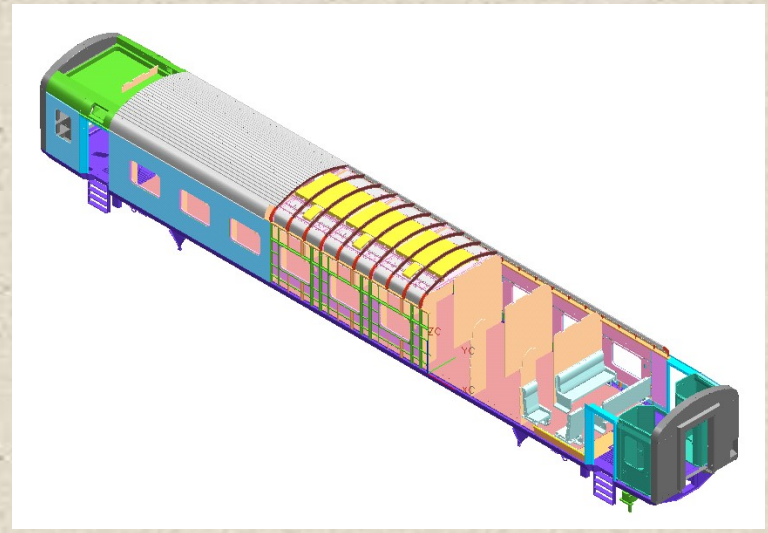
Presentation
on
LHB Coach Mechanical Design Features



Historical Development

- First generation coaches
  - Fully from timber
  - Causes heavy damages in accidents
- 1948-50-started steel body coaches
- 1955-ICF was set up at Chennai
  - Started steel body, integral design shell with fabricated bogie
  - Speed potential 140 kmph at present

Historical Development

- In 1995-Contract made with M/S Alstom LHB
- In 2001-LHB coach introduced in shatabadi exp from DLI to LKO
  - Stainless steel body,integral design coach
  - Fiat bogie
  - All coil suspension
  - CTRB
  - Hyd dampers

NEW GENERATION LHB COACHES

NEED FOR NEW TECHNOLOGY- I

INDIAN RAILWAY HAS BEEN MANUFACTURING PASSENGER COACHES OF "SCHLIRIEN" DESIGN FOR MORE THAN LAST 50 YEARS.

ALTHOUGH CONTINUOUS EFFORTS WERE BEING PUT TO UPGRADE THESE COACHES, BUT A NEED WAS ALWAYS FELT TO IMBIBE TECHNOLOGY IN-USE DEVELOPED COUNTRIES SO AS TO AFFECT A QUANTUM JUMP IN QUALITY OF COACHES.

NEED FOR NEW TECHNOLOGY - II

THIS WAS THE BASIC REASON BEHIND SETTING UP OF "RAIL COACH FACTORY" AT KAPURTHALA.

EXTENSIVE STUDIES WERE DONE TO LOCATE THE RIGHT TECHNOLOGY FOR INDIAN CONDITIONS.

TWO CONTRACTS FOR TRANSFER OF TECHNOLOGY AND SUPPLY OF FIRST TWO RAKES (24 COACHES) WERE SIGNED WITH M/S LINKE HOFFMAN BUSH(LHB) (NOW ALSTOM LHB), GERMANY IN 1995.

ALSTOM -LHB, GERMANY

"M/S ALSTOM LHB" ARE ONE OF THE LEADING MANUFACTURER IN TRANSPORT SECTOR HAVING PRESENCE IN MOST OF THE EUROPEAN COUNTRIES.

COACHES MANUFACTURED BY THEM ARE RUNNING IN MANY COUNTRIES ACROSS THE GLOBE.

FOR THIS CONTRACT THE BOGIES WERE DESIGNED AND MADE BY M/S FIAT, SWITZERLAND WHICH IS NOW A PART OF ALSTOM GROUP.

SUPPLY CONTRACT

COVERED SUPPLY OF

- **19 SECOND CLASS AC CHAIR CAR COACHES.**
- **2 EXECUTIVE CLASS CHAIR CAR COACHES.**
- **3 GENERATOR CUM BRAKE VANS**

CONTRACT FOR TRANSFER OF TECHNOLOGY -I

COVERED THE FOLLOWING :

- **TRANSFER OF TECHNOLOGY FOR ALL COACHES SUPPLIED BY THEM i.e. CHAIR CAR AND POWER CAR**
- **DEVELOPMENT OF LAYOUTS AND KEY DESIGNS FOR CARBODY SHELLS FOR**
  - AC FIRST CLASS
  - AC TWO TIER SLEEPER
  - AC HOT BUFFET CAR

CONTRACT FOR TRANSFER OF TECHNOLOGY -II

IT ALSO COVERED

- **ASSISTING RCF IN**
  - **DEVELOPING AND MANUFACTURING ALL ABOVE COACHES**
  - **DEVELOPING "SG" VERSION OF FIAT BOGIE**
  - **ESTABLISHING INDIGENOUS SOURCES OF BOUGHT-OUT ITEMS.**
- **PROVIDING TRAINING TO "IR" PERSONNEL IN MANUFACTURE AND MAINTENANCE OF THESE COACHES.**

LHB COACH EXTERIOR VIEW (IMPORTED)

Features of LHB Coach

- Corrosion Free Coach
  - Extensive use of Stainless steel and surface protection measures
- Longer Coach
  - Longer By 2.2 Meters (Approx) Than Conventional Coach
- Light Weight Coach
  - 10% lesser weight per meter length lesser than conventional coach
  - Better Pay to Tare Ratio
- Higher passenger comfort:
  - Ride Index 2.5 (Not exceeding 2.75)
- Suitable To Higher Speeds –Upto 200 Kmph

Features of LHB Coach

- Superior Shell and furnishing Design
  - Complete shell interlocked
- Better Acoustic and Vibration Measures
  - Superior Insulation
  - Damping elements
- Axle Mounted Disc Brakes With WSP
- Controlled Discharge Toilet Systems
- Centre Buffer Coupler

Features of LHB Coach

- Auto Closing Sliding Doors
- Wider Windows
- Modular Interiors
- Improved Air Conditioning System
- Use of Fire Retardant Materials

At a glance comparison of Weight and Capacity

	No	Weight t	Capacity		Weight t	Capacity
LHB/EOG				**ICF/EOG**		
FAC	1	43.3	24	**FAC**	46.2	18
ACCW	4	44.6	52	**ACCW**	44.8	48
ACCN	7	45.6	72	**ACCN**	48.3	64
CB	2	40.9	0	**CB**	47.9	0
WLRRM	2	53	0	**WLRRM**	60	0
	16	**728.7**	**736**		**779.3**	**658**

