NEW WAGON TECHNOLOGY

Presented by Rajendra Kushwaha Inst. (C&W)

What required in Wagon Design

- Increase in pay/tare ratio
- Increase in pay load
- Reduction in the tare wt. of freight stock
- Increase in the speed potential of the freight stock
- Increase in the reliability of the wagon component.

- It will increase by upgrading of specification of component and reduce the maintenance cost by increasing ROH from 18 to 24 months.



- Open type BOXN,BOXNHS,BOXNHA,BOXNCR,BOST,BO STHS,BOXNLW,BOXNHL,BOXNAL,BOY-25,BOXN-25,BOBSN-25
- <u>**Closed type</u>** BCN,BCNA,BCNAHS, BCNHL.</u>
- <u>Hopper type</u> BOBR,BOBRN,BOBYN, BOBRNAL, BOBRN-25
- <u>Flat type</u> BRN, BFNS, BFKI, BOXKH, BLC etc.
- <u>Tank type</u> BTPN, BTPGLN, etc.
- Brake Van BVZC, BVZI





- BOXN Wagon –
- Estimated tare 22.47 t
 Axle load 20.32 t
 Pay load 58.81 t
 Gross load 81.28 t
 Length 10713 mm
 Width 3200 mm
 Height 3225 mm







Fig. 1.3 BOXN WAGON (Ref. R.D.S.O. WD - 80007/S-2)



BOXN End view



- Estimated tare – 23.1 t - more Axle load – 22.32 t - more Pay load - 66.18 t -more Gross load – 89.28 t -more - 10713 mm - same Length Width - 3200 mm - same - 3233 mm - lower than Height BOXNHA and higher than BOXN.
 - Volumetric cap. 56.29 m³





BOGIE OPEN WAGON TYPE BOXNHS

•Pay to tare ratio – 2.5 (v/s 2.25 of BOXC)

•TLD of 7.59 t/m (v/s 5.925 t/m of BOXC)

•Nos. of wagons/rake – 58 (v/s 45 of BOXC)

•Compressed air based Brake system (v/s vacuum brake system of BOXC)

•Rake throughput increase (of 20.32 t BOXN) of 33% over BOXC

•Increase in revenue of Rs. 3.63 Crores per rake per year (of 20.32 t BOXN) over BOXC





- Estimated Tare 23.17 t
- Axle load 22.1 t
- Gross load 88.40 t
- Pay load 65.23 t
- Use of IRSM -41 Floor plate 6 mm
 Side stanchion 8 mm
 Body side sheet 5 mm
 End sheet 5 mm
 - Door sheet 5 mm
- Length& width same as Boxn
 Height 3450 mm 225 mm higher than BOXN







IRSM -41steel has following properties

- stronger than mild steel
- easily weldable

-develops its own protective film against corrosion.

Electrodes – IRS D2 shall be used.

- Nature of repair Bulging of body - puncturing of panels
 - distortion of doors

- wear on door hinges

Springs – 14 outer,14 inner,04 Snubber



- BOXNCR is similar to BOXN except the following –
- The wagon body is manufactured from steel to IRSM M-44 instead of steel to IS 2062 or IRSM -41.
- Crib angles side to ISA 50x50x6 is mfd. From IRSM-44 steel instead of IS 2062.
- Sole bar is mfd from IRSM-41 instead of IS 2062 steel.
- Other features like overall dimensions, CBC, brake gear, brake system are same as BOXN.







 IRSM-44 shall be cut by shearing or plasma cutting m/c and for welding, <u>consumables</u> to be used as follows –

Material combination	Welding consumables to be used		
	MMAW electrodes (as per IRS:M28-02)	MIG/MAG welding filler wires (as per IRS:M46-03)	SAW welding filler wire (as per IRS:M39- 01)
IS-2062*/5986/1079 to IS-2062/5986/1079	A2		
IS-2062*/5986/1079 to IS-1030	A2	I	I
IS-1030 to IS-1030	Λ3		-
IS-2062*/5986/1079 to IRSM-41 (Corten Steel)/ IS-8500 Gr. 570 B/ SAILMA-	A2		
	Material combination IS-2062*/5986/1079 to IS-2062/5986/1079 IS-2062*/5986/1079 to IS-1030 IS-1030 to IS-1030 IS-2062*/5986/1079 to IRSM-41 (Corten Steel)/ IS-8500 Gr. 570 B/ SAILMA- 350HV	Material combination Welding combination MMAW electrodes (as per IRS:M28-02) MMAW electrodes (as per IRS:M28-02) IS-2062*/5986/1079 A2 to IS-2062*/5986/1079 A2 to IS-1030 A3 IS-2062*/5986/1079 A2 to IRSM-41 (Corten Steel)/ IS-8500 Gr. S70 B/ SAILMA- 350HY	Material combinationWelding consumables to beMMAW electrodes (as per IRS:M28-02)MIG/MAG welding filler wires (as per IRS:M46-03)IS-2062*/5986/1079A2IIS-2062*/5986/1079A2IIS-2062*/5986/1079A2IIS-2062*/5986/1079A2IIS-1030IS-1030A3IIS-2062*/5986/1079A2IIS-1030 to IS-1030A3IIS-2062*/5986/1079A2IIS-1030 to IS-1030A3IIS-2062*/5986/1079A2IIS-2062*/5986/1079A2I



		MMAW electrodes (as per IRS:M28-02)	MIG/MAG welding filler wires (as per IRS:M46-03)	SAW welding filler wire (as per IRS:M39- 01)
5.	IRS:M41 to IRSM-41/ IS 8500 Gr. 570 B	D	IV	V
6.	IS-2062*/5986/1079 to IRS:M44 (Stainless Steel)	A3	I	-
7.	IRS:M44 to IRSM-44	M2	VI	
8.	IRS:M44 to IRSM-41	D		- V
9.	IS-1030 to IS-3885 IS-2062*/5986/1079 to IS-3885	A3 (with special welding procedure i.e. maintain of pre and post heating and inter pass temperature) A3 (with special welding procedure i.e. maintain of pre and post heating and inter pass temperature)	I	
11.	Mn- Steel liner to IS- 1030	M5	-	
12.	SAILMA-350 HY to IS-8500 Gr. 570 B/ SAILMA-350 HY	A3	I	П
13.	15-8500 Gr. 570 B to IS-8500 Gr. 570 B	CI	~111 **	UV.
14.	IS-2062** Copper bearing with IS- 2062** copper bearing	D	IV	V

Contd.

