

# DSC Trains

Faster Evacuation at Low Cost



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by

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INTEGRATED TRANSPORT

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CASE STUDY

DOUBLE STACK CONTAINER TRAINS

# DOUBLE STACKED CONTAINERS



**Dubble Stack Train Entering Botad Yard**

**No. 1**

# History of Double stack on IR

- Indian Railways have been considering the idea of running DSC trains for last 10 Years.
- PRCL started the first dedicated freight line in India in 2003. The feasibility study was done in 2001.
- In the mean time, Railway Board engaged CANAC for the detailed examination of this concept.
- CANAC gave their inception report in Nov. 2004.
- They could not pursue the study further.
- IR permitted PRCL for carrying out detailed foot by foot survey on the existing route connecting North India with Gujarat ports.
- PRCL completed this survey in 6 days, from 25.09.2005 to 30.09.2005.
- After removing infringements, the first DSC train rolled on 23<sup>rd</sup> March 2006 from Jaipur to Pipavav Port.

# Current Status

- Presently only North American Countries – USA, Canada and Mexico (NAFTA) are running DSC trains on Standard Gauge.
- In 1984, one double stack train per week originated on the west coast and served one US inland market.
- In 2002, over 241 DSC trains per week originated on the west coast and served all the major long haul US market.
- Their Railways have turn around because of savings in operating cost -- 40% savings.
- Their Rail rates are 29% lower today than 1981 and 60 % lower in inflation- adjusted terms for inter-modal cargo.
- The throughput per train are 280 TEUs.
- The mode of traction is Diesel.

# Why DSC operation on IR?

- The ports handled 4.5 M TEUs in 2004-05
- This traffic will go up to 14 M TEUs in next ten years.
- The no of trains required will go up from 25 to 137 per day at 30 % rail share.
- Rail Share is also likely to go up.
- Aiming 50% share will require 225 trains per day.
- This magnitude can not be handled with current practices.
- For increasing the share cost of haulage has to come down .

# Why DSC operation on IR ?

- IR has severe axle – load restrictions and lower speeds.
- Freight rates for high rated cargo are higher as compared to roads as well in comparison to other countries.
- Pay load per container train is very low.
- This affects throughput, cost of haulage and heavy detention on terminals.

# Why DSC operation on IR ?

## ■ Remove constraints

- a) Line capacity constrains – With DSC the no of trains can be reduced by 48%, for the same throughput.
- b) The payload capacity of the container train can be increased from 1500 MT to 2500 MT to match the carrying capacity of the locomotives.
- c) The terminal congestion can be minimized. Dwell time at terminal shall reduce.
- d) Matching of throughput for larger ships can be fulfilled in lesser time.

## ■ Derived Benefits

- a) Cost of unit transportation shall be reduced
- b) Rolling stock req. including locos and flats shall reduce substantially.
- c) Rail share will increase with the same rolling stock.
- d) Shall encourage direct service of bigger ships to Indian Ports.
- e) Overall Transit time of the EXIM containers shall be reduced and in turn cost of Export and Import.

