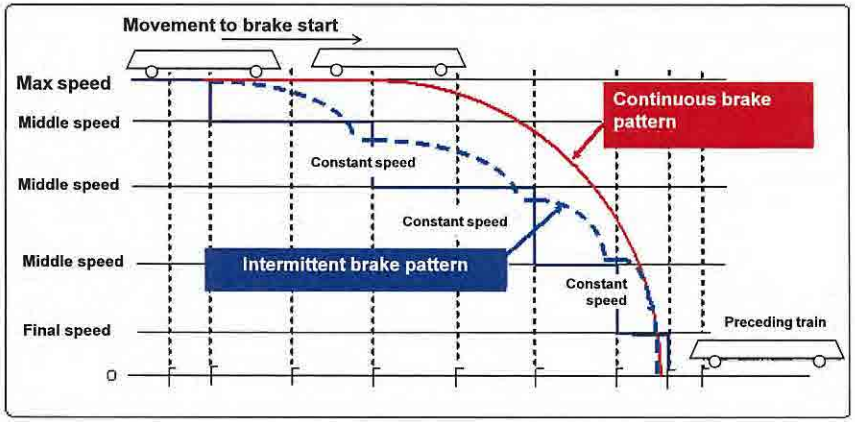
1. Track Vacancy Detection by a change in the ATC signal level
2. Generation of stopping point information by ATC signal controller
3. Transmission of stopping point information by ATC signal controller
4. Creation of speed check pattern by ATC onboard equipment
5. Brake control if train speed over the speed check pattern
   *03 loop coil is used for absolute stop

2.4 Traffic Control/Management system

- **Monitor**
  - Train tracing
  - Delays
  - Equipment
- **Control**
  - Automatic
  - Manual
  - Schedule control
- **Record**
  - Train operation
  - Failure record
  - Logging of operation
  - Record of actual operation
  - System availability

2.3 Automatic Train Control

Continuous brake pattern method is adopted



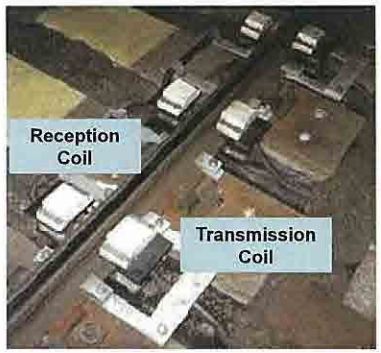
2.5 Others – Disaster Warning System

- Earthquake Warning System
- Environmental Monitoring System
  - Wind speed and direction measurement
  - Rainfall measurement
  - Water level measurement
  - Landslide Detection System
  - Rock fall Detection System

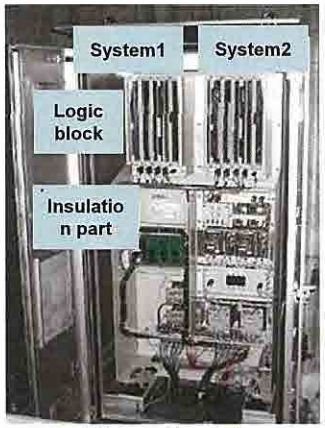
Wind speed and direction measurement

2.5 Others – Digital Axle Counter

Digital Axle Counter is used for Shinkansen as substitute safety system



Axle detector



Axle counting device

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日本信号 THE NIPPON SIGNAL CO., LTD.

NIPPON SIGNAL
THE NIPPON SIGNAL CO., LTD.

http://www.signal.co.jp/

Kawasaki

Technical Introductions of Kawasaki's High Speed EMU Trains

16 December 2011

Kawasaki

1. Company Profiles and Products

Kawasaki

1.1 Company Profiles

Established:	October 15, 1896
Capital:	USD $1,254 million (as of March 31, 2011)
Net Sales:	USD $14.8 billion (FY ending March 31, 2011)
Employees:	32,706 (as of March 31, 2011)

Kawasaki

2. Record of High Speed Train Production

Kawasaki

2.1 Chronicle of Shinkansen Development

Kawasaki's involvement in development of all Shinkansen trains

Kawasaki supplied 3,407 cars as of 30 November 2011.

Kawasaki

2.2 Taiwan High Speed Rail Series 700T

Train Consist:	9 Motor cars plus 3 Trailer Cars
Electric Power Supply:	AC 25,000 V (60 Hz)
Max. operating speed:	300 km/h
Propulsion system:	IGBT Inverter Control
Traction motor:	285 kW x 4 x 9 cars, 3-phase Induction Motors
Dimension:	25,000 mm(L) x 3,380 mm(W) x 3,650 mm(H)
Delivery:	FY2004-2005
Supplied Q'ty by Kawasaki:	360 vehicles
Fire Safety Standard:	BS6853 Ib (Material, Fire Barrier, etc.)