	Material combination	Welding consumables to be used		
15		MMAW electrodes (as per IRS:M28-02)	MIG/MAG welding filler wires (as per IRS:M46-03)	SAW welding filler wire (as per IRS:M39- 01)
	bearing to HCRS	D	IV	V
16.	HCRS to HCRS	D	112	
17.	HCRS to IRS:M41	D	IV	V.
18.	IS-2062** Copper	0	IV	V
	bearing with plain IS- 2062*	. A2	I	I
19.	HCRS to IS-2062*			
20.	HCRS to IS-5986	A3	I	
21	IS-2062 Cr. Eq. 410 A	A3	I	**
	with IS-2062 Gr. Fe. 410 A	Al	I	I
22.	IS-2062 Gr. Fe 410 B with IS-2062 Gr. Fe. 410 B	A2	I	1

Grade Fe 410 WA & Grade Fe 410 WB Grade Fe 410 Cu-WA & Grade Fe 410 Cu-WB

* **

BOXNLW Light Wt. BOXN wagon

- It has been designed with the purpose of reducing tare wt. as also to achieve higher put within the constraints of existing axle loads and TLD.
- Tare 20.6 t against 22.47 t
- Tare is reduced by using CRF section in place of fabricated members.





BOXNLW

- Drg. No. WD 88088-S-02
- Length over coupler faces 10713 mm
- Width overall
- Width inside
- Height overall

- 3250 mm
- 3022 mm
- 3263 mm

• 06 doors are provided.

Benefits of BOXNLW

- Reduction in tare wt. 1.8 t
- Increasing in pay load 1.8 t
- Increasing in through put 3%
- Increase in pay to tare ratio 2.94 compared to 2.61
- Lower maintenance cost
- Structural members CRF
- Plates & Sheets Stainless steel so as to minimize corrosion
- 250 NOs. order by Rly. Board

BOXNLW

- Pay load
- Tare
- Gross wt.
- Axle load
- Pay/tare
- TLD

- 60.87 t, less than HL
 20.6 t
- 81.28 t, less than HL
- 20.32 t, less than HL
- -2.94, less than HL
- 7.59 t/m less than HL
- Nos. of wagon in 620 m 58
- Vol. cap 58.84 m³

BOST

Open Air brake type Wagon for steel loading

- Purpose to introduce –
- Sizable proportion of steel plant products are being loaded in BOX wagon.
- The population of BOX wagon is declining because of condemnation
- Rly. Bd. Advise to RDSO to design for steel loading





<u>BOST</u>

- Length is same as BOX wagon
- Fitted with Casnub bogie air brake
- Lower side walls as compared to BOX wagon
- Speed 100 Kmph
- Underframe has been straightened to sustain to point loading of steel consignment
- Pay load same as BOX wagon
- GOC Workshop has been made.

<u>BOST</u>

10



BOSTHS

10





- Suitable for consignment from steel plants which can not be loaded in BOXN due to shorter length
- Equal in length to BOX and equipped with air brake
- Speed 100 kmph
- Casnub bogie



- Axle Load (in tonnes)
- TLD (in tonne/meter)
- Payload (in tonnes)
- Tare Weight (in tonnes)
- Gross Load (in tonnes)
- Pay to Tare Ratio
- Length (over head stock)

- : 20.32
- : 5.92
- : 55.78
- : 25.5
- : 81.28
- : 2.18
- : 12800



- Width (overall)
- Height (from rail level)
- Cubic Capacity(in cum) : 65.84
- Bogie type
- Wheel diameter (in mm)

- : 3100
- : 2835
- : Casnub 22 HS
 - : 1000 mm
- Speed Potential (in Kmph)E/L : 80/75
- Purpose : For transportation of Steel Plates, Sheets, Coal etc.



 Estimated tare-20.6 t-less than BOXNHS Axle load -22.9 t - more Pay load - 71.0 t - more Gross load – 91.6 t - more Length - 10963 mm - greater Width - 3250 mm - greater Height - 3301 mm – greater volumetric cap. – 61.05 m³ – more Floor ht.- 1273 - 2 mm less than BOXNHS









22.9 T AXLE LOAD OPEN WAGON TYPE

BOXNHL

- •Pay to tare ratio of 3.45 (v/s 2.5 of existing BOXN)
- •TLD of 8.35 t/m (v/s 7.59 t/m of existing BOXN)
- •Nos. of wagons/rake 58
- •Rake throughput increase of 20.32 % over BOXN (20.32 t) and 7.4 % over BOXN (CC+6+2 t)
- Increase in revenue of Rs. 1.2 Crores per rake per year over BOXN (CC+6+2 t)
Elevation



End View







Side Wall

Side Wall



Under frame of BOXNHL



Plan





- Center sill IS8500 &IRSM -44, HRF,CRF,press
- Sole bar IRSM -44 CRF pressed
- Pillar 8 mm IRSM -44 pressed
- Door way stiffener 4 mm, same, pressed
- Top coping 7 mm, same, pressed
- Side wall plate 4 mm, same
- Floor plate 4 mm, same
- Middle coping 4 mm, same, pressed
- End wall sheet 4 mm, same
- End stanchion 4 mm, same ,pressed
- Door 4 mm, same
- Stringers 4 mm, same, pressed



• All body and steel under frame designed for carrying bulk commodity like coal and iron ore without door.

 Except under frame all body structure, end sheets, side sheets and floor plates – Aluminium alloys.



