Supervisors Training Centre,
South Central Railway

COACHING THEORY (MCT – 07)

September 2017

INDEX

1. Design features of various wagons

Rolling stock used exclusively for transport of goods is termed as freight stock.Freight Stock are broadly classified either according to their under gear or according to utility.

Classification according to under gear:

Four wheeler wagon

Bogie wagons

Four wheeler wagons:

At present only Brake van is in service, other 4 wheeler wagons like tank wagon and CRT wagons are phased out.

Bogie wagons:

There are four different types of bogies used in wagons.

Diamond frame bogie, Cast steel Bogie, UIC fabricated bogie

CASNUB Bogie

Classification according to utility:

Open wagons, Covered wagons, Flat wagons, Hopper wagons

Well wagons, Container wagons, Tank wagons, Brake vans

Open wagons:

These are wagons are used for transportation of coal, ore, limestone's etc. which does not require protection from rain. The wagons are provided with flap doors for ease of loading/unloading of consignment.

Covered wagons:

The consignments which required to be protected from rain etc; are transported in covered wagons.

These wagons generally carry food grains, cement, fertilizers, fruits & vegetables etc.

Flat wagons:

These wagons are without side walls and are generally used for carrying steel coils, billets, rails sleepers etc.

Hopper wagons:

These are special wagons designed for Rapid discharge from bottom. These are used for transporting coal and ballast.

Well wagons:

These wagons have well shaped under frame and are used for larger consignments like military tanks, heavy equipments etc.

Container wagons:

These are special flat wagons designed for handling containers.

Tank wagons:

These are wagons designed to carry liquid consignment like petroleum products, milk, edible oils, etc.

Brake vans:

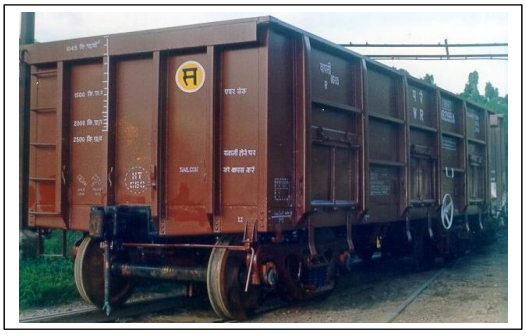
These are guards van used with freight trains as last vehicle

1.1 OPEN WAGONS

BOY: Designed in 1967 for heavy minerals. Axle Load - 22.9t. Cast Steel Bogie. It has no doors. Speed 65/75 Kmph.

BOY EL: Introduced in 2006 for operation at 25t Axle Load. Bogie -Casnub 22NLC.Differentiated from BOY by an Olive Green Band. Speed restricted to 50/65 Kmph.

BOXN: Designed in 1980 for coal. Axle Load - 20.32t.CASNUB Bogie, Speed 75/80 Kmph.



BOXN M1: In 2005 for increasing the CC up to CC+8+2t, suspension of BOXN is augmented by providing additional springs. A caption “Fitted with additional springs for Axle Load of 22.2t” in the centre of the wagon in golden yellow is printed to differentiate. Bogie side frame is also painted with Golden Yellow band. Speed 70/80 Kmph for CC+6+2t & 60/80 Kmph for CC+8+2t.

BOXN EL: Introduced in 2006 for operation with 25t Axle Load. Bogie - Casnub22 NLC.Differentiated from BOXN by an Olive Green Band. Speed restricted to 50/65 Kmph.

BOXN HS: Designed in 2000. Variant of BOXN with Casnub 22HS bogie for increasing speed.Differentiated from BOXN by a Golden Yellow band. Speed 100/100 Kmph.

BOXN HSM1: In 2005 for operation up to CC+8+2 t, suspension of BOXNHS modified by providing two additional inner springs. Differentiated from BOXNHS by a caption “Fitted with additional springs for Axle Load 22.82t” in centre of the Golden Yellow band. Bogie side frame also provided with Golden Yellow band. Speed 75/90 Kmph for CC+6+2t and 60/90 Kmph for CC+8+2t.

BOXN CR: Designed in 1999. Material of body of BOXN changed to stainless steel (IRS: M 44). Other parameters are same as BOXN.

BOXN R: Designed in 2007. It is upgraded rehabilitated version of BOXN. Entiresuperstructure of MS replaced with Stainlesssteel (IRS: M 44). Height is177 mm more thanBOXN. Carrying capacity increased by 6t.Nine stanchions provided, instead of 6in BOXN. Axle Load - 22.9t.

BOXNHA: This wagon was designed in 2001 for transportation of coal with an axle load of 22.1t. Bogie - IRF 108HS. Its height is more than BOXN. Speed at 20.32t and 22.1t Axle Load 100/100 Kmph and at 22.82t Axle Load 60/65 Kmph.

BOXN LW: Designed in 1988 to meet the requirement of higher pay to tare ratio. Axle Load - 20.32t. Casnub22HS bogie, Width is 50 mm more than BOXN. Stainless steel (IRS: M44) &corton steel (IRS: M41) used in body and under frame and Cold Rolled Formed (CRF) sections were used in design to reduce the tare weight of the wagons. Manufacturing of this wagon started in 2005. Speed 100/100 Kmph.

BOXN LWM1: In year 2008, design and Suspension of BOXNLW modified for operation up to CC+8+2t. Speed 60/65Kmph for both CC+6+2t and CC+8+2t.

BOXN HL: Designed in year 2005, 250mm longer, 76mm higher & 50mm wider than BOXN. Axle Load - 22.9t.Casunub22HS Bogie. Stainless steel (IRS:M44) and CRF section used in body and under frame to reduce tare weight (20.6t). Has been provided with improved quality coupler and draft gears. PU painting is used. Initially red oxide colour specified, later on changed to phirozi blue. In red oxide colour wagons ‘SS’ written on side in a circle in phirozi blue colour for identification. Speed 75/100 Kmph.

BOST: Designed in 2000 for long steel products. Axle Load - 20.32t.CASNUB 22HS Bogie. Speed 75/80 Kmph.

BOST M1: In 2006 for operation up to CC+6+2t, it is modified by providing additional springs. Differentiated from BOST by a caption “Fitted with additional springs for Axle Load 22.32t” in centre of the wagon in Golden Yellow. Speed 60/65 Kmph.

BOST HS: Designed in 2004. Variant of BOST with Casnub 22HS (Mod-1) bogie for increased speed. It is differentiated from BOST by a Golden Yellow Band. Speed 100/100 Kmph.

BOST HS M1: In 2007 for operation up to CC+6+2t. it is differentiated from BOSTHS by a caption “Fitted with additional spring for Axle Load 22.32t” in centre of the Golden Yellow Band. Speed 60/80 Kmph.

BOST HS M 2: Designed in 2006 for increasing speed. Axle load 22.32t.Variant of BOSTHS with CASNUB 22HS (Mod-II). Speed 60/100

1.2 COVERED WAGONS

BCN: Designed in 1984 for transportation of bagged commodities. Axle Load 20.32t. present stock is mostly with CASNUB 22NLB, Speed 75/80 Kmph.

BCN M 1: Introduced in 2006 for operation up to CC+8+2t. It is differentiated from BCN by a caption “Fitted with additional springs for Axle Load 22.82t” in centre of the wagon in Golden yellow. Golden Yellow Band is provided on bogie side frame also. Speed 75/80 Kmph for CC+6+2t and 65/80 Kmph for CC+8+2t

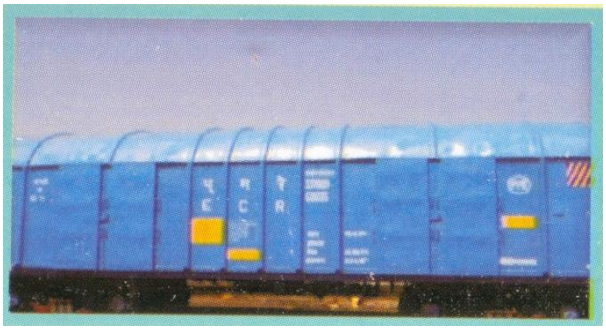
BCN A: Designed in 1990 by reducing the length of BCN wagon and increasing height,there by increasing the number ofwagons in a rake to 44. Axle Load 20.32t. Bogie is CASNUB22NLB, Speed 80/80 Kmph.

BCNA M 1: Introduced in 2006 for operation up to CC+8+2t. It is differentiated from BCNA by a caption “Fitted with additional springs for Axle Load 22.82 t” in centre of the wagon in Golden yellow. Golden Yellow Band is provided on bogie side frame also. Speed 75/80 Kmph for CC+6+2t and 65/80 Kmph for CC+8+2t

BCNA HS: Designed in 2001, variant of BCNA with CASNUB 22HS bogie for increased speed. It is differentiated from BCNA by a Golden yellow band. Speed 100/100 Kmph.

BCNA HSM 1: Introduced in 2006 for operation up to CC+8+2t. It is differentiated from BCNAHS by a caption “Fitted with additional springs for Axle Load 22.82t” in centre of the wagon in Golden yellow. Golden Yellow Band is provided on bogie side frame also. Speed 75/100 Kmph for CC+6+2t and 65/100 Kmph for CC+8+2t.

BCN HL: Designed in2006 for bagged commodities. Axle Load 22.9t. Length is further reduced and both width and height increased compared to BCNA. Hence number ofwagons per rake increased to 58.Bogie is of CASNUB 22 HS type. Stainless steel(IRSM: M44) and CRF sections usedin body and under frame construction to reducethe tare weight. Has been provided with improved quality coupler and draft gears. PU painting of Phirozibluecolour is used. Speed 65/65 Kmph.



BCCN/BCCN A/BCCN B:

BCN variants for carrying bulk cement (not packed in bags). Loading is through ports at the top; unloading via chutes at the bottom.

NMG: These are not narrow-gauge wagons, despite the classification code. The class code 'NMG' stands for 'New Modified Goods'

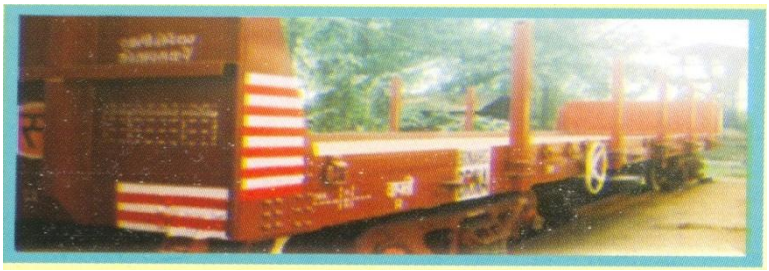
These are single-decker automobile carriers constructed out of old ICF and BEML passenger coaches. The design is not entirely uniform but generally all the windows and doors on the side walls are removed and the opening closed. End body is modified by providing doors to allow vehicles to be driven into it.

1.3 FLAT WAGONS

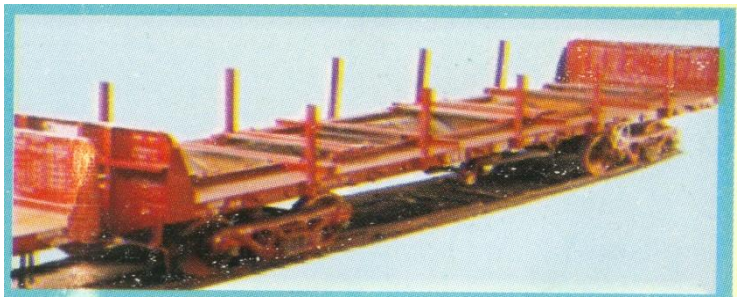
BRN: Designed in 1992 for transportation of rails and heavy steel products. Axle Load 20.32t. provided with CASNUB 22 NLB, Speed 75/80 Kmph.

BRN A: Designed in 1994, improved version of BRN. The design is riveted cum welded construction. Higher pay to tare ratio, compared to BRN. Other parameters are same as BRN. Speed 75/80 Kmph.

BRN AHS: Designed in 2001. Variant of BRNA with CASNUB22HS bogies for increased speed. Speed 100/100 Kmph.



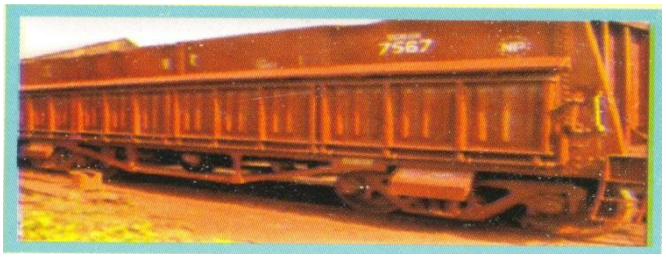
BFNS: Designed in 2002 especially for transportation of hot rolled/cold rolled coils, plates, sheets and billets etc. This is the first wagon designed in Indian Railways to carry point load. Provided with CASNUB 22HS bogie, Axle Load 20.32t. Speed 100/100 Kmph.



BRHNEHS: This bogie rail wagon was designed in 2004 for use of Engineering department of various Zonal Railways for Track Relaying Train (TRT), specially for loading RCC sleepers. Axle Load 20.32t. provided with CASNUB 22HS Bogies. The design was provided with Transition CBC and air brake system. Speed 50/65 Kmph.

1.4 HOPPER WAGONS

BOBSN: Designed in 1994 for transportation of iron ore, Axle Load 22.9t. Provided with modified CASNUB 22NLB bogie. It is provided with side discharge. Speed 75/75 Kmph.



BOBSNM1: In 2006 for operation at A/L 25t, suspension of BOBSN modified by providing 4 additional inner springs, Bogie renamed as Casnub22NLC. Speed 50/60.

BOBR: Designed in 1986 for transportation of Coal, it is provided with bottomdischarge. Axle Load 20.32t. Provided with CASNUB 22NLB bogie, Speed 80/80 Kmph.

BOBRM1: Introduced in 2006 for operation up to CC+6+2t. It is differentiated form BOBR by caption “Fitted with additional springs for A/L 22.32t” in centre of wagon in Golden Yellow. Golden Yellow Band is provided on bogie side frame also. Speed 70/75 Kmph.

BOBRN: Designed in year 1991 by reducing the length of BOBR wagon to increase the number of wagons in a rake to 58 (from 53 of BOBR). Axle Load 20.32t. provided with CASNUB NLB bogie. Speed75/70 Kmph.

BOBRNM1: Introduced in 2006 for operation up to CC+6+2t, it is differentiated from BOBRN by a caption “Fitted with additional springs for A/L 22.32t” in centre of wagon in Golden Yellow. Golden Yellow Band is provided on bogie side frame also. Speed 70/80 Kmph.

BOBRNHSM1: Designed in 2006 for Axle load of 22.32t. Variant of BOBRN with modified CASNUB 22HS Bogie for increased speed. Instead of BOBRNHS this (BOBRNHSM1) was manufactured. Speed 60/100 Kmph.

BOBRNEL: Introduced in 2008 for operation at Axle Load of 25t. It is differentiated from BOBRN by an olive Green band. Speed restricted to 50/65 Kmph.

BOBYN: Designed in year 1996 for transportation of ballast for engineering department. It has chutes at side & bottom for discharging ballast on both sides and centre of rails. Provided with CASNUB 22NLB Bogie, Axle Load 20.32t. Speed 75/75 Kmph.

BCBFG: Bogie covered Hopper Wagon for Food Grain. This wagon has been designed for transportation of food grain in bulk. It is provided with CASNUB-22HS Mod-I bogie, Non transition CBC, single pipe graduated release air brake system with automatic load sensing device. There are 2 Nos. gravity discharge gates at bottom for unloading. Axle Load 21.82t, speed 65/65 Kmph.

1.5 TANK WAGON

BTPN: Bogie Tank Wagon. This wagon was designed in 1986 for transportation of petroleum products i.e. Kerosene, petrol, diesel and naphtha. Axle Load 20.32t. CASNUB 22 NLB bogie. Speed 80/80 Kmph.

BTFLN: Improved version of BTPN, designed to increase the pay load. This tank is without complete under frame; hence the tare weight is reduced from 27t to 23.53t. Pay load is increased from 54.28t to 57.75t increasing the pay/tare ratio from 2.0 to 2.45. the volume is also increased from 70.4 m^3 to 76 m^3. since the under frame is not available the brake system is also modified to Bogie mounted brake system, with rigging components only on bogies.

BTPGLN: This wagon is designed for transportation of LPG. Provided with Air brake and CASNUB 22NLB bogie, Axle Load is 20.32t. Speed 75/80 Kmph.

BTALN: Bogie Ammonia Tank Wagon. This tank wagon was designed in 1984 for transportation of anhydrous liquid ammonia. Provided with UIC Bogie, Axle Load is 20.32t. Speed 65/65 Kmph.

BTCS: Bogie Caustic Soda Tank Wagon. This wagon was designed in 1980 for transportation of Caustic soda. Bogie CASNUB 22W. Axle Load 20.32t. Speed 65/65 Kmph.

BTAP: Bogie Alumina Tank Wagon

This wagon was designed in 1982 for transportation of Alumina powder. It is gravity loaded and has provision of fluidizing for evacuation. Present stock is fitted with CASNUB 22NLB bogie, Single pipe Air Brake System & non transition high tensile CBC. Axle Load 20.32t. Speed 65/65 kmph

1.6 BRAKE VAN

BVZI: Bogie Brake Van

This 8-wheeled brake van was designed in 2004 with ICF bogie to achieve comfort level(Ride Index) equivalent to loco for goods guard and capable of running at 100 Kmph. The brake van is 5 meter longer than BVZC brake van.

BVZC: 4 Wheeler Brake Van with Air Brake

This 4-wheeled brake van is fitted with 9 plated laminated bearing springs. Wheel base of 5400 mm. Fitted with cylindrical roller bearing wheels. Auxiliary reservoir capacity is 75 ltrs. Brake cylinder dia 304mm/12 inches. Speed potential 100 kmph.

1.7 CONTAINER WAGONS

BFKN: Bogie Container Flat Wagon. Broad gauge Bogie Container flat wagon type BFKN is modified version of BFKI wagons, which are in operation on IR from 1975 for transportation of containers (max pay load of 48t). Operating speed is 75 kmph. Modified BFKN (Air brake & enhanced pay load) wagons can carry payload of 61t.these wagons are fitted with indigenous designed Retractable Anchorage Locks (patented) to secure containers.

BLCA/BLCB: Bogie Low Platform Container Flat Wagon.Designed in 1994 for transportation of 20' & 40' long ISO containers with operation speed of 100 kmph. Lower height of under frame floor from R/L. has been achieved with introduction of hybrid design of bogie frame, bolster and use of smaller diameter wheel in LCCF 20(C) bogie, Axle Load 20.32t. Speed 100/100 Kmph. Provided with Automatic twist lock for securing of containers on the wagon.

BLLA/BLLB: Bogie Low Platform Longer Container Flat Wagon.

Designed jointly by RDSO & RITES in 2001 for transportation of 22', 24' & 45' containers. There is provision for carrying 20' & 40' long ISO containers also. Except the under frame the bogies are all of BLC wagons. Axle Load is 20.32t. Speed 100/100 Kmph.

DOUBLE STACK CONTAINER OPERATION:

In March 2006 double stack container train operation started with restricted speed of 75kmph. This was for the first time in the world that double stack container train operation of flat wagon was done. Speed 75/75 Kmph.

BLCAM/BLCBM: In the year 2007 bogie of BLC wagon was modified by providing upgraded side bearer, upgraded friction wedge & 2 additional inner springs for double stack container operation with Axle Load of 22t & 100kmph speed.

2. Wagon manufacturing – use of hulk bolts

Introduction:- To join two heavy duty pieces, riveting is being adopted. Riveting is a process of joining two pieces of metal by which non-homogeneous permanent joint is achieved. In this process compressor, furnace, buster machine & other necessary tools are required. This Process also involves Hot Forging.

Huck bolting is being introduced due to its following advantages over Riveting :-

1) Pollution Free.
2) Higher Strength.
3) Vibration Resistant.
4) Pre-tension.
5) Maintenance Free.
6) Visually examined.

Huck Bolting is widely used in construction, mining, equipment, bridge, building, rail track assembly, quarry plant & machinery, Rail car & Wagon Construction, Truck & Trailer Chassis, Ball & Rod Mills etc.