LHB Weighs Less by 50.6 t Capacity more By 78 passengers

Passenger Concerns

Sound Control Measures – within 65 dB Achieved Inside The Passenger Area

- Sound Insulating Paint
- Rubber D-coupling –Floating Floor
- Sandwich Floor Board -4mm cork
- Melamine foam Insulation for Ducting

  All Round the duct

  Sound Dampers in Duct
- Non-Metallic Interiors - FRP
- Sealed Auto closing Vestibule
- No direct opening in lavatories

  Closed Opening of Retention Tank -CDTS

Passenger Concerns

Vibration Control Measures

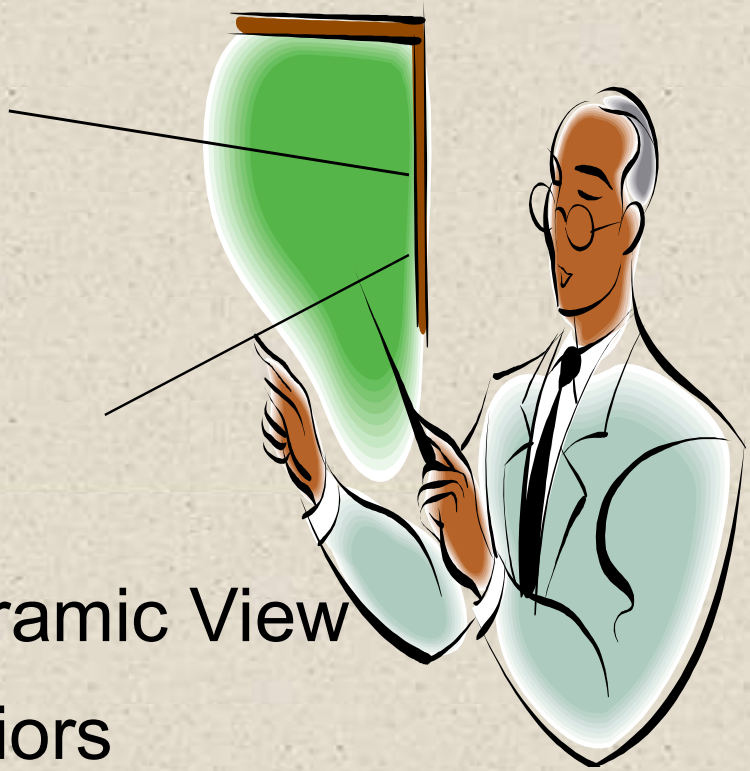
- Dampers in Bogies
- Silent blocks In bogies
- Well Separation of natural frequency of shell and bogie
- Floating Floor
- Pillars mounted on Rubber elements
- Non-Metallic Interior -such as FRP
- Higher passenger comfort:
  - Ride Index 2.5 (Not exceeding 2.75)

Passenger Concerns

Safety Aspects

- Anti Climbing Feature
- Superior Braking System
- Emergency Openable Window
- Fire Retardant Materials
- Expandable Fire Barrier
  - All Around The Vestibule Door
  - Fire Alarm System
- Proper Coach Earthing
- Public Address System
- Emergency Accident light

Passenger Concerns



- Wider windows for Panoramic View
- Screw less Modular interiors

Passenger Concerns

Coach Interior Environment

Thermal Insulation Measures

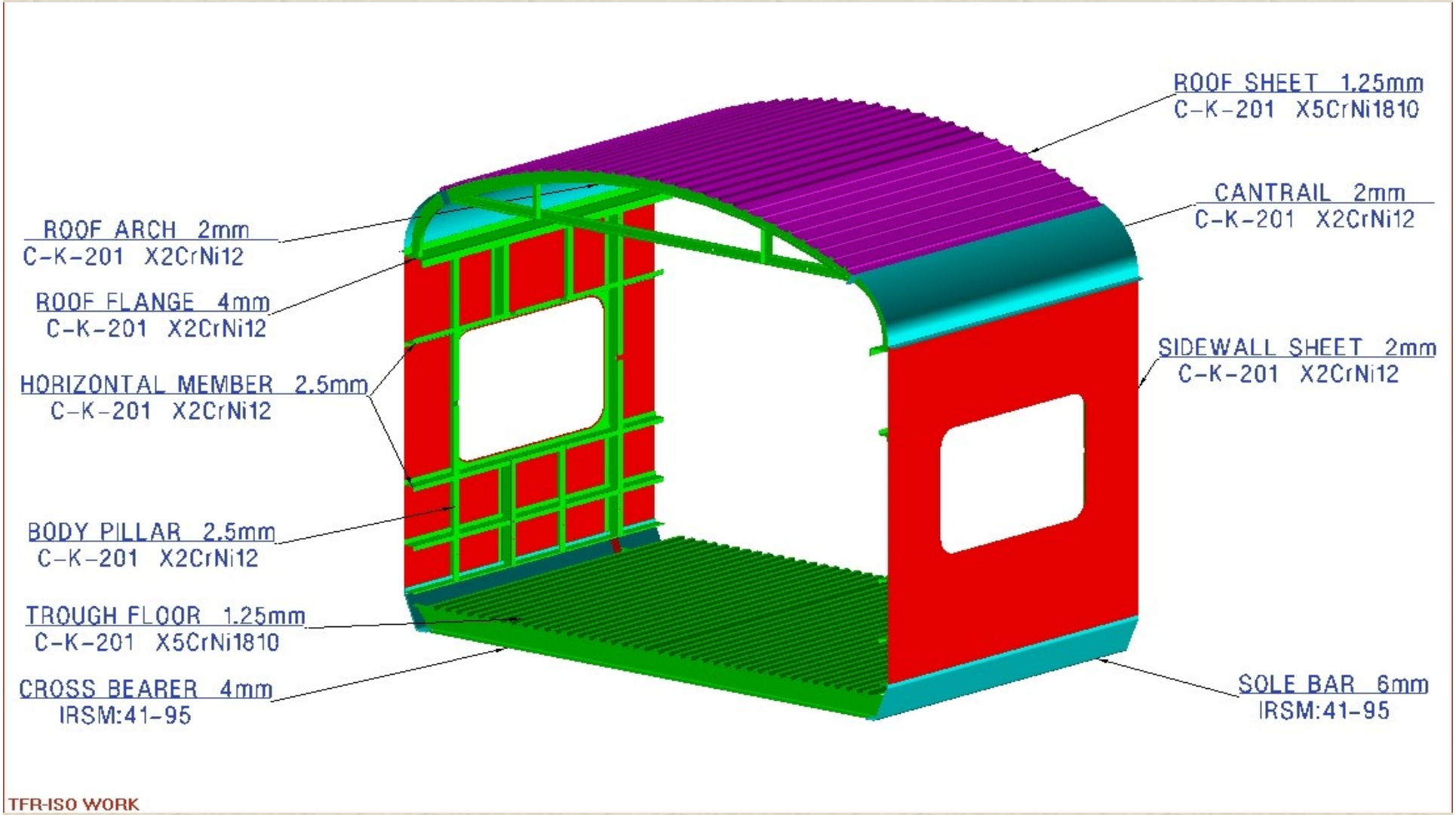
- Bary Skin
- Cork-sandwich floor board
- Reduced thermal Bridges
- PVB Film in Window
- Melamine foam in duct
- Phenolic foam in doors
- Non metallic interior
- Reasonafelx Insulation