- Use of Al in BOXN wagon –
- Advantages –
- 1. Lightness
- 2. Corrosion resistance
- 3. External appearance
- 4. Eliminate painting
- 5. Easy to work with



Disadvantages –

- 1. Very expensive
- 2. It is prone to pilpherage
- 3. Lower fatigue strength

Benefits of BOXNAL

- Use of AL in BOXN will result in –
- 4.21 t reduction in tare wt.
- 4.21 t increase in pay load
- 7.16 t improvement in throughput
- Pay to tare ratio 3.45 compared to 2.61 of existing BOXN wagon





Des	BOXN	BoxnHA	BoxnHs	BoxncR	Boxn HL
Tare	22.47	23.17	23.1	BoxN	20.6
Axle load	20.32	22.1	22.32	BoxN	22.9
Pay load	58.81	65.23	66.18	BoxN	71.0
G load	81.28	88.40	89.28	BoxN	91.6
Length	10713	same	same	same	10963
Width	3200	same	same	same	3250
Ht.	3225	3450	3233	same	3301
Mat.	IS2062,8 500	IRSM41,IS2 062.8500	IS2062,850 0	IRSM44,41	IRSM44,

<u>BOY</u> Drg No. SK-73511

- <u>Specific features –</u>
- Specially for transport of iron ores
- Fitted with air brake
- Fitted with SAB, Empty load device
- Suitable for tippling
- Fitted with cast steel friction snubbed bogies.
- 52 wagons per rake

BOY





- This is open low sided gandola wagon was designed at 25 t axle load.
- Stainless steel & CRF section
- Carrying minerals & Ores.
- The specifications and material schedule have been sent to Railway Board in November, 2006 for floating tender
- Pay to tare ratio of 3.76 (v/s 3.42 of existing BOY).
- Track loading density of 9.33 t/m (v/s 7.67 t/m of existing BOY)









25 T AXLE LOAD IRON ORE WAGON TYPE BOY-25

- •Pay to tare ratio 3.76 (v/s 3.42 of existing BOY)
- TLD of 9.33 t/m (v/s 7.67 t/m of existing BOY)
 Nos. of wagons/rake 58 (v/s 52 of existing BOY)
- •Bogie mounted brake system
- •HT CBC with bottom shelf and high capacity draft gear
- •CTRB of 'K' type with matching axle and wheel
- Rake throughput increase of 24.3% over BOY
 Increase in revenue of Rs. 4.76 Crores per rake per year over BOY

Comparison bet.BOY/BOY-25

Description	BOY	BOY-25
Length over coupler faces	11929	10713
Width overall	3134	3135
Height overall	2450	2607
Bogie	20.3 t NLB	25t CASNUB

CASNUB BOGIE (YEAR 1980) (Replaced diamond frame and fabricated UIC bogie) SPECIAL FEATURES/ADVANTAGES **OVER EARLIER DESIGNS** CAST STEEL BOGIE WITH SPRING PLANK (THREE PIECE BOGIE) •MAINTENANCE FREE BOGIE SIDE FRAMES WITH SECONDARY SUSPENSION INCREASED SPEED POTENTIAL OF 100 KMPH (LOADED/EMPTY) •INCREASED AXLE LOAD UP TO 22.9 TONNES

HEAVY HAUL BOGIE (75 KMPH) FOR 25t AXLE LOAD (DESIGNED IN YEAR 2006)

•25 T AXLE LOAD
•MAXIMUM SPEED 100 KMPH (EMPTY CONDITION)
•MAXIMUM SPEED 75 KMPH (LOADED CONDITION)
•34% INCREASE IN THROUGHPUT
FOR COAL CARRYING TRAIN
•24% INCREASE IN THROUGHPUT
FOR ORE CARRYING TRAIN





Features of CASNUB -25

- Wide jaw
- Outer -7, Inner -7, Snubber -2
- Flat type Center pivot
- Bolster cross section more
- Spring dia more
- Axle dia more
- Distance between liners more

Routes of running 25 t axle load CASNUB bogie

- ROUTE CONNECTING TO MAIN LINE: -
- Dallirajhara Bhilai (Durg) 87 Kms (New line)
- Banspani Daitari (Tomka) -162Kms (New single line) E. Co. Rly.
- Daitari (Tomka)- Cuttak Paradeep -(30+ 64 +100)=194 Km - E. Co. Rly.
- Daitari (Tomka) Jakhapura -30 Km (E-special route single line)
- Jakhapura Cuttack -64 Kms (B-route double line)
- Cuttack Paradeep -100 Kms (Special route double line)

• CONNECTING BRANCH LINE ROUTES:

S.E.Rly. -

- Gua Barajamda -8.94 Kms (Single line)
- Bolanikhadan Barajamda -16 Kms (single line)
- Barajamda Padapahar -15.80Km (Double line)
- Padapahar Banspani -28.27 Km (Single line)

routes of running 25 t axle load train.pdf

 As per direction of the railway board, the minimum track structure to be provided for running 25 T axle load trains is 60 Kg, 90UTS rails on PSC sleepers with 1660 (M+7) nos. per Km and 300 MM ballast cushion.







SIX YEARS LIFE ELASTOMERIC PADS (YEAR 2004)

•EXISTING ELASTOMERIC PADS LIFE 18 MONTHS •FIVE DESIGNS OF LONG LIFE ELASTOMERIC PADS •SELECTED THROUGH GLOBAL TENDER •FIELD TRIALS OF TWO DESIGNS IN PROGRESS

CONSTANT CONTACT SIDE BEARER (YEAR 2006)

•"VULCANITE" SIDE BEARER FOR OTHER THAN HIGH SPEED BOGIES •REDUCED LATERAL FORCES ON CURVES •INCREASED WHEEL LIFE DUE TO LESS RAIL WHEEL FORCES

CONSTANT CONTACT SIDE BEARER (YEAR 2005)

•CAST POLYURETHANE SIDE BEARER FOR HIGH SPEED BOGIES

•SOLUTION TO PROBLEM OF BREAKAGE OF SPRINGS IN EARLIER SIDE BEARER ASSEMBLY OF HIGH SPEED BOGIES





PU Side bearer (old drawing)



PU Side bearer (modified)



25 T AXLE LOAD COAL WAGON TYPE BOXN-25

Pay to tare ratio – 3.6 (v/s 2.5 of existing BOXN)
TLD of 9.33 t/m (v/s 7.59 t/m of existing BOXN)
Nos. of wagons/rake – 58
Rake throughput increase of 34.3% over BOXN (20.32t) & 14.6% over BOXN (CC+8+2t)
Increase in revenue of Rs. 2.5 Crores per rake per year over BOXN (CC+8+2t)





25 T AXLE LOAD BOGIE HOPPER WAGON TYPE BOBSN-25 •Pay to tare ratio - 3.0 (v/s 2.01 of existing BOBSN) •TLD of 9.33 t/m (v/s 7.9 t/m of existing **BOBSN**) Nos. of wagons/rake – 58 (v/s 53 of existing BOBSN) Rake throughput increase of 34% over BOBSN Increase in revenue of Rs. 4.85 Crores per rake per year over BOBSN

