

**RCF**

# **INNOVATIONS IN COACH DESIGN**

**RCF**

# **LHB DESIGN STAINLESS STEEL COACH**

# Trains with RCF built LHB coaches

- ❑ New Delhi - Mumbai Rajdhani Express
- ❑ New Delhi - Mumbai August Kranti Express
- ❑ New Delhi - Howrah Rajdhani Express
- ❑ New Delhi – Sealdah Rajdhani Express
- ❑ New Delhi – Patna Rajdhani Express
  
- ❑ New Delhi – Lucknow Shatabdi Express
- ❑ New Delhi - Bhopal Shatabdi Express
- ❑ New Delhi – Amritsar Shatabdi Express
- ❑ New Delhi – Kalka Shatabdi Express
  
- ❑ New Delhi - Jammu Shalimar Express(One Rake)

# LHB Coaches



**Shatabdi Chair Car**

**Rajdhani Sleeper Coach**



# LHB Coaches (Chair Car)



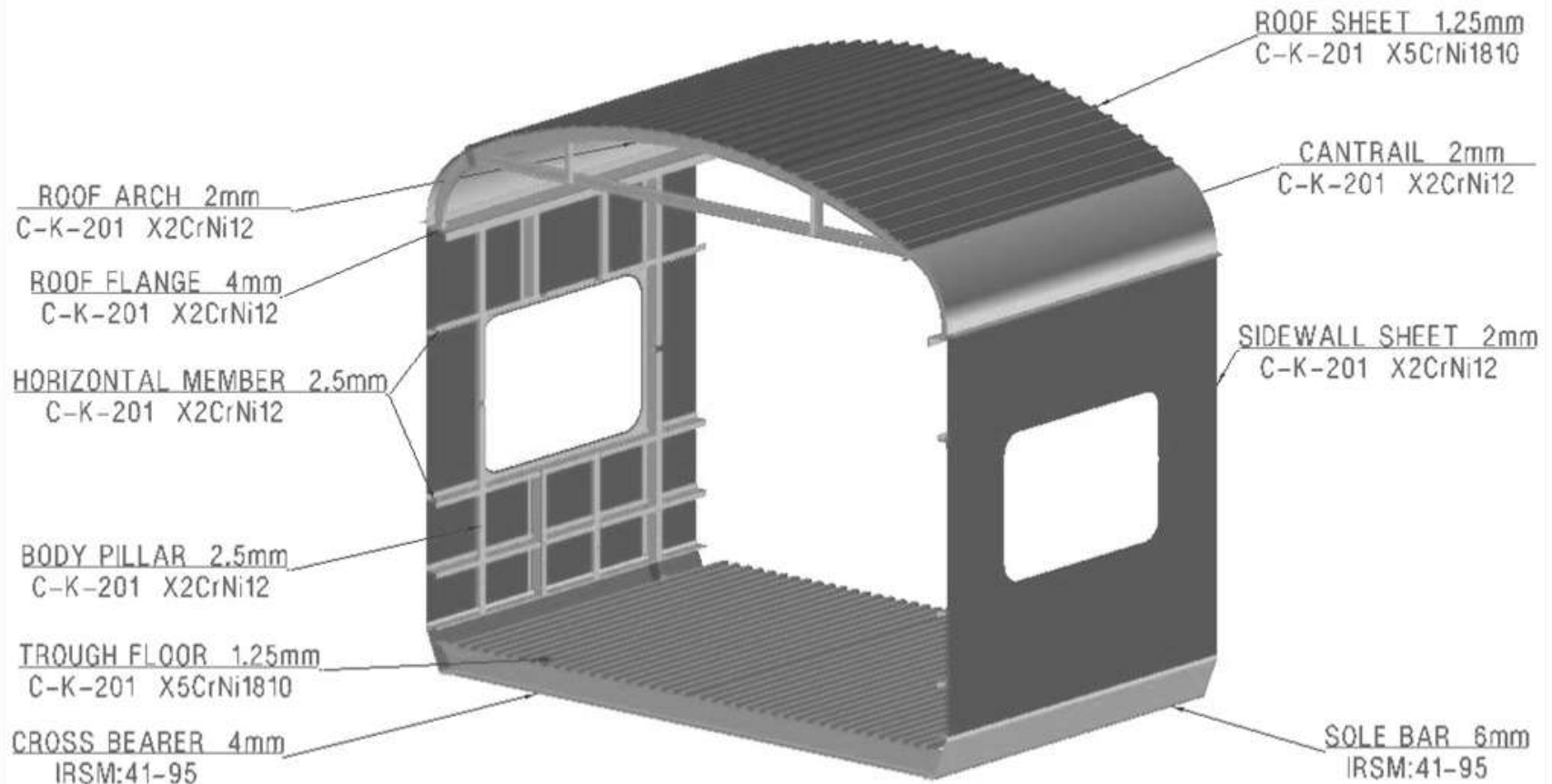
# LHB Coaches (Ex. Chair Car)



# Stainless Steel Shell



# Shell structure



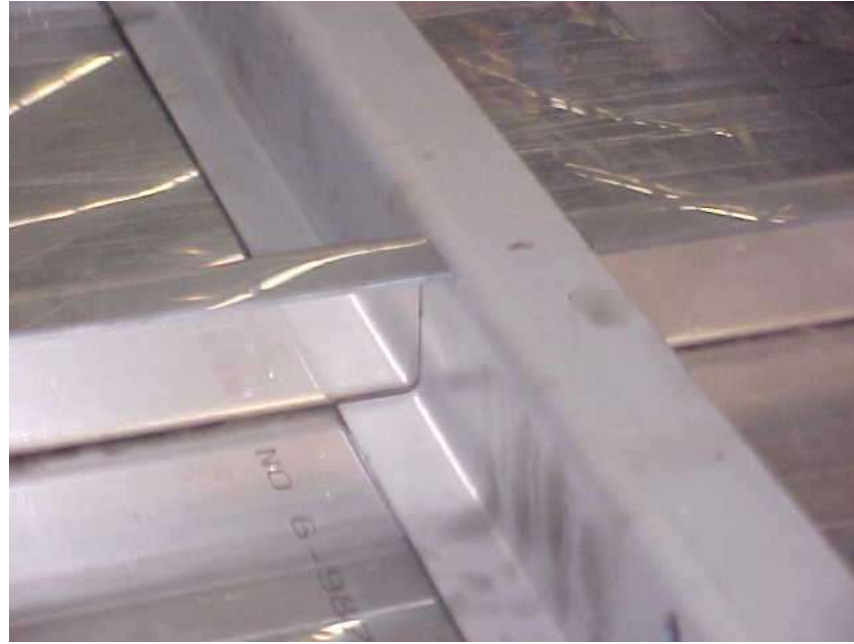
**X2 CrNi12 – Ferritic Steel (SS409)**

**X5 CrNi1810 – Austenitic Steel (SS304)**

TFR-ISO WORK



# Side Wall - Interlocking Joints



- Positive interlocking between all horizontal and vertical members
- Better strength, reduction of side wall thickness to 60mm from 90 mm, better geometrical integrity