Kawasaki

2.3 Ministry of Railway, China CRH2

Train Consist:	4 Motor Cars plus 4 Trailer Cars
Electric Power Supply:	AC 25,000 V (50 Hz)
Max. operating speed:	200 km/h
Powering:	IGBT Inverter Control
Braking:	Re-generating & Friction Brakes Blending
Traction motor:	300 kW x 4 x 4 cars, 3-phase Induction Motors
Dimension:	25,000mm(L) x 3,380mm(W) x 3,700mm(H)
Floor height:	1,300 mm
Delivery:	FY2006-2007
Supplied Q'ty by Kawasaki:	480 vehicles

Kawasaki

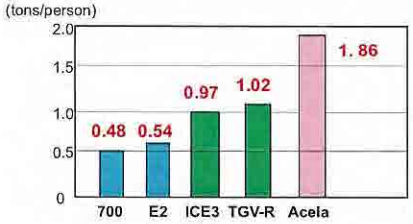
3. Features of Shinkansen Trains

Kawasaki

3.1 Light Weight Design (1)

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

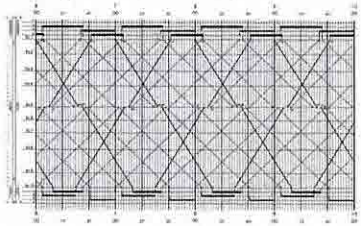


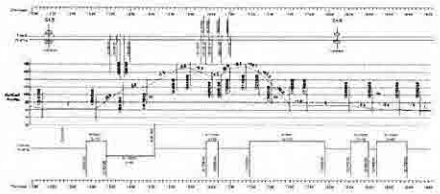
Kawasaki

3.1 Light Weight Design (2)

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





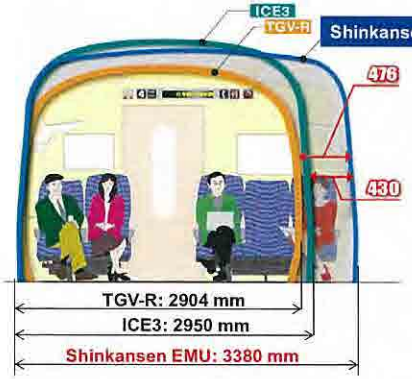
Result (Effect of weight difference only)

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

Kawasaki

3.1 Light Weight Design (3)

Wide-body Design Contributes to Weight / Capacity Ratio.

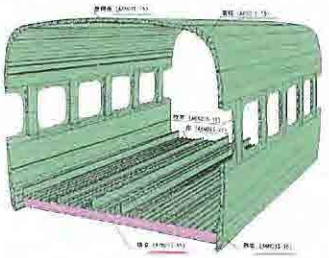


Standard Class	Seat pitch (mm)	Aisle width (mm)
Series 300,700 (*)	1040	570・600
Series E3,E2 (*)	980	550・600
TGV-D	920	450
TGV-R	900	450
ICE3	920	554

Note
(*) Rotation seat

Kawasaki

3.1 Light Weight Design (4)



Carbody – Aluminum Double Skin

Bolster-less Bogie

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

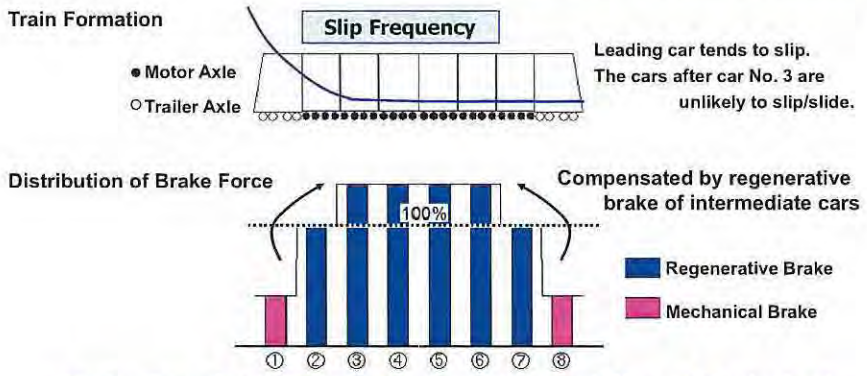
Skin Thickness: Minimum 2.0mm

Kawasaki

3.2 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**



Reduction of Total Power Consumption and Wear of Brake Pad

Kawasaki

3.3 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)
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 sophisticated signaling system and other wayside systems.

↓

Total System Approach Realizes safe high-speed rail.

Kawasaki

4. Kawasaki's Original High Speed Train

Kawasaki

4.1 efSET – Proposed Model

efSET=
environmentally friendly Super Express Train

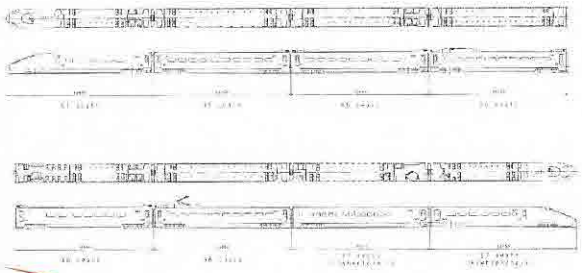
Proven Shinkansen Technology
+ Requirements of the Country

The principle design development of efSET is completed.