BOBSN-25








BOGIE COVERED WAGON TYPE BCNAHS

- •Pay to tare ratio of 2.31 (v/s 1.85 of BCX)
- •TLD of 5.625 t/m (v/s 5.15 t/m of BCX)
- •Nos. of wagons/rake 44
- •Rake throughput increase (of 20.32 t BCNAHS) of 7.4% over BOXC
- •Increase in revenue of Rs. 1.41 Crores per rake (of 20.32 t BCNAHS) per year over BOXC



Description	BCN	BCNA/HS
Length over coupler	15429	14450
Length over h/stock	14500	13521
Height	3787	4017
Width over sole bar	2950	2950
Tare	27.20	24.55
G. Weight	81.28	81.28
Axle load	20.32	20.32
Pay load	54.08	56.73
Bogie	22NLB	NLB/HS



- Designed in 2006
- 22.9 t axle load
- CRF section
- Stainless steel made structures
- One door in one side

22.9 T A/L COVERED WAGON TYPE BCNHL

- Pay to tare ratio of 3.40 (v/s 2.30 of existing BCNA)
- TLD of 8.35 t/m (v/s 5.625 t/m of existing BCNA)
- Utilisation of 'Garib Rath' profile
- Wagon length reduced to 10.963 m from existing 14.45m for BCNA wagon



- Nos. of wagons/rake 58 (v/s 44 of existing BCNA)
- Rake throughput increase of 21.40% for different commodities (Cement 40%, Food grain 31.6 %, Fertilizer 21.5 %) over existing BCNA wagon
- Increase in revenue earning of Rs. 5 Crores per rake per year over BCNA (CC+8+2 t, Cement)







Hopper Wagons

- BOBR A long pull rod is used for connecting two bogies.
- **BOBRN** A SAB is used for this purpose.
- **BOBYN** Side buffers
 - CBC transition type
 - DOM 04 hand wheels are

provided for operating side doors and bottom doors.

BOTTOM DISCHARGE COAL HOPPER WAGON TYPE BOBRN

Pay to tare ratio – 2.2 (v/s 2.126 of BOBR)
TLD of 7.67 t/m (v/s 7 t/m of BOBR)
Nos. of wagons/rake – 58 (v/s 53 of BOBR)
Rake throughput increase of 10.2% over BOBR
Increase in revenue earning of Rs. 1.3 Crores per rake per year over BOBR









Description	BOBR	BOBRN	BOBYN/HS
Length over couplers	11600	10600	11647/12000 over buf
Height	3735	3735	3050
Width	3500	3500	3189
Tare	26.0	25.6	27.04
Pay load	55.28	55.68	54.24
G. Wt.	81.28	81.28	81.28
Axle load	20.32	20.32	20.32
No. of wagons	51	55	50

BOBRNAL

- Carrying bulk commodities like iron ores & coal
- Bottom discharge wagon for fast unloading of commodities
- Aluminium is used in structures and remains parts same

BOBRN AL

- 3.2 t reduction in tare wt.
- 3.2 t increase in pay load
- 5.75 % increase in throught put
- Pay to tare ratio 2.63 against 2.17% of existing BOBRN wagon

25 T AXLE LOAD BOTTOM DISCHARGE COAL HOPPER WAGON TYPE BOBRN-25

- •Pay to tare ratio 3.26 (v/s 2.2 of existing BOBRN)
- •TLD of 9.33 t/m (v/s 7.67 t/m of existing BOBRN)
- Based on Garib Rath MMD
- •Nos. of wagons/rake 58

Rake throughput increase of 37.4% over BOBRN (20.32t) & 20.1% over BOBRN(CC+6+2t)
Increase in revenue earning of Rs. 3.23 Crores per rake per year over BOBRN(CC+6+2t)

9784 LENGTH OVER STANCHIONS 9422 LENGTH INSIDE $T\Gamma$ 2756 HEIGHT INSIDE OF WAGON (L.V) TOP 4025 -1105 (L.V.) 'R.L 1 2000 WHEEL BASE -464,5 1440,5 6903 BOGIE CENTRES 1440,5 - 464,5 10713 LENGTH OVER COUPLING FACES

<u>BOBRN-25</u>



BTPN

- Length 12420 mm over coupler faces
- Height of barrel from rail level 4154 mm
- Barrel length 11458 mm
- Barrel 2850 mm inside dia.
- Bogie NLB
- Volumetric cap. Of barrel 70.40 m³
- Tare 27 t
- CC 54.28 t
- Gross wt. 81.28 t
- Axle load 20.31 t
- Cc/rake 2551.16 t
- Axle load 20.32 t

BOGIE TANK WAGON TYPE BTPN

Pay to tare ratio – 2.0 (v/s 1.74 of TPR)
TLD of 6.54 t/m (v/s 3.921 of TPR)
Nos. of wagons/rake – 47
Volumetric capacity – 70.4 m3
Rake throughput increase of 76% over TPR
Increase in revenue earning of Rs. 4.8 Crores per rake per year over TPR



- <u>BTPGL</u> Bogie liquefied petroleum gas tank wagon.
 - tare 45.7 t
 - CC 35.5 t
 - Gross 81.28 t
 - Vacuum brake system
 - Length over h/stock 18000 mm
 - Length over coupler faces 19282 mm

BTPGLN - Bogie liquefied petroleum gas tank wagon. Tare – 41.60 t, CC – 37.6 t, Gross – 79.20t, Air brake, Length is same as BTPGL.



- It is a frameless bogie tank wagon, was developed and validated for strength during the year.
- Existing BTPN has pay load /tare wt. ratio 2.0 A need to improve payload with the existing axle load.
- No center sill
- Tractive & buffing forces are taken up by the barrel itself, thus optimizing the use of wagon mass which is subjected to bi-axial stress.





Design of BTFLN Wagon

Comparison bet BTFLN & BTPN

Description	BTPN	BTFLN
Length over H/stock	11491	11491
Axle load	20.32	20.32
Tare wt	27	23.53
Pay load	54.28	57.75
Pay/Tare	2.0	2.45
Vol. Cap.	70.40	76
Pay load/rake	2605	2772



Flat wagons

- **BFNS** Bogie flat steel wagon type
 - for transportation of HR coil
 - Tare weight 23.6 t
 - Pay load 57.7 t
 - adjustable stoppers have been

provided for placement of coil in the groove and preventing longitudinal shifting of coils.

- Length and width equal to BRN to

facilitate loading flat products as being done on BRN. - fit to run at 100 kmph.