Maintenance Aspects

- Corrosion free
  - Extensive Use Of Stainless Steel
- Better Design Concepts
  - Better rigidity and dimension control
- Reliable Hi-Tech Systems:
  - Axle mounted disc brake system
  - CDTS
- Modular units
- Superior Mounting of under slung Equipments
  - Fail safe mounting due to interlocked members

Extensive use of Stainless Steel

Use of Stainless Steel



TFR-ISO WORK

Steels used in LHB Coaches

Shell Assemblies	Steels used and their %age compositions	UTS N/mm^2	Yield Stress N/mm^2
Side wall, End wall and Roof structure	X2 Cr11 Ferritic Steel (C < .03%, Cr 10-12%, Si 1%, Mn 1.5%)	450-600	320
Roof sheet and Trough floor	X5 CrNi 18 10 Austenitic Steel (C < .07%, Cr 18%, Ni 10 % Si 1%, Mn 2%)	700-850	235
Underframe	IRS M-41 / CortenSteel (C < .01%, Cr .35 -.6%, Ni .2 - .4% Cu .3 - .6% Si .3 - .7%, Mn .25%)	440-480	320


Stainless Steel Shell

Summary Of Steels Used In SS Coaches

MATERIAL	THICKNESS	WEIGHT in kg
Austenitic Steel	1.25 mm	1380
Total		1380
Ferritic Steel	2 mm	2800
-do-	3 mm	300
-do-	4 mm	60
Total		3160
Corten Steel	4 mm	725
-do-	6 mm	2000
-do-	8 mm	600
-do-	10 mm	200
Total		3525
Grand Total		8065

Stainless steel pipes: 10/12/15/18/22/28 mm - 385m
(DIN2391-C- DIN17456 Grade 1.4301 X5CrNi 18 10)

Details of SS used in Stainless Steel coach

Main Assembly	Application area	Steels used	Thickness	Qty of finished product
Side wall	Side wall sheets	X2 CrNi 12 Ferritic Steel	2 mm	979 kg
	Vertical pillars	-do-	2 mm	425 kg
	Horizontal member	-do-	2 mm	288 kg
	Roof flange	-do-	2 mm	270 kg
Roof	Roof sheet	X5 CrNi 18 10 Austenitic Steel	1.25 mm	654 kg
	Carlines	X2 CrNi 12 Ferritic Steel	2 mm	160 kg
	End parts	-do-	2 mm	380 kg
	Final roof arch	-do-	4 mm	56 kg
End wall	End wall sheets	-do-	2/3 mm	98 kg
	End wall frames	-do-	2/2.5/3/4/6/10 mm	260 kg
U/frame	Trough floor	X5 CrNi 18 10 Austenitic Steel	1.25 mm	680 kg
	Sole bar	IRS M41 Corten steel	6 mm	645 kg
	Cross bearers	-do-	4 mm	645 kg
	Body bolster	-do-	6 mm	750 kg
	Head stock	-do-	4/6/8 mm	1280 kg
	Coupler carrier/Center sill	-do-	10 mm	200 kg
Vendor supplied items	Water tanks	SS 316 Ti	2 mm	300 kg
	Roof ventilators	X5 CrNi 18 10 Austenitic Steel	1.25 mm	49 kg

Journey Of RCF To Stainless Steel Coach

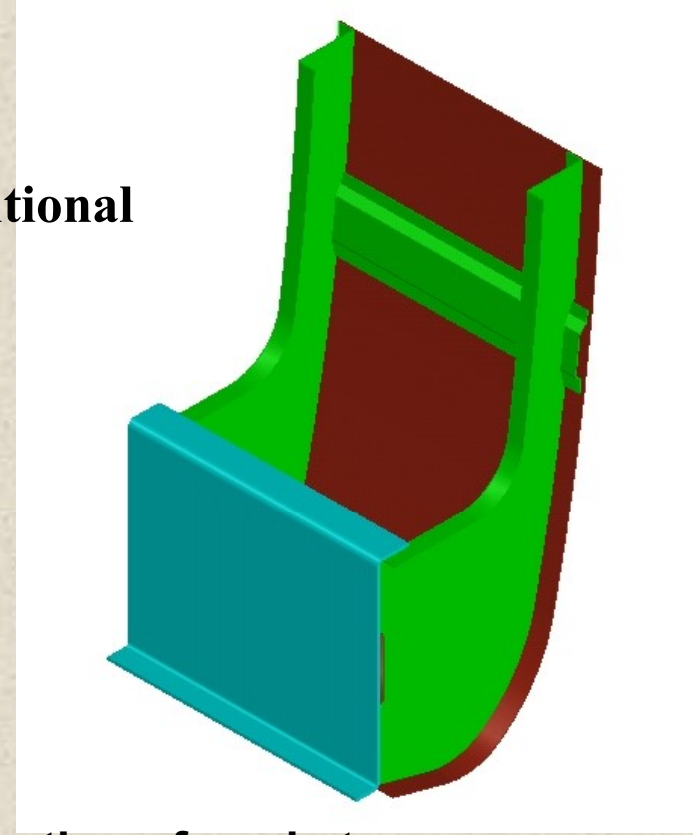
Corten steel Conventional coach - First coach turned out by RCF in March 1988

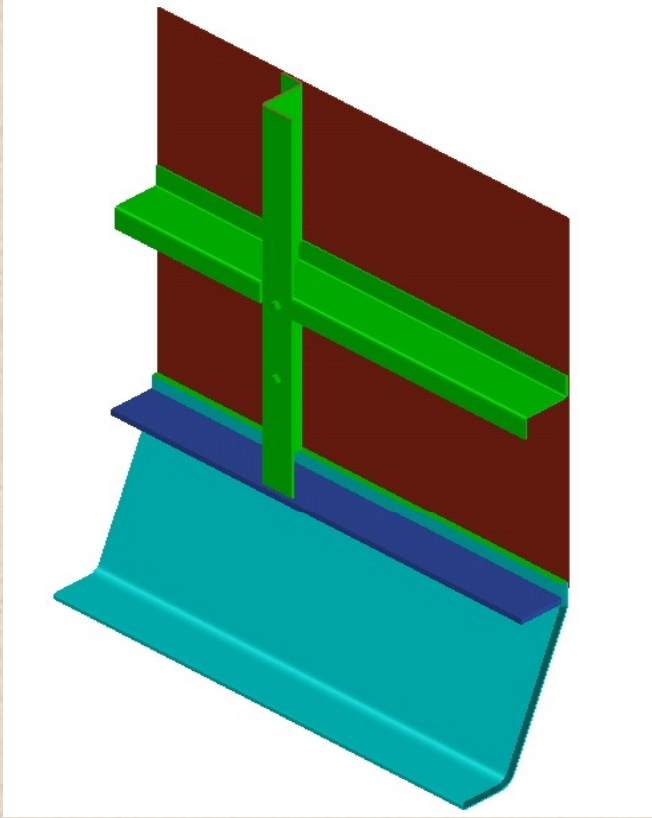
Stainless steel coach - Ist batch of newly designed coaches turned out in Dec 2002