This Process is particularly used in BOXNHL, BCNHL, BOSTHS, BOXNR& BRN Wagons.

2.1 Huck Bolting Process :-

Tools &Equipments:-Following Tools &Equipments are used in Huck Bolting Process:-

1) Huck Bolting Machine – (a) Power Pack (b) Hand held Machine
   (c) Connecting Hose.
2) Power Supply.
3) Huck Bolt with Collar. (Huck Bolt is Made of Alloy Steel Coated with Nickel-Platinum). They are of Different size, i.e. ½ ‘’, ¾ ‘’, 7/8 ‘’, 1 “& $1\text{-}_{1/8}$”.

Process: - Before starting the process it is ensured that power pack and hand held machine is in

proper working order. Hydraulic pressure of 800 psi is maintained in the Power Pack. Both should be connected through Connecting Hose and required size of hole has been drilled in both pieces of metal which are to be joined. Insert Huck Bolt from back side and fit the Collar from front side. To achieve Huck Bolting the machine should be applied over Huck bolt and ‘ON’ the Machine and Process is completed in few seconds. In this process at first machine pulls the bolt to remove the clearances between the joining pieces and simultaneously it crimps the collar over the Knurling portion of the bolt to make tight joint and the bolt is finally broken from its groove.

3. Stainless steel wagons, Aluminum wagons, Higher Axle load wagons

3.1 BOXNHA WAGON

a) SALIENT FEATURES

A BG Bogie Open wagon type `BOXN-HA' has been designed for carrying increased payload for bulk movement of Coal and Iron Ore over Indian Railways. The length and width of the wagon are same as those of existing BOXN wagon except the height of wagon, which is 3450 mm from rail level. Thus BOXNHA wagon is higher by 225 mm compared to BOXN wagon. The wagon is fitted with cast steel IRF 108HS, secondary suspension bogie, non-transition centre buffer coupler and single pipe graduated release air brake system.

The Salient Features of BOXNHA wagon are given below:

i.	Length over coupler faces	10,713 mm
ii.	Overall width	3200 mm
iii.	Overall Height	3450 mm
iv.	Estimated Tare Weight	23.17 tonnes
v.	Axle Load	22.1 tonnes
vi.	Gross Load	88.40 tonnes

These wagons are expected to run in close circuit initially on Hospet-Chennai section of Southern and South Central Railway.

b) WAGON SUPERSTRUCTURE

The wagon superstructure consists of the following sub- structures:

- Underframe
- Body sides
- Body Ends
- Side Doors

i. Underframe : The underframe is provided with two sole bars of ISMC 250 rolled channel section with centre sill of standard `Z' section alongwith ISMC 100 for stringers. To combat corrosion, corrosion resistant steel has been used. The body bolster is of box type construction fabricated by welding of plates and the cross bars are also of fabricated design made out of plate sections. The underframe is of all welded construction with material IS2062 Fe 410 CuWA. The floor plate is made out of Corten Steel to IRS-M41 and welded to the underframe. The details of underframe members are given in Table.

3.2 DETAILS OF SUPERSTRUCTURE

Description	Section	Material Specification
Sole bar	ISMC-250	IS:2062 Fe410CuWA
Centre Sill	Standard `Z' Section	-do-
Underframe Stringers	ISMC 100	-do-
Bolster	Fabricated Box Section using 12 mm thick plate.	-do-
Floor Plate	6 mm thick plate	IRSM 41
Side Stanchion	Fabricated with 8 mm Plate	IRS-M41
Top Coping	Fabricated with ISMC 100 +6 mm plate	IS:2062 Fe410 CuWA,
Inter Coping	ISMC 100	-do-
Body Side Sheet	5 mm Sheet	IRSM-41
End Stanchion	ISMC 150	IS:2062 Fe 410 CuWA
End Sheet	5 mm Sheet	IRSM-41
Door Frame	Fabricated IS:1079 Gr.0 Sheet	IS:2062 Fe 410 CuwA
Door Sheet	5 mm Sheet	IRSM-41

ii. **Body Side:** The body side consist of box section stanchions with sturdy top coping and intermediate copings. Body side sheets are made out ofcorten steel and are welded to the underframe crib angle on top of solebar. Floor plates are manufactured from Corten Steel. The side stanchions are however, connected tounderframe by riveting.

iii. **Body-Ends:** Body- ends consist of end panels, end stanchions, top coping and intermediate coping. During assembly to the underframe, the end panels are welded to end floor-angles. End stanchions are, however, connected to the head stock by riveting.

iv. **Side Doors:** Each side of BOXNHA wagon is provided with three side doors alternately between the dummy quarters. The doors have been provided to unload the material manually in case of emergency when mechanical unloading system is out of order. The side doors are hinged at the bottom similar to conventional doors of wagon. The doorplates are made of corten Steel and door frames are of fabricated design.

v. **Use of IRSM 41 Steel:** Body panel of Coal Wagons like BOXNHA encounter corrosive environment due to presence of sulphur and other carbonoic acid components in coal. Use of corrosion resistance steel to IRSM-41 will face the situation better due to

formation of an adherent protective oxide film on the surface if it is left undisturbed. IRSM-41 steel has following properties-

- Stronger than mild steel
- Easily weldable
- Develops its own protective film against corrosion.

vi. Welding of IRSM-41:- Barring a few riveted joints, wagon structure is an all welded assembly of plates and rolled section. Extensive repair by welding is, therefore done during maintenance/rectification of defects.

vii. Precautions during welding of IRSM-41

For welding fabrication of IRSM 41, following precautions should be taken-

- Electrodes to IRS D2 shall be used.
- Edge preparation shall be done as per IS:9595.
- Electrodes shall be preheated as per recommendation of manufacturer.
- Interpass runs shall be cleaned properly.
- Welders should be qualified.

c) NATURE OF REPAIRS IN BOXNHA

BOXNHA wagons are used extensively for transportation of Coal/Iron ore in bulk. Due to mechanised loading/unloading, these wagons are subjected to heavy shock loads due to which following defects may develop:-

- Bulging of Body Structure
- Puncturing of panels due to improper loading
- Corrosion of panels
- Slackening of rivets
- Failure of welded joints
- Distortion of doors
- Wear on door hinges

d) MAINTENANCE & REPAIR PROCEDURE

i. **Body Building:** Body normally bulges out on the sides due to improper handling at tipplers during unloading of commodity. Similarly, the end structure bulges out due to shunting forces. If there is no serious damage on side/end structure other than bulging, bulges can be effectively removed without dismantling. When bulging of the structure is more than 25 mm, it should be rectified by pulling with the help of chain& screw coupling. Bulging of all welded body sides can be rectified by spot heating and pulling by chain and screw coupling. In case of end bulging, two wagons with bulged end are coupled together and hydraulic jack is applied between them at the bulges. Suitable packing can be interposed between jack and wagon body. For all welded ends spot, heating can be applied for straitening.

ii. **Puncturing of Panels:** Body side/end panels are punctured due to improper loading and shunting. Punctured end side panels are repaired by welding of panel patches as per standard practice.

iii. Corrosion of panels : Corrosion of body and floor takes place due to the following:-

- Water logging
- Accumulated dust and refuse which retain moisture for long period
- Spillage of corrosive fluid due to defective packing
- Inadequate protection due to poor painting.

The current practice is not to paint the wagon from inside because the painting on inside wall can not withstand the constant scrubbing action of commodity during mechanized unloading. The following measures should be undertaken-

a) Most important measure to be taken in day to day working is to ensure that the wagon is kept thoroughly cleaned after unloading. It should receive attention in this respect after it has transported a corrosive or hygroscopic commodity.
b) While attending to repairs and panel patching, it is important to ensure that surfaces in contact are well fitted to avoid water pockets. Due care should be taken to clean and paint the affected surface to prevent corrosion.
c) The table below indicates the sizes of panel patches to be used for repairs of corroded panels. If area of the patch extends beyond 260 mm from floor height, either two standard patches of 5 mm thick seat should be used one above another or a single patch of 5 mm thick and 520 mm width should be used. In case two or more adjacent panels require patching at the same time, the complete length of corrosion can be covered by a straight pitch which must extend from stanchion to stanchion.

iv. Slackening of Rivets for BOXNHA wagon: Rivets are provided at the bottom of the side stanchions to join them with underframe structure. These rivets sometime get loosened due to combined effect of shock, corrosion and wear. Loose rivets can be identified by gentle hammering on rivets which will produce dull sound. The loose rivets shall be cut by chisel and then holes shall be set/repaired by welding. Re-drill to size and put new rivets.

v. Door Defects: The main defect in doors is distortion due to mishandling, wedging or jammed hinges. The distorted doors shall be taken down and straighten to ensure proper fitment. Worn out /damaged hinges should be replaced by reconditioned/new hinges. After repair, doors must sit flush against striking plates with adequate overlap between levers. Graphite grease should be applied on all the hinges.

vi. Repairs to Door and Fittings: The main defects which arise in side doors of these wagons are distortion due to mis-handling, jamming of engine and Bulging of door panels due to improper handling during un-loading on tipplers. Distorted or bulged doors must be taken down and straightened to ensure proper fitment. The worn out hinges, which are responsible for sagging/gaping of doors, shall be replaced with new or reconditioned ones. The corroded frame of door must be cut out and replaced by welding after repairs. The doors must sit flush against the wagon structure with proper support.

3.3 BOXNCR WAGON

a) SALIENT FEATURES

Bogie open wagon type BOXNCR is similar to BOXN wagon except the following:-

i. Barring rolled sections, the wagon body is manufactured from steel to IRSM M-44 instead of steel to IS:2062 Fe410CuWA or IRSM-41.

ii. Crib angles side to ISA 50x50x6 is manufactured from IRSM- 44 steel instead of IS:2062 Fe 410 CuWA steel.

iii. Sole bar is manufactured from IRSM-41 instead of IS:2062FeCuWA steel.

Other features like overall dimensions, bogie couplers and draft gear, brake gear, brake system, etc. are exactly same as BOXN wagon.

b) MAINTENANCE & REPAIR

i. Since BOXNCR wagon is similar to BOXN wagon, the maintenance schedule and repair procedure shall be similar to BOXN wagon. However, since the wagon body is made from IRSM-44 steel, the body panels, when corroded, shall be replaced with IRSM-44 steel panels only. The IRSM-44 steel panels/plates shall be cut either by shearing machine or by plasma cutting machine but not by oxy-cutting. The welding electrodes to be used for repairs are indicated in table.

ELECTRODES FOR WELDING

S. No.	Material to be welded	Electrodes/filler wire to be used
1.	IRS M-44 to IRS M-44	IRS class M1 with IS code E19. 9LR16 (as per IS;5206-83) or 3081 (MIG) as per AWS.
2.	IRS M-44 to IS:2062/5986/1079	IRS class C2 basic coated low hydrogen type having IS code EB5426H3JX or EB5424H3JX as per IS:814-91.
3.	IRS M-44 to IRS M-41	IRS class D2 with high deposition.
4.	IS:2062/5986/1079 to IS:2062/5986/1079	Same as indicated in (2) above or CO2 filler wire as per IRS class I and IA.
5.	IRS M-41 to IRS M-41	Same as indicated in (3) above or CO2 filler wire as per IRS Class-III.
6.	IRS M-41 to IS:2062/5986/1079	Same as indicated in (5) above.

ii. The edge preparation should be done as per IS:9595 for both "V" butt as well as fillet joints. Electrodes and filler wires should be procured from any RDSO approved sources and the parameters like current, voltage, etc. should be as per IS code and manufacturers recommendations. Preheating of electrodes of IRS class C2 & D2 at 250 deg. C for 2 hours, 350 deg. C for one hour or as recommended by the manufacturer be done prior to use. After heating, electrodes are to be kept in an electrode oven at 110^{o} C to avoid any moisture pick up.

c) PRECAUTIONS FOR WELDING STAINLESS STEEL

i. Since Stainless steel has high coefficient of thermal expansion and less heat conductivity, it is advised to use low welding currents with the recommended range and smaller gauge electrode to minimize heat input and reduce distortions.
ii. Surface to be welded must be clean, dry and free from dirt, oxide film, oil, grease etc.
iii. Electrodes should be re-dried before use.
iv. Always maintain short arc to minimize the loss of alloying elements.
v. Avoid weaving and make stringer beads.
vi. After finishing welding, lift electrode slowly and fill the crater before breaking the arc. This will avoid crater cracks.
vii. Use stainless steel wire brush for cleaning welds.
viii. Use electrode preferably with DC(+).
ix. Every bead should be properly cleaned before further welding on it.
x. Welding should be preferably carried out in flat position.
xi. Correct electrode size, recommended current, arc length, travel speed and electrode angle must be followed.
xii. Any defect like crack, blowhole etc. must be properly gouged out and re-welded.
xiii. Do not strike arc adjacent to the weld.
xiv. Tack the welded area correctly to ensure proper gap.
xv. Proper welding sequence must be followed to reduce internal stresses and hence reduce warpage of structure.
xvi. Always weld towards the free ends.

d) SURFACE PREPARATION & PAINTING

i. The surface preparation and painting schedule for underframe of the wagon shall be as per standard specification No.G-72 (Rev.1) read with latest amendments.
ii. Surface preparation of the wagon body
Degreasing with petroleum hydrocarbon solvent to IS:1745-1978 (low armatic grade 145/205) or any other degreaser (applicable for both SS,MS and corten steel).

iii. **PAINTING OF WAGON BODY**
For stainless steel

- Apply thin coat of etch primer to IS:5666-1970.
- Two coats of IS:2074-1992, ready mixed paint, air drying, red oxide zinc chrome priming to minimum DFT of 50 microns.
- Two coats of IS:123-1962, ready mixed paint, red oxide, brushing, finishing, semigloss to ISC:446 to IS:5-1994 to a DFT of 80 microns.

For mild steel and corten steel

- Remove dust, loose rust and mill scale etc. manually by scrapping, chipping and wire brushing to at least St.2 of IS:9954.
- Two coats of IS:102-1962, ready mixed paint, brushing, red lead, priming to minimum DFT of 80 microns.
- Two coats of IS:123-1962, ready mixed paint, red oxide, brushing, finishing, semi-gloss to ISC:446 to IS:5-1994 to a DFT of 80 microns.

iv. The painting of bogies, couplers and air brake equipment shall be done as given in para 11.2.5 of General Standard Specification No. G-72 (Rev.1) read with latest amendments.

3.4 BOGIE LOW PLATFORM CONTAINER FLATS (BLC)

Bogie container flat wagons have been designed for transportation of 2896 mm high Series-I, ISO containers for a gross payload of 61t at an operating speed of 100 km/h. These containers, when loaded on the earlier flat wagon caused infringement to the X-class MMD, resulting in constraints in their free movement.

In order to ensure that the wagons loaded with 2896 mm containers lie within the X-class MMD, a low platform height of 1009 mm has been achieved with the use of hybrid design of bogie frame and bolster and with the use of smaller diameter wheels (840mm).

The wagons have all welded construction and are mounted on two cast steel bogies. The flats are formed into units of five wagons, each unit having two “A” car at ends and three intermediate “B” cars. One end of “A” car is fitted with centre buffer couplers to ensure proper coupling with the locomotive while the other end has slackless draw bar to couple with “B” cars. “B” cars are coupled together and to “A” cars by slackless drawbars.

The length of A car is 1362 mm while the length of B car is 12212 mm. The coupler of A car for attaching to loco or other stock is at 1105mm. The coupler in the B car at both ends is at 845 mm from rail level. The wagons are equipped with Air Brake. The diameter of new wheel is 840 mm and the condemning size is 780 mm.

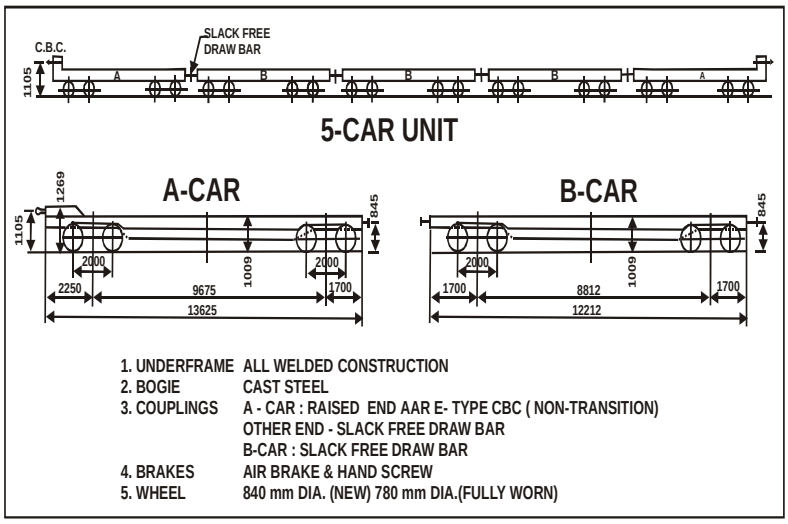


Fig 11.1 : BOGIE CONTAINER FLAT WAGON

9.5 NEW WAGONS

S.No.	Stock	Description
1.	BLCA/BLCB (Holding = 1080)	Low platform container flat wagons, light weight, all welded skeleton design underframe for an optimum tare to payload ratio, 840 mm wheel dia, A&B cars with AAR 'E' type CBC on raised ends of 'A' cars and use of slackness draw bar system on the inner ends of 'A' cars and on all 'B' cars, tare weight 'A' cares 19.lt 'B' cars 18.01, pay load 6lt.Fit to run 100 Kmph.
2.	BOXNHA (Holding = 125)	Higher axle load wagon suitable for 22.lt axle load and 8.25t/m TLD for coal loading. Payload per rake shall increase to 3783t as against341lt. In the existing BOXN wagon resulting in 11% increase in throughput per rake. Fit for 100 Kmph Tare weight=23.17, Payload = 23.17t Pay Load=65.13t
3.	BOXN (Holding = 580)	Use of corten steel in place of mild steel for the manufacture of BOXN wagons has resulted in arresting the problem of corrosion only to a limited extent. In order to reduce the problem of corrosion substantially, 3CR12 stainless steel has been used in the manufacture of BOXNCR

S. No.	Stock	Description
4.	BFKN (Holding = 580)	Air Brake CASNUB bogie container flat wagons owned by container corporation LTD. (being converted from BFKI)" Another 175 are yet to be converted.
5.	BCCN (Holding=30)	Double Decker Bogie covered wagon for transportation of automobile cars, Low platform 840 mm dia, air brake, fit for high speed (100 Kmph) axle load = 10.5t, pay load = 10t, Gross load = 42t, No. of wagons per rake = 18
6.	BFNS	Special wagons for transportation of HR coil, Tare weight 23.6t, payload 57.7t suitable for accomodating various sizes of coils Adjustable stoppers have been provided for suitable placement of coil in the groove and preventing longitudinal shifting of coils. The length and width have been kept equal to BRN wagons to facilitate loading flat products as being done on BRN wagons, Fit to run at 100 Kmph, The commercial production is yet to start.
7.	BCW (Holding = 125)	It is privately owned by M/s. Bulk Cement Corporation India Ltd. and are based at Wadi, Sholapur Division of CR, to run between Wadi and Kalamboli (Mumbai Division). Axle Load = 20.32t. The wagon is fitted with Air Brake.
8.	BTPGL	Bogie liquefied petroleum gas tank wagon, tare 45.7t, CC 35.5 t, Gross 81.28t. The wagon is fitted with automatic vacuum brake, length over head stock 18000 mm, length over Coupler faces 19282 mm.
9.	BTPGLN	Bogie liquefied petroleum gas tank wagon, tare 41.60t, CC 37.6 t, Gross 79.20t. The wagon is fitted with Air brake system, length over head stock 18000 mm, length over coupler faces 19282 mm

4. NEW PATTERN OF TRAIN EXAMINATION OF GOODS STOCK-CC/Premium/End to End

4.1 Intensive Examination for Closed Circuit Rakes (Air Brake Stock)

Formation and replacement of the CC rakes shall be done predominantly by Off POH/ Off ROH wagons .

The rake shall be offered in full formation in 'EMPTY' condition only for examination. About 5-6 hours time, preferably during daylight will be provided for the intensive repairs. (In case of container flat wagon e.g. BLC/ BLL etc. the rake shall be offered for examination after unloading of the containers from the wagons whether empty or loaded).