BFNS

- Length 14645 mm over couplers
- Height 2776 mm over stanchions bkt
 - 2650 mm over side wall
- Width 3045 mm over stanchions bkt
- **BRN** Bogie Rail wagon type
- Purpose: For transportation of Rails, Steel Coils, Plates etc.

Description	BRN	BRNA
Length	14645	14645
Width over sole bars	2845	2845
Height	2544	2409
Tare	24.393	23.543
CC	56.887	57.737
G. Wt	81.28	81.28
Axle load	20.32	20.32





- Air brake CASNUB bogie container flat wagons owned by container corporation Ltd.
- Converted from BFKI.
- Tare wt. 20.5 t
- Pay load 61 t
- Speed 75 kmph



- <u>Meaning of BLC</u> Bogie Low platform container flat wagons.
- Low platform container flat wagon, light weight, all welded skelton design underframe for an optimum tare to payload ratio.
- Wheel dia 840 mm, condemn. 780 mm.
- CBC on raised end of A car and slackless draw bar on inner end of A car and on all B cars
- Tare wt (A) 19.1 t, B 18.01 t
- Pay load 61 t.
- Speed 100 kmph

Necessity for introducing BLC

 If the ISO containers are loaded on the BFKI wagons, the overall dimensions exceeds the Standard moving dimensions of X-class engine by 254 mm at the top side height, in such a case the load is to be moved as ODC with speed restrictions. This will in turn decreases the speedy movement of containers.



BFKI wagon

 If the same containers are loaded on the specially made well wagons, the load can very well be moved as Non-ODC, but at either ends of the wagon 1.5 metres of length are necessary to accommodate the CBC couplers. Consequently the length of the wagon is increased by 3 metres (3000 mm). This will inturn reduces the number of wagons on a loop line from 42 for the existing BFKI wagons to 38 resulting in loss of earning capacity.

Interesting the second second AAR CBC Well Wagon 1105mm

Well Wagon

 So to over come the above two shortcomings, the BLC wagons are developed with a intention to move the ISO containers as non-ODC load with high speed as well as with more number of wagons for a given length of formation.
BLC Wagons

- 1. Special features of BLC wagons.
- A. These wagons are designed to carry ISO containers with a height of 2896 mm as non-ODC load.
- B. These wagons are manufactured in multiple unites. Each multiple units consist of two A-CARS.

C. The buffer height of outer end of A-CAR is 1105mm and it the inner end is 845mm.



One Unit BLC Wagons



- D. Both the ends of B-CARS are having a buffer height of 845 mm.
- E. The outer end of A-CAR is provided with AAR CBC coupler and it the inner end is provided with slackness Couplers.



CBC fitting



• F. Both the ends of B-CARS are provided with slack less coupler.



G. The overall slack in slackness couplers between the two wagons is only 1^{1/2}",when compared to a slack of 7^{1/2}" in the standard AAR CBCS between the two wagons.

Slack less draw bar fitting





CBC fitting

- The maximum permissible wheel diameter for both the wagons is 840mm. the Condemning diameter is 780mm.
- These wagons are provided with two stage load sensing device which admits a maximum pressure of 2.2kp/sq.cm when the gross load is less than 40 tons and 3.8kg/sq.cm when the gross load exceeds 40 tons automatically.
- The maximum permissible speed is 100KMPH.

Load Sensing Device



 These wagons are provided with CASNUB 22 HS bogies. The spring loaded side bearers are used on these bogies. The spring loaded side bearers are designed to take 90% of load in tare condition.

- These wagons provided with automatic twisting locks. These locks are designed to lock the containers with the wagons with a force of 600 kgs. It unlocks the container from the wagon with a force of 1000 kgs.
- The floor height of these wagons from the rail level is decreased to 1009 mm from the standard of 1269mm.
- A formation can be formed with 9 multiple units with 45 wagons. The length of each unit is 69 metres approximately.





- These wagons are provided with new hybrid design of bogie frame and bolster. In order to bring down the plat form height.
- Note (1) Use of L type composition brake blocks are used in order to achieve an emergency braking distance within 1200 m.
- Note (2) One container wagon sick, the unit of 5 wagons to be disconnected.

Basic characteristics and dimensions

SI No.	Description	A car	B car
1	Track gauge	1676	1676
2	Estimated tare wt.	19.10 t	18 t
3	Pay load	61 t	61 t
4	Gross wt.	80.10 t	79 t

SI No.	Description	A car	B car		
5	Length over H/stock	13625	12212		
6	Width over sole bar at c/line	2100	2100		
7	Distance between bogie centers	9675	8812		
8	Floor height	1009	1009		
9	Ht. of CBC from rail level	1105	-		
10	Ht. of draw bar from rail level	845	845		
11	Wheel base	2000	2000		
12	Dia. Of wheel	840/780	840/780		

Salient features at a glance

- **<u>Bogie</u>** High speed cast steel bogie
- Floor height 1009mm which is 266 mm less than IRS wagon height.
- <u>Axle load</u> 20.32 t
- <u>C.C</u> 61 t
- <u>Max. speed</u> 100 kmph
- <u>Unit</u> 5 wagons A -2, B -3.
- <u>Rake</u> 45 wagons in form of 9 units, length of each unit – 69 meters approx.

- Brake beam Bogie is fitted with sliding type brake beam and brake head is the integral part of brake beam. Composition brake blocks are fitted.
- Air brake system single pipe graduated release
 - DV fitted with empty load function
 - Automatic load sensing device (LSD)
 BC pressure -2.2 in tare and 3.8 kg/cm² in loaded condition.
- Automatic twist locks- for securing
 containers for quick loading and unloading

Cast steel Bogie type LCCF 20(C)

- BLC wagons are mounted on two nos. of cast steel bogies **similar to** CASNUB bogies.
- Salient features -

Gauge - 1676 mm Axle load - 20.32 t Wheel dia. – 840(new)/780 mm (worn) Wheel base – 2000 mm **Type of roller bearing** – CTRB Distance bet. Journal centers- 2260 mm Distance bet. Side bearers – 1750 mm **Side bearers** – Spring loaded side bearers

- <u>Center pivot</u> Flat type
- Bolster spring group Helical springs, inner spring lower than outer spring.
- <u>Damping</u>— friction spring arrgt. With spring
 manganese steel wedge
 - friction liners on bolster & side frame.
- Anti rotation features Anti rotation lugs are provided on bolster and simultaneous anti rotation stopper at side frame.
- **LSD** fitted on bolster and spring plank
- Brake beam Unit type fabricated brake beam