Better Design Concepts

Sole Bar Sidewall Connection

Conventional Design





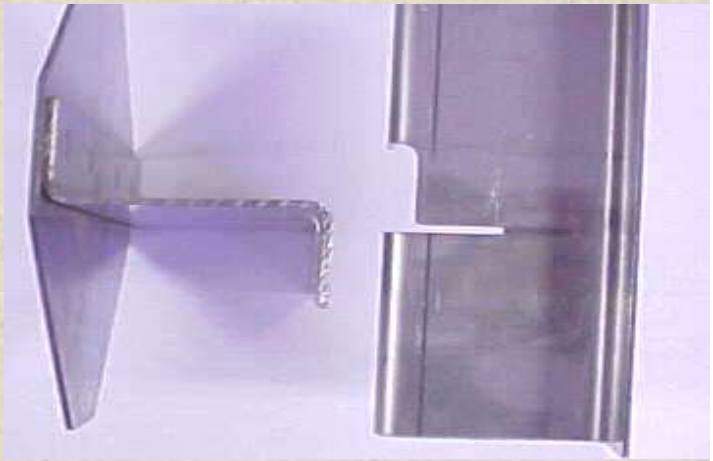
New Design

- **Elimination of pockets**
  - Turn Under Has Been Eliminated
  - Clear Approach For Sand Blasting And Painting
  - No Accumulation Of Water And Muck
  - Pillar Rests On Solebar As Compared To Load Transfer Through A Vertical Welded Joint In Conv. Coaches

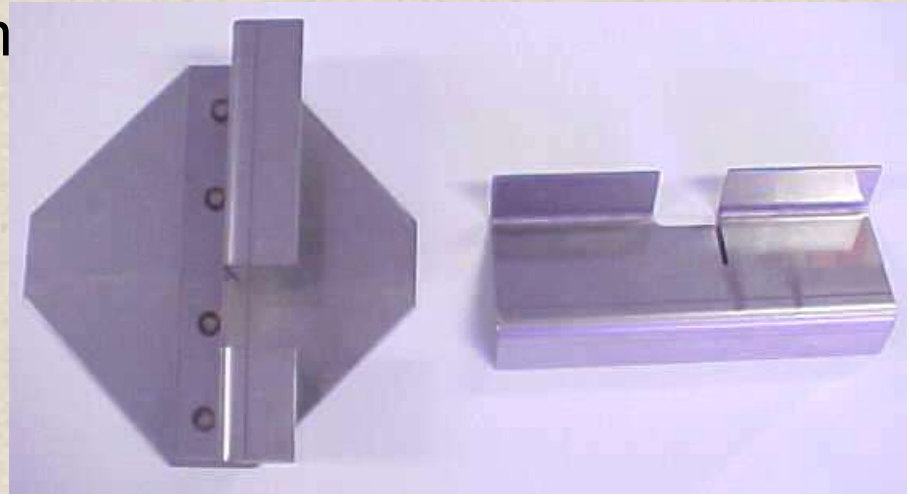
Sidewall-Interlocking

- Interlocking between the horizontal and vertical stiffening members of sub-assemblies like sidewall, endwall, underframe, etc.

- Aligned stress flow
  - Better strength

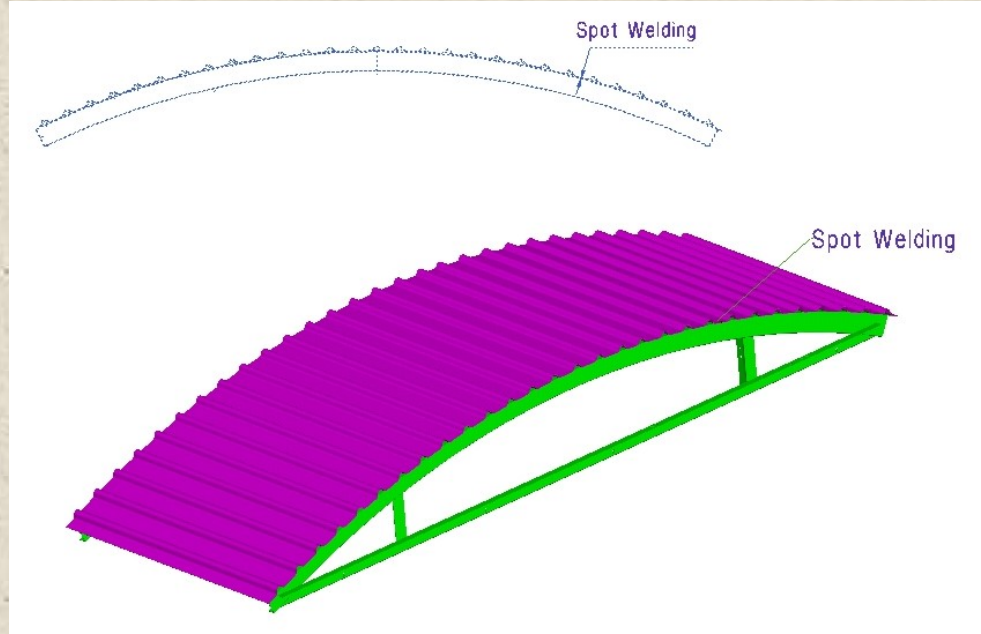


- Reduction of side wall width from 90 mm to 60mm
- Better geometrical integrity
  - Resistance to distortion



Roof

- Corrugated roof sheet spot welded to z-section roof arches
- Uniform height of arches along it's length
- Roof weighs only about 1000kg
- Spot welded austenitic steel cladding
- Pocket free



End Wall

Holes provided in all stiffeners of end wall to reduce weight

End Wall

End wall overhangs beyond head stock

-Releasing more space inside

-Reducing space and hence wind resistance due to turbulence between coaches.