Marking and detachment of due ROH / POH wagons will be done at base depot only and the wagons so identified and detached will be moved to the nearest / nominated POH Shop / ROH Depot.

The Closed Circuit rakes will be examined at their respective base depot only. After intensive repairs at base depot, the rake should have 100% brake power with adequate brake block thickness to last for the run of kilometer prescribed for the respective rake. Only composite type brake blocks should be used.

Brake Power Certificate:

The brake power certificate shall be prepared in standard prescribed format only (Colour Yellow) in triplicate, one copy each should be issued the Driver and Guard of the train and one copy retained as record copy by the C&W Depot issuing the BPC. No deviation from this procedure is permitted.

In the BPC, the name of the zone over which valid , should only be mentioned & the rakes shall be used for round trip operation on identified circuits only over the zone mentioned in BPC as laid down in Table 'A' except for Dudhsagar (DDS) rakes which will be operated as prescribed therein.

The JE/SE/SSE (C&W) should enter each individual wagon number and brake van in the rake, in the BPC as prescribed in order of marshalling, starting from engine end.

Rake integrity as listed in the BPC shall be maintained. However up to 04 wagon may be replaced by 'good –examined' wagons in the entire run between two primary maintenance Examinations (PME) with due endorsement in the BPC. Exception is made for BLC/BLL rakes, in which detachment / replacement of a unit comprising of 5 wagons will not render the BPC invalid.

A mere change in the marshalling order will not render a BPC invalid. However, efforts shall be made to marshal the wagon in their original order where possible or it shall be ensured that, instructions as per Para (Marshalling order) are complied with to ensure adequacy of brake power.

The Brake Power Certificate shall be issued for a validity of 6000 kms or 30 days whichever is earlier from the date of issue of BPC (inclusive) & the rake shall become due for examination on completion of the kms or on days basis whichever is earlier. It will be the responsibility of the GDR to ensure that, the kms earned by the rake are logged in the BPC after each trip continuously and properly, indicating also the cumulative kms earned in ascending value.

In case, the record of the distance covered by the rake is discontinuous or not mentioned properly, the BPC will be deemed to be valid for 20 days only from the date of issue of BPC & the rake shall be returned to base depot in empty condition for examination and issue of fresh BPC.

The BPC will become invalid if the rake is stabled for more than 24 hours in train examination yard, such rakes shall be offered for examination and issue of fresh BPC.

The Closed Circuit rakes with BPC validity nearing completion and falling due for examination within next two-three days shall not be loaded for far off destination to prevent running of rakes with invalid BPC / getting lost due to issue of end to end BPC by some other examination depot. However, such rakes can be loaded for the unloading destinations falling with in the division, so that, it's monitoring and return to base depot can be ensured.

Post loading / unloading examination by C&W staff is discontinued for all type of stock with a valid BPC except for the rakes/wagons loaded with steel consignment and container wagons. However, post loading / unloading check will be carried out by Guard and Driver as per proforma enclosed as annexure - I & II for all other trains. Non compliance of the instructions for GDR check shall be viewed seriously as it is safely related and staff violating the instructions shall be taken up suitably.

To avoid shifting of consignments on running trains, Post loading check of all trains that are loaded with steel consignments should be carried out by C & W staff. In case the loading point is not a Train Examination point, necessary C&W staff should be deputed for checking and certifying proper lashing / securing of steel consignments.

No intermediate examination of the CC rake by C & W staff is required after loading / unloading except for the unloading of wagons done by tippling operation. After tippling, the rake will be subjected to post-tippling examinations. In case, less than three rakes are being tippled per day, the check may be carried out by Guard and Driver as stated above. In case three or more trains are being tippled, post tippling check will be done by skeleton C&W staff.

Any detachment / attachment of wagons/s at outstation shall be promptly entered and endorsed by SM /GDR in the Brake Power Certificate, indicating clearly the reasons for the detachment /attachment station and date and append their signatures.

The rakes going down the Ghat between CLR – QLM section in UBL division and SKLR-SBHR section in MYS division will however be offered at CLR & SKLR respectively for checking adequacy and up gradation of Brake Power by C&W staff along with other conditions / rules stipulated as per the special instructions for working of trains in these Ghat section. A minimum of 90% Brake power must be ensured. An endorsement should be made in the BPC to this effect.

Operation of "BOXN Closed Circuit Rakes "with invalid BPC Due for Examination: Procedure for Revalidation of BPC

With change in pattern of freight train operations on Indian Railway, there has been a substantial increase in dissipation / loss of CC rakes. Rly Board has reviewed the procedure for maintenance & operation of Closed Circuit BOXN rakes. The relevant instructions applicable for operation of CC rakes belonging to SWR and other affiliated zonal Railways i.e. SR & SCR are given below-

In order to prevent loss/dissipation of CC rakes and at the same time maintain standard of safety, it has been decided to introduce following system for BOXN CC rakes for limited depots only. The basic features of this system are as under:

The system will apply to a group BOXN CC depot serving a particular origin destination flow.

Whenever rake of any depot of this group will become due for its next examination, on certain specify foreign railways, and if the rake is in empty condition, the BPC of such rakes may be revalidated by JE/SE/SSE (C&W) once, after intensive examination at the nearest train examination point for one trip (maximum 7 days from date of such examination or date of expiry of Original BPC, whichever is earlier) for loading to specified destinations and

onward movement as empty to base CC depot. Such rake will not lose their CC character if returned back to their base CC depot, with in the extended validity of BPC.

Once such a rake is unloaded at destination, it will be routed back to the original base depot.

In order to maintain integrity of CC rakes, during intensive examination for revalidation of BPC as mentioned above, as far as possible, wagons due for ROH/IOH and unloadable wagons provided such wagons are safe for movement , shall not be detached at outstation depots and efforts will be made to attend maximum possible repairs in yard itself.

To ensure that the rakes are returned back to the original base depot, these rakes will move as " FLYING RAKES" even in loaded condition so that, identification is made easy. For example, if a TNPM CC rake is over due in SWR and is loaded for HOM, the rake will be named and moved as "FLYING HOM". The "FLYING HOM" rake after release at HOM will be sent back to TNPM in empty condition.

In order to enhance availability and prevent dissipation of closed circuit rakes of BOXN following circuit applicable to SWR, SR & SCR has been identified

Circuit	CC base
Circuit-3	HPT, GY ,RDM, BZA, TNPM, JTJ

Detailed instructions for operation and maintenance of closed circuit rakes in the identified circuit (for SWR, SR & SCR rakes)

Base Depot/Railway	Location of Overdue rake	Location for which loading is permitted after revalidation
HPT/SWR	SR	One trip to Bellary Power House and JSW siding in SWR or Muddanur TPS/Raichur TPS/destination in Bellary-Renugunta section of SCR
	SCR	One trip of Bellary Power House and JSW siding in SWR
TNPM, JTJ/SR	SWR,SCR	One trip to all destinations on SR only via destinations in GTL division
GY/SCR	SR	One trip to Muddanur TPS/Raichur TPS/destinations in Bellary-Renugunta section of SCR
RDM/SCR	SR	All destinations on secunderabad (SC) & Vijayawada (BZA) Divisions only
	SWR	All destinations on Secunderabad (SC) and Vijayawada (BZA) Divisions via destinations in GTL division only.

Special conditions for maintenance and operational discipline for the above circuits:

CC rakes formed from off ROH/POH wagons based for maintenance on CC pattern at nominated base shall be operated over the ZRs defined in the circuit only mentioned on the BPC Provision of following facilities is a must at the nominated point.

Proper computerized record keeping and documentation at CC base depot shall be ensured to monitor health/condition of CC rakes operating under this scheme including reliability, utilization, loss of rakes and integrity etc.

Outstation depots, after intensive examination and revalidation of BPC for one trip (Maximum 7 days from date of such examination or date of expiry of original BPC, whichever is earlier) for specified destinations (as applicable) will make sure to transmit details of repairs attended, deferred repairs, attachment, detachment, unloadable, incoming brake power etc. to the CC base depot through email for condition monitoring and corrective actions as may be necessary at the base depot to ensure safety and reliability of train operation. Necessary facilities for email and training to staff/supervisors, wherever necessary, should be provided in DRM‘s power at the earliest.

FOIS terminal to be provided with C&W control, Sr.DME/C&W, CRSE (frt) and Head Quarters C&W control and at CC base depot & outstation depot of the railways served by above circuits.

Rakes operating on ZRs not mentioned on the BPC will lose their CC character and will be treated as per instructions prevailing for normal end to end rakes.

All rakes will be returned back to their nominated base CC depot as per validity of BPC.

The BPC of such CC rakes shall be valid for 7500 kms/35 days or 6000 kms/30 days (whichever is earlier) according to the depot nominated for issue of such BPC validity the BPC shall be valid on the ZRs defined in the circuit. Incase kms are not logged on BPC, the validity of BPC should be treated as per the Railway Boards instruction for Premium end to end rakes.

Infrastructure facilities at the nominated CC points shall be made available at par with ‘A’ category Depots. DRM should ensure that proper lighting arrangement, material handling equipments, welding facilities etc. are made available in these yards, if required by hiring so that quality of examination /repairs and safety is not compromised.

In empty condition –In case BPC of the CC rake becomes invalid or nears invalidity at outstation in the specified circuit, it can be intensively examined by JE/SE/SSE(C&W) at the nearest point and BPC may be revalidated once at the outstation depot (within the circuit) for one trip (maximum 7 days from date of such examination or date of expiry of original BPC , whichever is earlier) as mentioned in table above, so that it can move to its nominated CC base for examination and issue of fresh BPC on CC base. Thereafter, the rake should be returned back to its nominated CC base depot for examination and issue of fresh BPC on CC pattern, otherwise it will lose CC character and treated as normal rake.

In loaded condition – In case BPC becomes invalid at outstation in the circuit, it will be examined at the next available train examination point in the direction of movement and BPC shall be revalidated for movement in the specified circuit up to its nominated depot via unloading point. Examination in the loaded condition should be in exceptional circumstances.

In case of examination and revalidation of a rake at other than its nominated mother CC base, it is essential that in case of sick marking, the examination point have to try for in repair and as far as possible also replenish the sick wagon.

After revalidation of BPC as per above, loading /unloading in such rakes will be confined to the destinations mentioned in table above. Else, the rake shall lose its CC character and will be logged in FOIS.

The rake should be given a unique nomenclature. These nomenclature rakes should be entered in FOIS and monitored, including breaking/loss of CC rakes.

Terminal equipments and connectivity for FOIS terminals, as specified above should be provided under extant powers of GM/DRM.

Besides special conditions mentioned herein above with respect to maintenance and operation of these special CC rakes, all other general instructions regarding maintenance of air braked freight stock and 7500/6000 km CC rakes, issued by Board from time to time shall be observed.

MONITORING OF CC RAKES:

In order to have effective check/control, close monitoring of these CC rakes at Division and Zonal Head Quarter level is essential for which following guide lines are issued for strict compliance by all concerned

The Chief Traffic Controller and C&W controller of the division should keep close watch on day-to-day basis on movement of the rakes

CC rakes with invalid BPC shall normally not be permitted to run in service. However, deviations within the purview of Board's instructions can be permitted in exceptional cases.

The kms earned by the rake as logged in the BPC should be relayed to the Chief Traffic Controller of the Division by the Traffic/Commercial staff at each loading/unloading station. The kms earned by the rakes shall also be nominated through FOIS and crosschecked.

It shall be the responsibility of the Chief Traffic Controller of the Division to ensure that, the rakes are returned to the base depot for Primary Maintenance in empty condition before the expiry of BPC either on kms or days basis whichever is earlier.

The movement of rakes shall be monitored closely at Zonal HQ level, in liaison with division control and through FOIS by CHC,C&W control , TI/HQ and ATM (Freight).

As far as possible the rake shall be moved in defined circuit only as mentioned in Table 'Á'. Any deviation in the pattern of movement shall be brought to the notice of Sr.DOM&Sr.DME (C&W) and necessary message should be given to the concerned for close follow up and return of the rake. However, CFTM & CRSE may permit change in route/circuit in case of exigencies.

The rakes shall bear clear-stenciled mark of respective nomenclature with Base depot and divisions. The rakes shall be blocked by their respective nomenclature as 'RR-1, CONSTAR-2 etc, either by suffixing or prefixing to the train no. during their movement for easy identification.

The station/Yard staff, both commercial and operating at the loading/unloading points shall always check the nomenclature of the rakes stenciled on wagons on arrival at their station, So that, the same is ensured at the time of dispatch of Empty/Loaded rakes and the control is informed accordingly.

Any failure in this respect shall be viewed seriously and the concerned staff shall be taken up fixing the responsibility.

Frequent surprise checks should be conducted by the inspector of traffic and mechanical department to ensure that staff concerned is scrupulously following the instructions laid down.

No CC rakes shall be dissipated, disintegrated or dissolved without the specific approval of CFTM and CRSE.

Only BOXN rakes with invalid BPC of the nominated depots either on Kms basis or on days basis shall be dealt with as indicated above, for all other type of CC rakes when detected with invalid BPC following procedure should be followed.

For other Railway CC rakes running on SWR, as and when the BPC becomes invalid either on Km basis or days and the rake is in Empty condition, it shall be pushed to the nearest nominated Train Examination point for safe to run (STR) examination and endorsement on BPC by JE/SE (C&W) that the train is safe to run up to the base depot. One trip loading/unloading may be permitted if required for destinations Enroute to the base depot.

Any other CC excluding the BOXN CC rakes of nominated depots as stated above, either of SWR or of any other railway running with invalid BPC, when detected in loaded condition, shall be subjected to GDR check and pushed to destination. After unloading, the empty rake shall be offered to the nearest nominated Train Examination point for STR examination and endorsement on BPC by JE/SE (C&W) that the train is safe to run upto the base depot.

Such rakes with invalid BPC that are potentially unsafe, shall be moved on GDR check from the point of detection to the nearest nominated Train Examination point.

Premium End to End Examination

Premium end to end rakes will be formed out of nominated air brake stock only (all type of BOXN, BCN & BTPN).

Premium End to End rakes will be intensively examined in 'EMPTY' condition and certified by examination points nominated as per Table 'B'. Any alteration /addition in the nomination of depot/type of stock will be advised as and when required.

If any of the condition, i.e. examination in empty condition or examination at nominated points is not satisfied; rake will not be certified as premium end to end rake and will operate as normal end to end rake.

Brake Power Certificate issued for such premium end to end rakes will be valid for 12 days from the date of issue. During this 12 days period, the rakes will be allowed multiple loading/unloading.

After each loading and unloading, the rake will be examined by Guard and Driver before commencement of journey and observations will be recorded under the relevant columns of the Brake Power Certificate. In case of mechanized loading/unloading examination by TXR will be desirable.

Stipulation to form rakes out of off POH/ROH wagons as is applicable for CC rakes will not apply in case of Premium end to end rakes. However, the rakes shall be turned out with minimum of 95% brake power by examining depot.

After lapse of 12 days, the rake should be offered for next intensive examination at the first examination point in the direction of movement. To avoid examination in loaded condition, a grace period of 3 days will be permitted. However, after expiry of the grace period, i.e. after lapse of 15 days after issue of BPC, even a loaded premium rake shall be offered for examination at the first Train Examination point in the direction of movement. Further, in no case, Premium end to end rake shall be offered or loading through bypass routes or through yards which are not nominated for examination. After examination, the rake will be certified as premium rake subject to fulfillment of above mentioned conditions otherwise as conventional end to end rake.

Movement of Premium end to end rakes will be monitored through FOIS by Traffic and Mechanical departments.

The BPC for Premium rakes shall be issued in prescribed format only, printed on good quality green colour paper.

The conditions governing validity of BPC and the check list for GDR check have been made part of the BPC (copy enclosed) and shall be applicable in general and followed by all concerned.

4.2 INTENSIVE (END-TO-END) EXAMINATION FOR VACCUM BRAKE AND AIR BRAKE RAKES (NON-CC)

Intensive (End-To-End) examination has been introduced for Vacuum and Air brake stock.

Following instructions shall be applicable in common for both type of stock-

Normally, 'EMPTY' rakes shall be offered in full formation for intensive examination and repairs and issue of Brake Power Certificate except when back loading of the rake has to be done at stations/sidings. Thereafter the empties shall be moved to the loading stations as per requirement of traffic.

The BPC shall be prepared in prescribed format printed on a good quality green paper for air brake stock and pink paper for vacuum brake stock, in triplicate, one copy to be issued to Driver, one to Guard and third copy to be retained as record copy by issuing depot. The JE/SE/SSE (C&W) should enter individual wagon numbers in the BPC starting from the engine end, for ensuring the sanctity of rake.

The time taken for examination and issue of BPC will be 3 to 4 hours.

Due POH/ROH wagons identified during the examination shall be detached and moved to the nominated POH shop / ROH Depot as per the joint instructions in force.

END-TO-END Running of Vacuum brake (UIC) stock:

UIC stock will be permitted to run on End-to-End basis with following conditions-

The rake should be intensively examined in 'Empty' condition except when back loading of the rake has to be done at stations/sidings. After such intensive examination, the rake should be moved in empty condition to the loading station as per requirement of traffic.

The BPC of the empty rake may not have the destination mentioned. At Train Examination point, the JE/SE/SSE (C&W) should write "Up to loading point & further to Unloading point" on the BPC. After loading the empty rake, the operating staff (Commercial staff if operating staff is not posted at that station/siding) will ensure that, the destination of the loaded train is clearly mentioned on the BPC and the same BPC will then become valid up to such destination.

No driver should move the loaded train from the loading point unless the destination is clearly mentioned on the BPC. BPC of the loaded train without destination will be considered 'INVALID' and such train should be moved on GDR check & offered for examination at the first C&W point for examination and issue of BPC in the direction of movement.

The empty rake must reach the loading point within 4 days of the issue of BPC including the day of issue, for the loaded rake to move on the same BPC. Otherwise, the rake (Empty or loaded) will have to be offered for examination for issue of fresh BPC at the 'first nominated' freight train examination point in the direction movement.

At the destination after unloading, the rake must be examined once again in the empty condition and the above cycle repeats. In absence of freight train examination facilities at the loading point, the empty rake/back loaded rake must be examined at the first freight train examination point in the direction movement. The movement of empty rake/back loaded rake from the unloading point will be permitted after GDR checks as prescribed vide annexure 'I'.

It is important to note that, this check has been introduced to take care of an eventually that rake, which is to be offered for examination after completion of the loading and unloading cycle is required to travel for another 400 kms max. only before hitting the first Train Examination point in the direction of the movement. Examination due should not be avoided by taking the trains through bypass routes or through yards which are not nominated for examination.

It may be noted that, if a train unloaded at one point is required to be taken to another point for loading, then the train should not be taken to that loading point over shooting a Train

Examination point, if such point falls enroute. The train must be got examined & BPC issued at that Train Examination point before taken to the loading point.

END-TO-END RUNNING OF AIR BRAKE STOCK:

All the conditions mentioned for End-to-End Running of vacuum stock shall apply for End-to-End Running of Air brake stock also except the 4 days limit for reaching the loading point will only not apply to air brake stock.

BACK LOADING OF TRAINS:

When back loading is done at a station where freight train examination facilities exist, the loaded rake should be examined at that station only and BPC issued.

In cases, where back loading is done at a non Train Examination, such trains will be:

Checked by the Guard and Driver as per the laid down procedure as Annexure I & II & allowed to run on Driver and Guard's memo only up to the first nominated freight examination point in direction of movement.

5. Container wagons-BLC Train operation and maintenance practice

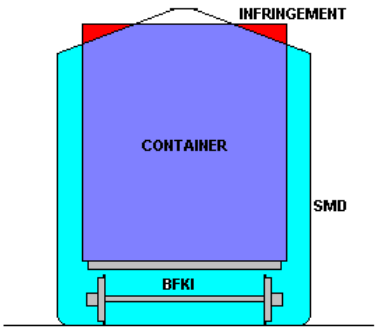
Introduction:

Bogie Low platform flat wagons for carrying ISO containers.