Kawasaki

4.2 efSET – Main Specifications

Item	Value
Max. Service Speed	350 km/h
Motor/Truck Ratio	6M2T
Total Traction Power	9,720 kW
Seated Passengers	575
Width	3,380 mm
Train Length	200,000 mm
Train Weight (Empty)	400 t
Max. Axle Weight	14.5 t

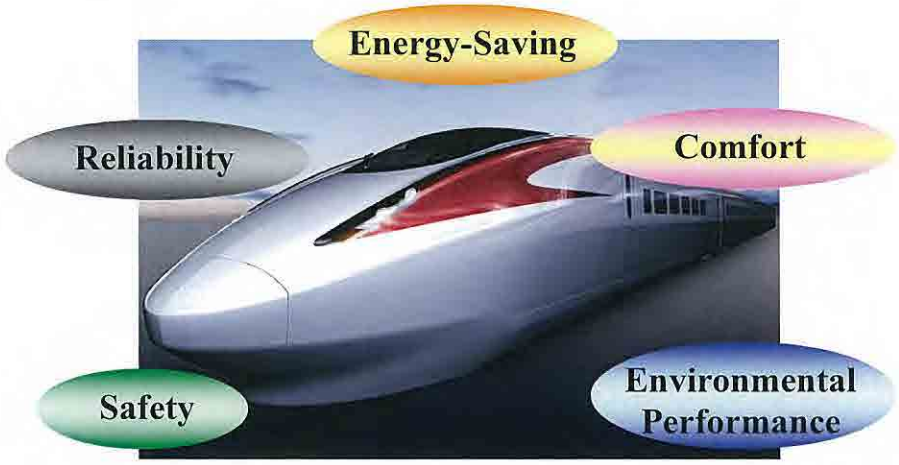


Wide Interior

Light Weight

Kawasaki

4.3 efSET – Design Concept

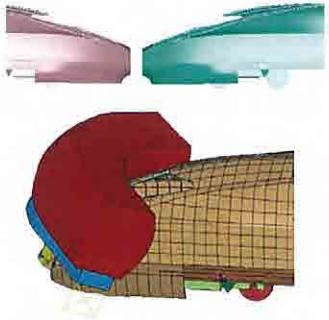


Kawasaki

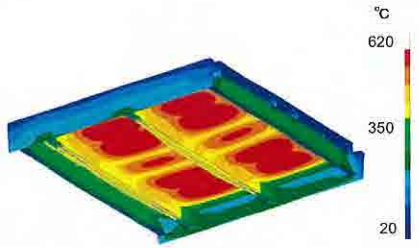
4.4 efSET – Safety

Through operation into conventional line may be required.

⇒ Consideration of Collision and Fire.



Collision Simulation EN15227



Thermal Analysis

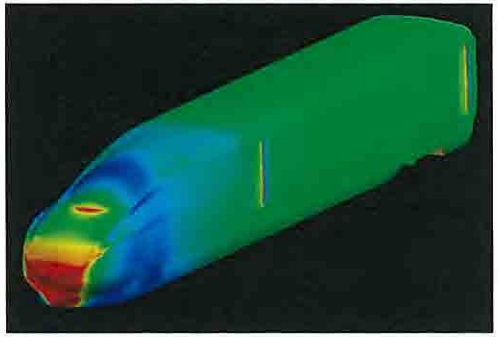
Kawasaki

4.5 efSET – Energy Saving

Light Weight Design

Optimum Use of Regenerative Brake

Low Running Resistance(Aerodynamic Design)



Aerodynamic Commotion Simulation (CFD)