-Gap between end walls of two coupled coaches is 300 mm only

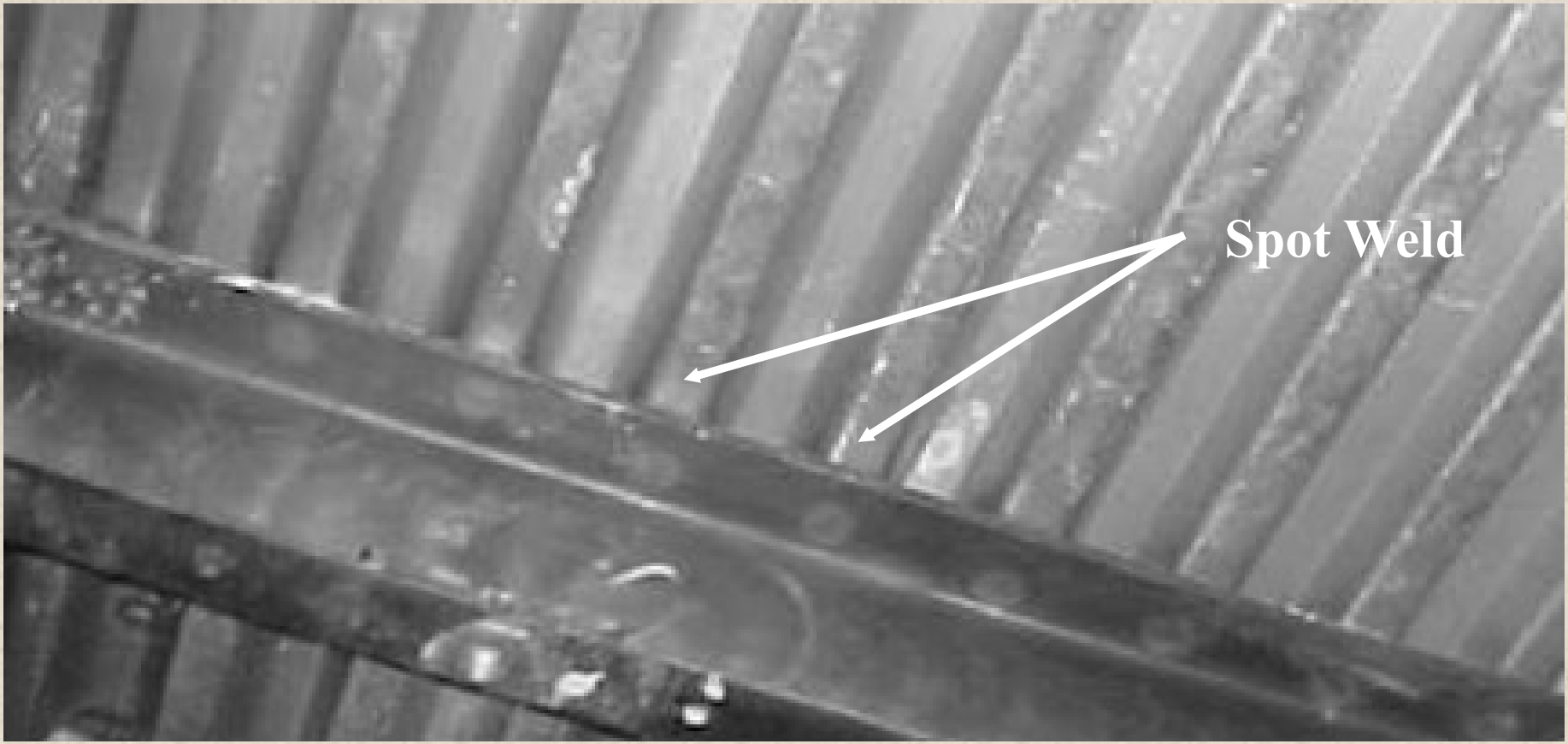
Vestibule Foot Plate

- Vestibule Fall Plate Can take later movement
- Vestibule fall plate can slide and also lift up.
- When fall plate is up, the vestibule door can not be opened more than 150mm

Underframe

- Spot welding of austenitic trough floor with cross bearers

Aluminium based weldable primer used for welding corten steel to SS to prevent bi-metallic corrosion



Underframe

Provision for CBC as well a side buffer mounting in head stock

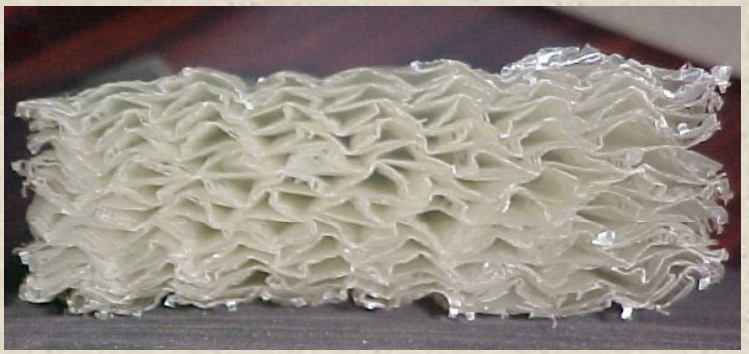
Flooring Support Members On Underframe

Superior 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) provide heat insulation
Resonaflex on u/f prevents water absorption/ retention.



Glass wool pads held by pins, welded on the roof

Sound Insulation Paint

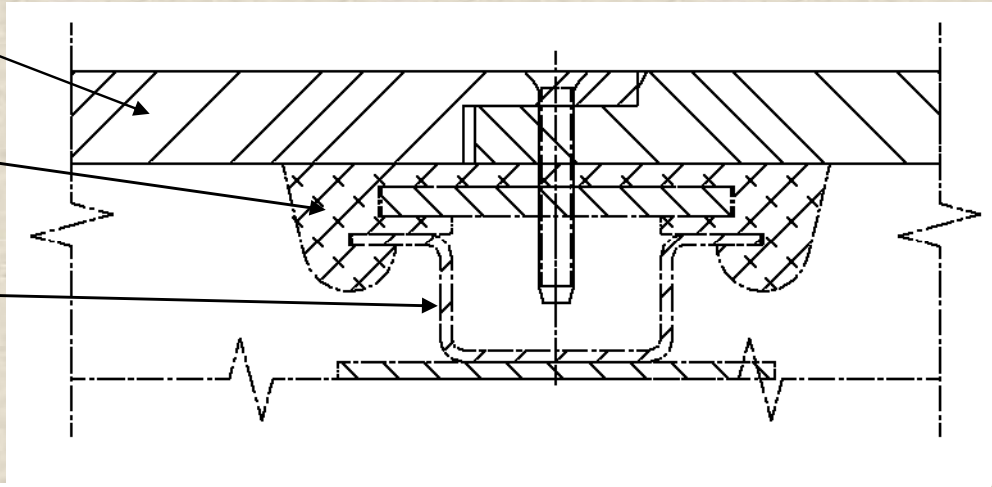
- "Baryskin v60dB" or eq. Sound insulation PU paints on full coach shell interior, provide anti drumming sound insulation as well as corrosion resistance
- Sound insulation of 31 dB
- Coating of 2-3 mm thickness in the coach interior, 6-8 mm in body bolster area
- Extremely good fire retardancy of class SR-4 to DIN- 5510