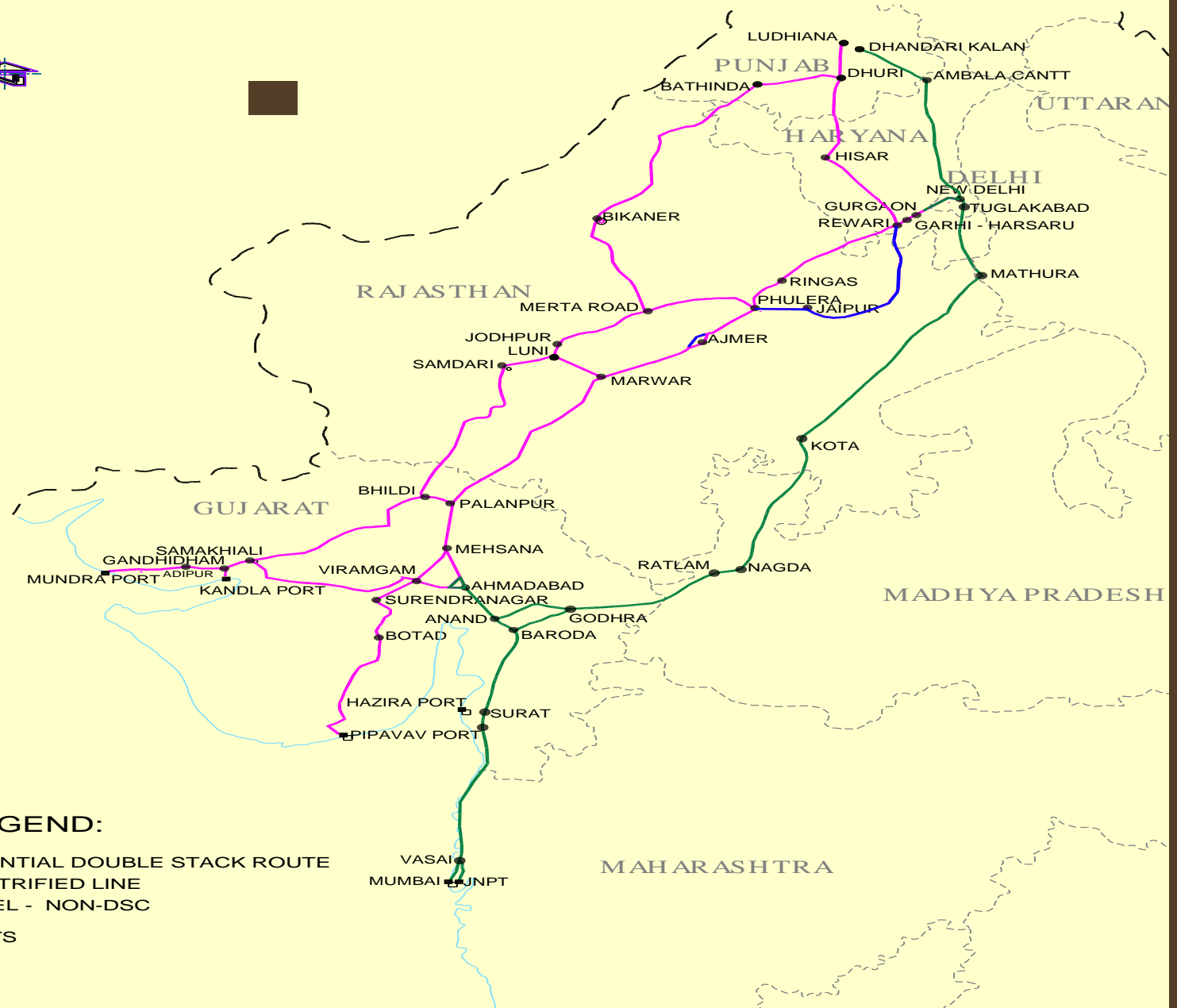
# How It is Possible ?

- Defining of the Maximum Moving Dimensions (MMD) of DSC Movement.
- Identification of fixed structure infringing MMD.
- Modification of these structure.
- The axle – load constraints to be tackled.
- The terminal to be located in the diesel traction territory.

# Action Plan

- Delhi(Gurgaon/Rewari) can be linked to Kandla , Mundra and Pipavav ports by modifying fixed structure like ROBs, FOBs , HT lines, LT lines etc. which has been identified.
- The total cost of Modification shall be approximately Rs.50 Crs
- Route shall be cleared for 9-1/2' high cube.
- This shall take a little longer time and involve high cost because of through girder bridge near Dausa and low height ROBs (07no.)in Jaipur City.
- Therefore this needs phasing of implementation of DSC . To derive immediate benefits this can be done in 2 phases.
- Phase-1 started between Jaipur- Gujarat ports (950 kms Lead) .
- Phase-1, Initially for 8-1/2 containers- 76 % population of containers.- App. Cost Rs 7.76 Crs.
- Later in phase-1, 9-1/2' containers can be Double stacked, this shall cover 95% of the containers- App. Cost Rs 14 Crs.
- Phase-2 , Gurgaon shall be connected after the conversion of Rewari - Phulera section via Ringas.