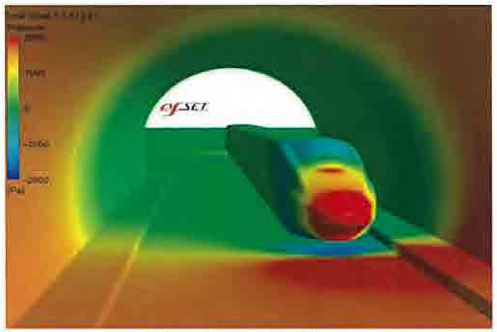
Kawasaki

4.6 efSET – Environmental Performance

Low Noise Emission

Low Vibration to the surrounding Area

Low Micro Pressure effect



Micro Pressure Effect

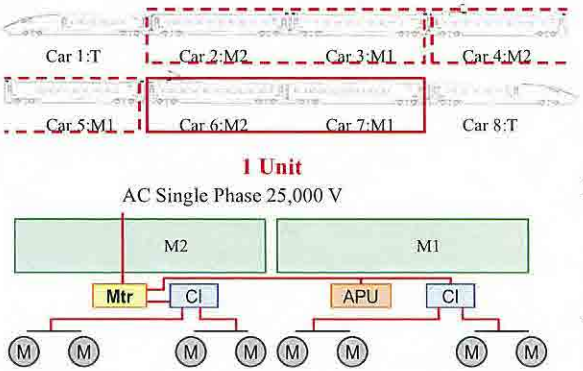
Kawasaki

4.7 efSET – Reliability

Application of Service Proven Technologies

Multi-unit system (2 cars = 1 unit) ensures system redundancy

⇒Possible to continue operation even if one unit fails



T* : Trailer Car

M* : Motor Car

Mtr : Main Transformer

M : Traction Motor

CI : Converter/Inverter

APU : Auxiliary Power Unit

Kawasaki

4.8 efSET – Comfort

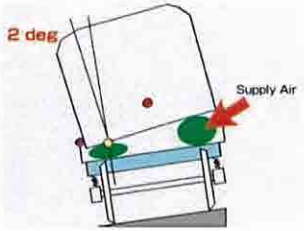
Good Ride Quality

Good Air - tightness

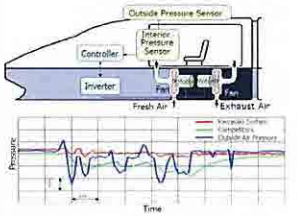
Quiet Salon

Welcoming Design

Full Active Suspension



Carbody Tilting System

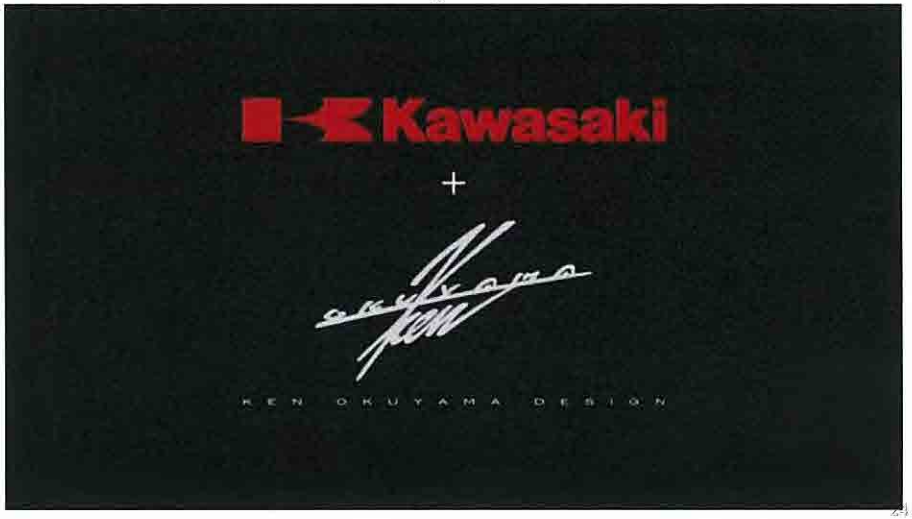


Continuous Ventilation

Kawasaki

4.9 efSET – Design

Collaboration with Ken Okuyama



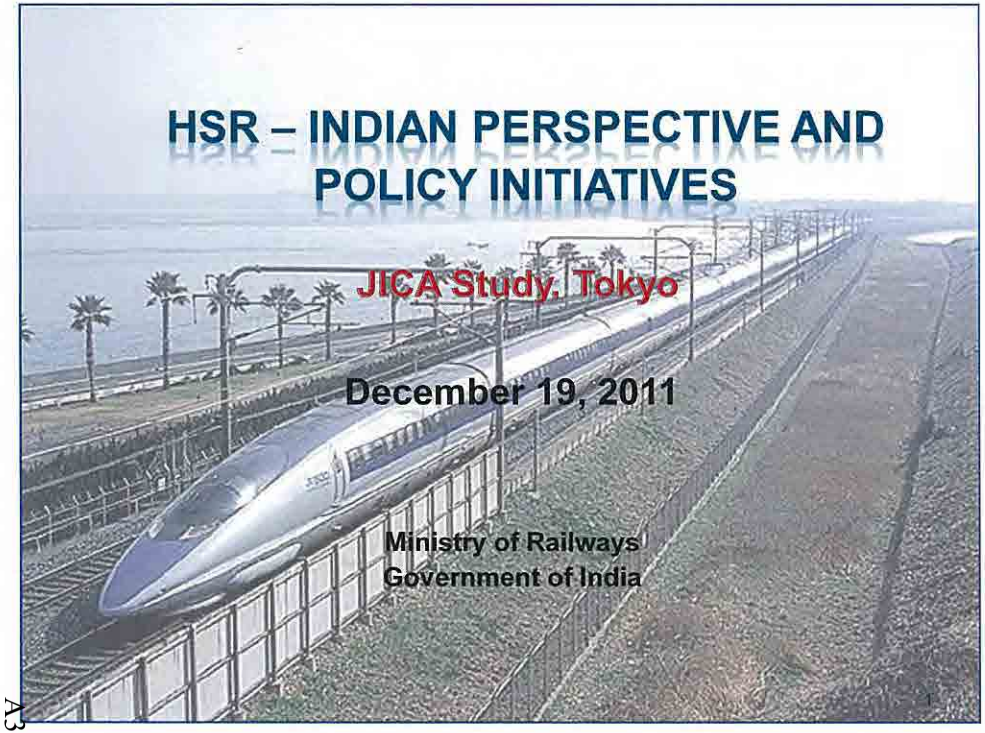
Kawasaki

Thank You Very Much for Your Attention

19th December 2011

Conference with Japanese Government Agencies and JR East

- Presentation by MOR Staff : HSR - Indian Perspective and Policy Initiatives



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CONTENTS

INDIAN TRANSPORT SYSTEM

INDIAN TRANSPORT SYSTEM

- India being the seventh largest country in the world has a large and diverse Transport infrastructure system.
- India's transport sector caters to the needs of 1.4 billion people. Urban population constitutes 31% of total population growing at rate of ~2.3% per annum.
- Railway, Road and Airport - the lifeline and the mainstay of the country's transport Infrastructure.

STATUS OF INDIAN TRANSPORT SYSTEM - RAILWAYS

- Indian Railways - the 3rd largest railway systems in the World, approx. 64,000 route kms.
- Approx. 7 Billion passengers, 922 million tones freight traffic (2010-11).
- Railways - account for approximately 10% of passenger traffic, 35 % of freight traffic.