# Endwall – extended

- End wall overhangs beyond head stock
- Releasing more space inside
- Reducing space and hence wind resistance due to turbulence between coaches
- Gap between endwalls is 300 mm only as against 830 mm in conventional coaches

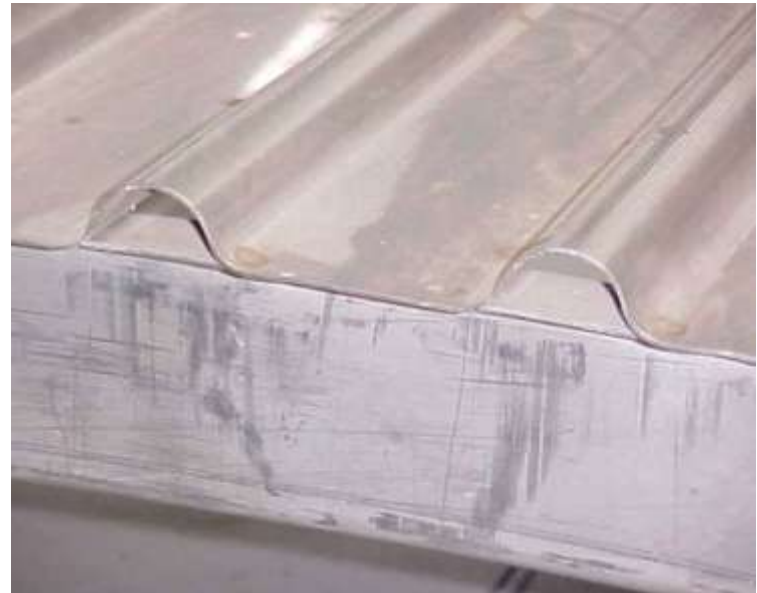


# Laser Cutting



# Roof – corrugated

- Corrugated roof sheet spot welded to z-section roof arches
- Uniform height of arches along it's length
- Roof weighs only about 1000 kg as against 1300 kg in conventional coach



# Roof – Spot Welding



# Superior Insulation

- Sound insulation
  - “Baryskin V60db” or eq. Sound insulation PU paints on full coach shell interior
- Heat insulation
  - “**Resonaflex**” (diagonally glued pleated cellulose acetate film, light weight, high thermal resistance) ON side wall & floor
  - **Glass wool** on roof and side wall (above window)

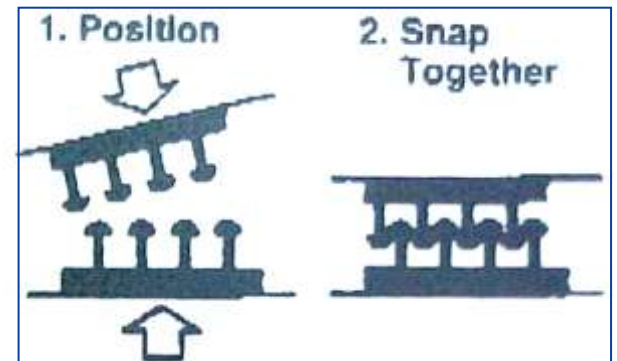


# Use of composite materials



← Aluminium honeycomb for partitions

3M Pressure locks →



← “Alucobond” lavatory ceiling panel

# Emergency openable window

- Four units provided in each coach to allow emergency evacuation of passengers



- A handle connected to the rubber profile opens the glass unit of the emergency window



# Lavatory interiors



# Controlled Discharge Toilet System

- The waste gets accumulated in retention tank
- Speed sensed through WSP
- Discharge valve opens above 30KMPH
- Discharge after every set no of flushes (0-15, programmable)
- Flushing with pressurised water
- Overflow pipe provided in retention tank
- Slide valve on top of tank prevents foul smell from entering the lav



Waste Retention Tank

# Luggage rack (Chair Car)

- Made from aluminium extrusions and tempered safety glass
- Can withstand distributed load of 1000 N (100 kgs) per metre length and point load of 850 N (85 Kgs) as per UIC 566.
- Halogen reading lights, for individual seats, fitted into outer extrusion and wiring hidden by polycarbonate cover



# Salient features – FIAT bogie

- Eurofima Y-frame design
- Fit for 180 kmph
- No metal wearing parts
- Nine dampers per bogie for improved ride
- Rubber suspension components
- Cartridge Tapered Roller Bearings