LCCF 20 (C)









Centre pivot rivetted to bolster

Integral flat type centre pivot

Comparison of 22 NLB &container bogie type LCCF 20(C)

Description	22 NLB	LCCF20 (C)	
C/pivot ht. from rail	932 mm	715 mm	
Max ht. of side frame from rail	851	786	
Bottom of side frame	165	149	
Ht. of side bearer top	921	772	
Wheel dia	1000/925	840/780	
Side frame design	Cast steel design for narrow jaw adapter	Cast steel design for wide jaw adapter	
Bolster design	Separate c/pivot	Integral c/pivot	
Side bearer	CC pad	Coil spring	

Description	22 NLB	LCCF20 (C)
Load bearing coil spring	12 outer,8 inner spring	14 outer,12 inner spring
Snubber springs	4,material IS:3195Gr.60 Si7	4, IS3195 Gr 50 CrMoV4
Brake shoe	Conventional	Non metallic
Adapter	Narrow jaw	Wide jaw
Elastomeric pads	similar	Similar
Side frame key	similar	Similar
Spring plank	similar	Similar

	1.6	8.6	COMPAG						
	[s		AF	ATIVE FEATU	RES				
	N	o. Fea	tures	1		JF BLC-E	BFKN-B	OVER	
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	8 00	-9011	Jnit	Consist of a		B	FKN	BOY	
	100			nos. A-Car + 2	agons	2 Single		SOXK/BOXK	H
	02	Platform	Height	Car	nos. B	-	wagon	Single was	
	03	Was R.L.	·······································	1009 mm	-	1		agon	1
		overboard	length	A-Car too	a cha	1265	mm	1	1
	04	Tare	stock	B-Car 12210	n	1071	and the second s	1275 mm	+
	05	1		A-Car 10 10	2	13/16	mm	12800	1
	06	Payload		B-Car 18.10	t.	20 5		.2000 mm	1
	07	Vyheel dia	-+	611				19.5 t	
		'spe of bea	ring T	840 mm		61 1			·.'
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1 '	Brake	e cvlindor	Air brak	ie	Mirs.	US 587	84 TE	yons J	
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13					K	RO,			



Brake Van



- Discomfort to Guard
- Chances to derailment due to sudden lifting of wheels as it is lighter than BOXN wagon specially in case of high speed.



- Designed to improve riding quality of the brake van
- To increase speed potential to 100 kmph
- To provide increased comfort level for the guard during running goods train
- Two ICF bogie are used
- Oscillation trial is satisfactory up to 110 kmph
- Manufacturing at ASR workshop

BVZI

- Improved Amenities on Brake Vans_
- Provision of additional window.
- Provision of cushioned fixed seat with arms.
- Provision of table with sun mica top for writing.
- Provision of storage space in cabin for guard's equipment.
- Provision of additional railings and fencings for safety during exchange of signals.

BVZI

- Provision of door locking arrangement from inside and outside.
- Provision of extended roof on both sides with steel sheet.
- Provision of modified footsteps with rounded corners.

BVZI

- Provision of side window glass of transparent acrylic sheet with wire mesh.
- Painting outside with silver paint and inside with white enamel paint.
- Painting of railings with reflective red colour to make them visible during the night.
- Further, provision of light and fan in 50 brake vans has also been approved by Railway Board on trial basis.

New Developments in Wagons

Sanjay Kumar Lecturer/IRIMEE

New Numbering System of Wagons

- 11 digit's no. used.
- First two digits shows the type of wagon.
- Next two, owning railway.
- Further next two, year of manufacturing.
- 7th to 10th digit, for serial number.
- Last one for a check digit.

Calculation of Check Digit: 1st Method

- Say a Wagon no. is 61250619336
- Add odd positioned nos.=6+2+0+1+3=12- (i)
- Add even positioned nos.=1+5+6+9+3=24-(ii)
- Now, (ii)*3 + (i) = 24*3 + 12 = 84
- The number to be added to get a multiple of 10 is check digit i.e. 6.

Calculation of Check Digit: 2nd Method

- The Wagon no. is 61250619336
- Add odd positioned nos.=6+2+0+1+3=12--(i)
- Add even positioned nos.=1+5+6+9+3=24-(ii)
- 9 X last digit of (i) = 9X2 = 18 --- (iii)
- 7 X last digit of (ii) = 7X4 = 28 ---(iv)
- Add (iii) and (iv) =18+28=46 ---(v)
- So, the last digit of (v) is check digit i.e. 6
Requirements for Better Design

- Low tare weight.
- Higher pay/tare ratio.
- Higher speed potential.
- Higher reliability of the components.
- These can be achieved by
 - Upgrading the specification of components.
 - Reducing the maintenance cost by
 - Increasing ROH interval from 18 to 24 months.

Types of Wagon

- Open type
 - BOXNR, BOXNHS, BOXNHA, BOST, BOSTHS, BOXNHL, BOXNAL, BOY-25, BOXN-25,.
- Covered type
 - BCN, BCNA, BCNAHS, BCNHL.
- Hopper type –
 BOBR, BOBRN, BOBYN, BOBRNAL, BOBRN-25
- Flat type -
 - BRN, BFNS, BFKI, BOXKH, BLC etc.
- Tank type-
 - BTPN, BTPGLN, etc.
- Brake Van
 - BVZC, BVZI.

Historical Background

- Pre-independence
 - 25 types of wagons designed by M/s Rendol Palmer.
 - Axle load was 16.3 t.
 - Pay to tare ratio ranging from 1.09 to 2.64.
- Post-independence (upto 1960)
 - 9 wagon designs developed by various designers from all over the world.
 - Some of the important wagons are BOBS, BWS
 - Axle load max. 22.9 t.

Historical Background

- Post-independence (Recent)
 - After formation of RDSO in 1957, responsibility of development of design taken by RDSO.
 - In 1960, first wagon designed by RDSO: BOX wagon with vacuum brake having UIC bogie.
 - In 1980, BOXN wagon with air brake, Casnub bogie. CTRB & CBC was introduced.
 - Since then BOXN and other wagons like BCN, BTPN, etc. having Casnub bogie became workhorse of IR freight transportation.
 - Max. Axle load 20.32 t, Max. speed 100 Kmph.