STATUS OF INDIAN TRANSPORT SYSTEM – ROADS & HIGHWAYS

- 2nd largest road network in the world - 3.3 million kms.
- National Highways form 2% of road network and account for 40% of total road traffic
- Roads -account for approximately 88% of passenger traffic and 65 % of freight traffic.

STATUS OF INDIAN TRANSPORT SYSTEM - AIRPORTS

- 125 airports - 11 international airports.
- Planned investment in airport infrastructure is estimated to be $9 billion by 2013.
- During the past year, passenger traffic has been 34 million and freight traffic has been 0.3 million.

CHALLENGES IN TRANSPORT

- Congestion on the roads, longer journey times, higher vehicle operating costs, higher vehicle emissions, and more traffic accidents.

- Dependence on imported fossil fuels.
- Average passenger train speed is less than 60kmph and average freight train speed is less than 30kmph.

INVESTMENT PLAN IN TRANSPORT: NEXT FIVE YEARS

- USD 1 Trillion Investment in Infrastructure
  - Railway: USD 65.9 Billion
  - Roads and Highways: USD 120 Billion
  - Airports: USD 14.7 Billion

INCREASING URBANIZATION

The major challenges faced are:

- Major Urban centers are severely congested:
  - Dramatic growth in vehicle ownership in the past decade.
  - Accessing jobs, education - becoming increasingly time-consuming.
  - Billions of man-hours are lost with people stuck in traffic.

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NEED OF HSR IN INDIA ?

INCREASING URBANIZATION

Explosion in Inter City Travel

India's urban population - 285 million reported in the 2001 census and 377 million in 2011 census.

McKinsey Global Institute (MGI) projects - 590 million by 2030 (40% of India's total projected population).

INCREASING URBANIZATION

Explosion in Inter City Travel

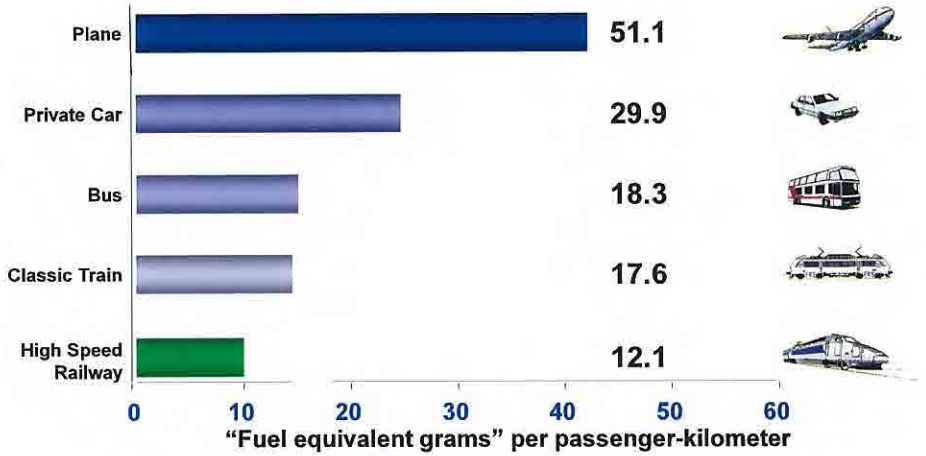
The rapid urbanization in the country has triggered a growing demand for inter city traffic between metropolitan cities and 2nd and 3rd tier cities.