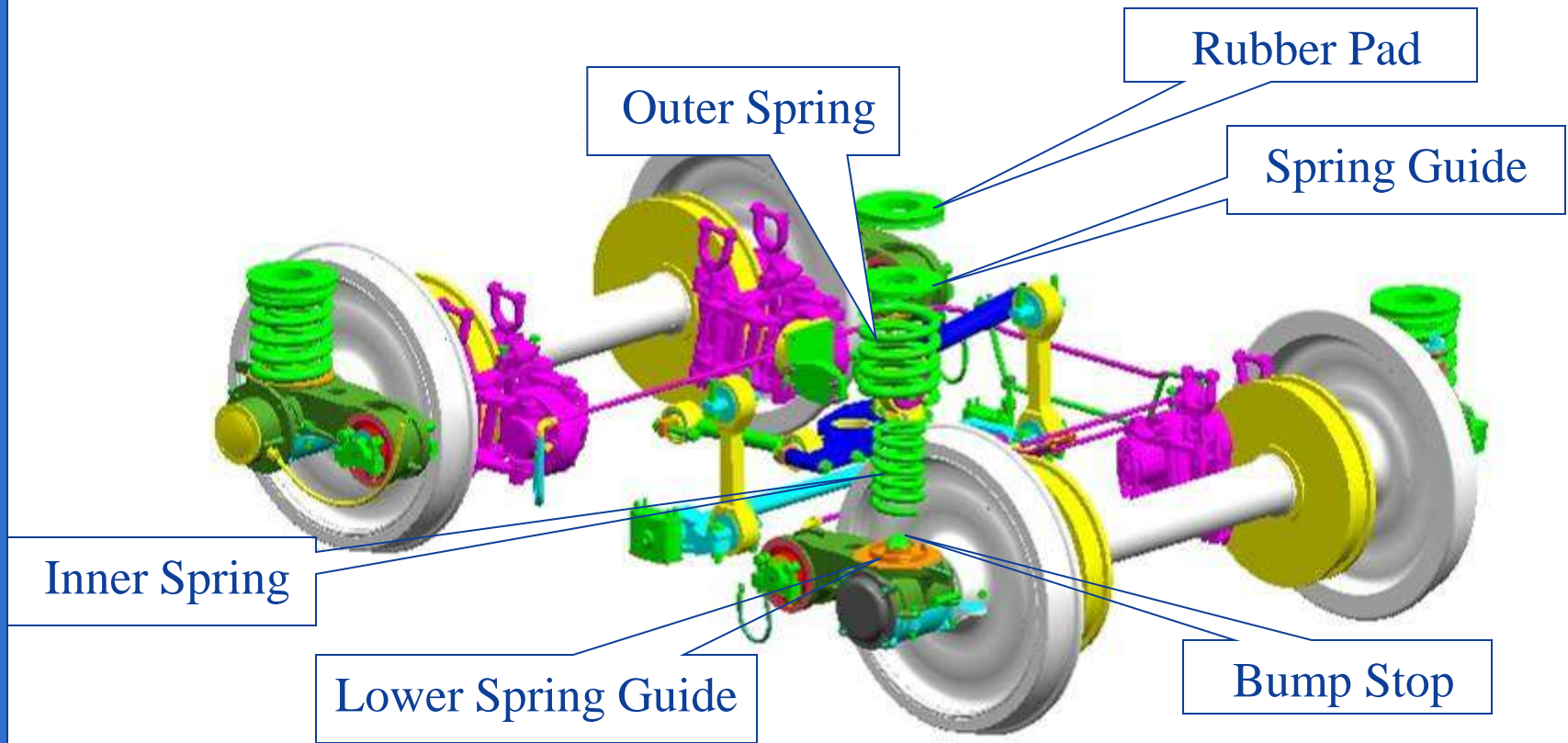
# Under Water Plasma Cutting



# Bogie frame – robotic welding



# Primary suspension



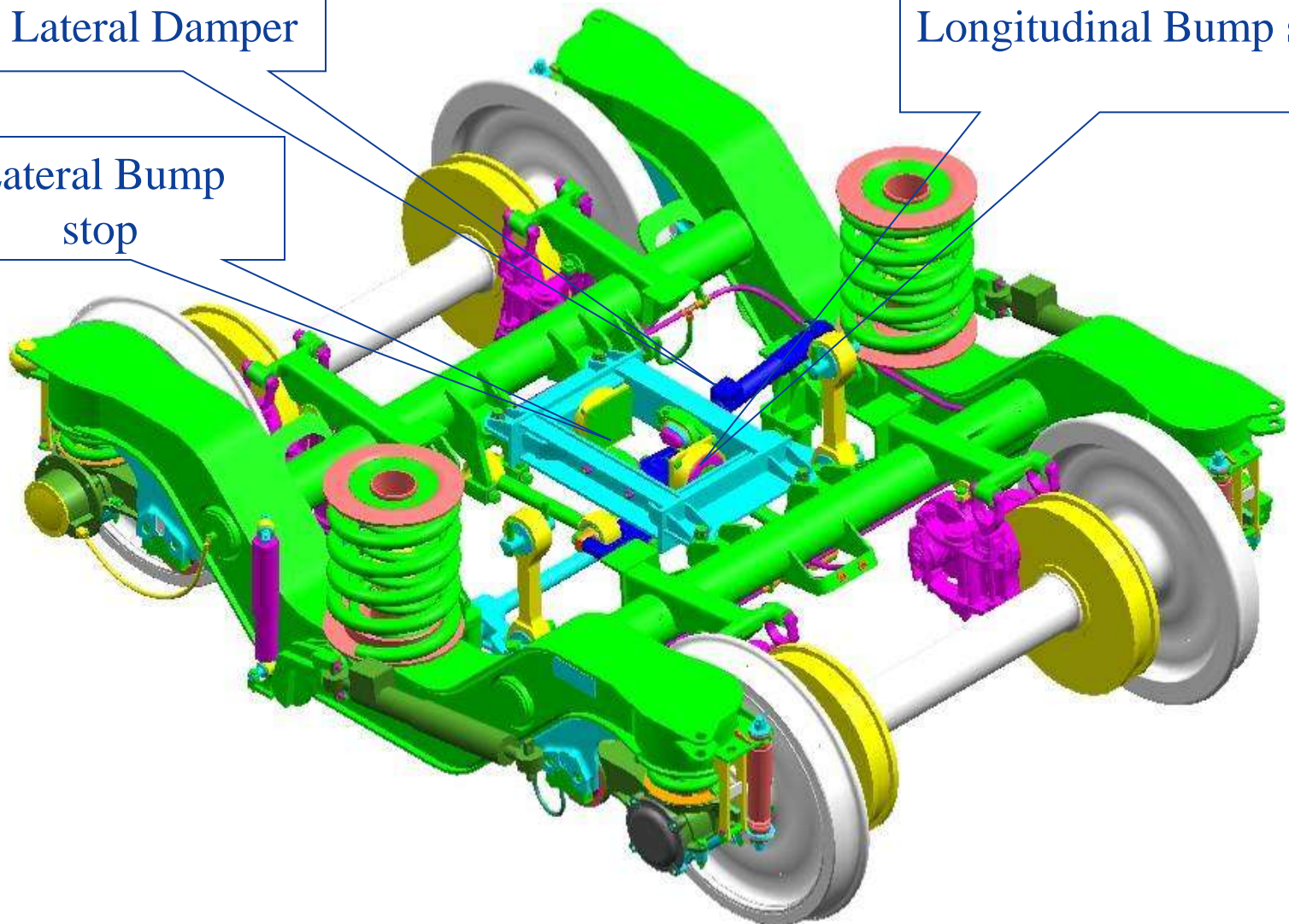
# Secondary Suspension

(With Bolster removed)

Lateral Damper

Longitudinal Bump stop

Lateral Bump stop





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# GARIB RATH



# Garib Rath

- Purpose of such trains is to provide facility of AC travel to the common man.
- First train flagged off by Prime Minister on 4th Oct' 06. Sixteen such rakes have been delivered to railways.