BOXN WAGON

- Rake throughput increased from 2588 t to 3369 t (30.2 % increase).
- Other variants like covered, flat & other types of wagons were also designed
- New design increased the rake throughput for other commodities also.



Bogie Tank Wagon

- In 1986, RDSO designed BTPN due to less capacity for transportation of petroleum product in 4-wheeler wagons.
- This wagon increased the rake throughput by 78%.



Container Wagon

- In 1996, RDSO completed design of first Container wagon (BLCA/BLCB) for carrying ISO containers.
- It was the first wagon on IR for running at 100 Kmph in loaded and empty conditions (1997).



Advantages of Increasing Axle Load

 Increasing by one tonne 	
Increase in payload of one rake per year (in million tonnes)	0.013
Increase in payload of all existing wagons (in million tonnes)	42

Advantages of Reducing Tare Weight

•by One tonne (payload increased)

Increase in payload of all existing wagons (in million tonnes)	10.5
 Increase in number of wagons in a rake 	
 Saving of traffic Path 	

Financial Advantage of Reduction in Tare Weight One Tonne

Extra Earning per year (in Rs.)	43277
Fuel saving in empty running (in Rs.)	2229
Total extra earning per year of all the wagons (aprox. 2 lac) if weight of each one is reduced by one tonne (in Crores of Rs.)	910

BOXN



BOXN Wagon

- Estimated tare 22.47 t
- Axle load
- Pay load
- Gross load
- Length
- Width
- Height

– 20.32 t

– 58.81 t

- 81.28 t
- 10713 mm
- 3200 mm
- 3225 mm

BOXNHS

- Estimated tare
- Length
- Width
- Height

- 23.1 t (more)
- 10713 mm (same)
- 3200 mm (same)
- 3233 mm (more)
- Volumetric cap. 56.29 Cubic meter

Bogie Open Wagon Type BOXNHS

•Pay to tare ratio – 2.5 (v/s 2.25 of BOXC)

- •TLD of 7.59 t/m (v/s 5.925 t/m of BOXC)
- •Nos. of wagons/rake 58 (v/s 45 of BOXC)
- •Increase in revenue of Rs. 3.63 Crores per rake per year (of 20.32 t BOXN) over BOXC



BOXNHA

- Estimated Tare 23.17 t
- Use of IRSM -41
- For, Floor plate 6 mm Side stanchion - 8 mm Body side sheet - 5 mm End sheet - 5 mm Door sheet - 5 mm
- Length & width same as BOXN
- Height 3450 mm (225 mm higher than BOXN)

BOXN CR

- Features like overall dimensions, CBC, brake gear, brake system are same as BOXN.
- The body is made of steel to IRSM M-44 instead of IS 2062 or IRSM -41.
- Crib angles side is made of IRSM-44 steel instead of IS 2062.
- Sole bar of IRSM-41 instead of IS 2062 steel.

BOXNLW

- Drg. No. WD 88088-S-02
- Light weight BOXN wagon
- Tare 20.6 t against 22.47 t
- CRF section used.
- Length over coupler faces 10713 mm
- Width overall
- Width inside
- Height overall

- 3250 mm
- 3022 mm
- 3263 mm

Benefits of BOXNLW

- Reduction in tare wt. 1.8 t
- Increasing in pay load 1.8 t
- Increase in pay to tare ratio 2.94 (compared to 2.61)
- Low corrosion on Plates & Sheets
 Stainless steel used.
- Lower maintenance cost.

BOXNLW

- Pay load
- Tare
- Gross wt.
- Axle load
- Pay/tare HL
- TLD
- Vol. cap

- 60.87 t, less than HL
- 20.6 t
- 81.28 t, less than HL
- 20.32 t, less than HL
 - -2.94, less than
- 7.59 t/m less than HL– 58.84 m3

BOXNHL

and a starter

BOINHL

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CARRYING CA TARE AREA

RITED WITH SINGLE PIPE GRADUATED Inlense ar brake

BOXNHL

- Estimated tare BOXNHS
- 20.6 t less than

- Axle load
- Pay load
- Gross load
- Length
- Width
- Height

- 22.9 t (more)
- 71.0 t (more)
- 91.6 t (more)
- 10963 mm (more)
- 3250 mm (more)
- 3301 mm (more)
- volumetric cap.– 61.05 m3 (more)
- Floor ht. 1273 (2 mm less)

BOXNHL

- Pay to tare ratio3.45 (v/s 2.5 of BOXN)
- TLD of 8.35 T/m (v/s 7.59 T/m of BOXN)
- Nos. of wagons/rake 58
- Increase in revenue of Rs. 1.2 Crores per rake per year over BOXN (CC+6+2 t)

HUCK BOLTING





Huck Bolts fitted in Wagon



Pneumatic Tool for huck Bolting



BOXNHS v/s BOXNHL

Description	BOXNHS	BOXNHL	Difference
Length over Buffer/Coupler	10,713	10,963	+250
Length over Head stock	9,784	10,034	+250
Overall height from RL	3,233	3,301	+68
Floor height from RL	1,275	1,273	-2
Buffer height	1105	1105	-
In side height	1,950	2,028	+78
Width inside	2,950	3,022	+72
Width over all	3,200	3,250	+50
Floor Area	28.87 m ²	30.32 m ²	+1.45 m ²
Volumetric capacity	56.29 m ³	61.05 m ³	+4.76 m ³
Wheel base	2,000	2,000	same
Wheel diameter	1,000	1,000	same
Bogie centre distance	6,524	6,690	+166

BOST

- Open Air brake Wagon for steel loading.
- Purpose to introduce:
 - Sizable proportion of steel plant products are being loaded in BOX wagon (Vac. Brake).
 - BOX wagon is condemned.

BOST

- Length is same as BOX wagon and more than BOXN.
- Fitted with CASNUB bogie air brake.
- Lower side walls as compared to BOX wagon.
- Speed 100 Kmph
- Pay load same as BOX wagon
- Mfd. In GOC Workshop.

Benefits of BOST

- Suitable for consignment from steel plants which can not be loaded in BOXN due to shorter length.
- Equal in length to BOX equipped with air brake.
- Speed 100 kmph.