In absence of HSR, passenger traffic of Airlines/ Car users growing at 15-20%

Indian Railways

ENERGY EFFICIENCY

High Speed saves Energy Costs and reduces Greenhouse Gases



Indian Railways

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NEED FOR HSR IN INDIA

HSR is energy efficient and is less polluting than Road/Air travel.

Indian imports about 80% of its oil requirement. HSR will use indigenous energy resources like thermal/hydel/nuclear based energy

Economically as well environmentally, Rail based Transport system is ideally suited for India.

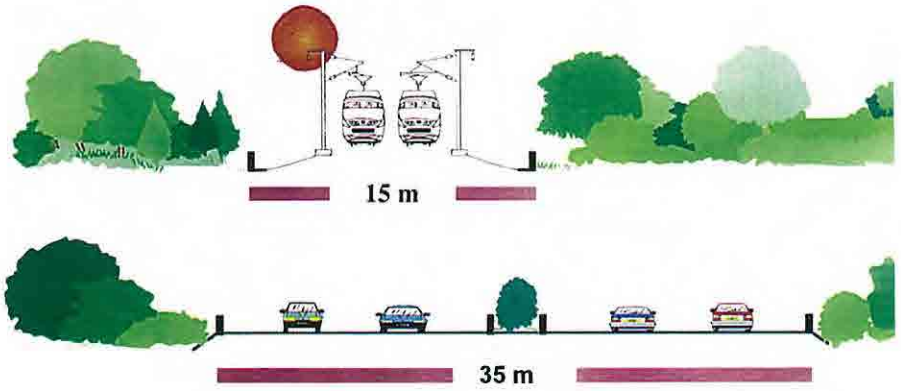
Indian Railways

LAND REQUIREMENT

Land requirements are Smaller

A rail-line allows more passengers than an eight lane highway.

Elevated rail corridors limits Land Acquisition.



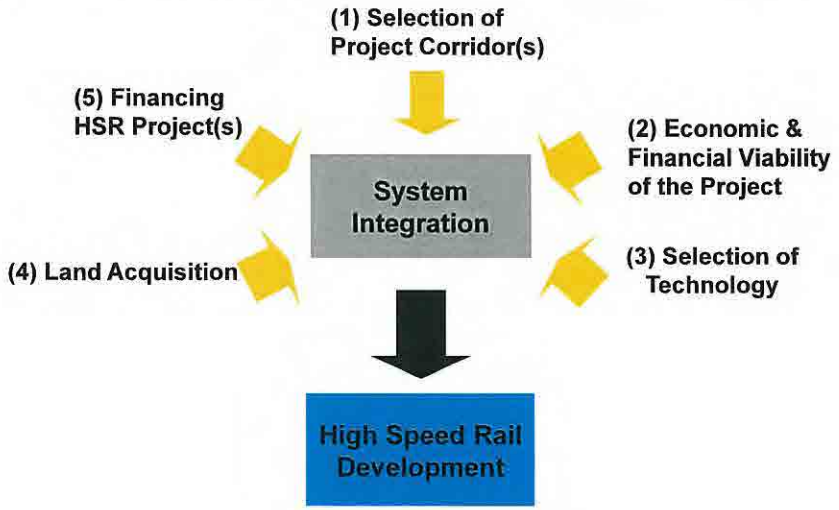
DECONGESTION AND CAPACITY ADDITION

High Speed Rail	Motorway
Double Track	2x3 Lanes
12 Trains per hour per Direction	4500 Cars per hour per direction
1000 Pax/Train	1.7 (Average) Passengers per car
Capacity = 12000 Passengers per hour	Capacity = 7650 Passenger per Hour

Reduction in commuting time between cities and added capacity gives an excellent opportunity for decongestion of the urban centers and growth of smaller towns and other cities.

KEY ISSUES & CHALLENGES

KEY ISSUES & CHALLENGES



(1) SELECTION OF PROJECT CORRIDOR(S) FOR IMPLEMENTATION

- Many choice: Selection of pilot Project;
- Economically/financially viable projects to be given priority;
- Willingness of local governments to participate in the project by way of land and funding support.

(2) ECONOMIC & FINANCIAL VIABILITY OF THE PROJECT

- HSR will be a dedicated line; Huge demand risk due to higher tariffs as compared to conventional rail.
- The high capital costs of HSR makes it a financing challenge.
- Emphasis on other alternative revenue sources like Real estate revenues, carbon credits, cross-subsidy from road/air travelers.