Different sizes of containers:

Description	Length	Breadth	Height
ISO Containers inland	20 feet	2438 mm	2593 mm (8'-6")
ISO containers international	20 feet	2438 mm	2896 mm(9'-6")
ISO containers for international	40 feet	2438 mm	2896 mm(9'-6")

BFKI wagons were used for movement of containers. When ISO containers, with more height than the inland containers is loaded on the BFKI wagons, the overall dimensions exceeds the Standard moving dimensions of X – class engine by 254 mm at the top side. And the load is to be moved as ODC with speed restrictions. This in turn affects the speedy movement of containers.



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 in turn reduce the number of wagons on a loop line from 42 for the existing BFKI wagons to 38 resulting in loss of earning capacity.

To overcome 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.

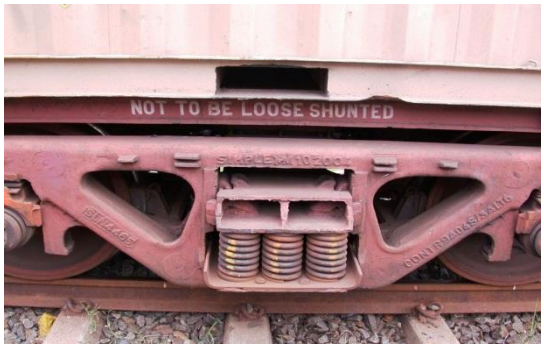
These wagons are manufactured in multiple units with low floor height at the centre to accommodate the ISO containers and raised at ends to facilitate coupling of these unit with the Loco and brake van. The wagon which is having raised at one end is called A-Car and the wagon which is not having raised end is called B-Car. Each multiple unit of five wagons consists of two A-Cars at the ends and three B-Cars in the middle.

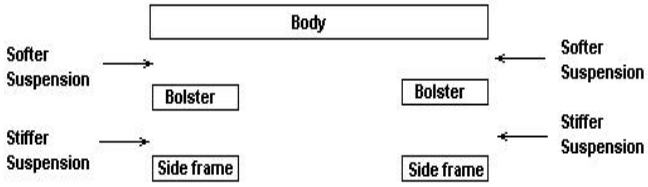
5.1 The special features of BLC wagons

These wagons are designed to carry ISO containers with a height of 2896 mm as Non-ODC load.The floor height of these wagons from the rail level is decreased to 1009 mm from the standard of 1269 mm.These wagons are provided with with new hybrid design CASNUB LCCF20 (C) bogie frame and bolster in order to bring down the plat form height.The maximum wheel diameter is 840 mm and condemning is 780 mm.

These wagons are provided with two stage vertical suspension for providing softer suspension under tare and stiffer suspension under load condition.

The two stage vertical suspension is necessary to provide higher static deflection in empty condition, so that the spring off-loading in the empty condition lies within limits. Vertical suspension in loaded condition is stiffer on account of the constraint in the space between the bolster and the bogie frame.





The softer suspension is provided between the body and bolster and the stiffer suspension is provided between the bolster and bogie frame.

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.

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

Description	22 NLB	LCCF 20 (C)
Centre pivot height from Rail level	932 mm	715 mm
Max height of side frame from Rail level	851 mm	786 mm

Bottom of side frame	165 mm	149 mm
Height of side bearer top	921 mm	772 mm
Wheel diameter	1000/906 mm	840/780 mm
Side frame design	Cast steel design for narrow jaw adapter	Cast steel design for wide jaw adapter
Bolster design	Separate center pivot	Integral center pivot
Side bearer	CC pad	Coil spring
Load bearing coil spring	12 outer, 8 inner spring	14 outer, 12 inner spring
Snubber springs	4 Nos, IS: 3195 Gr.60 Si 7	4 Nos, IS 3195 Gr.50 CrMoV4
Brake shoe	Conventional	Non metallic
Adapter	Narrow jaw	Wide jaw
Elastomeric pad	Similar	Similar
Side frame key	Similar	Similar
Spring plank	Similar	Similar

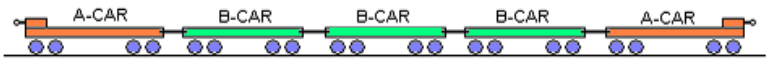
Centre pivot riveted

to Bolster

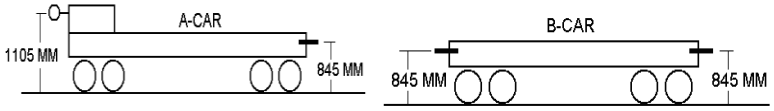
Centre pivot Integral

Flat type

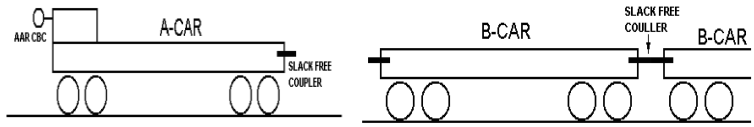
These wagons are formed in multiple units. Each multiple units consist of two A–CARS and three B-CARS.



The buffer height of Outer end of A-CAR is 1105mm and at the inner end is 845mm. Both the ends of B-CARS are having a buffer height of 845mm.

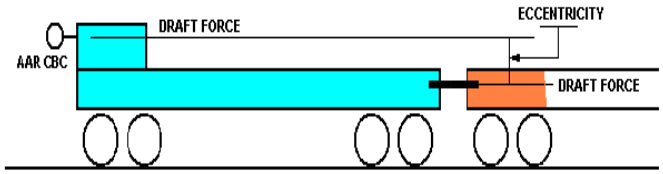


The outer end of A-CAR is provided with AAR CBC coupler and at the inner end is provided with Slack-less Couplers.Both the ends of B-Cars are provided with Slack less coupler.



We know that the buffer height of A-Car at raised end is 1105 mm and for the B-Car is 845 mm. Due to the difference in buffer heights between the raised end of A-Car and the B-Car, the draft force transmission not lies on the same line. Because of the eccentricity in the draft force line between these wagons, there is a possibility for off loading of wheel whenever the tractive force/buffing force is applied suddenly.

This sudden load is mainly caused by the excessive slack available in the standard AAR couplers. The shock loads acting on couplers can be prevented by reducing the slack between the two couplers.



To overcome the above shortcoming, the Slack less/free couplers are introduced for the BLC wagons at one end of A-Car and at both ends of B-Cars.

Description	AAR CBC	Slack free coupler
Draft Gear travel of first wagon	3 ¼ Inches	¾ Inches
Draft Gear travel of adjacent wagon	3 ¼ Inches	¾ Inches
Slack between the two knuckles	1 Inch	No Knuckles. Straight draw bar is provided
Total Slack	7 ½ Inches	1 ½ Inches

Different parts of Slack free couplers are Key stone Mini draft gear, Straight draw bar, Standard AAR yoke, Striker casting.

These wagons are provided with two-stage load sensing device, which admits a maximum pressure of 2.2 kg/cm^2 when the gross load is less than 40 tons, and 3.8 kg/cm^2 when the gross load exceeds 40 tons automatically.

These wagons are provided with automatic twist 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.

5.2 Comparison between the BLC and BFKI type wagons.

Sl. No	Features	BLC	BFKI
01	Wagon unit	Consists of 5 Wagons. (2 Nos of A-Car and 3 Nos of B-Cars.)	Single Wagon.
02	Platform height	1009 mm	1269 mm
03	Length of wagon over head stock	A-Car - 13625 mm B-Car - 12212 mm	13716 mm
04	Tare weight	A-Car - 19.25 tons B-Car - 18.50 tons	20.5 tons
05	Pay load	61 tons	48 tons

06	Wheel diameter	Max - 840 mm Cond - 780 mm	Max - 1000 mm Cond- 906 mm
07	Permissible speed	100 Kmph	75 Kmph
08	Coupler	CBC and Slack less draw bar	CBC
09	Empty load device	Two stage automatic Pneumatically operated	Manually operated.
10	Suspension	Two stage suspension	Single suspension
11	Lock for locking containers	Automatic Twist Lock	Manual Retractable Anchorage Locks
12	No. of wagons per Rake	45 Wagons	42 Wagons

Attentions to be paid for these wagons during the Examination

All under gear items including brake gear, draw & buffing gear and running gear should be examined and kept in sound condition.

Wheels must be tapped to detect Loose/Cracked wheel and profile checked visually and in the case of doubt to be checked with Tyre defect gauge for the rejectable defects.

Maintain Control A dimension to 72 +0 / – 2 mm. Ensure 100% brake power.

The general conditions of underframe should be examined and repairs attended, Check all the automatic locks mounted on underframe for its proper working condition and inspect for any welding failure of mounting brackets. Side bearer assembly should be examined and repairs attended. Check all the safety fittings, safety brackets etc, and defects if any should be attended.Check the hand brake for its proper functioning.

Maintain a clearance of 21 mm within a tolerance of $\pm$1 mm between load sensing device and the stopper.

5.3 SAB (SVENSKA AKTIE BOLAGOT BROMS Regulator)

This is a mechanical device provided in the brake rigging, and forms part of the pull rod, for automatic adjustment of the clearance between the brake blocks and wheels in the brake rigging. This automatically operates to shorten or lengthen the length of the pull rod, to adjust the excess or less slack in the brake rigging or brake block clearance.This helps to maintain the clearance between the brake block and the wheels to a pre-determined constant value always, thereby maintaining the piston stroke of the brake cylinder constant. This, in turn, always maintains constant brake power for the wagon or coach on the run.

Types of SAB

DRV 450

DRV 600

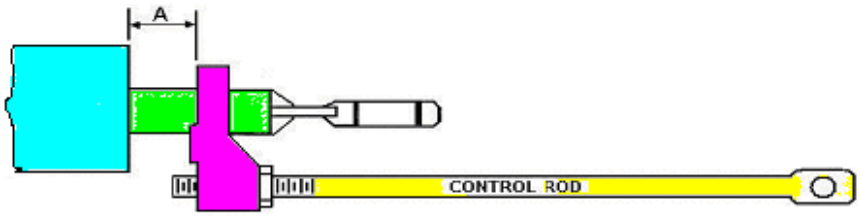
Code	Expansion	Remarks
D	Double acting	It increases or decreases the length of the pull rod automatically to maintain a constant piston stroke/clearance.
R	Rapid	It is fast in adjusting the piston stroke/clearance. It takes a maximum of only two brake applications and release for adjusting the piston stroke/clearance.
V	Verificative	It always verifies the piston stroke/clearance with control A dimension for the purpose of automatic adjustment of piston stroke/clearance.
450/600		This is the capacity of SAB up to which the length of the SAB pull rod can be increased or decreased. It is 450 mm for Coaching stock and 600 mm for Goods stock.

Main parts of the SAB

1. Adjuster Spindle
2. Leader Nut
3. Adjuster Nut
4. Traction sleeve
5. Barrel
6. Adjuster Tube
7. Barrel Spring
8. Clutch spring
9. Take up Spring
10. Pay out Spring
11. Adjuster Ear
12. Control Rod Head
13. Control rod

Control “A” Dimension

This is the distance between the slack adjuster barrel and the control rod head, measured when the brake is in fully released condition.



This is called as ‘Control Dimension’, because this is the pre-determined dimension, according to which the slack adjuster pays-out /takes-up the slack in the brake rigging.

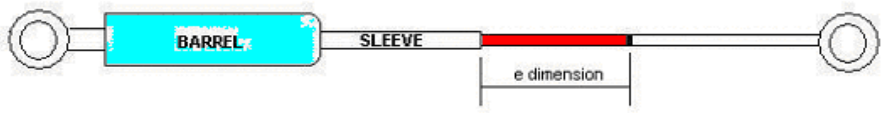
The control rod ‘A’ dimension for Different Rolling stock is given below.

‘e’

a) Coaching stock	16+ 2/ -0mm for 13 T Bogie stock 22+ 2/ -0 mm for 16.25 T bogie stock 22+ 4/-0 mm for Air Brake Stock (HS)
b) Goods Stock	50 mm for VB Stock 70 mm for Air brake stock 27 mm for BOBRN

Dimension

This is the distance between the end of the protective sleeve of the screw and the grooved mark on the screw rod when the brake is fully released



This indicates the total capacity of the slack adjuster available for the adjustment of the brake rigging clearance. This dimension will be 375±25 mm for coaching stock and 555±20 mm for goods stock. It will decrease as wear takes place on brake blocks, wheels, brake gear pins and bushes due to brake applications. And it will be the maximum when all Brake blocks, brake gear pins and bushes are new and all the wheels are at maximum diameter.

As the ‘e’ dimension decreases and reaches to the minimum due to the wear on the wheel tread, which cannot be made up (worn out brake blocks, brake gear pins and bushes can be replaced with new ones), manual adjustment shall be done according to the worn out wheel diameter, on the adjusting link of the bogie. This will ensure that sufficient capacity of ‘e’ dimension will be again made available for subsequent adjustments.

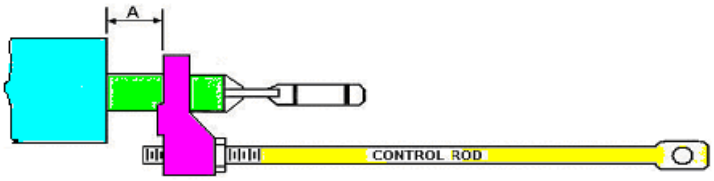
Functioning of the SAB:

The SAB is working based on the principle of LIMITING FRICTION.Due to this Limiting friction, the nuts that are provided inside the SAB get rotated automatically, whenever the excessive forces offered due to the incorrect slack acting on them. The rotation of these nuts on the screw rod causes the screw rod to move inward or outward for increasing or decreasing the length of pull rod till the correct adjustment of piston stroke and clearance is obtained.

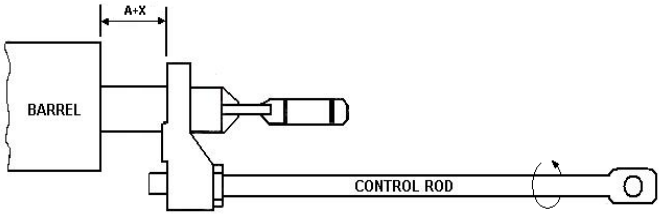
Adjustment of control ‘A’ dimension

Assemble the slack adjuster (SAB brake regulator) on the bogie brake rigging. Ensure that the hand brake and brake cylinders and the rigging are in fully released condition and in

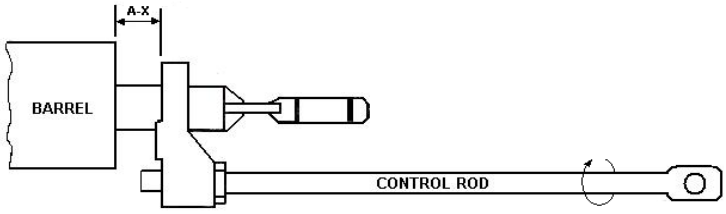
proper working order.Apply and release the brakes few times and again ensure that the brake rigging is in fully released condition. Check the ‘A’ dimension, if found correct, secure the pins correctly.



If found more, disconnect the control rod from its bracket and lengthen it by rotating anti-clockwise.



If found less, shorten its length by rotating it clock-wise.



One full rotation of the control rod will alter the ‘A’ dimension by 2 mm. Fix the control rod in its bracket and apply and release the brakes few times, check ‘A’ dimension, adjust it if required and test.Secure the pin when correct.

‘A’ Dimension to be correctly set to maintain the correct piston stroke and in turn the correct brake power.Rotating the SAB or slack adjuster barrel will not alter the ‘A’ dimension. Once set correctly shall not alter it during service.

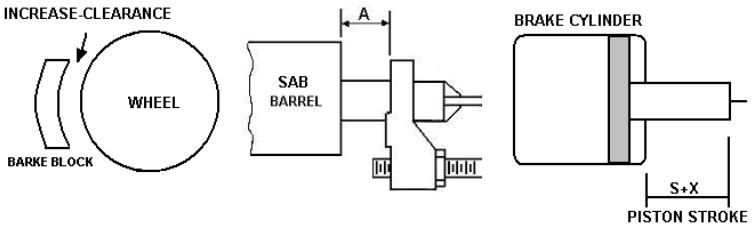
Take –Up and Pay-Out Test of SAB

For testing the slack adjuster, it need not be removed from the bogie brake rigging. It can be tested as it is on the bogie, during pit-line examination as follows.

Make few brake applications and release and note the piston stroke.

Take-up test:

Rotate the barrel anticlockwise 2 or 3 times, to increase the brake block clearances.Apply the brake and release.

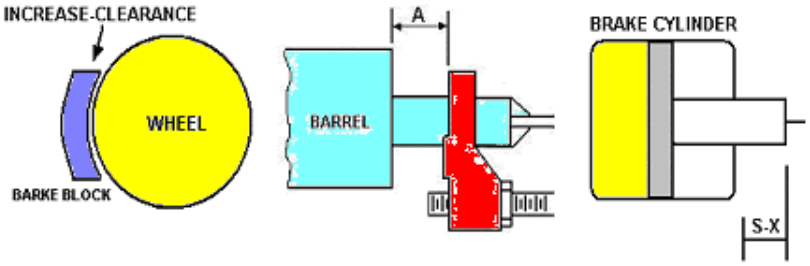


Note the higher piston stroke, at first application.

Apply and release the brakes. The stroke will be normal (equal to the original piston stroke) after 3 or 4 applications.**This shows take up is satisfactory,** If not slack adjuster is defective

Pay-out test:

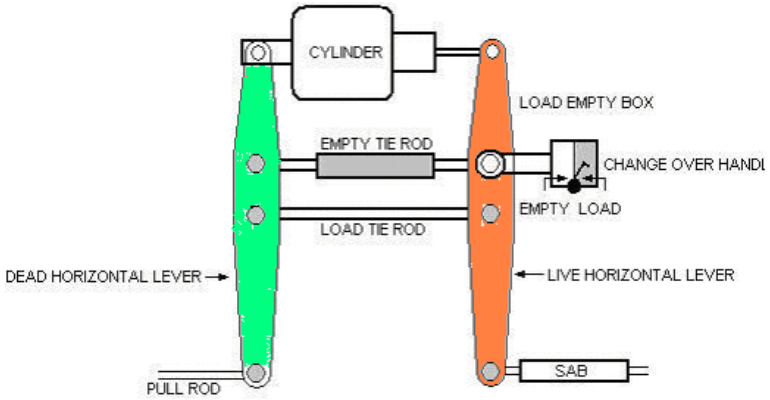
Rotate the barrel 2 or 3 times clockwise to decrease the brake block clearance.Apply the brake and release.



Note the short piston stroke at the first application. The stroke will be normal (equal to the original piston stroke) after 3 or 4 applications. **This shows Pay-out is satisfactory.**If not the slack adjuster (SAB) is defective.

5.4 Empty-Load Device

It is a mechanical device, which enables to provide two different leverage ratios to the brake rigging of the wagon for the empty and the loaded conditions



SCHEMATIC DIAGRAM OF LOAD EMPTY DEVICE

The braking force required to stop a train within the permissible stopping distance depends on the load of the train.As the load increases, more brake power is required, and as the load decreases, less brake power is required to stop the train.So the brake power should be increased or decreased according to the requirement by changing the brake leverage ratio. To enable this, the 'EMPTY-LOAD BOX' device is provided on wagons, in between the brake cylinder and the brake blocks in the brake rigging.

The position of the change over lever of the E/L Box is to be set to ensure correct brake power according to the gross weight, as given below.

Less than 42.5 tonnes – in **empty** position

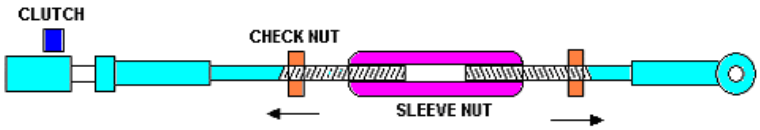
42.5 tonnes&above - in **loaded** position Brake

The LOAD-EMPTY device consists of two horizontal levers (one live and the other dead) and are connected by means of empty and load tie rods. When the handle is kept in empty

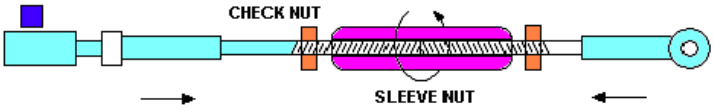
position, the empty tie rod is connected with the system and in turn provides low leverage ratio, thereby gives lesser brake force.When the handle is kept in load position, the load tie rod is connected with the system and in turn provides higher leverage ratio, there by gives higher brake force as required.