# Garib Rath Rake

- 12 AC 3-Tier coaches
  - each with 78 (normal - 64) passengers
- 4 AC Chair Cars ( manufactured by ICF)
  - each with 102 (normal - 74) passengers
- 2 High Capacity Power cars
  - with compartment for disabled passengers

# GARIB RATH AC 3T

- Capacity of 78 passengers to seat and sleep
- Comfortable seats
- Better aesthetics



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# EXPORT OF COACHES



# Myanmar Railway Coaches

- Roof mounted top loading SS water tank
- Stainless steel luggage racks
- Revolving chairs in upper class day coach.
- Cushioned seats in lower class day coach also.
- PA room in Brake Van



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## COACHES FOR MALI & SENEGAL



# MG/AC Chair Car

- Ergonomically designed PU cushioned chairs
- Roof mounted AC units
- Wider windows for panoramic view
- Underslung water tank
- Aesthetically pleasing SS luggage racks with reading lights
- UIC vestibule

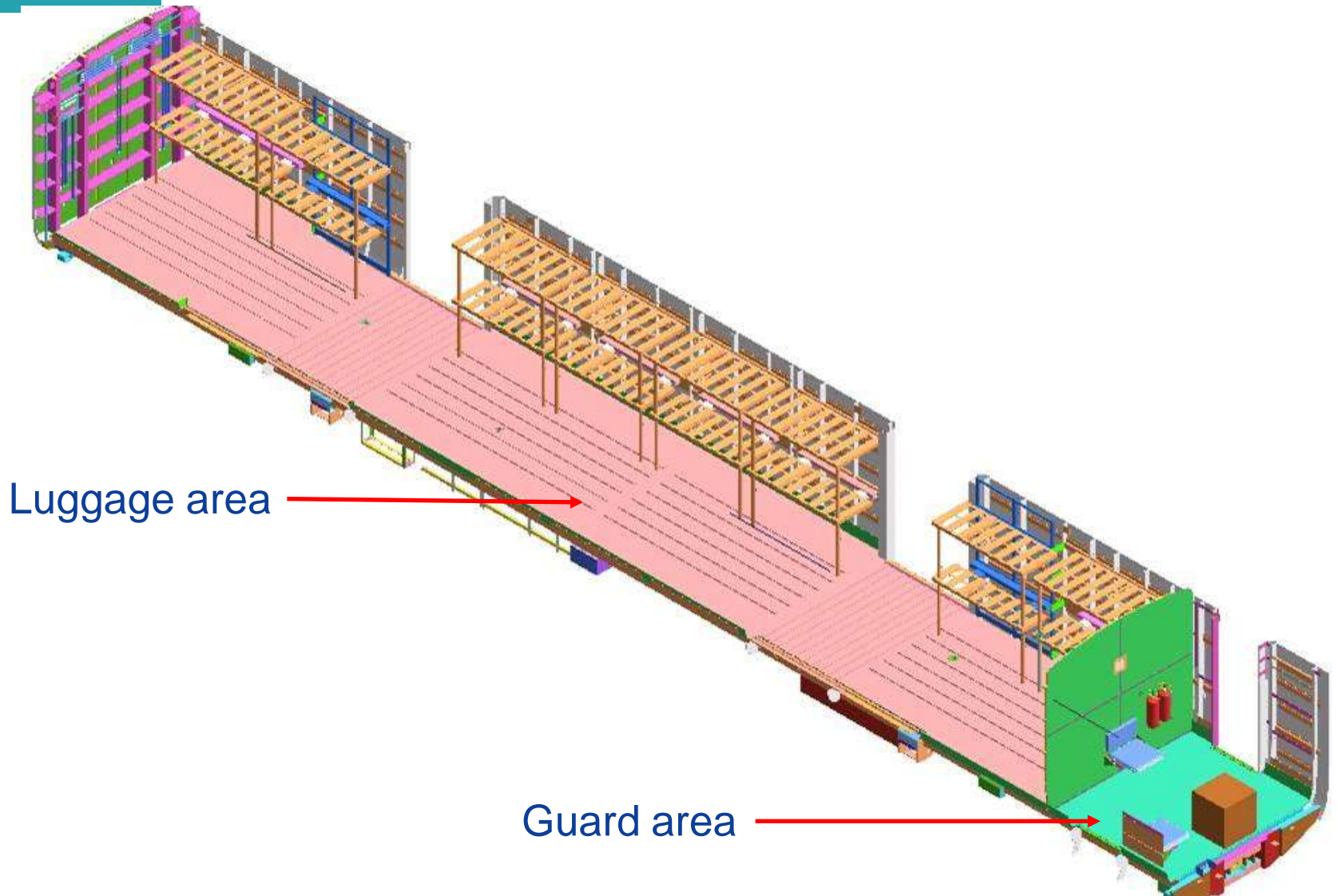




# Non AC Chair Cars

- 56 ergonomically designed PU cushioned chairs
- PA system
- UIC vestibule
- Mobile charging socket
- Al. water tanks having capacity of 1200 ltrs.