# The Potential Western DSC Network



# EXIM Container Traffic Projections

- **The** EXIM Traffic in India is growing @ 15% annually.
- The growth rate has been more than what was projected in 10<sup>th</sup> Plan.
- The rail share has been in the range of 30 – 31% from 1998-89.

<u>YEAR</u>	<u>Projected (MTEUs)</u>	<u>Actual (MTEUs)</u>	<u>Rail Share (MTEUs)</u>
2000 - 01	--	2.47	0.75 (30.5%)
2001 - 02	--	2.80	0.9 (31.3%)
2002 - 03	2.90	3.30	1.00 (30.3%)
2003 - 04	3.40	3.90	1.20 (30.7%)
2004 - 05	4.06	4.50	1.35 (30.0%)
<b>2005 - 06</b>	<b>4.50</b>	<b>5.40*</b>	<b>1.83 (34.0%)</b>
<b>2006 - 07</b>	<b>5.00</b>	<b>6.40*</b>	<b>2.24 (35.0%)</b>

\* Projected

# No of trains Projected

Year	No of trains
2004-05	25.5 (Actual)
2009-10	62.8
2014-15	137.6

# Mumbai - The Epicenter of Container Traffic

- Total National traffic- 4.5MTEUs (2004-05)
- Handled at JNPT/NSICT-2. 37 (53%)MTEUs.
- Rail share – 6.2lacs TEUs (26%) .
- No of Trains for Northern Hinterland – 8 Trains each way daily ( 80% of Rail traffic)

## Delhi -JNPT route – Whether ready to cope up with Demands?

- Traffic growth at CAGR of 15% - 15 Trains each way by 2006-07.
- Last year JNPT had frequent traffic hold ups.
- With the commissioning of 3<sup>rd</sup> Container Terminal by Aug.2006,- additional capacity of 1.5 M TEUs. Coupled with saturated line capacity on JNPT- Delhi route, traffic may get severely constrained.
- In 03-04, average line capacity utilisation on Delhi – JNPT rail corridor -125%, and 162% on critical section of Nagda – Ratlam.
- Automatic signaling- not practicable on Nagda- Ratlam due to undulating terrain.
- Demand is much ahead of supply.

# Issues and Alternatives

## Issue I

- The DSC Movement – Not possible on Electrified routes at present.
- Congestion of Delhi – JNPT rail corridor.

## Alternatives

- Pipavav/Mundra/Kandla – Delhi corridor being strengthened rail corridors at a investment of below 1000 Crs
- Pipavav/Mundra/Kandla ports are almost ready to handle increasing traffic demand.
- Line capacity on these routes will get considerably enhanced with DSC movement.
- DSC was possible with least cost (Rs.14Crs )
- DSC operation were launched within two months of decision.

# Cost of Transportation

- Cost of transportation by rail in India is much higher than that of other countries. i.e. cost per 1000 Tonne Kms is:
  - India - \$16.2
  - China - \$8.3
  - Russia - \$7.3
- **The inland transport cost component by rail, for EXIM cargo is much higher in the total transportation cost.**

# Logistic Advantages of Gujarat Ports

- The alternate route of Delhi – Jaipur- Ajmer- Gujarat ports is shorter by 200 Kms as compared to Delhi – Mumbai route.
- It gives savings of \$ 40 per Box to customers on account of shorter route.
- However, this route is also getting congested, and on some sections line capacity utilisation is more than 150%.  
(169% utilisation on Phulera – Jaipur section).
- Comparative cost of Rail Infrastructure on this route is lesser than Delhi – Mumbai sector.