Resetting of Empty/Load box:

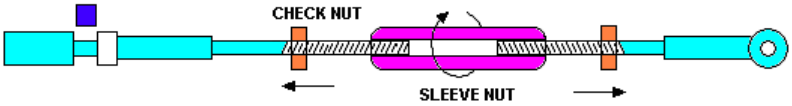
Release brake rigging completely, including the release of hand brake fully.Ensure horizontal levers can move freely.Keep change over lever in ‘load’ position.Shift lock nuts and washers of sleeve nut as far as possible.



Rotate sleeve nut and tighten empty tie rod fully.



Then rotate sleeve nut slowly in reverse direction to lengthen empty tie-rod. Stop rotating as soon as the end of the “live horizontal lever” starts moving.



Carry out test.

Tighten lock – nuts and bend lock washers.

Testing the Load-Empty device for its effective functioning

Keep the change over lever in ‘empty’ position, a clear click sound should be heard.Apply the brake and tap the empty tie rod pins, it should be tight.Tap the load tie rod pins, they should be loose. If tight, the adjustment is wrong, and indicates the sleeve nut might have been tampered with.

Release the brake and keep the change over lever in load position and apply brake. Tap the load tie rod pins, they should be tight. Tap the empty tie rod pins, they should be loose. If not adjust the empty tie rod as given above.

6. WILD, Hot Box detector, track side bogie monitoring system

6.1 WHEEL IMPACT LOAD DETECTOR (WILD)

Introduction

Defective rolling stock produce high impact loads. These loads over a prolonged period of time leads to Rail/Wagon failure, wheel bearing failure etc. WILD measures the impact load independent of the cause. WILD system assists the railway engineer to attend to the defective rolling stock immediately. Reduces Service Failures and unplanned Maintenance Cost of Rolling Stocks & Tracks. WILD is used to catch the defects in the early stage and thereby protecting Rail Infrastructure & avoids Catastrophic Failures.

Defects that can cause High Impact Load:

Uneven loading, Coil spring weak, Shelled Tread, Friction liner broken, Snubber spring broken, Axle box canting, PU/CC/EM Pad Shifted/Pressed/Perished, CC Pad housing broken, S/Bearer roof/Friction Liner welding open, Bolster tilted one side, Defect in suspension, Broken spring, Skidded wheel etc.

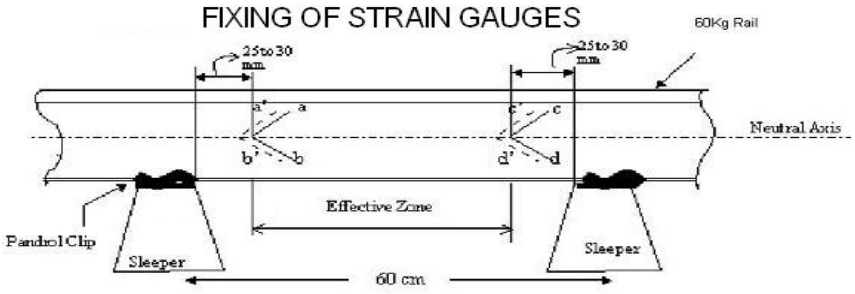
Components of WILD

Instrumented Tracks, Signal conditioning unit, Train trigger sensor

Real time embedded controller, Impact load analyzer software, Wireless data transfer, Power back up, Calibration set up

Instrumented Track

Tracks are instrumented with strain gauges to measure the load pattern of the wheel on the rail. The track consists of 18 Strain gauge measuring channels. Each channel has a full bridge consisting of 4 Rosette type strain gauges.



Signal Conditioning & Data Acquisition Unit:

Signals from strain gauges are connected to Signal conditioning unit. There is in built Surge Protection to meet harsh field conditions. Real time embedded controller analyzes the condition of signal and prepares the summary report for publishing in the website

System Capabilities

Counts number of axles from various measurement channels.

Measures Average Dynamic Wheel Load for all wheels.

Determines Maximum Dynamic Wheel Load (WA) for all points of contact.

Calculates speed of each axle and the average speed of train.

Identifies and counts defective wheels as per specified thresholds and rates them according to the severity of defect.

Points out exact position of defective wheel from loco for easy examination.

Has solar panel providing a power backup.

Identifies and count number of Engines, Coaches /Wagons and Brake Vans.

Relates each axle with engine or coach / wagon or brake van. Also it's position in the identified rolling stock.

Operates 24x7 without any human assistance.

Transmits run reports to a central server that can be accessed by simple web browser.

Can operate from a low speed of 30Km/hr.

Automation Features:

Automatic Diagnosis of faulty channels and switching them off to avoid erroneous data at every start.

Automatic start of Data Acquisition (DAQ) on the arrival of train in response to the start trigger switch.

Automatic stop of DAQ after the passage of train by intelligently identifying the event.

Uploads analyzed data to remote server .

Software Flow

Starts acquisition once train trigger is received.

Logs all the data in to file for analysis.

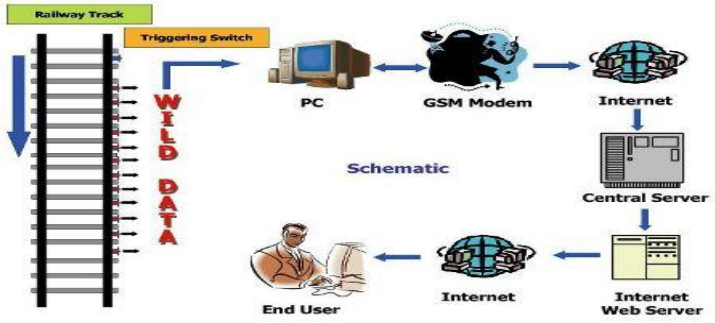
Stops acquisition and logging after the train crosses the instrumented track.

Calls an analysis program that loads each channel data and furnishes processed data.

Summary report is produced and is transmitted to remote server.

Server stores the report and publish in the website.

WILD SYSTEM



WILD Site Selection Details

These criteria are drafted out based on the site conditions given in COFMOW's WILD Specification no: COFMOW/IR/WILD/2006 and its recommendation. The system will be installed on straight and level track of minimum 250m length including approaches to the site. There should not be any permanent speed restriction at site of WILD system.

The rail section shall be 60Kg/m with flat foot laid on Pre-Stressed Concrete (PSC) sleepers at 60 cm spacing with elastic fastenings viz. pandrol clips on rubber grooved sole and clean

ballast cushion of 250/300 mm. The site will not be very close to any station or at the approach of a signal to avoid acceleration or braking over the instrumented rails.

The Railways (DRM/Mechanical) shall ensure advance arrangement like sanction etc. to meet out recurring expenditure after one year of installation. The Railways shall ensure provision of reliable 230 V + 10% single phase electric power supply anywhere in 3 Km along track from the site of installation of the system before system installation is taken up by the firm.

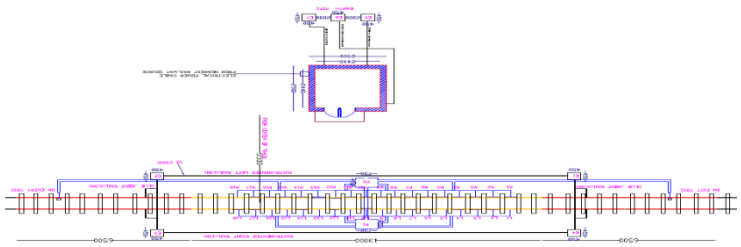
Site should have proper road approach for taking 13m instrumented rail near site through trailer.

Site should have good GSM network connectivity for sending the reports (Preferably TATA INDICOMM.)

Proper locality to safe guard the system from Theft / untoward activities. At least one side of the ground area is close to the level of Track and soil is strong and good for earthing.

Preferred power connecting from OHE through Auxiliary transformer or near by power resource from Railway infrastructure. Power taken from agriculture field will lead to lot of fluctuation and improper working.

LAY OUT OF WILD



Hot Box:

Every journal which runs warm necessitating a vehicle, wagon or brake van being detached from a train from the commencement of its journey to its booked destination inclusive should be considered a hot box.

Electrical equipments.

Dynamo/Alternator:

It is an electrical generator fitted on the under frame/bogie of the coach and driven by a flat belt/ 'V' belts from the pulley fitted on the axle of the bogie.

Emergency Coupler:

It is a detachable coupler consisting of two 7/2.52 (35 sq.mm) size aluminium cables for providing emergency feed through emergency feed terminal board between two adjacent coaches.

Switch Gear:

It is the device for control of lights and f as and when required.

DC generator/Alternator:

It is a regulator used for supplying power to air-conditioning equipments, lights and f and for charging the battery. It takes drive from axle when the coach is running. Motor coupled to generator/pre-cooling rectifier provided on coach works on out side supply for working of AC equipment, lights, f and battery charging when coach is stabled for long period.

Condenser motor:

It is a motor used for driving the cooling fan of the condenser where the refrigerant is liquefied.

Delta panel:

It is used for starting and running a 3-phase motor and automatically changes the connection of the motor windings from star to Delta.

Thermostat:

It is a temperature sensitive device used to control the apparatus for maintaining temperature within pre-determined limits.

Expansion Valve:

It is used for automatically controlling the flow of refrigerant into the coils of tubing of the evaporator unit, in accordance with the refrigeration duty requirements of the air-conditioner or evaporator.

Silent Block:

It is a synthetic rubber bonded bush fitted in certain components of the ICF/BEML (HAL/MAN) bogies to facilitate alignment and reduce noise.

Slack Adjuster/Brake regulator:

It is a mechanical device, which automatically maintains a predetermined distance between the brake blocks and wheel tread and restricts piston travel.

Chapter II deals with the Workshop Repair practices.

Chapter III deals with maintenance practices in open line.

Chapter IV deals with Rejection

From workshops, coaching stock must not be allowed with any rejectable, chargeable or other defects. The stock must be turned out after complete repairs, in accordance with prescribed methods and the rules laid down in Chapter-II.

The permissible wear and clearances on different components shall confirm to the limits and tolerances specified for workshops by the Chief Mechanical Engineers/Chief Electrical Engineers

Maintenance depots shall follow the prescribed procedure and relevant rules in Chapter-II and III and also ensure that coaching stock is not allowed with any rejectable defects.

7. Repair & maintenance of goods stock - ROH

ROH PROCEDURE: -

I. DISMANTLING

Collect and note down PRO particulars of BOX N/BCN wagon to be attended for ROH

1. Take initial readings such as Coupler height from Rail level and note down other defects.
2. Disconnect bogie brake rigging to under frame and under frame brake gears.
3. Lift the body, run out the bogies and keep the body on trestles.
4. Strip the bogie components and insert assembly pins (12mm and 250 mm long) to retain friction shoes (Snubber wedges)
5. Raise the bolster to connect top members of side frame and remove all the outer, inner and snubber springs.
6. Remove the assembly pins and lower wedge blocks to take them out.
7. Lower the bolster to rest on the spring flank.
8. Examine bogie spring plank for cracks and check side frame alignment by trammeling Gauge as follows: -
   Wheel base – 2000 + 5 mm

   Journal centre – 2260 + 5 mm

   Diagonal distance of Trolley frame – 3018 + 5 mm.

9. Take out side frame keys and adopter retaining bolts.
10. Lift side frame and spring plank assembly and release the adopters and wheel sets.
11. Slide Bolster to one side to check up the column liner plates, slope liner, Land surface, Anti rotating lugs and Bolster column with prescribed gauges and use suitable thickness Sims.
12. Check up for wear on pedestal jaw and Adopters.
13. Check up wear on Wedge.
14. Check centre pivot for cracks and wear.

7.1 ASSEMBLING OF BOGIE COMPONENTS:

1) Replace all worn out pins and bushes.
2) Replace new brake blocks.
3) Reassemble the coil springs in nest after pairing, that is in one nest the variation of free height of the springs not more than 3 mm. Mixing up of new and old springs should be avoided.
4) Check the wheel profile. If required replace the wheels with ultrasonically tested wheels.
5) Check up the side bearer rubber pads and Elastomeric rubber pads for cracks and free height, if necessary replace with new one.
6) Lower the body on the bogie after sprinkling Graphite powder in the centre pivot.
7) Check the CBC heights if necessary keep the (CBC) Buffer height pickings in between Adopter and Elastomeric pads.
8) Lubricate all the pins.
9) Replace all the worn out brake gear pins and use over hauled SAB and adjust A and E dimensions and tack weld the anchor pin.
   'A ' dimension must be 70 + 2 /-0 mm.
   'E ' dimension must be 555 mm to 575 mm.
10) Check the CBC operating handle for any defect and free of operation.

11) Check the Draft gear, Yoke, CBC shank, Knuckles for wear and cracks if necessary replace by new ones.
12) Check hand brakes and doors for easy movement.
13) Check up Empty/Load gear arrangement and paint Yellow and Black respectively for easy identification and set the empty tie rod check nuts correctly if required.
14) Provide side frame keys.
15) Clean the Dirt collectors and Brake cylinder strainers.
16) Change the defective Air hose assembly.
17) Examine and lubricate Cut off angle cocks and change if required.
18) Examine and attend leakages of all pipes and joints.
19) Carry out the Single wagon test for proper functioning of Air brake system.
20) Carry out the medications recommended by RDSO and other authorities Touch up paint for sole bar and stencil station and date.

7.2 MODIFICATIONS TO BE CARRIED OUT ON WAGON STOCK DURING ROH:

1. The striker casting wearing plate is modified and secured by means of bolts and nuts with the striker casting to prevent working out of wearing plates on run.
2. A stopper is welded at an angle of 20º with the vertical on the air hose carrier suspension bracket, to prevent the excessive displacement of air hose carrier on run. This modification prevents damages to the air hoses.
3. Metallic bushes are used in the brake rigging instead of nylon bushes, to prevent frequent replacement of bushes.
4. Bulb cotters are used instead of split cotters.
5. Worn wheel profile is adopted for the RB wheels.
6. Truss beams are strengthened near brake heads by welding three numbers of MS strips to the length of 215 mm to prevent the truss beams from getting crack near the brake heads.
7. Bogie push rods are provided with safety straps on either ends to prevent the dropping of truss beams on run, whenever the pins are working out. A bolt is fitted with the floating lever to keep the bogie push rod in position, in case the pin fails.
8. Load empty horizontal lever support bracket is strengthened at the joint with the body by welding gusset plates at the joint.
9. An anti rotation lug is welded between the sleeve nut and screw rod of empty tie rod to prevent the tampering of empty tie rod.
10. Control rod diameter of SAB is increased from 28 mm to 32 mm, to prevent the control rod from getting bent.
11. An additional support bracket is given for supporting the SAB pull rod to prevent malfunctioning of SAB enroute.
12. The centre pivots are secured by means of rivets, to prevent the trolleys from getting shifted.
13. Quick couplings are used in the brake vans, to facilitate easy fitment and removal of pressure gauges.
14. For Casnub 22 W retrofitted bogie, the centre pivot bottom is cut by 5 mm at the top of the projected portion, to prevent the jamming of pivots.
15. 8mm strips are to be welded on either side hand brake wheel spindle 150mm away from sole bar to avoid accidental working out of hand brake wheel from its position when the sleeve and its riveting is defective.

8. Tank Wagons – repairs & maintenance

Tank wagons form a special class of non-pooled rolling stock. They are classified according to the product carried by the tank and its design as follows:

Tanks as pressure vessels, Tanks for corrosive liquids

Tanks for petrol and other highly inflammable products

Tanks for middle distillates of petroleum and others products.

The design of the underframe of 4 wheeled and 8 wheeled wagons is generally similar to that of other IRS wagons except that a pair of saddles is provided on the underframe at each end for mounting the barrel.

The barrel is cylindrical vessel generally fabricated out of low carbon structure steel to IS 2062 Fe 410 Cu W. The barrel is placed longitudinally on the underframe and secured by means of rivets to the saddle. The saddle is welded on underframe at each end.

Codes used for different types of tank wagons

Sl.No	Type of wagon	Code for the wagon
1	Ammonia tank	TAL, BTAL, BTALN
2	Chlorine tank	LCT
3	Liquefied petroleum gas tank	TLGL, BTPGL, BTPGLN
4	Sulphuric acid tank	TSA & MBTSA
5	Petrol tank	TPR/A, MBTPX & MBTPZ
6	Oil tank	TORX
7	Heavy oil tank	TORX
8	Bitumen tank	TBT
9	Coal tar tank	TR
10	Petrol tank	TR & MBTP
11	Oil tank	TO
12	Oil tank	MBTOX
13	Caustic soda tank	TCS, BTCS
14	Hydrochloric acid tank	THA
15	Molasses tank	TM & MBTM

Various types of barrel mountings, safety fittings and their functions:

S.N.	Mounting/Fittings	Functions
1	Safety valve	The safety valve is provided to prevent building up of excess pressure inside the barrel. It is fitted on the barrel either on the diaphragm plate inside the dome or on a separate opening on the barrel. This is provided on tanks for highly inflammable liquids such as petrol, Aviation sprit etc.
2	Relief valve	It is a spring-loaded valve fitted on the barrel of tanks for corrosive liquids. Its main function is to release built up pressure, if it exceeds the working pressure limit.
3	Safety vent	This consists of frangible disc (lead or any approved material not affected by lading), which ruptures at specified pressure. It is an additional safety fitting to safeguard against the failure of the relief valve. When the built up pressure exceeds the working pressure of the relief valve and the latter fails to function for any reason the frangible disc of this safety vent ruptures to release the pressure.
4	Compressed air valve	It is provided on tank from which the contents are unloaded by compressed air. Its main function is to control the rate of discharge by controlling the rate of air admission.
5	Vapour extractor cock	Its function is to extract vapour from the tank while filling
6	Master valve	It is a gravity discharge valve fitted with a hand wheel in the dome for manual operation.
7	Bottom discharge valve	BG 4-Wheeler Bottom discharge valve are provided with single bottom discharge valve situated underneath the master valve while on BG/MG eight wheeler stock two bottom discharge valves are fitted, one on either side and connected with the master valve through a “T” pipe. The main function of the valve is to control the flow of the contents and also to serve as an additional safety stop in case the master valve fails or breaks. The bottom discharge valve openings are also provided with blank flanges to be used with 2 mm compressed asbestos fibre jointing material to serve as further check on accidental leakage of contents.

The periodicity of POH is given below:

S.N	Type of wagons	For Ist POH	For subsequent POH
1	4 wheeler tank wagons except those listed below	4 years	3-1/2 years
2	Tanks for liquid chlorine and hydro chloric acid	2 years	2 years
3	Tanks for liquid ammonia	2-1/2 years	2-1/2 years
4	Tanks for petroleum gas	4 years	4 years
5	BTPN	6 years	6 years

The codal life of tank wagons is 45 years.

Steam cleaning for pressure vessels, petroleum and other highly inflammable products:

Tanks as pressure vessels, tanks for petroleum, other highly inflammable products, vegetable oils, bitumen, coal tar and molasses are cleaned by steam. The tanks requiring steam cleaning should be placed as near the steam supply line as possible and protected against any movement. The berthing siding should be completely isolated from all other traffic.In case of pressure vessels, it should be ensured that all the gas has been discharged to the atmosphere.

After ensuring that the tank barrel is no longer under pressure, the following sequence should be followed:

Remove the manhole cover together with manhole housing, valves etc. and leave the tank exposed to atmosphere for 24 hours.Entry of staff in the tank barrel should be strictly prohibited and signs with suitable legends displayed at a reasonable distances away from the tanks to be steam cleaned.Insert pipe through manhole and steam the interior of barrel for 12 hours. In order that the tank barrel is thoroughly steamed from inside, the steam pipe should be provided with a “T” connection at its lower end and so directed as to blow steam towards both ends.Remove condensed steam collected in the tank barrel and keep the barrel exposed to atmosphere for another 24 hours.

The following are the tests that should be conducted to ensure the tanks are free from contamination gases of the contents.

AMMONIA TANK BARREL

Fill the tank barrel with water.Collect a specimen of the water in a clean glass bottle.Test the specimen of the water with red litmus paper. If the colour of the litmus paper turns into blue, it indicates that the barrel is still having the gases of ammonia and requires steam cleaning.