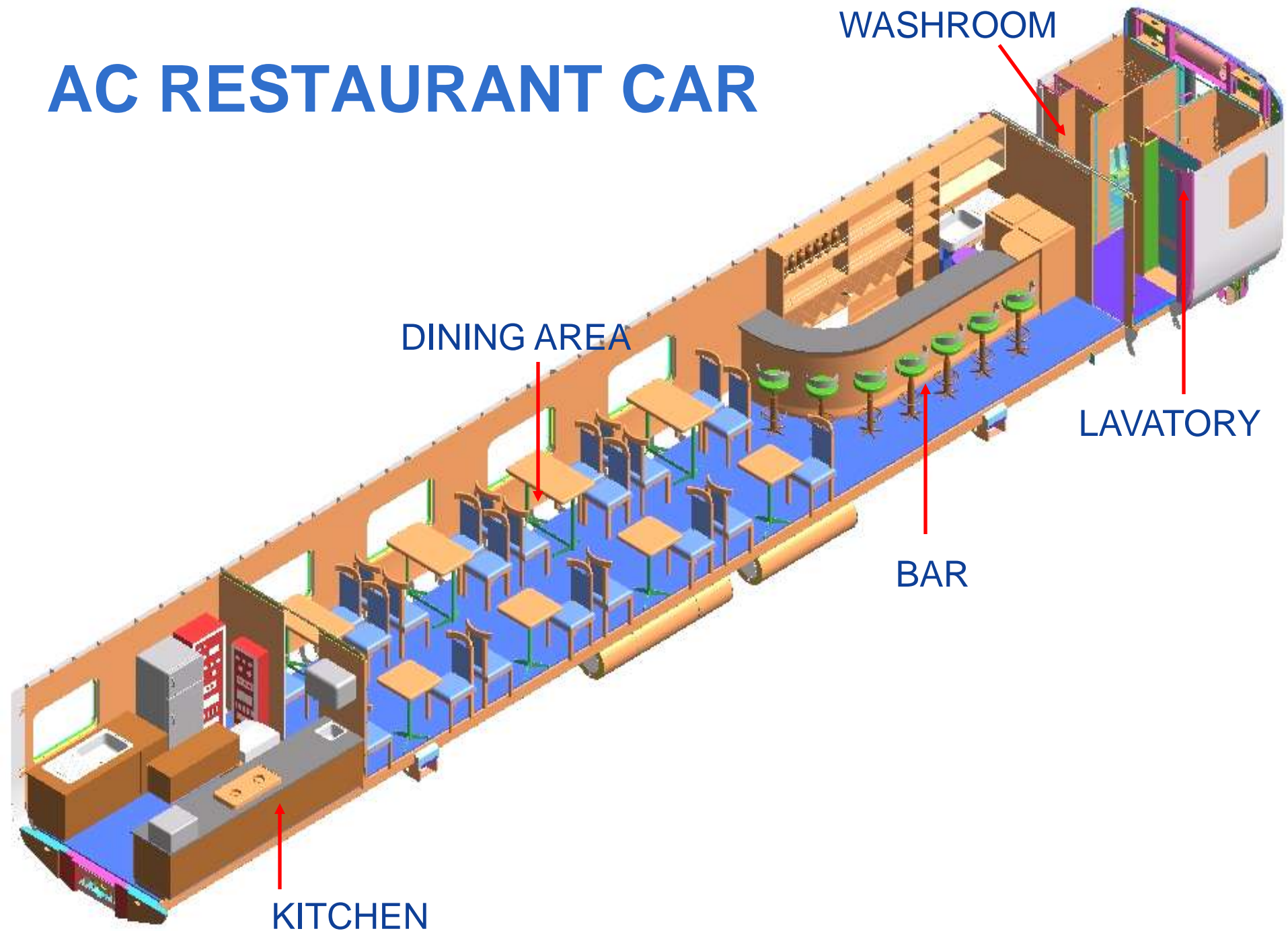
# Luggage cum Brake Van



# AC Restaurant Car

- Provision of Refrigerator, cooking range, hot case, water boiler, microwave oven, etc in kitchen
- 24 dining chairs with table in Dining area
- Provision of granite-top counter, deep freezer, bottle rack,
- 7 nos. of elevated chairs & music system below counter in bar area

# AC RESTAURANT CAR





**AC RESTAURANT CAR**





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# **SPECIAL PURPOSE COACHES**



# Special purpose vehicles



**POSTAL VAN**



**COACHES FOR DEFENCE**



**REFRIGERATED VAN**



**SELF PROPELLED  
ACCIDENT RELIEF TRAIN**

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# **SCIENCE EXPRESS TRAIN**

# SCIENCE EXPRESS TRAIN

- Turned out in association with Max Planck Society of Germany
- Inaugurated by Hon'ble Prime Minister of India and Her Excellency, The Chancellor of Germany on 30.10.2007 in Delhi.



# SCIENCE EXPRESS TRAIN

- AC 3 Tier EOG Shell with no lavatory
- Pure white panelling covering windows
- Interior by Max Planck
- Exterior Painting as per requirement of Max Planck



# SCIENCE EXPRESS TRAIN



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# **OTHER DESIGN INNOVATIONS**

# Longitudinal Middle Berth

- Additional berth on longitudinal side
- Retro-fitment possible in existing coaches
- The berth can be folded during daytime
- Un-obstructed view of windows when berth is in folded condition
- Sleeping capacity to increase by 8 & 9 berths in existing AC 3 T and SCN coaches respectively
- Sleeping capacity to increase to 78 in Garib Rath AC 3 T coaches alongwith provision of linen room and mini-pantry

# Longitudinal Middle Berth





# Modified SLR (SRD) Coach

- A variant designed in which luggage compartment has been eliminated
  - For use in trains where luggage loading is not significant
  - Seating capacity increased from 20 to 60

## Composite AC 2T + AC 3T Coach

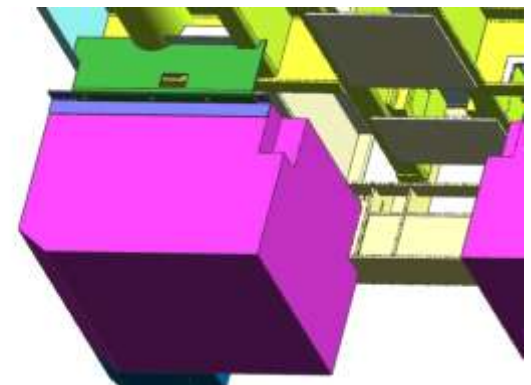
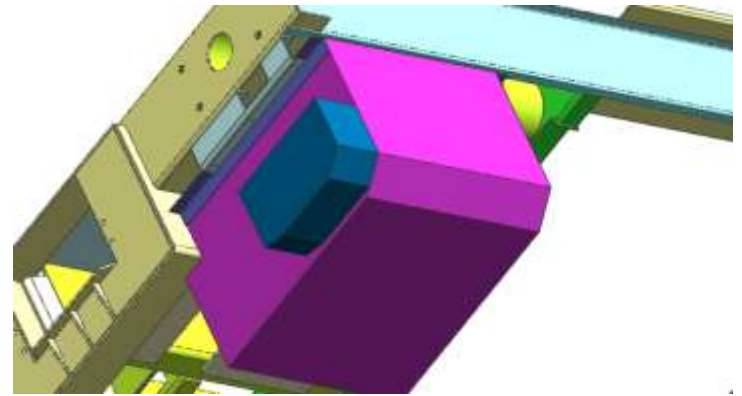
- Sleeping capacity of 24 and 36 passengers in AC 2-Tier and AC 3-Tier area respectively
- Provision of western style toilet on both ends
- Provision of linen rooms for both the areas
- Use of AC 3-Tier shell giving better head space in 2-Tier area

## Composite First AC+ AC 3T Coach

- Sleeping capacity of 10 and 33 passengers in First AC and AC 3-Tier area respectively
- Provision of linen rooms for both the areas
- Use of AC 3-Tier shell

# Biological Toilets

- To have environment friendly toilets in coaches Biological toilets have been fitted on one ACCN coach in April 07
  - The toilets tried out in Prayag Raj Express between New Delhi-Allahabad
  - Fitted in one rake of Reva express.
- Works on the principles of decomposition of waste by the bacteria proliferating.
- The effluent is disinfected before it is discharged.



# Coaches with Improved Interiors

- Upholstery in pleasing shades.
- Matching PVC with mosaic pattern with better wear resistance and fire retardancy used
- Matching LP sheets with better fire retardancy
- Use of Recron as a cushioning material for fire retardancy
- Better fire retardancy for the upholstery
- Specifications for fire retardant PVC, LP SHEET, NFTC, upholstery developed by RDSO