BOST

- Axle Load (in tonnes)
- TLD (in tonne/meter)
- Payload (in tonnes)
- Tare Weight (in tonnes)
- Gross Load (in tonnes)
- Pay to Tare Ratio
- Length (over head stock)

- : 20.32
- : 5.92
 - : 55.78
 - : 25.5
- : 81.28
- : 2.18
 - : 12800

BOST

- Width (overall) : 3100
- Height (from rail level) : 2835
- Cubic Capacity (in cum) : 65.84
- Bogie type : Casnub 22 HS
- Wheel diameter (in mm) : 1000 mm
- Speed Potential (in Kmph)E/L : 80/75
- Purpose : For transportation of Steel Plates, Sheets, Coal etc.

BOXNAL

- Aluminium aloy body and steel under frame designed for carrying bulk commodity like coal and iron ore without door.
- Except under frame all body structure, end sheets, side sheets and floor plates – Aluminium alloys.

Advantages of BOXNAL

Lightness

- -4.21 t reduction in tare wt.
- 4.21 t increase in pay load
- Pay to tare ratio 3.45 compared to 2.61 of existing BOXN wagon
- Corrosion resistance
- External appearance good
- Eliminate painting
- Easy to work with

Disadvantages of BOXNAL

- Very expensive.
- Pilferage cocern.

BOY Wagons

- Drg No. SK-73511
- Specially for transport of iron ores.
- Suitable for tippling.
- Composition: 52 wagons per rake.
BOY -25

- Open low sided gandola wagon.
- Designed at 25 t axle load with BMBC.
- Stainless steel & CRF section.
- Carrying minerals & Ores.
- Pay to tare ratio of 3.76 (v/s 3.42 of existing BOY).
- Track loading density of 9.33 t/m (v/s 7.67 t/m of existing BOY)
- Increase in revenue of Rs. 4.76 Crores per rake per year over BOY.

BOY v/s BOY-25

Description	BOY	BOY-25
Length over coupler faces	11929	10713
Width overall	3134	3135
Height overall	2450	2607
Bogie	20.3 t NLB	25t Self Steering

COVERED WAGON

BCN



BCNHL











BCNHL

- Designed in 2006
- 22.9 t axle load
- CRF section
- Stainless steel made structures
- Nos. of wagons/rake 58 (v/s 44 of BCNA)
- Increase in revenue earning of Rs. 5 Crores per rake per year over BCNA (CC+8+2 t, Cement)

Hopper Wagon



Hopper Wagons

- BOBR A long pull rod is used for connecting two bogie's brake system.
- BOBRN An SAB is used for this purpose.
- BOBYN Side buffers
 - CBC transition type
 - DOM (04 hand wheels are provided for operating side and bottom doors.)















Tank Wagon



BTPN

- Length over coupler
- Height of barrel
- Barrel length
- Barrel inside dia.
- Volumetric cap.
- Tare
- CC
- Gross wt.
- Axle load

- 12420 mm
- 4154 mm
- 11458 mm
- 2850 mm.
 - 70.40 m3
 - 27 t
 - 54.28 t
 - 81.28 t
 - 20.31 t

BTPGL

- Bogie liquefied petroleum gas tank wagon.
- Vacuum brake.
- Tare – 45.7 t
- CC - 35.5 t
- Gross - 81.28 t
- Length over h/stock
- Length over coupler 19282 mm
- 18000 mm

BTPGLN

- Bogie liquefied petroleum gas tank wagon.
- Air brake.
- Tare 41.60 t,
- CC 37.6 t,
- Gross 79.20t,
- Air brake,
- Length is same as BTPGL

Flat Wagon



Flat wagons

- BFNS Bogie Flat Steel loading Wagon.
 - for transportation of Hot Rolled Steel coil
 - Tare weight 23.6 t
 - Pay load 57.7 t
 - Adjustable stoppers provided to prevent longitudinal shifting of coils.
 - Length and width equal to BRN to facilitate loading flat products as being done on BRN.
 - Fit to run at 100 kmph.

BFNS

- Length 14645 mm over couplers
- Height 2776 mm over stanchions
 bracket 2650 mm over side wall
- Width 3045 mm over stanchions bracket

BRN – Bogie Rail loading Wagon

 For transportation of Rails, Steel Coils, Plates etc.

BFKN Wagon

- Air brake bogie container flat wagons owned by container corporation Ltd.
- Converted from BFKI (Vacuum Brake).
- Tare wt. 20.5 t
- Pay load 61 t
- Speed 75 kmph

BLC WAGON

Necessity for introducing BLC

- Loading of ISO containers on the BFKI becomes ODC.
- Developed with an intention to move
 - The ISO containers as non-ODC load
 - With high speed
 - With more number of wagons in a formation.

BLC Wagon

- Bogie Low platform Container flat wagons.
- Manufactured in multiple units consist of two A-Cars and three B-Cars.
- CBC on raised end of A car.
- Slackless draw bar on other end of A car and both ends of B cars.
- Tare wt A car 19.1 t, B car 18.01 t
- Pay load 61 t.
- Speed 100 kmph

One Unit of BLC Wagon



A-Car and B-Car



Couplers in BLC

- Slack less coupler at both ends of B-car.
- The overall slack is only 1.5", when compared to a slack of 7.5" in the standard AAR CBC between the two wagons.

Special Features of BLC

- Automatic twisting locks fitted.
 - Locks the containers with the wagon with a force of 600 kgs.
 - Unlocks the container from the wagon with a force of 1000 kgs.
- The floor height decreased to 1009 mm from the standard of 1269mm.
- A formation can be formed with 9 multiple units with 45 wagons. The length of each unit is 69 metres approximately.

Brake System in BLC

- Air brake system single pipe graduated release.
- DV fitted with empty load function.
- Automatic load sensing device (LSD).
- Brake Cylinder pressure:
 - -2.2 in tare and
 - 3.8 kg/cm2 in loaded condition.

BRAKE VAN

BVZC

- Discomfort to Guard.
- Chances to derailment due to sudden lifting of wheels as it is lighter than BOXN wagon specially in case of high speed.

BVZI

- Improved riding quality to provide increased comfort level for the guard.
- Increased speed potential to 100 kmph.
- Two ICF bogies are used
- Oscillation trial is satisfactory up to 110 kmph
- Manufactured at ASR, JMPW etc.

BVZI



• Additional window.

ushioned fixed seat ith arms.

able with sun mica top or writing.

torage space in cabin or guard's equipment. dditional railings and encings for safety uring exchange of signals.