NESSLER’S TEST

Test the specimen of the water with a mixture of potassium mercuric iodide and potassium hydroxide. If the colour of the mixture turns into brown, it indicates that the barrel is still having the gases of ammonia and requires steam cleaning

CHLORINE TANK WAGONS

Fill the tank barrel with water.Collect a specimen of the water in a clean glass bottle.Test the specimen of the water with red litmus paper. If there is any bleaching effect on the litmus

paper, it indicates that the barrel is still having the gases of chlorine and requires steam cleaning.

LPG TANK WAGONS

Fill fresh water in a clean bottle. A string is to be attached to the bottom of the bottle.Lower the bottle through the manhole up to the bottom of the tank and tilt the bottle. Allow the water to flow out and let the gas get into the bottle.Wait for 5 minutes and lift the bottle and close the mouth immediately after withdrawing. Take it away from the tank.Bring a lighted matchstick near the mouth of the bottle after opening it. If there is no flame it is free from injurious gas. But in case it gives out a flame, the tank should again be steam cleaned again.

Procedure for steam cleaning of bitumen and molasses tank wagons:

Close the manhole cover and open bottom discharge valve.Pass steam through the air inlet valve for sufficient time till the bitumen melts and drains away through the water discharge valve. The bitumen should be collected in containers and not drained out on the floor.Open the manhole cover to see whether the tank is completely cleaned from inside. In case any residue is left behind the above procedure should be repeated.Remove heating arrangement i.e., heating pipe, internal pipe, etc, from the tank. Clean inside surface of the heating pipe by scrapping the carbon layer with wire brush or other suitable process. Blow in air under pressure from one end.The outer surface of the heating pipe should be cleaned with kerosene oil.

Procedure for cleaning of tanks for corrosive liquids:

HYDROCHLORIC ACID TANKS:

Open the manhole and the washout cover and start cleaning the barrel with water. Initially the water coming out of the washout opening will show excessive acidity, which will turn blue litmus paper into red. The washing should be continued till blue litmus paper shows no change. Then close the wash out cover, fill the tank with water. Collect a sample of the water in a bottle. Test the sample of water with blue litmus paper. If the colour is changing to red, it indicates that the tank is still having traces of acid and requires cleaning.

SULPHURIC ACID TANKS:

Wash the Sulphuric acid tank barrels with ½ % to 1% solution of sodium phosphate commercial or half percent solution of soda ash so as to neutralize the sulphuric acid. The washing should be done as soon as it is received in workshops. Since concentrated sulphuric acid absorbs moisture when left open to moist air, the acid will be diluted with time. It is to be remembered that diluted sulphuric acid is highly corrosive and attacks the tank barrel more vigorously.

Collect a sample of water in a bottle. Test with blue litmus paper. If the colour of the paper changes into red, it indicates that tank is having still traces of acid and requires cleaning again. After cleaning allow the tank for drying.

Caution: As addition of water to sulphuric acid will produce intense heat, resulting in splashing of steam, the solution of commercial sodium phosphate should be added or spread gradually and with care.

CAUSTIC SODA TANKS:

Wash the barrels with hot water.Freedom from alkalinity can be easily ascertained by litmus test (if red Litmus changes to blue, there are still traces of alkalinity). After it is free from alkalinity, water should be drained and barrel dried before inspection and repairs

Checks to be carried out by the C&W Engineers before the tank wagon is certified for loading

Master Valve: Leakage of master valve should be checked while keeping the bottom discharged valve in open.

Bottom discharge Valve: Proper functioning and fluid tightness of the bottom discharge Valve should be ensured.

Blank flange: The blank flange of the correct thickness made out of steel plate and with a gasket of proper material between the blank flange and bottom discharge valve flange should be tightened by six bolts and nuts.

Tank barrel: Tanks with cracks on barrels should be marked sick.

Leaky Tank barrels:

The leakage of tank barrels may be caused due to the following reasons.Mechanical injury to the valve face and /or valve seat as a result of foreign material, particularly nuts and bolts finding their way inside the tank wagon,valves seat not properly secured to the stool by proper interference fits and malfunctioning of master valve.

Precautions in the case of leakage from the loaded tank wagons:

CHLORINE & AMMONIA tanks;

Chlorine and ammonia gases are poisonous and have a characteristic pungent odour, which gives warning of their presence in the atmosphere before dangerous concentrations are attained.In the case of chlorine, the greenish yellow colour of the gas makes it visible when high concentrations are present.In the case of ammonia, if sufficient concentration of the gas is present in the atmosphere, it will irritate the eyes and the respiratory system.

As such, in the event of leakage, all present in the vicinity should be warned to keep on the windward side of the tank.

HIGHLY INFLAMMABLE GAS tanks;

All the flames or fires near it should be extinguished or removed.

- Smoking should not be allowed.Spectators should be kept away.Only battery operated torches or incandescent electric lights with gas proof sockets should be used.Oil lanterns or signal lamps used for signalling must be kept away.The steam engine available if any should be moved away from the site.The leaky tank wagon should be removed as quickly as possible to an open area, where the escaping gas will be less hazardous.Earth should be spread over any surface on which the LPG has leaked out in liquid form.Call the company concerned for further attention.

9. IRCA Part III

IRCA – Indian Railway Conference Association situated in New Delhi gives out the rules for the standard and condemning sizes of various components used on a rolling stock. They also give the guidelines for the maintenance of rolling stock in workshops and in open lines. The rulebooks issued for the Carriage & Wagon department are:

Part III - For Wagon Stock

Part IV - For Coaching Stock

There are 4 chapters in each parts IRCA

Chapter	**Details**
Chapter I	Definitions
Chapter II	Workshop repair practice
Chapter III	Maintenance practice in open line
Chapter IV	Rejection rules

REJECTABLE ITEMS FOR GOOD STOCK AS PER IRCA PART – III

- ✓ Wheel defects such as sharp flange, thin flange, deep flange, hollow tyre,skidded wheel etc.
- ✓ CBC coupler body broken / cracked.
- ✓ Center pivots broken / cracked.
- ✓ Trolley frame cracked or broken.
- ✓ Hotbox.
- ✓ Sliding type brake beam broken / bent.
- ✓ Suspension bracket broken on UIC stock.
- ✓ Trolley frame broken at horn gap stiffer & Bridle bar breakage.

- ✓ CBC yoke broken.
- ✓ CBC draft gear defect.

10. ODC

10.1 Classifications of ISMD load

The ISMD/ODC loads are classified as ‘A’, ‘B’ and ‘C’ Class load. The classification of load is based upon the clearances between the load and the fixed structure.

Class of ODC	Gross clearance	Net clearance
A – Class	230 mm and above	150 mm
B – Class	150 to 230 mm	76 to 150 mm
C – Class	76 to 150 mm	Less than 76 mm

Gross clearance is the clearance between the load and the fixed structure when the load is at rest.

Net clearance is the clearance between the load and the fixed structure when the load is in motion.

Following has to be observed for the movement of ISMD load:

Description	‘A’ class	‘B’ class	‘C’ class
Speed En-route	Section Speed	40 kmph	25 kmph
Speed at turnout & yards	30 Kmph	8 Kmph	8 Kmph
Speed while passing fixed structures	30 Kmph if the gross clearance is less than 380 mm	Stop/move	Stop/move
Movement restriction	Day & Night	Day & Night	Day only
Sanctioning authority	COM	COM/CE	COM/CE/CRS
Escort	C&W staff	JE/C&W with Staff, JE/P Way, OHE staff	JE(C&W), (P Way), TI & OHE staff

The speed restrictions in electrified sections are based on the gross clearance between the ISMD load and the contact wire.

Clearance between the ISMD load and contact wire	Speed restriction
390 mm and above	No speed restriction
Below 390 mm and above 340 mm	15 Kmph
Below 340 mm and up to 100 mm	15 Kmph with overhead power switched off.
If below 100 mm	Not permitted.

Actual overall dimension should be checked by JE (C&W) after the consignment is loaded and properly lashed and advised for getting sanction of movement duly indicating the painted no. of the wagon.

The consignment has to be taken through nominated lines in station/yard as per the station working rules.

If ODC is passed through platforms the speed shall not exceed 5 Kmph

ODC wagons should be marshalled next to Train Engine.

Over carrying and diversion of ODC is prohibited.

11. Brake Binding – Causes & remedies

During release even after the brake pipe pressure is charged to 5 Kg/Cm2, in case of air brake stock or a maximum vacuum is re-created in case of vacuum brake stock, due to various reasons, the brake will not release and thus the wheels will not revolve freely on the track. This phenomenon is called brake binding.

The repercussions of brake binding are,

It damages the wheels, damages the bearings, gives discomfort to the passengers, leads to detention to the trains, leads to detachment of rolling stock enroute, leads to train parting and high power / fuel consumption. It also damages the track.

Causes of brake binding:

The causes of brake binding can broadly be classified based on the failures in the following;

Brake power creations system (Pneumatic system)

Brake power transmission system (Brake rigging)

Brake binding due to defects in Brake power creation system;

Brake power creation system is a system through which the brake power is made available on the piston with the help of compressed air in case of air brake system or with the help of vacuum/ atmospheric pressure in the case of vacuum brake system.

All the parts which are available for the passage of compressed air / atmospheric air between loco and the brake cylinder come under the power creation system. Any failure in these parts between loco and the brake cylinders results in brake binding.

The main parts coming under power creation system are

Brake pipe, Auxiliary reservoir, Control reservoir, Distributor valve, Brake cylinder, Cut off angle cock, Air hoses, Feed pipe etc.

Under normal conditions the BP is charged with 5Kg/Cm^2 from the loco. The control reservoir and the auxiliary reservoir are also charged with 5 Kg/Cm^2 from BP through distributor valve in case of single pipe system. In case of twin pipe system the auxiliary reservoir is charged to 6 Kg/Cm^2 through FP. When the brake pipe pressure is 5 KG/Cm^2 the brake cylinder is connected to exhaust through distributor valve in order to keep the brakes in released position. Whenever the BP is reducing below the CR pressure, the DV will connect auxiliary reservoir to the brake cylinder to apply the brake. Whenever the brake pipe pressure is equal to CR pressure, AR will be disconnected from BC, and in turn BC will be connected to exhaust through distributor valve to release the brake completely. As such, any leakages in the system on run results in reduction of BP pressure, which in turn lead to brake binding due to unintentional brake application.

The defects in the power creation system that lead to brake binding are;

BP pressure less than 5 Kg/Cm^2, CR Pressure is more than BP pressure, defects in the distributor valve, breakage in the pipe connection between DV and BC and leakages in auxiliary reservoir

The reasons for the brake pipe pressure to become less than 5 Kg/Cm^2 are;

Leakages in air hoses, leakage through cut-off angle cocks, dirt collector, brake pipes, Distributor valve particularly at the joints. Leakage through PEAS, Guard Emergency Valve and Auxiliary reservoir.

Reasons for CR pressure to become more than BP pressure;

Due to the difference in calibration of brake pipe pressure gauges in the locomotives there is a chance of over charging/under charging of BP pressure during loco change, even though pressure gauges indicates 5 Kg/Cm^2which will result in brake binding throughout the formations due to differential pressures in the incoming/ outgoing locos.

Whenever the locos are reversed at the junction stations for lengthy train (58 BOXN wagons) it is not possible for the loco to charge 5 Kg/Cm^2in the rear most vehicle, whereas, CR is already charged with 5 Kg/Cm^2before the reversal of locomotives. This difference of the pressures will cause brake binding in the rear portion of such train.

The defects in the distributor valves which causes brake binding are;

Exhaust port blocked due to dirt & moisture content. Interchanging of DVs between coach and goods results in excessive release timings. Due to the internal defects in the DV

Breakage in the pipe connection between DV and the brake cylinder leads to excessive leakages of air from AR after the brake application. This excessive leakage drops the MR pressure abruptly. Once MR pressure drops it is not possible to restore the BP pressure to 5 Kg/Cm^2during release, results in brake binding in the entire formation.

Remedial measures: - Detect and Isolate the D.V:

In case of single pipe, auxiliary reservoir is charged through brake pipe. Excessive leakage in the AR due to working out of drain plug or corrosion and foreign body hit on the AR, prevents recharging of BP to 5 Kg/Cm^2 and results in brake binding on the entire formations.

Remedial measures: -Detect and Isolate the D.V.

Brake binding due to defects in the Brake power transmission system;

The system through which the brake force available on the piston is transmitted to the wheel is called power transmission system.

The main parts comes under power transmission system are

SAB, Load empty device, Floating leavers, Hangers, Brake gear pins, Brake blocks etc.,

The defects in the power transmission system that lead to brake binding are,

Defects in the brake cylinder, SAB, load empty device, hand brake, levers/ truss beams and brake blocks

The brake binding can happen due to the defects developed within the brake cylinder due to the,

Bent piston rod, Weak/ broken return spring or Jammed piston

The defects in the automatic slack adjuster cause malfunctioning of the same en route. This sometimes results in the brake regulator not paying out slack after brake application and subsequent release. This results in brake binding. Though the brake regulators are not to be repaired in the open-line, it is necessary to ensure that the following precautions are observed during maintenance. Use the correct length of pull rod for the particular type of coach, otherwise this may result in incorrect `e' dimension and consequent failure on run. While welding the pull rod to the adjuster spindle ensure that the return lead of the welding machine is connected close to the point of welding. This will help to minimize the chances of craters forming inside the leader nut or adjuster nut assembly, which in turn jamming of SAB.

Remedial measures: -

Change SAB & at the time of overhauling the leader nut, adjuster nut and spindle rod to be replaced as a whole unit. Never use a slack adjuster, if it behaves erratically even once. Send it to shops for inspection and repairs. Set the "A" dimension prescribed for the particular type of coach correctly. Always ensure correct "A" dimension, whenever brakes regulator is changed.

The defects in the load empty device that cause brake binding are,

Jamming of horizontal levers, wrong setting of change over handle when the wagon is in empty and tampering of Empty tie rod setting.

Remedial measures: -

Lubricate and check the horizontal levers for its free movement during POH/ROH & Sick line repairs.Weld an anti rotation lug between sleeve nut and empty tie rod to prevent tampering.

Jamming of hand brake results in partial or full application of brakes.

Remedial measures: -

Every trip operate the hand brake

During POH/ROH & Sick line repairs, Clean and lubricate the moving parts.

The excessive worn out of Brake beam at ends will throw the brake heads along with the brake blocks out of wheel tread and get wedged between wheel and the primary suspension spring in case of coaching stock. In case of goods stock brake block will be wedged between wheel and bogie frame, which in turns results in severe brake binding.

Remedial measures: -

Worn out truss beams and bushes to be changed during IOH/POH and maintenance.

Secure the brake heads properly with the truss beams using the correct size split pins. Change the worn-out truss beams.

Reasons of brake binding when K type high friction composite brake block is replaced with L type low friction composite brake block for under frame mounted brake cylinder

It is important to note that the brake force available on each brake block is 1.0 tonne in bogie mounted brake system when compared with 3.0 tonnes in the standard under frame mounted air brake system. To overcome the deficiencies in brake force offered by the brake blocks in the bogie mounted brake system, high friction “K” type composite brake blocks are used to enhance the brake force.

In the under frame mounted air brake, with the help of cast iron brake blocks or low friction composite “L” type brake blocks, 100% brake power is achieved. When high friction composite “K” type brake blocks are interchanged unknowingly, due to the higher frictional value of “K” type brake blocks, the brake force will abruptly increases than the normal. This sudden increase of brake force makes the wheels to become hot, due to abnormal friction. Once the wheels become hot, deposition of material takes place over the wheels, which in turn results in severe brake binding.

Remedial measures:

Use only “L” type brake blocks or cast iron brake blocks for under frame mounted air brake system.

Use only the brake heads which is prescribed for underframe mounted air brake system.

Reason for the ensuring rocker arm to face the gauge face of the wheels in Bogie mounted brake cylinder;

When the brake is applied the piston rod connection with the floating lever moves in a circular path along with the floating lever with respect to its fulcrum point.This horizontal position of rocker arm facilitates the piston to move in a circular path along with the floating lever during brake application.

Or

It facilitates the piston to move linearly outward as well as vertically down ward during brake application. If the vertical displacement of the piston is prevented by keeping the rocker arm facing upwards will result in brake binding due to the jamming of the piston with the cylinder.

12.Train Parting – Causes & remedies

12.1 Train Parting in CBC Stock

Train Parting: Any train divided in to two or more portion is known as a train parting.
Note - A set of Vehicle attached with engine or any self propelled vehicle are light engine is known as train parting.

Train parting takes place due to following failures:

1. Mechanical Failure
2. Crew Failure
3. Operating
4. Commercial
5. Engineering failure
6. Miscellaneous

Mechanical Failure: Such type of failures take place due to poor maintenance of CBC fitted stock and material failure.

Crew failure: Such type of failure take place due bad engine men ship. Like improper handling of engine during course controlling the train and nigilance for observing the signals.

Operating: (Traffic) Such type of failure takes place due to not observing proper procedure for handling of the train in addition during the course of shunting /marshalling of train formation not ensuring proper coupling of stock.

Commercial: Such type of failure takes place due to over and uneven loading of stock not ensured by commercial staff.

Engineering Failure: Generally such type of failure contribute in train parting due to poor maintenance of track i.e. uneven track joints and muddy track.

Miscellaneous: Miscreant activities play major role in train parting. Whenever any train is stable, outsider are used to mishandle the operating handle of the CBC resulting in to train parting

Mechanical failure:

1. Ineffective of Anti-creep function – Lever connector nose of rotary lever assembly in CBC works as a Anticreep device during motion of train it restrict lifting of locking peace through toggle. In case of missing rotary lever assembly or due to bent of lever connector participate in failure of Anticreep function.

2. Improper locking of knuckle: During course of coupling CBC stock lock peace should be properly sited on knuckle lock face, improper locking or partial locking can be detected during examination, for ensuring proper locking of knuckle with locking piece the distance between lever connector nose and bottom of the coupler head should not be less than 25 mm. Wear in knuckle and lock piece face: 1.5 mm wear is permitted on knuckle lock face and lock piece face respectively. Total wear 3 mm is permitted in knuckle and lock piece. Due to excess wear in one or both play between knuckle and lock piece will increase beyond permissible limit and will create tendency disengagement resulting in to uncoupling of CBC.

During course of examination in sick line/ ROH /POH it should be detected by applying contour gauge no 1 & 2. The distance between knuckle nose and guard arm should not be more than 130.18 mm in case distance is more than 130 mm knuckle and locking piece faces should be checked and in case of wear replaced one of them or both which ever is required.

3. Defective CBC Operating Assembly: It consist CBC Operating handle connected to rotary lever assembly and rest on CBC bearing piece connected to CBC operating handle bracket at the right end of head stock in air brake stock and left end in vacuum brake stock. In the assembly operating handle bent due to mishandling, anti rotation lug (210 x 16 x16 mm) wear, operating handle bracket welding uprooted from head stock and bearing piece slot elongated i.e beyond 22 mm. Any one of the above defect contribute disengaging of knuckle from lock piece.

4. Expansion of coupler guard arm.: Such type of defect takes place due to impact of adjacent wagon and the distance between knuckle nose increase beyond prescribed limit i.e 130 mm causing slippage of knuckle resulting into parting of train. These effect should be detected by means of contour gauge no 1 & 2.

5. Abnormal variation in CBC Height: Such type of defects takes place due to use of improper size crown packing, shank wear, wear in centre pivot, inadequate spring camber and deformation in sole bar camber.

6. Defective Draft Gear: Slackness in draft gear 12 mm in new, 19 mm from off POH and 25 mm in service is permitted. Due to perished electromeric pad / spring weakness will lead to increase the slackness resultant heavy impact on CBC component and lead to brakeage of knuckle, CBC yoke causing parting of train.

7. Defective CBC Knuckle: Excessive wear on knuckle nose which should not be less than 10 mm. excessive wear on knuckle nose lead to breakage of knuckle and slippage of Knuckle. Stretched of knuckle is another defect which takes place due to sudden/excessive tractive force causing slippage of knuckle. Wear in knuckle lock face 1.5 mm is permitted beyond prescribed limit lead to uncoupling of knuckle. Knuckle pin hole should not be its wearing limits.