# Coaches with Improved Interiors

Middle berth in folded position



# Toilets with SS paneling



# Toilets with SS paneling

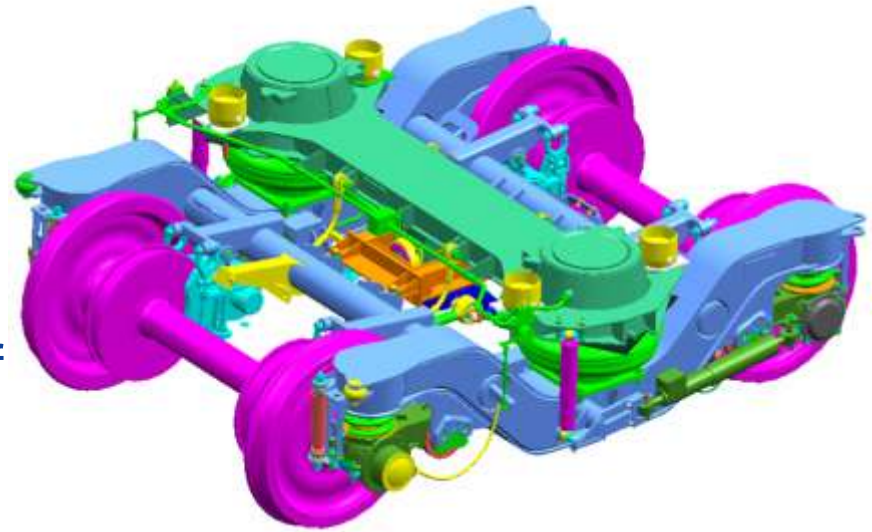


- Screw-less dull satin finish stainless steel panels inside
- LP paneling outside
- Concealed plumbing
- Pivoted door and door frame as one assembly
- Aluminium Composite ceiling panels in roof
- Provision of health faucet, controlled discharge tap, SS soap dispenser
- Anti slip wear resistant coating on floor and skirting instead of PVC flooring sheet



# Air Springs in conventional and LHB type coaches

- Better ride index, especially lateral
- Constant height of air spring under varying loads. Hence, problem of insufficient clearances due to overloading is eliminated.
- Same suspension can be adopted for different variants.
- Fitted on one GS coach
  - Cleared oscillation trials



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# Low Cost LHB design

# LHB Shell on ICF Bogies

## (With Air Spring)

- LHB Features retained
  - Stainless steel shell
  - LHB design windows
  - Fire barrier sliding vestibule door
  - CDTS
- Furnishing and Electrics as in conventional ICF coaches
- Oscillation trials completed (Fit to run at 130 km/h)

## LHB Shell On ICF Bogies - Advantages

- Stainless steel shell
- Lower maintenance due to use of stainless steel
- Coach cost only marginally higher than that of existing coaches
- Higher carrying Capacity
- Similar maintenance practices
- An alternate to SG variants



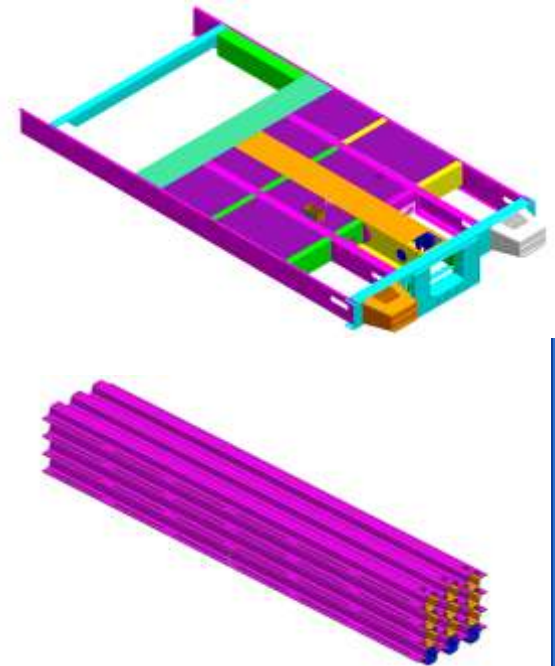
# LED BASED LIGHTS

- Provided in one ACCN coach
- Almost all lights except berth reading lights
- Trials by M/S Srikon Enterprises, Mumbai in collaboration with M/S Richardson, Malaysia



# Crashworthy Features

- Designed to absorb crash energy in the end
- Crash tests conducted upto 60 km/h
- Specially designed energy absorbing elements-
  - Buckle initiators
  - Primary and Secondary Absorbers (Honey Comb)
  - Draft Gears
- Total energy 2.4 MJ
- Absorbed 1.3 MJ (54%)



# Crashworthy Features





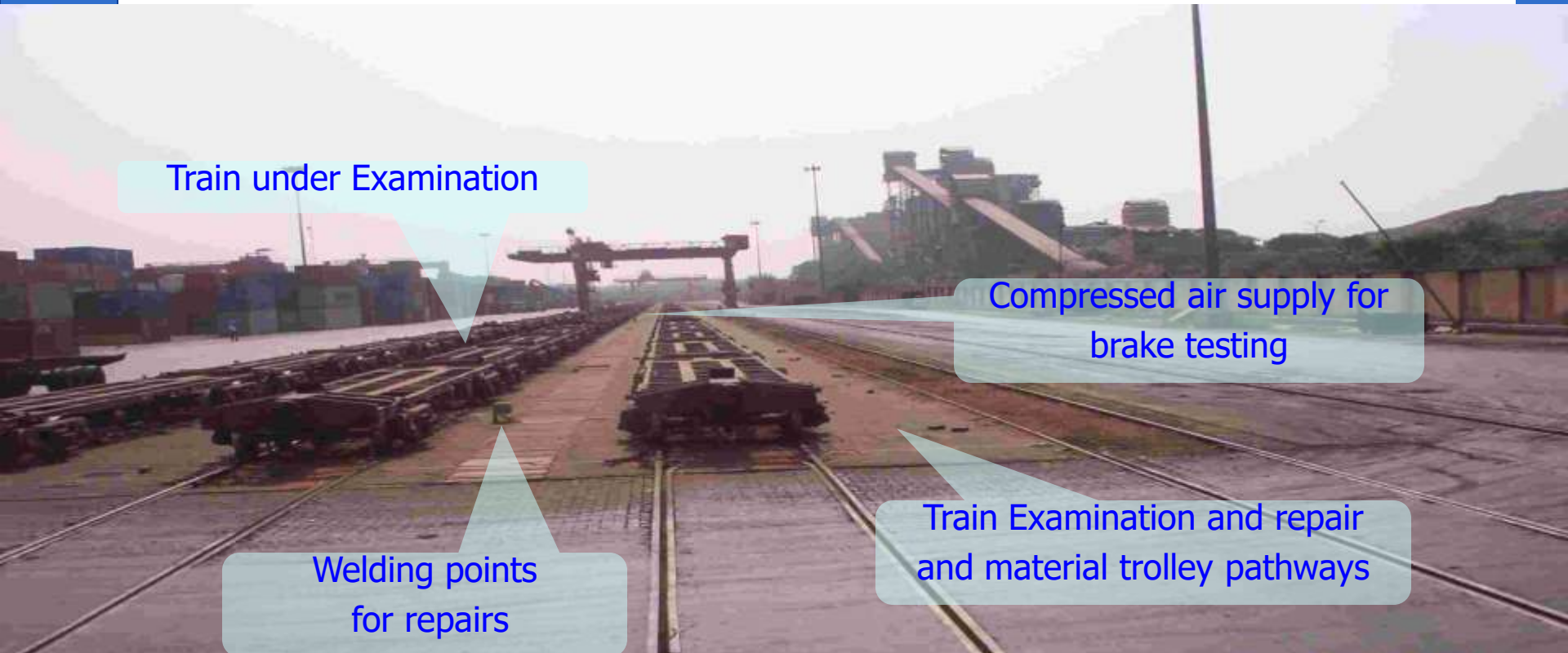


THANKS

# BLC Container Wagons

# BLC Container Wagons System of Wagon Operations

THE Rail head at Terminal (ICD, Tugalakabad)