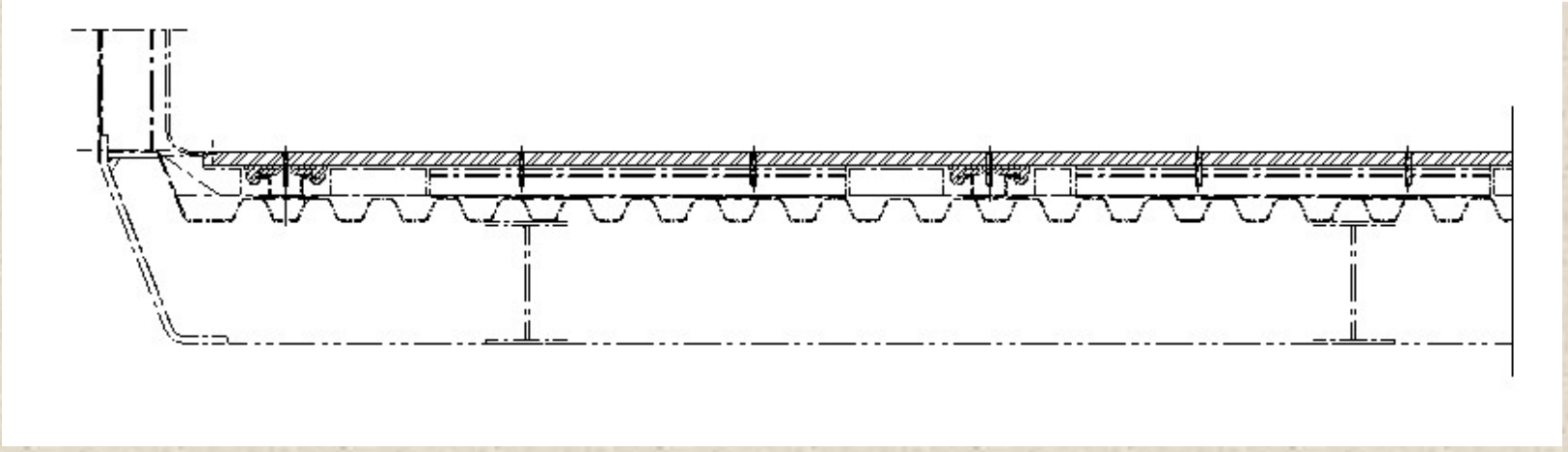
Rubber De-coupling Elements In Flooring

Floor board with sandwitched cork layer

Rubber element

Metallic floor support member

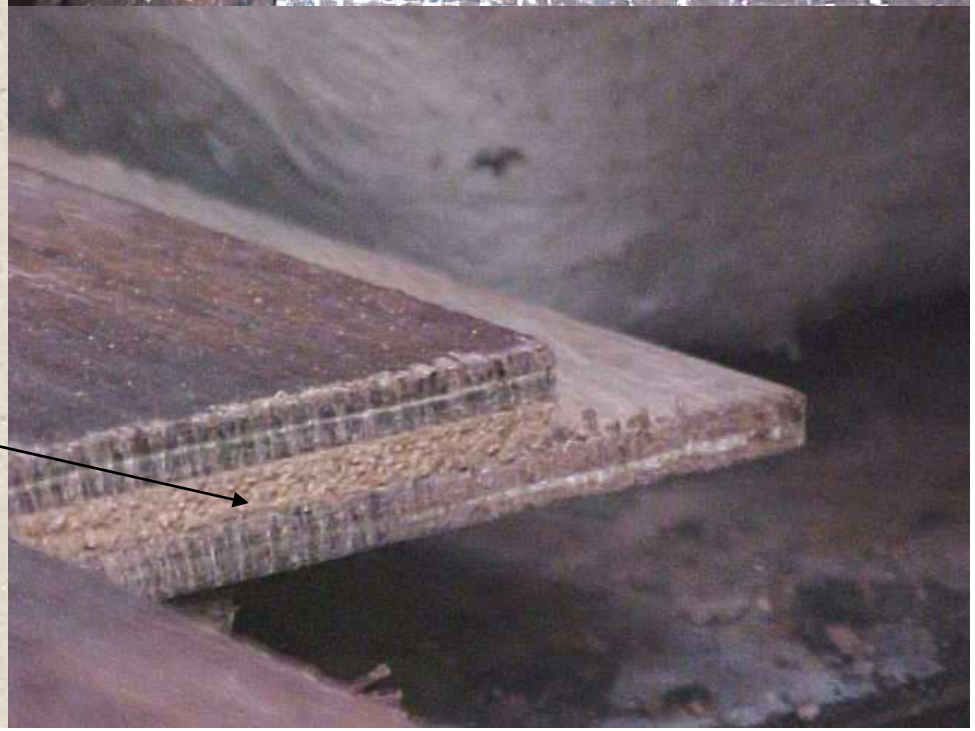




Rubber De-coupling Elements In Flooring

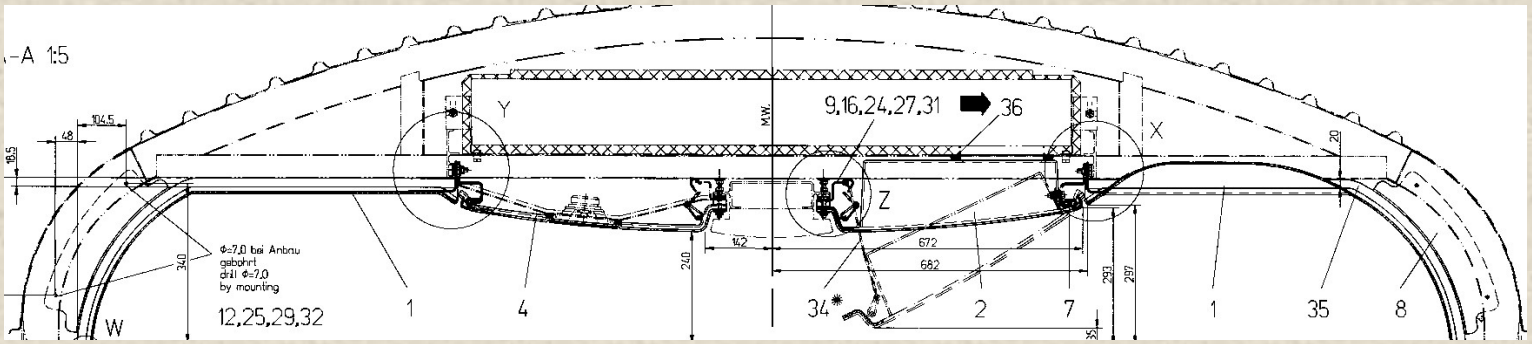
Flooring boards resting on rubber de-coupling elements