8. Dislocation of knuckle thrower. This is the vital component of CBC it assist for opening of knuckle during formation of rake. It is sited in coupler chamber and proper sitting will be ensured by visual examination seeing its lug. Once it is dislocated never allowed to lock CBC.

9. Misalliance

a) Wear in yoke strip and elongation lead to breakage of yoke.
b) Wear in yoke pin support plate improper/ bolted head of yoke pin support plate rivet lead working out of yoke support plate causing parting.
c) Deformation of yoke pin
d) Wear in striker casting.
e) OHE Tripping and passing through neutral section.

10) Material failure:

a. The incidence of material failure of CBC components like coupler body, yoke, knuckle, locking piece is high. On analysis of such type failure is minutely observed and found that component are used of not suitable grading, casting failure and improper composition of material.

Procedure for using the Gauge:

a. When the loco knuckle is below the coach knuckle. In this case the gauge should not be used.

b. When the Loco knuckle is above the Coach Knuckle.Washer should be placed on the top of the loco knuckle and the bolt should be allowed to go down. The gauge should be kept is such way that the washer rests evenly on the top of the loco knuckle and lower end of the bolts touches the top of the coach knuckle. In this position, it should be seen that the mark provided in the centre of the bolt is above the washer. If the mark is not visible above the washer, the washer, the generator van should be unloaded till such time the centre mark is visible above washer.

Note: It should be noted that this gauge should not be taken as a measure of minimum buffer height of 1030 mm as per IRCA rules. To ensure this stipulation, the extant instructions shall be followed.

A similar letter was earlier issued vide this office letter no: MC/LHB/Coach dated 11.10.2001 to Northern Railway and reiterated to NR, WR, ER, NCR, SR and SCR vide letter no MC/LHB/Coach dated 22.12.2006

12.2 The Guidelines for Operation of CBC Equipped Coaches

The following procedure order should be adopted for a coaching train fitted with CBC.

1. After berthing the CBC rake on the plat form and before releasing the rake by C&W the first five coaches should be in brake applied condition.

2. For attaching the loco motive the loco shall be stopped at 20 mtr from the first coach (SR 5.12.3) and shall move slowly to again stop at not less than 3 mtr from first coach of the rake.

3. The SLR CBC and loco CBC shall be aligned horizontally so that they are with in gathering range.

4. SLR CBC knuckle shall be in the close position and ensure full clearance of tell tale recess. The loco CBC knuckle shall be unlocked and in open condition.

5. The loco pilot shall proceed the loco up to the 3rd notch in succession so that the loco can coupled with the coach at a speed of 2 to 3 KMPH

6. On coupling full clearance of tell tale recess of both couplers shall be ensured by C&W staff. C&W Staff after ensured that both the coupling are in place shall lock uncoupling rod by putting locking pins in place in both the CBCs and the locking pin shall be tied by GI wire.

7. The training of all the loco pilots shall be arranged. A dedicated training session on correct procedure of coupling the CBC rake and how to ensure proper locking should be part of the training. Once all the loco pilot are fully trained in handling CBC coupling they should be made responsible for checking proper locking of CBC 1st coach with locomotive. Till all concerned loco pilots are trained the work may be assigned to C&W staff escorting the train.

8. A vertical restrictor should be provided when locomotive are not fitted with AAR 'H' type lock coupler head.

9. The loco pilot shall take the 2nd notch for checking the proper coupling by pulling C&W staff shall insert the shim as per RDSO sketch.

10. When the loco in the pulled condition the gap in the CBCs shall be filled by providing shims of adequate thickness by C&W staff the shims shall be tied with wire to the restrictor plate

11. The loco pilot and guard shall ensure that the require amount of BP and FP pressure are built up in loco and SLR respectively.

12. After ensuring the above procedure for coupling the brakes of the first five coaches shall be released by C&W staff.

13. C&W staff shall travel in rear cab of the working locomotive authority for travel in rear cab by C&W escorting staff. Shall be issued by the divisions in case of any problem en route in coupling notice by the loco pilot. He will sound the whistle code and advise the guard regarding the difficulty any abnormality in the coupling. Escorting staff shall immediately report to the loco pilot.

14. The CBC of the coaching staff should be maintained as per RDSO Maintenance Instructions No. RDSO/2006/CG/CMI-01 dated 16/10/2006 the loco CBC should be maintained as per RDSO Technical Booklet no G-76.

12.3 PROCEDURE FOR INSPECTION OF ANTI CREEP PROJECTION.

To determine that effectiveness of anti creep protection insert a bar between lock and knuckle tail self and try to lock upward at the same time force the lock leg rear ward inserting a screw driver between the lock leg and front of the lock piece hole.

If the lock can be raised by the method enough to permit opening of the knuckle the coupler as insufficient anti creep protection. Correction in sufficient anti creep protection should be made by replacing.
1. lock lift assembly
2. lock piece
3. knuckle

Usually replace of the lock lift assembly sufficient but in some cases further sufficient to obtain but renewal of lock piece and/or knuckle. If the renewal of these part does not exit, the faulty is probably due to worn anti creep projection or wear the rear wall of the bottom lock hole in the coupler head and the coupler body should be renewed.

A train after starting its journey fro m a station and during run parts in two or more causing stalling of the train and blocking of the line is called Train parting.

Reasons:

- ✓ Defective CBC and its components.
- ✓ Poor enginemanship of the driver.
- ✓ Improper marshalling/ shunting by operating staff.
- ✓ Act of miscreants.

Remedies:

- ✓ The TXR should check the CBC with all prescribed gauges during ROH and sick line attention.
- ✓ The knuckle should be tested with knuckle stretch and nose wear gauge.
- ✓ The CBC should be checked with sickline contour wear limit gauge for guard arm expansion.
- ✓ The anti creep arrangement should be checked invariably during every sickline / inspection.
- ✓ The draft gear pocket should be checked for loose/dead draft gear.
- ✓ Any surface cracks on knuckle and CBC body should be detected by dye penetrant test during ROH.
- ✓ Shank wear, wear on striker casting, drooped buffers should be checked for.
- ✓ Repeated failures of particular make of knuckle should be watched for.
- ✓ h. Provision of modified operating lever to avoid hitting of high level platform.
- ✓ Drivers should be given learning in engine and train dynamics and adequate learning of the route by LI.
- ✓ Driver should allow adequate release time for different type of stock to ensure full release of the brakes.
- ✓ Driver should not resort to injudicious application of brakes.
- ✓ After completion of shunting, the shunting staff should pull and push the formation for two wagon length and ensure coupling of all wagons.
- ✓ A minimum gap of 19 mm between CBC body bottom and center of the toggle rivet should be ensured for proper locking.
- ✓ Cases of miscreants intervention to be reported to RPF from time to time.

13.ACCIDENT RELIEF TRAIN

Introduction-Accidents and disaster are unpredicted and unavoidable. In Indian Railways to face such type of circumstances has his own mechanism. Relief, rescue & restoration is being carried out at accident site.

ART (Accident Relief Train)- At present there are 174 ARME and 184 ARTs stationed at strategic locations over Indian Railway system. As per Rly. Board guideline Beat of A class ART is approx.250 to 300 KM.

Classification of ART:-

a) 'A' class ART
b) 'B' class ART
c) 'C' class ART
d) Road ART(Modified road vehicle)
e) (SPART also treated as B class ART)

Composition of 'A' class ART-

1) 140T crane with match truck
2) BCNHS(For Engg.& C&W mat.)
3) BRNHS(For Rails and wheels)
4) RT (staff car)
5) RT(officer's car)
6) RT(Packing van)
7) RT(Equipment van)
8) RT(HRE & Power van)
9) RT Crane tool van

Composition of 'B' class ART-

a) BCNHS (For Engg. & C&W mat.)
b) BRNHS(For rails and wheels)
c) RT(Staff car)
d) RT(Packing & OHE van)
e) RT(Equipment van)
f) RT(HRE & Power van)
g) RT(Tool van)

Composition of 'C' class ART-

1. RT(Break down van)

Authorities to order ART- CME, CMPE, Sr.DME, DME.

CODES FOR ACCIDENT ALARM SIREN/HOOTER-

- Two hooters each of 45 seconds duration with 5 seconds interval indicate ART required at home stations.
- Three hooters each of 45 seconds duration with 5 seconds interval indicate ART required at out station.
- Four hooters each of 45 seconds duration with 5 seconds interval indicate ART & ARME required at Home station.
- Five hooters each of 45 seconds duration with 5 seconds interval indicate ART & ARME required at out station.

- One long hooter of 90 seconds duration indicates cancellation of ART & ARME.

Turnout time-

- Turnout time of ART in day time
  30 Minutes
- Turn out time of ART at night time
  45 Minutes
  - Turnout time of ARME with double exit 15 Minutes
  - Turn out time of ARME with single exit 20 Minutes
  - Mock drill of ART/ARME is being conducted once in a three month by Sr DSO with permission of DRM, If actual movement is not there.
  - Trial run of ART/ARME is also conducted once in a three month by concerned in charge by getting permission from all concerned.

List of Tools and equipment in 'A' & 'B' class ART-

i. Generator and electrical equipment
ii. Aska lights
iii. Illumination
iv. Self contained breathing apparatus
v. Oxy cutting equipment
vi. Inflatable lifting air bags
vii. Compressor pneumatic tools
viii. Life Jackets
ix. Hydraulic re-railing equipments
x. V Sat equipment
xi. Jacks
xii. Satellite phone
xiii. Wire ropes, slings and shackles.
xiv. Plasma cutting equipment
xv. Chains slings and wooden packing
xvi. Oxy fuel cutting equipment
xvii. Other mechanical equipments
xviii. Fitters tools
xix. Records
xx. Camera and video recorder
xxi.

140 T CRANE

- 140 T crane is available with 'A' class ART
- There two types of 140 T cranes in Indian Railways

1)Jessop 140 t crane is fit for 75 Kmph&Gotwaldcrane is fit for 100 Kmph.

- All crane are self propelled at a speed of 25 Kmph.
- Speed- Existing speed of ART 100 Kmph

Books and manual required in ART-

1)Transportation manual 2)Accident manual 3)G&SR book

4)IRCA part III & IV 5)Telegraph code book 6) First aid manual

7)Safety first instruction book 8)Rules for working of crane

9)Working time table

Sequence of movement of ART & ARME to the accident site

ARME from the other end

- ART
- ART from the other end
- Additional break Down special
- Special train carrying GM & other officers
- Unaffected portion of accident involved train, if possible Coaching Spl. for Clearing passengers.

14. Derailment Mechanism

Safe carriage of passengers is fulfilment of the trust and faith expressed in Railways by general public. The accidents tarnish our image and question our claim of having safe and sound working procedures. The accidents may occur on account of acts of omission or commission, evasion of rules, unsafe practices, adoption of short cut methods etc. Out of various categories of accidents, most serious consequences are witnessed in collisions, - derailments, fire in running trains and level crossings accidents. Human factor is found to be the main contributor in Railway accidents:

"The interface between man and machine has been largely responsible for errors and mistakes on the part of railway operators manifesting in unsatisfactory working and accidents."

It is not possible to fix a single reason or set of factors for all the occurrences of a particular type of accident on Railways. The accidents normally take place due to variety of factors acting in combination with each other. The experience has established that the accidents on Railways can be largely classified into following two main categories:

i) **Equipment failures**
ii) **Human failures**

This technical guide concentrates only on derailments. Therefore in the subsequent pag

es, only one category of accident i.e. derailments are discussed in detail.

Definition of Derailment

Derailment of rolling stock is defined as a wheel or set of wheels leaving their due place from the rail top surface.

A derailment may be minor or major in nature i.e. just one empty wagon may derail near a station limit not affecting traffic considerably or a good number of loaded wagons may derail, capsize and foul other lines thus obstructing traffic even on other lines. It may even lead to a collision if there is insufficient time gap between the derailment occurring and movement of other trains on other obstructed lines. There may be loss of human life if a - passenger train coming from opposite direction collides with the derailed stock obstructing the other line. When a derailment occurs approaching a bridge, the results are likely to be disastrous as evidenced in many cases in the past.

Derailments are therefore serious occurrences and may also cause loss of human life besides loss of Railway property. They also result in heavy interruption to through traffic of trains leading to substantial loss of railway revenue. Therefore all efforts should be made to avoid derailments. Whenever a derailment occurs, thorough investigation must be carried out to find out the exact cause and avoid recurrence in future.

Statistics about derailments reveal that the most prominent causes are: failure of railway staff in properly examining railway equipment; inadequate maintenance of locomotives, rolling stock, track, signals etc.; and other operational irregularities.

There are two broad categories of derailment:

■**Sudden derailments** - Instant dismounting of wheel from rail.

■**Gradual derailments** - Gradual climbing of flange on the rail.

Sudden derailments:

When derailing forces are quite high on a wheel, it may suddenly jump off from the rail table and the rolling stock derails. In this case, no flange mounting marks are available on the rail table. However the wheel drop marks can be seen on ballast or sleepers.

The possible causes for a sudden derailment are:

- Sudden shifting of load
- Improper loaded vehicle
- Excessive speed on curve or turn out
- Sudden variation in draw bar forces induced due to improper train operations(sudden braking or acceleration)
- Broken wheels/springs or suspension gear components.
- Failure of track or vehicle component
- Obstruction on track.

Gradual Derailments (Mounting **of wheel flange)**

On the track, the wheel flange travels performing lateral movements as well due to clearances between rail face and wheel flange. If the derailment occurs due to climbing of wheel flange, the derailing wheel first rubs with the inside face of the rail (see fig. 1.1) and grazing/rubbing marks are seen on the inside edge of one of the rails. Thereafter due to - excessive lateral flange forces, wheel flange mounts on the rail table and drops on the other side causing derailment. In this type off accident, wheel flange mounting marks are also clearly

visible on the rail table.

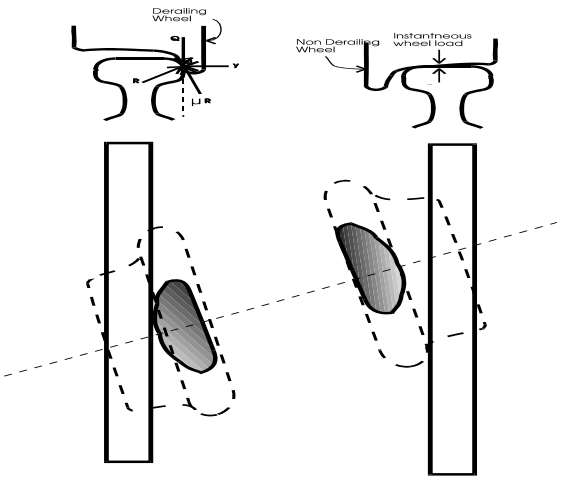
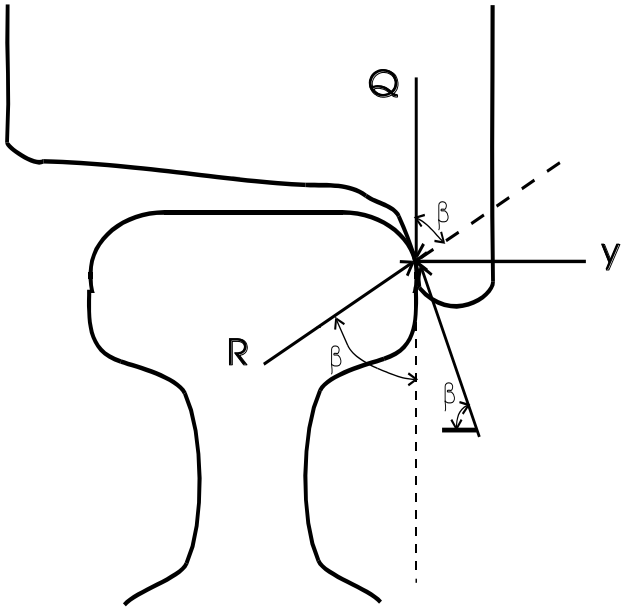


Fig. 1.1 Derailing and Non derailing Wheels

MECHANISM OF WHEEL FLANGE CLIMBING

It has long been accepted that the ratio oflateral force to vertical wheel load i.e. Y/Q has a major contribution in determining derailing tendency of the rolling stock. (see fig 1.2) When this ratio, denoted by Y/Q , exceeds for a sufficiently long period of time, a critical state occurs when wheel flange climbs and mounts on the rail table and causes derailment.



FORCES AT RAIL-WHEEL CONTACT

For safety against derailment, Y/Q should not exceed 1.4. This is considered the critical value. For Indian Railways, this value has been further reduced and should lie between 0.8 & 1 for safe running.

For assessing the stability of a particular rolling stock, Y and Q have to be measured at the rail-wheel contact. For laying down a limiting value of Y/Q for safety, the right side expression has to be evaluated. For this, we have to decide the value to be taken for μandβ. For large majority of wheels, $\beta = 68^0$ (for new wheel profile). The value of μ depends on the geometry of the surfaces in contact. On Indian Railways, the value of μ in general is taken as 0.25. For $\beta = 68^0$ and $\mu = 0.25$, the expression works out to approximately 1.4.[1]

1 Ministry of Railways, Government of India*. Investigation of derailments.* (Pune: Indian Railway Institute of Civil Engineering, 1995), p. 22.

As already explained, there are two broad categories of derailments: Sudden and Gradual. Nadal's formula deals only with gradual derailment cases i.e. flange climbing. When the ratio Y/Q reaches a critical value, it has to remain above such value for certain minimum duration of time for flange to mount on the rail and derail. A higher Y/Q ratio would be needed to cause a derailment if the duration for which it acts is less. The time frame followed all over the world is 5 milli-seconds as the time duration which delineates the boundary between the two categories of derailments. The final form of the criterion adopted on Indian Railways is that derailment coefficient Y/Q should not exceed 1.0. The said coefficient being measured over a duration of 5 milli-seconds.

The various stages of wheel flange climbing on the rail table during a gradual derailment are shown in the fig. 1.3.

Angle Of Attack

Further attempts were made to refine NADAL'S formula given above. In further detailed studies, it was noticed that to derail a wheel from the rail, another factor called "angle of attack" plays a vital role. (See fig 1.4)

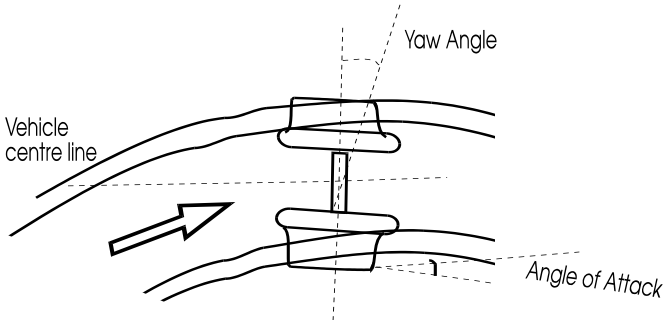
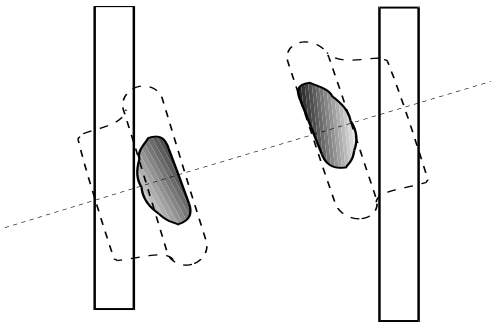


Fig. Angle of Attack

The effect of angle of attack plays an important role in derailment. The higher positive angle of attack increases derailing tendency as the contact point of the flange with the rail is then nearer the flange tip. This requires a lesser degree of lateral force to cause flange mounting.

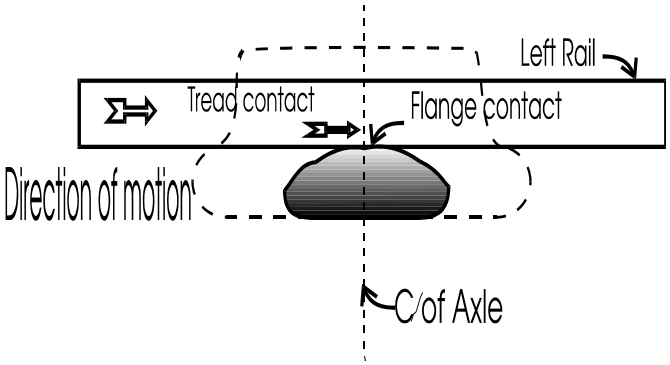
Angularity of Axle

Once the wheel lifts upto the end of straight portion of flange, no additional force is required to further lift it i.e. the rounded portion at the root of the flange does not prevent lifting. The angularity of the axle (Fig. 1.5) shifts the point of contact with flange down towards the root thus curtailing the amount of lift required to derail the wheel.