Train under Examination

Compressed air supply for  
brake testing

Welding points  
for repairs

Train Examination and repair  
and material trolley pathways

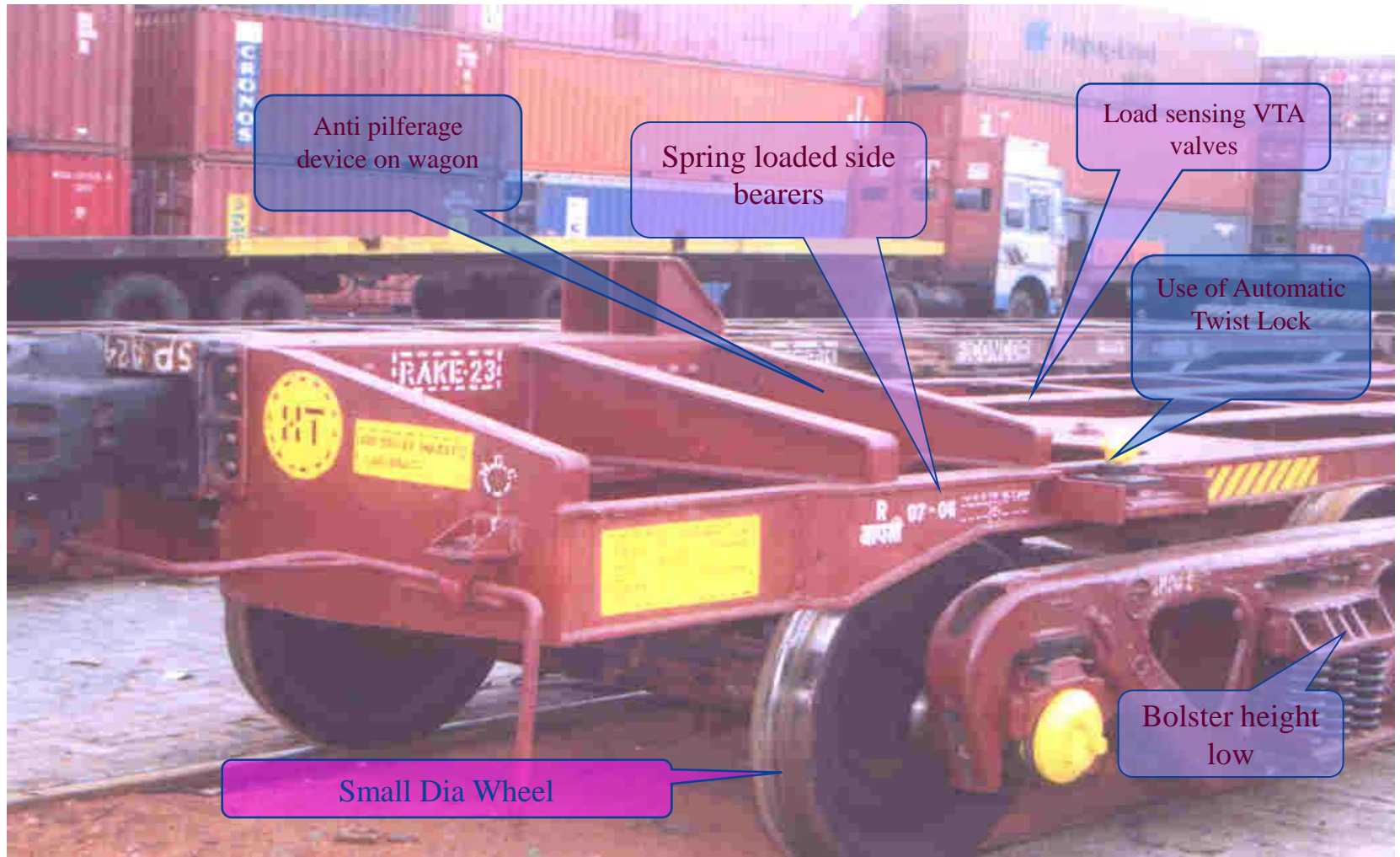
# CONCOR – Principal assets

- Network of 56 terminals
- Fleet of over 5430 high speed wagons (BLC/BLL)
- Fleet of 1357 BFKN wagons

## Problems with conventional wagons

- With the increase in height of ISO containers from 8'-6" to 9'-6", these would be treated as Over Dimensional Consignment
- Unable to provide guaranteed & faster transit times for export/Import containers synchronizing with Ship sailing schedule
  - The maximum speed of these wagons is 75 KMPH only
  - Lower precedence vis-à-vis Mail/Express trains
- Poor reliability

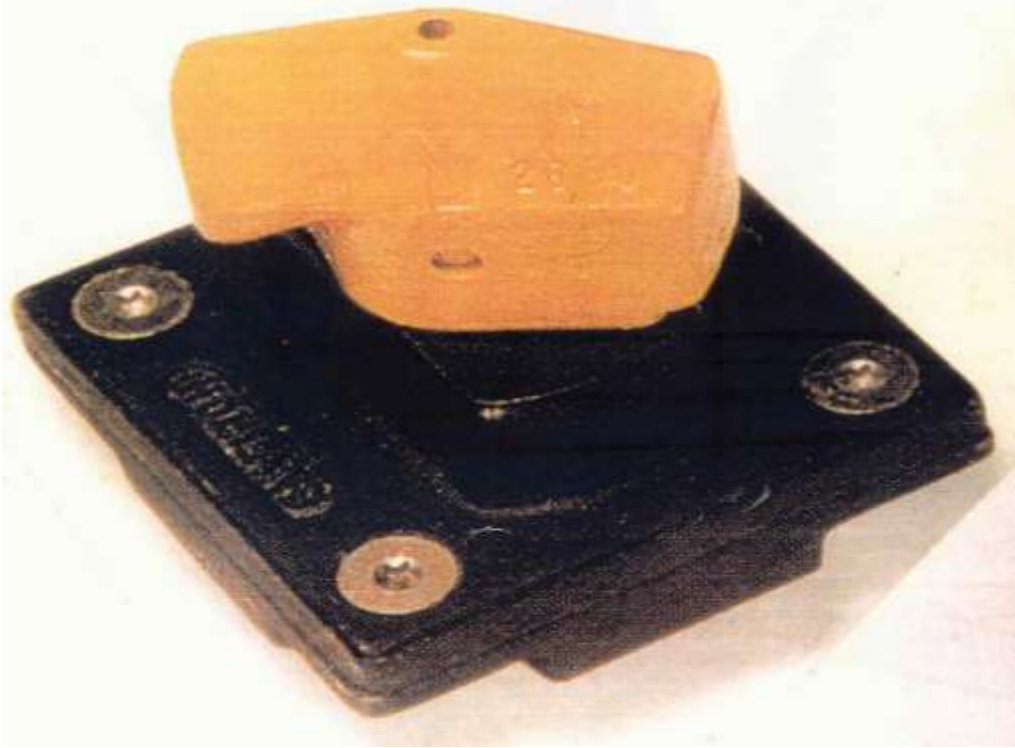
# BLC Container Wagons



## Salient features of BLC wagons

- Low platform height wagons of 1.07m to carry 20 feet and 40 feet ISO containers
  - without infringing Indian Railways X class Broad Gauge moving dimensions
- 100 kmph operation capability.
- Automatic container twist locks for automatic locking and unlocking of Containers during loading and unloading.
- Load sensing device to obviate manual resetting of load/empty device handle of wagon at loading/unloading point