Flooring boards - cork sandwiched between compreg to absorb noise

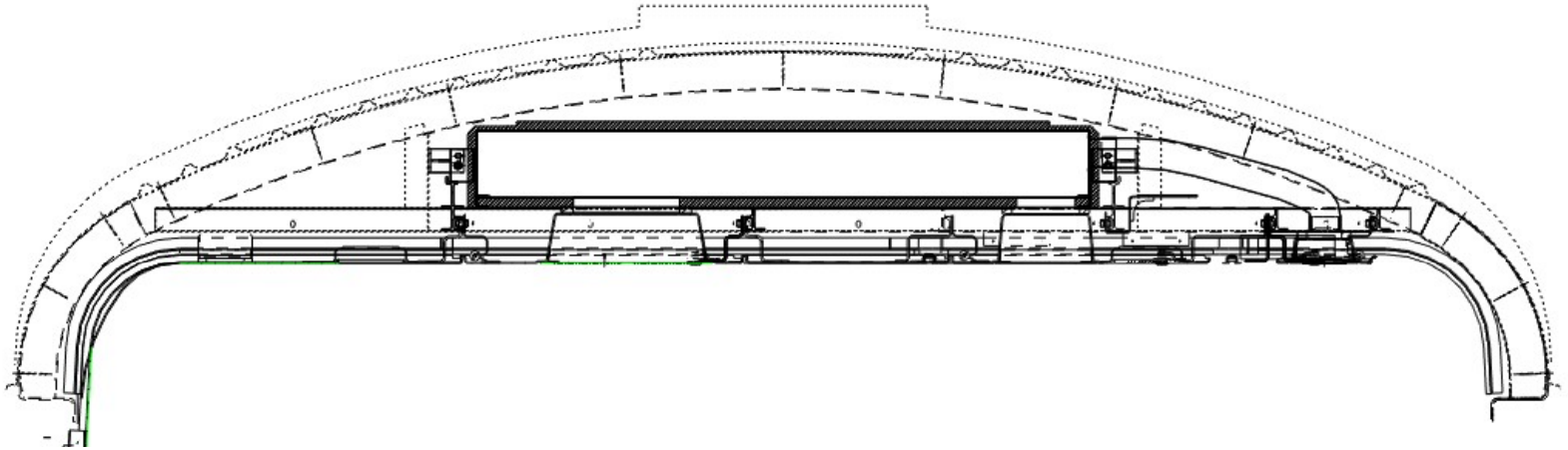


AC DUCT

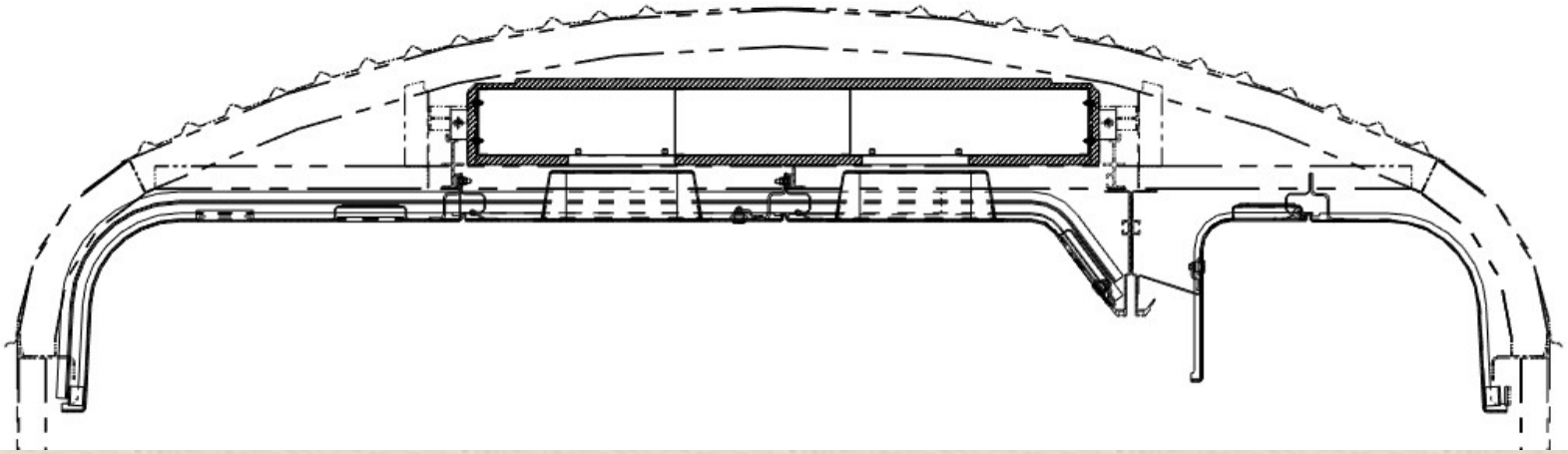
- Superior 2 tier design
- No loss of cooling air
- Superior thermal insulation
- Better sound dampening
- No direct blast of cool air