# Continue...

- Recent initiatives of IR shall increase line capacity on this route:
  - GC of Mehsana–Viramgam, Commissioned in Dec. 2004.
  - GC of Palanpur – Gandhidham, work started, SPV formed, work likely to be completed by March 2006.
  - Doubling of Rewari - Delhi, work started and likely to be completed by July 2006.
  - GC of Ajmer – Phulera – Ringus – Rewari , being planned by RVNL
- These will provide faster connectivity to Gujarat ports with Northern Hinterland.

# Maximum Moving Dimensions

	Flat Height in mm	Container Height in mm	Connect height in mm	Clearance for A – Class ODC in mm	Total Vertical Clearance in mm
8-1/2' Containers	1009	5182	20	225	6436
9-1/2' Containers	1009	5792	20	225	7046
Combination of 8-1/2' & 9-1/2' Containers	1009	5486	20	225	6740

## Foot by foot survey ---Methodology

- A box structure of more than double stack height having provision of varying the height was fabricated in Loco Workshop , Ajmer, NWR.
- This box structure was mounted in a BOXN wagon with measuring devices.
- The wagon was run throughout the route during day time under the escorts of concerned PWIs, TIs, LIs and the team of experts from PRCL headed by Vice President ( Tech.)
- The measurements of height , span, and width of the fixed structure namely FOBs, ROBs etc were taken.
- The locations of HT lines, LT lines, and telegraph lines crossing over the track were recorded, while foot plating on locomotive.
- The survey was completed in 6 days.

# Foot by Foot Survey --- Taking Measurement of Through Girder Bridge on Banganga River in Bhankri- Dausa Section



# Foot by Foot Survey --- Taking Measurement of ROB Limdi



# Foot by foot survey --- Taking measurement of FOB , MADAR



# Axle - Load Analysis.

- The containers originated and destined ( 6172 TEUs) for TKD, DDR,DDL and KKU to and from port of Pipavav handled in the month of September 2005 were examined in details with respect to their type and weight .
- 86% of the container movement is to and from the above ICDs.
- Out of these 52% are 40' containers in terms of no. of containers and 69% in terms of TEUs.
- As per Load analysis 93 % containers of import and 99% of Export containers can be double stacked if the axle loads are taken as 21.8 Tonnes per axle in the combination of two twenty, one forty and two forty foot containers per wagon.
- Hence Axle load was not a major constraint at this stage.

# Weight wise analysis.

The existing pattern for port of Pipavav

Cont	20'				40'			
	<=15	15-20	20-24	>24	<=15	15-20	20-24	>24
Exports	34	10	27	29	36	20	17	27
Imports	6	18	34	42	25	2	4	72

The survey done by RITES of the year 2001-02 for ICD TKD

	20	40
Lass than 12	20.9	6.4
12-24	39.8	18.5
>24	6.2	8.1

## Height- Wise Analysis

- All 20' ISO containers are 8-1/2' high.
- 40' ISO containers are having 8-1/2' & 9-1/2' height.
- 70%, 40' containers are of 8-1/2' & 30 % are 9-1/2' height.
- Hence 79 % of the containers moving to and from the TKD, DAR, DDL, KKU are of 8-1/2' height and only 21% are of 9-1/2' high.
- Hence overall 76% of 8-1/2' can be moved in double stack considering the weight criterion.

# Terminal

- At present all the major ICDs of OCNCOR in the northern hinterland are on electrified route.
- Only rail linked ICD at Kanakpura ( Jaipur ) and Rewari are on Diesel route for Gujarat Ports.
- A new ICD has to be developed in the Gurgaon Area to cater the growing demands of the ports and double stack operations.