# BLC Container Wagons



**Automatic Twist  
Lock**



## Salient features of BLC wagons ..contd.

- Fabricated body with High tensile steel to IS 8500 Fe 570 B Cu instead of mild steel
  - to ensure lightweight design and more pay load capacity
- Reduction in coupler forces by use of slack free draw bar
  - Reduced wagon damage, Smooth acceleration and deceleration
- Two stage vertical suspension
  - to provide higher static deflection in empty condition
  - Vertical suspension in loaded condition is stiffer
- Load proportional friction damping arrangement using stiffer snubber springs
- Load distribution between centre pivot and side bearers has been optimized to avoid hunting.

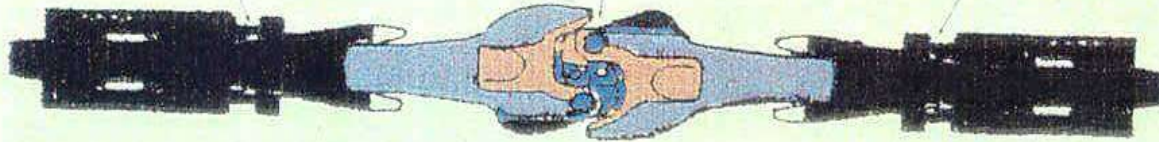
# BLC Container Wagons

## C B C SLACK

3-1/4" DRAFT GEAR TRAVEL

1" KNUCKLE SLACK

3-1/4" DRAFT GEAR TRAVEL



TOTAL = 7-1/2"

## DRAWBAR SLACK

3/4" MINI GEAR TRAVEL

3/4" MINI GEAR TRAVEL



TOTAL = 1-1/2"

# Slack Comparison

## Other Design features ..contd.

- The IRS CBC at height of 1105 mm is technically not desirable in low height container wagons
  - the eccentricity between the draft line and the centre of U/Frame, will result in momentary off loading of certain wheels
  - 2 A-Cars having raised ends with CBC couplers at a height of 1105 mm and connected with 3 B-Cars in the middle through slackless draw bars at a height of 845 mm was adopted on optimum consideration of flexibility and use

# BLC Container Wagons - Couplers



SDB

## **Slack less Draw Bar ( SDB)**

: This is a semi permanent coupler.

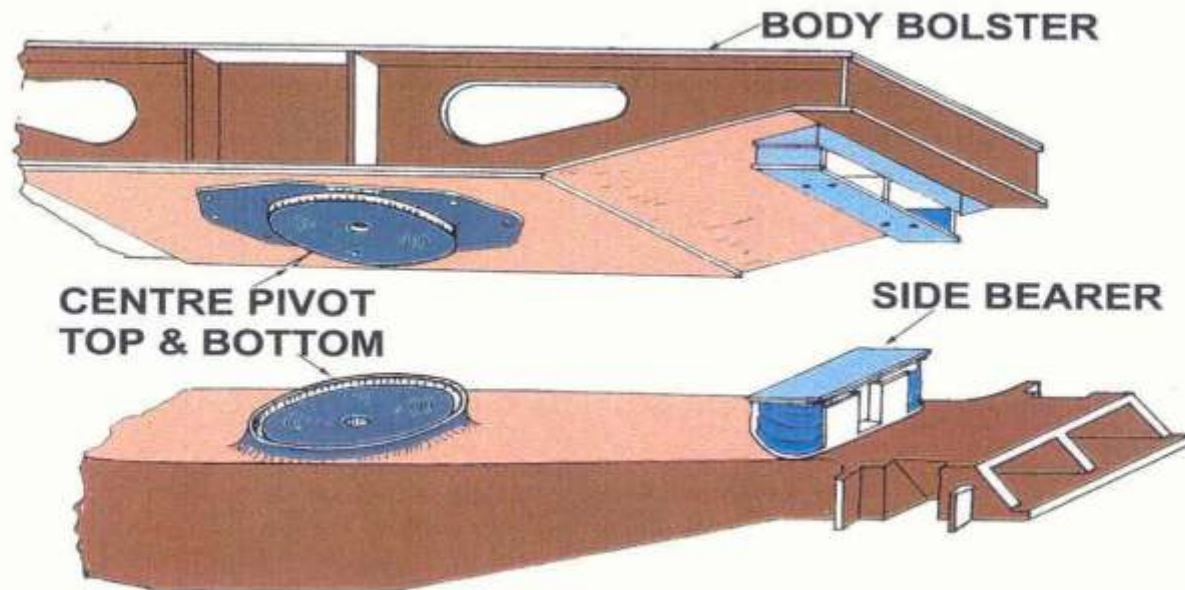
Normally not disconnected unless required for repairs .

## **Center Buffer Coupler ( CBC) :**

Most commonly used coupler in wagons over Indian Railways and abroad.



# BLC Container Wagons



GENERAL VIEW SHOWING THE WORKING OF SIDE BEARER ARRANGEMENT

# Other Design features ..contd.

- Two stage automatic load sensing device (LSD) in each of the bogies
  - operates when gross weight of the wagon crosses 40 tonnes obviating the need for manual resetting of the handle and thus expediting operating at terminal
- Automatic twist lock is used
  - Minimizes time, manpower and operator errors
  - operates if a force of 600 Kg is exerted by the container
  - a force of 1000 Kg is required to unlock and release the container

# Mobile Bridge Inspection Unit

# Mobile Bridge Inspection Unit



**Heavy Platform Units for  
Bridge Inspection and Repair Work**



# FEATURES OF MBIU

- Driver cab at both ends for flexibility in operation
- Shacku coupler between two cars and provision of draw hook at ends for towing by loco
- Air brake system
- Provision of UIC vestibule between two cars
- Provision of creeping mechanism



Actual Demonstration of  
Platform Unit

(Manufactured at RCF)





Actual Demonstration - of  
Bucket Unit