ACCZ



ACCW

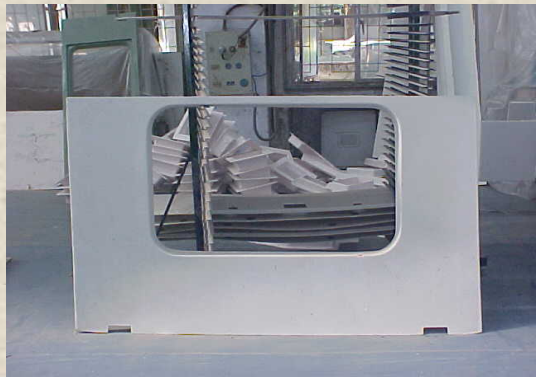


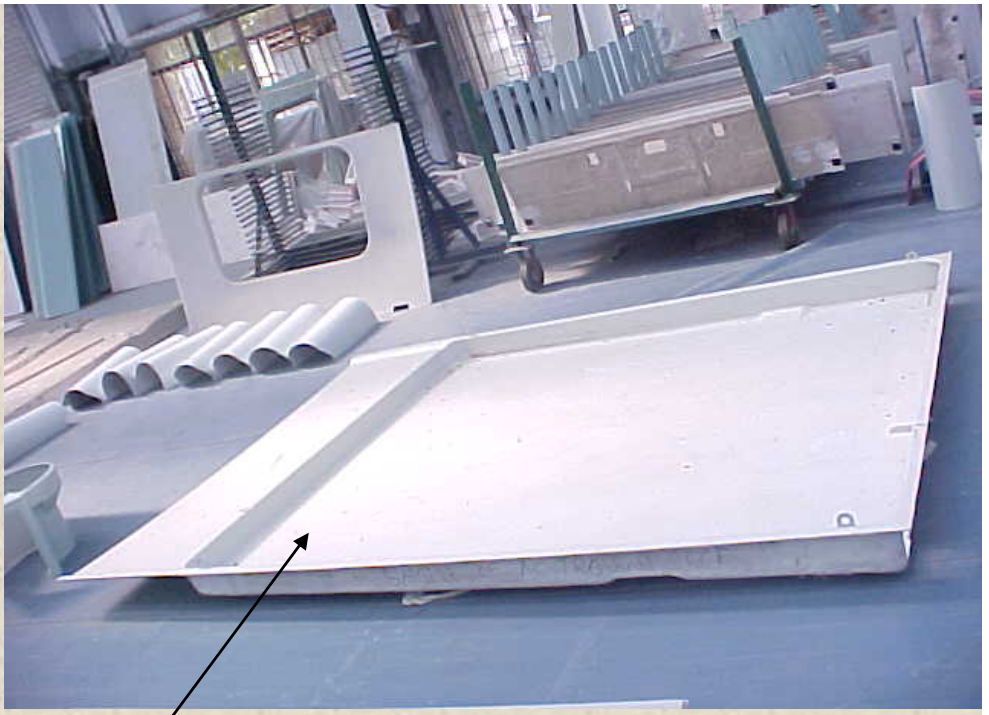
FAC

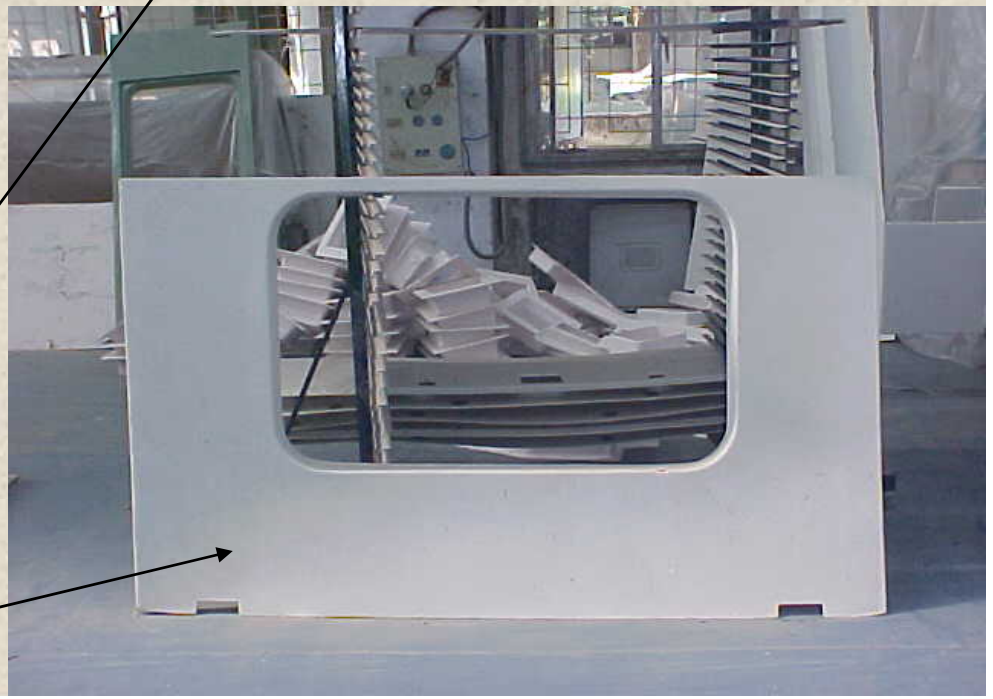
FRP ITEMS

A NO. OF FIRE RETARDANT FRP ITEMS HAVE BEEN USED IN THE INTERIORS FOR:

- IMPROVED AESTHETICS
- ABILITY OF FRP TO BE MOULDED INTO INTRICATE SHAPES/CURVED SURFACES, AVOID JOINTS
- BETTER STRENGTH TO WT RATIO
- SCRATCH RESISTANCE
- RESILIENCE TO SMALL DENTS
- EASY REPAIRABILITY
- NO VISIBLE SCREWS
- BETTER MAINTAINABILITY
- NO PROBLEM OF CORROSION



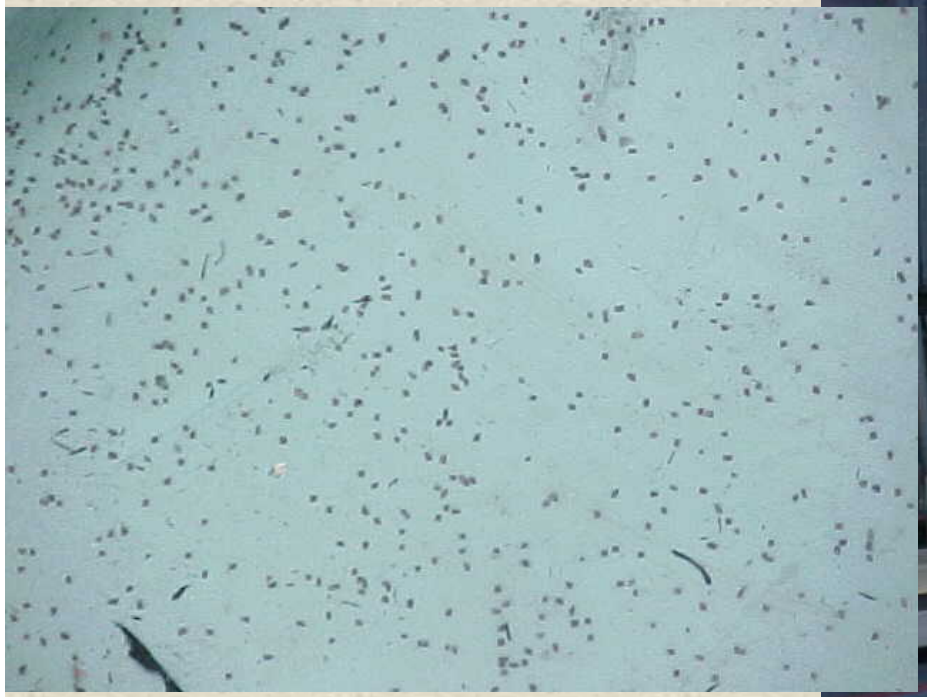




FRP LAVATORY MODULE (PVC FOAM SANDWICHED BETWEEN FRP)

FRP, AC UNIT TROUGH

FRP SIDE WALL PANEL



CORUNDUM GRAINS IN FRP RESIN FLOOR IN LAV FOR ANTI-SLIP PROPERTIES AND WEAR RESISTANCE

BRACKETS FOR MOUNTING THE ROOF PANELS

BRACKETS FOR MOUNTING LIGHT FITTINGS