# Recommendations

- The implementation of DSC can be done in two phases.
- Phase-1, containers having height of 8-1/2' & later on 9-1/2' to be double stacked .
- The population of such containers on Pipavav – Northern Hinterland is more than 76% of 8-1/2' containers and later on 95 % containers can be covered on DSC.
- The double stack operations can be started between ICD at Kanakpura (Jaipur) and Pipavav Port within two months.
- The port of Mundra and Kandla can be connected after the gauge conversion of Palanpur- Gandhidham, which is likely to be completed by March 2006.They should clear the infringements if any .

## Recommendations ( Contd.)

- Gurgaon can be connected after the gauge conversion of Rewari- Ringas- Phulera bypassing Jaipur, which is a sanctioned work
- The DSC operation is feasible on the existing flat wagons. RDSO has already done the feasibility trials between Sidhhpur- Umerdesi (20 Kms) and cleared these wagons for commercial speed of 75 kmph with 9-1/2' double stacked containers.

# Procedure for DSC operation

- The single stack trains from TKD, DDR and DDL may be brought to KKU and double stacked in KKU yard.
- IN KKU ICD, The containers have to be sorted out in terms of two categories of weights <20 Tonnes and > 20 tonnes.
- The loading of DSC trains has to be done as per the weight of the containers so that the heavier containers are put below the lighter containers and overall weight should not be more than 87.2 tonnes including the weight of the wagons.
- Reverse can be adopted in case of imported containers.

# Requirements from Railways

- The work of modification should be coordinated by one authority - Railway Board.
- Execution can be got done one agency in order to expedite the works.
- The detailed speed certificate should be got issued from RDSO for operation of double stack trains for phase-1 on flat wagons.
- The connectors – 800 No. to be made available.

# Picture of the connector



# Contd...

- The phase-2 from Gurgaon can be started soon after GC of Rewari- Ringas- Phulera and modification of fixed structure during the GC.
- The vertical clearance for the ROB under construction on Narnaul Road bet. RE-JP should be kept as 7210mm above R.L. to keep ICD Rewari on Double Stack map.
- After the modification, the test wagons used for foot by foot survey can be moved on the section for confirmation of vertical clearances.

# DSC - Savings in Cost

	2005-06	2007-08	2009-10	2014-15
Projected TEUs	200959	326671	483557	1239285
No of trains with SSC	6.5	10.5	15.6	39.9
No fo Trains With DSC.	3.4	5.6	8.3	21.2
Saving in Rakes Ass. 17 % extra transit time for DSC. Trains	7.4	12.0	17.8	45.6
<b>Saving in Cost of Rakes ( Rs. In Crs.)</b>	<b>88.7</b>	<b>144.1</b>	<b>213.3</b>	<b>546.7</b>
Saving in Locos assuming 17 % extra transit time	2.5	4.0	5.9	15.1
Saving in Expenditure on Loco account in Rs Crs.) / annually	1.20	1.95	2.88	7.39
Saving on Account of Maint of Rakes in Rs Crs. / Annually	4.43	7.21	10.67	27.34
Saving in Fuel in Crs of Rs	9.1	14.8	22.0	56.3
Saving in Crew in Crs.of Rs.	2.4	3.8	5.7	14.6
<b>Total Saving in revenue Expenditure</b>	<b>17.13</b>	<b>27.85</b>	<b>41.22</b>	<b>105.65</b>

Apart from above, savings on deferment of line capacity works, detention of boxes at ports and ICDs, savings in the ICDs and manpower for running less no of trains are to be accounted .

# Conclusion

- DSC started from Jaipur – Pipavav Port for 8-1/2' containers on 23.03.2006.
- The population of such containers is 76% for this corridor.
- Later on DSC operation with 9-1/2' cont. can be started after six months – app cost Rs 530 Lacs.
- In phase-2 DSC from Delhi area can be started after GC of Rewari- Phulera. With no additional cost.

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**THANKS**

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