(3) SELECTION OF TECHNOLOGY

- Choice of Technology:

A) Fixed Infrastructure:

  - Mix of Embankment/Elevated/ Underground Structures and their dimensional control;
  - Construction Gauge;
  - Fencing of the complete track;
  - Electrical Installations.

B) Fast Upgrading Technology

  - Rolling Stock
  - Signaling and Communication
  - Train Control
  - Fare Collection

(4) LAND ACQUISITION

- Critical due to stringent alignment requirements
- HSR corridors pass through conurbations or sensitive land;
- Strong public protests adversely affecting large number of projects.

(5) FINANCING OF THE PROJECT(S)

- GOI may not fully fund the corridors.
- Most state governments will have to raise finances by extra levies, real estate etc. even for part funding
- Private sector may not have adequate financing capability to fund the large HSR projects. Proper project structuring by unbundling the projects into smaller packages may be essential.

SYSTEM INTEGRATION

- A typical HSR corridor might have large number of stakeholders (Centre, state governments, local municipalities, Indian Railways, technology vendors etc.), multiple concessions and complex interplay between roles and responsibilities of various authorities and concessionaires.
- The system integrator, the NHSRA or project specific SPV to derive the project to successful development and commercial operations.

REGULATORY STRUCTURE

EXISTING SET UP OF INDIAN RAILWAYS

- Indian Railways is a department owned and controlled by the Government of India, via the Ministry of Railways.
- Constituted under the Indian Railways Act, 1890, Indian Railways is administered by the Railway Board.
- Railway is a Central subject; State govt. do not have jurisdiction on Railway systems

NEED FOR AN INDEPENDENT HSR AUTHORITY ...1

- Operation of High Speed Systems are different as compared to the conventional Railways in terms of financial structuring, tariff, technology and safety parameters.
- The mix of social and commercial principles which guide the policies of conventional railways will not be the appropriate model for HSR
- HSR is highly capital intensive and proposes to provide a value-added service

NEED FOR AN INDEPENDENT HSR AUTHORITY ...2

- HSR Authority will:
  - With a dedicated focussed approach will be able to implement specific tasks more efficiently
  - Raise resources through multiple sources for financing the development
  - Can adopt different PPP structures on case to case basis.

NEED FOR AN INDEPENDENT HSR AUTHORITY ...3

- HSR Authority backed by national legislation will be better suited to interact with multiple state governments and other strategic partners.
- To operate on sound commercial and economic principles.
- The Authority is also envisaged to perform a regulatory role for various HSR concessionaires.

NATIONAL HIGH SPEED RAIL AUTHORITY

NATIONAL HIGH SPEED RAIL AUTHORITY

Government of India to set up a National High Speed Rail Authority (NHSRA)

- An autonomous body for implementation of High Speed Rail Corridor projects.
- This authority will be entrusted with the work of planning, standard setting, implementing and monitoring these projects.

GOALS OF NATIONAL HIGH SPEED RAIL AUTHORITY

- Carry out DPR's for 2000 km of corridors by 2015
- Award of high Speed corridor/corridors of 500 km length for implementation on PPP basis by 2015
- Carry out Pre-Feasibility studies for 10,000 km of corridors by 2025
- Award/Develop high speed corridors of at-least 2000 Km, connecting various major cities having population of more than 2.5 million each with other important urban/industrial centers by 2025.

ROLE OF THE NATIONAL HIGH SPEED RAILWAY AUTHORITY...1

- Planning of core infrastructure and identification of regions for HSR Systems
- Creating platform for long term development of HSR in India
- Identifying and specifying processes and technologies to be used
- Invitation and award of contracts/concessions for implementation of the project
- Land acquisition for setting up new stations and tracks

ROLE OF THE NATIONAL HIGH SPEED RAILWAY AUTHORITY...2

- Overseeing implementation of projects and awarded contracts
- Periodic Monitoring of activities of Concessionaires/SPVs
- Interface with Indian Railway Units
- Coordination between various HSR SPVs
- Identifying sources of financing and assist in achieving financial closure for each project.

ROLE OF THE NATIONAL HIGH SPEED RAILWAY AUTHORITY...3

- Developing additional revenue streams – real estate.
- Optimisation of input costs
- Carry on research activities in relation to the development, maintenance and management of HSR systems or any such facilities
- Advise the State & Central Government on matters relating to HSR systems

IMPLEMENTATION STRUCTURE

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PRESENT STATUS...1

Policy Initiatives:

- Development of high speed rail corridors has been proposed through PPP in the Railway Budget Speech of the Hon'ble Minister for Railways for the Financial Year 2010-11
- Vision 2020 of Indian Railways: Completion of 4 High Speed Corridors of 2000 kms and subsequently development of 8 other corridors

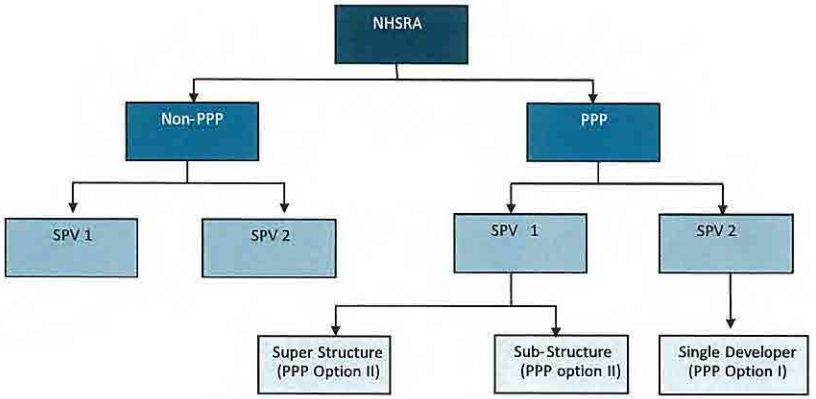
PRESENT STATUS...2

PRESENT STATUS...3

Project Corridors	Status of Prefeasibility Studies
Pune – Mumbai - Ahmedabad	Final Report submitted
Delhi – Agra-Lucknow-Varanasi-Patna	Consultant selected.
Howrah –Haldia	Consultant selected.
Hyderabad-Dornakal-Vijaywada-Chennai	Consultant selected.
Chennai-Bangalore-Coimbatore-Thirvanantpuram	Consultant to be engaged shortly.
Delhi – Chandigarh - Amritsar	Consultant to be engaged shortly.

IMPLEMENTATION STRATEGY

NHSRA shall act as the facilitator and regulator.



IMPLEMENTATION STRATEGY

- Project Structuring Options:
  - Option 1: DBFOT
  - Option 2: Unbundling the project into different components, so as to make the project components attractive to private players from the perspective of affordability in terms of size and risk allocation:
    - B&T (Fixed infrastructure)
    - DFOT (Train operations)

NHSRA FUNDING…1

- Project Development Activities
  - A separate fund will be created
  - To be recovered from viable projects along with additional fee
  - Rolling fund for further project development activities

NHSRA FUNDING…2

- Funding Support by National High speed Railway Authority for PPP projects:
  - Viability Gap Funding
  - Multilateral/Bilateral loans by providing Centre government guarantees
  - Centre government guarantee for Long term Bonds of Project SPVs

NHSRA FUNDING…3

- Funding Support by NHSRA for Non-PPP Projects
  - Directly funded by Centre/State Governments
- Other Sources of Funds
  - Revenue share from Concessionaires (train operators)
  - Contribution from State Governments
  - Real Estate Development

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Shinkansen - A Study Tour Perspective

- Dedicated Network
- Dedicated Organisation
- Infrastructure and Operations
- Integrated Supply Chain
- Creating value for customers
- Continuous Innovation

The Network & Organization

- "Shinkansen" – The Brand
  - Many entities, One Brand
- The Organisation – Public & Private – alignment of Objectives and Goal
  - (Manufacture, Operations, Maintenance & Research)
  - Customer Focus – Safety, Punctuality, Comfort, Speed and Capacity
  - Environment friendly – Emissions, Noise
- Central & Local Government Support

Infrastructure and Operations

- Creating Infrastructure - JRTT
- Separation of Operations
  - Privatisation and division into six private companies of the Japanese National Railway thus fostering efficiency in operations
  - Focused and lean structure for Operations through region based Organisations (East, Central, West, Kyushu)
  - Creating Mini Brands within "Sinkansen" to foster efficiency and dedication in operation (Tokaido, Sanyo, Tohuku, Joetsu)

Integrated Supply Chain

- Backward
  - Specialised Manufacturers, Suppliers (Hitachi, Kawasaki, Toshiba, Nippon... et al.)
  - Robust Maintenance Organisations aligned towards efficient operations
- Forward
  - Creating value beyond travel – The Life style Business

(retail, restaurants, vending machines, shopping centers, hotel chains, advertisement, sports and leisure...)

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Innovation – The Hallmark

- Sinkansen Series – creating new milestones
- New Technology – scaling new heights
  - Construction
  - Rolling stock Manufacture (eg. FSW, PMSM, Bolsterless Bogie, Wt Reduction)
  - Operations and Control (COSMOS)
  - Maintenance
  - Passsenger services – Suika
- Innovative Operation
  - Coupling and de-coupling
  - Mini Shinkansen

OPPORTUNITIES FOR COOPERATION WITH JAPAN

- Japan being pioneer in HSR Technology, can be an important partner in developing Indian HSR.
- Both the countries have very long and close bilateral association.
- The possible areas for cooperation are:
  - Funding assistance
  - Technological assistance – Slab track, construction in congested areas, rolling stock, signalling and control system etc.

Arigato Gozaimasu