Zero Angularity

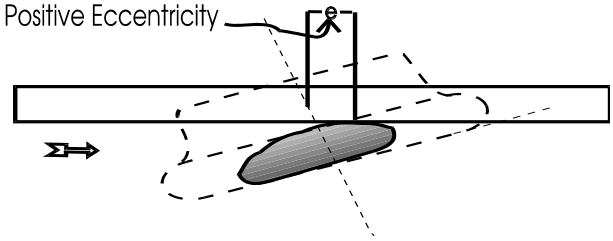
The wheel set is parallel to the rail and thus angularity with the rail is zero (Uniform contact with rail in both wheels). From the position of contact points of the wheel tread and flange, it may be seen that the longitudinal eccentricity between them is zero(see fig. 1.6).



Zero Angularity

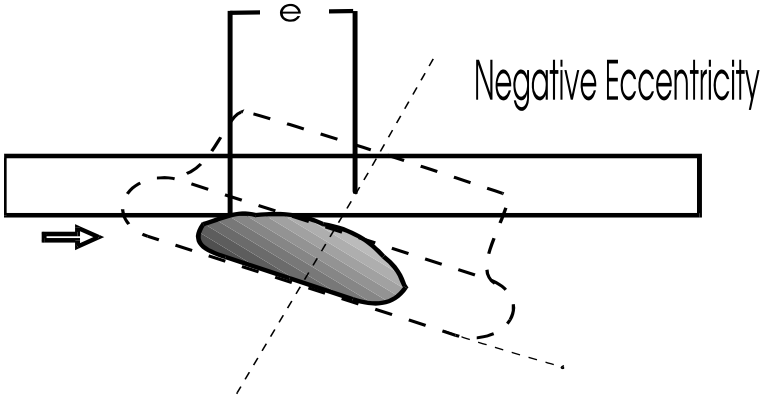
Positive Angularity

In this case the wheel set is angular to the rail so that the wheel makes the flange contact nearer its leading edge (front contacting- contact absent in rear). The longitudinal distance between the points of contact at the tread and the flange is called positive - eccentricity and the angularity here is called positive angularity. The angle between the wheel and the rail is called positive angle of attack



Negative Angularity

In this case, wheel set makes a flange contact near its trailing edge (rear contacting and front contact absent). The longitudinal distance between the points of contacts at the tread and the flange is called negative eccentricity. The angle between the wheel and the rail is called negative angle of attack (see fig. 1.8).



Negative Angularity

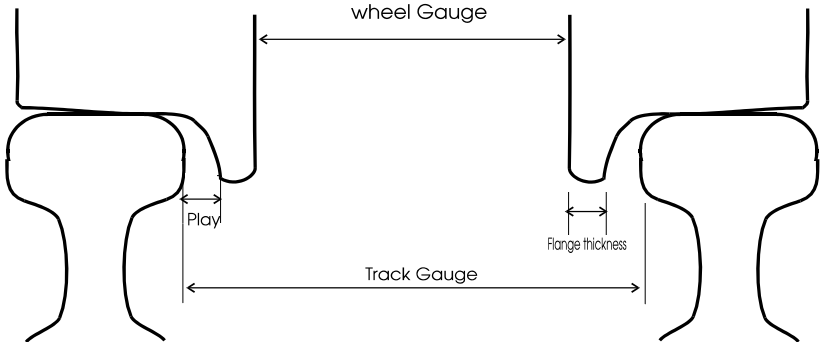
Positive Angularity is Most Critical

In the case of positive angularity, the wheel flange rubs against the rail in a down ward arcing motion resulting in frictional forces acting upwards. In the case of negative angularity, the frictional forces will be directed downwards and in the case of zero angularity, the frictional force acts horizontally.

Positive angularity is most critical of the above three conditions. The derailment proneness is highest when the wheel makes flange contact with the positive angle of attack. On straight track, this configuration occurs only during certain period of the oscillating motion of the wheel set. But on curves, it occurs more or less throughout the period of curve negotiation.

~~Play between Wheel and Rail~~

A wheel set should not have a tight fit with the track gauge. In such a situation, the wheel set will tend to run at the flange slope rather than at the tread thereby increasing the derailment proneness. This may also cause undue strain on the track fastenings with more wear on wheel tread as well as rail.



The standard play between gauge face and wheel flange is 19 mm for the B.G. stock as calculated below (fig 1.9):

= Gauge - (Wheel gauge + Two * Flange thickness)

= 1676 - (1600 + (2*28.5)

= 19 mm

Besides the above play, certain lateral andlongitudinal play is also provided on the vehicle to avoid undue straining of vehicle components. These are:

- Play between Axle guard and Axle box
- Play between Brass and Journal collar etc.

Due to the above play and clearances, wheel set is able to become angular to rails on run and thus it rarely runs parallel to the rail but moves with varying angularity.

~~WHEEL OFF-LOADING~~

Whenever derailment takes place due to mounting of flange on the rail, the flange first comes in contact with the gauge face of the rail. As a result, a certain lateral force is exerted on the track. Another factor that comes into play is the off-loading of wheel. The derailment of a wheel occurs when the flange force exerted on the rail exceeds a critical

value in relation to the instantaneous wheel load. Most of the derailments take place due to gradual off-loading and climbing of the wheel flange on the rail table. It is evidenced in such cases that the wheel travelled on the rail table for quite a few feet before finally falling outside the rail. But when the wheel off-loading is considerable, the wheel may simply jump over the rail and derails leaving no marks of mounting on the rail table.

In the case of flange climbing derailments, rolling stock properties which reduce the wheel load or increase the flange forces momentarily or permanently play an important role. These may be expressed as static or dynamic properties and arise from design - characteristics of rolling stock and field conditions during run.

The major cause of wheel unloading is the vehicle's dynamic response to the vertical irregularities in the track. This wheel unloading effect is perhaps the most important factor in the majority of "Flange Climbing" derailments occurring at normal speeds.

Reduction of vertical wheel load can also arise due to uneven loading. The uneven loading can occur due to lack of supervision during loading. This can also take place later due to an evenly distributed load getting shifted in transit. In either case, one side or one corner of the vehicle experiences a permanent and significant loss of loading.

For various reasons, the wheel set travels along the track executing a variety of oscillations. Lateral and vertical oscillations force the wheel set to make flange contact with the rail which results in development of lateral flange forces. The excessive lateral flange forces are found to be another main cause of derailment in large number of cases.

VEHICLE OSCILLATIONS DUE TO RAIL-WHEEL INTERACTION

For any wheel to mount and derail, the flange tip must get lifted to the top surface of the rail and then get displaced laterally to drop on the other side. The factors contributing towards oscillations and resulting in off-loading and lifting of an individual wheel under running conditions are:

- Unequal spring characteristics
- Vertical irregularities of track
- Uneven loading of wagon
- Axle Load Variations during run
- Dynamic Aspects
- Unequal Spring Characteristics

The most important variation in the characteristics of spring that contributes to - asymmetrical distribution of weight is free camber. Thevariation amongst the springs in the free camber, especially those which are located at corners diagonally opposite to each other, produce unequal load distribution on the axles. The springs in service also lose some amount of free camber with passage of time. As long as the difference in camber at diagonally opposite springs is within reasonable limits, there is little uneven distribution of load.

The shifting of spring buckles in relation to the spring does not result in any significant uneven distribution of load unless the free action of the spring is restricted. The

cracks on spring plates reduce the load bearing capacity of the spring but this does not necessarily result in a derailment. But if the complete spring collapses, there is a serious danger of derailment.

~~Vertical Irregularities in Track~~

The variations in cross levels affect the distribution of load on the axles. For details about the measurement of cross levels, please refer to " Track Defects".

~~Uneven Loading~~

A vehicle is considered to be unevenly loaded when the centre of gravity of the load is not in the same vertical axis as that of centre of the vehicle.

Axle Load Variations during run

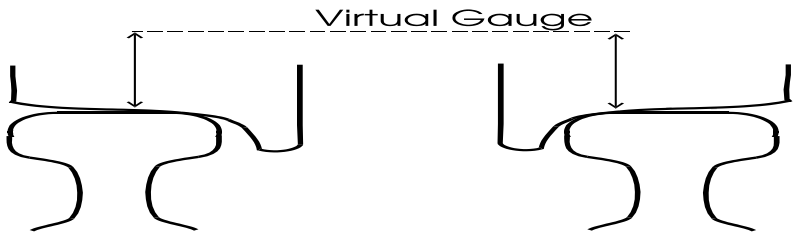
The distribution of the lateral forces between wheels depends on the local contact conditions between the wheel and the rail. If gradient is falling, the vehicle leans forward. Due to cant, the vehicle also leans towards the inner rail. These differences from the normal condition produce small increase in the load on the wheels situated towards the inner rail. The corresponding reduction on load takes place on wheels located towards the outer rail side. Under these conditions, derailment can occur due to lightly loaded rail which is generally the outer rail on curves.

Thus even at very low speeds, serious adverse conditions may occur due to combination of any or all of the following factors:

- Reduction in vertical wheel load due to cant.
- Reduction in vertical wheel load due to a twisted vehicle.
- Reduction in vertical wheel load due to an out of plane track.
- Lateral forces generated due to curve and other oscillations.
- Potentially high angle of attack presented to the leading wheel in a sharp curve by the out side rail .

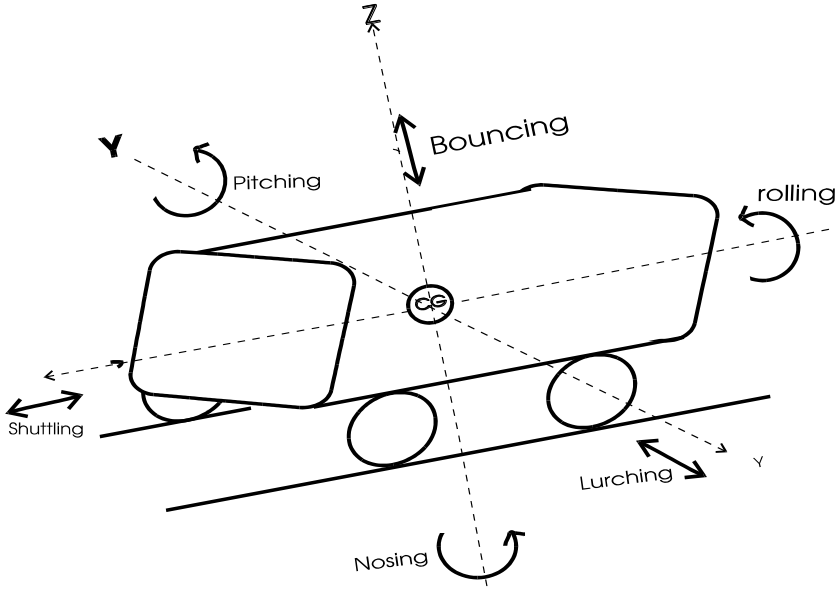
Dynamic Aspects

As a pair of wheel rolls along the track , it is perpetually in a state of lateral motion due to the conical tread trying to centreitself on the rail top. The central point of contact of the wheel tread on the rail table is known as Virtual Gauge.



There are various other disturbing movements of the wheel set in motion which are known as **exciting oscillations**. These are transmitted to the vehicle body through the suspension system. While in motion, the sprung mass is subjected to following oscillations with respect to the three main axes:

Axis	Type of Oscillation	
	Linear	Rotational
X	Shuttling	Rolling
Y	Lurching	Pitching
Z	Bouncing	Nosing or Yaw



When the amplitude of the lateral oscillations exceed the clearance between the flange and the rail, one of the flange rubs against the rail and then gets deflected back.

The amplitude and frequency of the oscillations depend upon the condition of the following :

- Track
- Flange rail clearance
- Axle load
- Speed
- Running and suspension gear characteristics

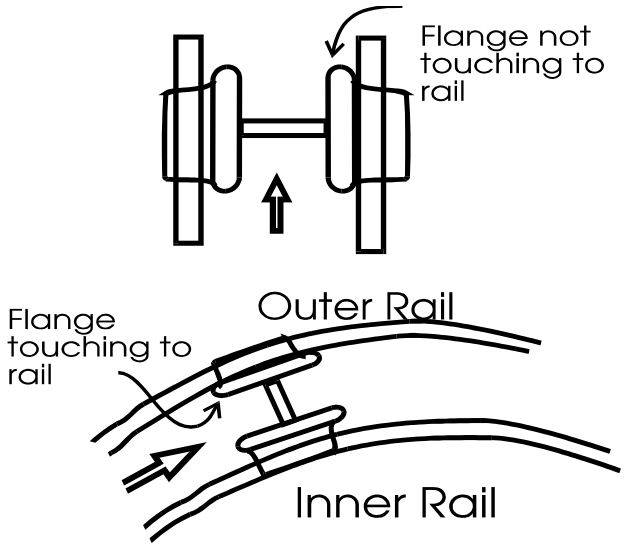
The lateral lurching and nosing oscillations give rise to flange forces. The angularity ofnosing also depends upon the wheel base in relation to the track gauge. The shorter the wheel base, the greater is theangularity.

~~DERAILMENT ON CURVES~~

A survey of accidents for three years was taken on Central & Northern Railway. The results revealed that about 80% of the total derailments occurred on curved tracks due to climbing of wheels on the rail table leaving mounting marks. These derailments occurred due to excessive lateral forces at the flange.

In practice, vehicles negotiate curves with almost continuous contact of wheel flange with the outer rail (see fig. 1.13). Thus a continuous flange force is present which could reach large values depending on the track curvature, cant, axle load, speed etc. On higher speeds, the wheels start lurching within the rail. The lateral forces generated during lurching are capable of inducing misalignment in the track especially if the lateral resistance of the track is low. The misalignment could grow under the passage of traffic to an extent which may eventually cause derailments. The lateral flange forces occur mainly due to following reasons:

- Unsatisfactory curving characteristics of vehicle or track.
- Unsatisfactory lateral riding of vehicle.
- Misalignment of track.



On negotiating a curve with significant positive angle of attack at the leading outer wheel, the derailment coefficient Y/Q may reach its limiting value. If cant is given in excess then even greater positive angle of attack will develop at the leading outer wheel which will further increase the chances of derailment.

15. Accident Investigation

The derailments present a burning problem to Railways. Unless cause is obvious e.g. cattle run over, sudden falling of boulders, trees etc. on the track, sinking of track, breach or wash-away etc., it is necessary to thoroughly investigate the role of track and vehicle in causing the derailment.

While investigating the derailments, track defects, vehicle defects and other operational features have to be examined which could have caused:

- Flange force Y to increase
- Wheel load Q to decrease
- Angle of attack to increase

The above factors are explained in detail later in this chapter under “MECHANISM OF WHEEL FLANGE CLIMBING”. The list of such contributory defects and operating features help in analyzing and determining the most probable cause of derailment.

A derailment may be sudden or gradual due to failure of one or more of the following:

A) Operational factors

B) Track

C) Rolling Stock

D) S & T

E) Others

To investigate these, it is necessary to take a complete set of measurements and observations and to obtain such back ground information as may be relevant. Thereafter critically analyze these factors in a logical sequence. This data and analysis should enable - identification of the first wheel to derail and the dynamic and quasi-static forces both lateral and vertical acting on that wheel at the time of derailment. It is also essential to determine the point of mount/drop.

If the cause is obvious e.g. tree or boulder falling on the track, breach, wash away, formation failure etc., then investigation becomes easier. If cause is not obvious then thorough investigation is required to be made by measuring various parameters of rolling stock, track etc. in order to ascertain the exact cause of derailment. The derailments occurs if a combination of factors act for a long enough period for the flange to climb the gauge face of the rail and then cross the rail table. The important theoretical aspects concerning derailments are:

1. Derailment mechanism
2. Wheel off loading
3. Vehicle oscillation
4. Lateral stability of track

16. ART. MFD maintenance

The following points may be kept in mind by the Divisions for Accident Management:-

A. For accidents involving Passenger trains, the BD cranes and MFDs in either direction in the vicinity of the site must immediately be ordered by the Control as a routine.

B. In case of Goods train accidents involving mainline, the following procedure should be followed:-

⇒ Movement of 140 Te BD cranes must have the approval of CMPE/Hqrs who is overall incharge of the management of ARTs, and in his absence any Mechanical Officer in Headquarters. In rare cases, where both lines are affected and when delays in contacting Headquarters are envisaged, cranes may be ordered by Division, but this should only be an exception.

⇒ Movement of MFDs can be ordered by the Divisional Mechanical officers as desired by DRMs.

C. Incase of accidents in Yard not affecting through movement, the derailment may be tackled using ramps to the extent possible and MFD/Crane ordered only if the derailment CANNOT be tackled by Jacks(HRE). This decision may be taken by the Divisional officers at their discretion depending upon the information available from site.

D. ARTs should be turned out within the target time of 30 minutes by day and 45 minutes during night. ARMV should be turned out within 20 minutes from double entry siding and 25 minutes from single entry siding during both day and night (zonal railways may decide target time).

E. Movement of ARTs to the accident spots should be given top priority and should not be stopped enroute. It is the responsibility of the Controlling DRM and his Officers that no slackness is allowed in this regard.

F. ARTs should be moved to the base Depot as soon as the restoration work is over.

G. For a minor derailment involving a few wagons, as far as possible MFDs should only be deployed leaving the crane at the base station in readiness to attend major accidents.

H. Wherever road approach is available, attempt should be made to take the MFD equipment by road through lorry and for this purpose, departmental lorry should be earmarked. Wherever department lorries are not available to move the MFD/HRE, private lorries may be invariably hired.

I. Wherever MFD/HRE is required to serve both BG and MG territory, arrangement for moving MFD/HRE by lorry is a must.

J. Mock trials of ART should be done earnestly as prescribed to test the efficacy and correct any deficiency in the system.

K. Whenever assistance of additional BD crane/MFD is required from neighbouring division or adjacent Railways. CMPE or any other HOD of the Mechanical Department will do the necessary liaison.

17.Prevention of Accident on C&W Account

18. Layout of Coaching and goods stock yard and infrastructural facilities

FACILITIES REQUIRED FOR MAINTENANCE OF 24 COACH TRAINS
(Railway Bd.'s letter no. 98/M(C)/137/19 Pt. I dt. 28.7.99 &dt. 05.05.2000)

a) Infra structural Requirements

(i) 24 coach length fully equipped pit line.
(ii) High pressure jet cleaning pipeline with plant for cleaning at primary pit line. Mechanized external cleaning is preferable.
(iii) Water hydrants for 24 coach length at en route watering stations with 20 minutes stoppage at nominated stations
(iv) Availability of the prescribed air brake maintenance and testing equipment.

b) Coach Design related Requirements

(i) Air brake with twin pipe graduated release system
(ii) Only enhanced capacity draw gear and screw coupling to RDSO sketch No. 79061 and 79067 are to be provided on the rake

c) Maintenance Practices and system related requirements

(i) The integrity of the rakes to be maintained.
(ii) Primary maintenance of the rake should be done in one hook without splitting
(iii) Minimum maintenance time of 6 hours on the pit during primary maintenance
(iv) Trains leakage rate to be maintained within prescribed limits by using rake test rig.
(v) Provision of proportionate brake system on the locomotive in good working order
(vi) Provision of audio visual alarm system on the locomotive
(vii) In case of double-headed diesel locos maximum traction motor current will be restricted to **650 Amperes** and in case of double headed WAP1/WAP3 electric locos, the traction motor current limit will be **750 Amperes** as prescribed in RDSO 's instructions for operation of main line air brake trains - C-9408.

d) Operational requirements

i) Communication between driver and guard should be provided through suitable means.
ii) Special care to ensure no gap between coach buffers after tightening the coupler.
iii) No additional coach attachment beyond **24 coaches** will be permissible.
iv)

Note: As per Railway Board Instruction now one occupied saloon & one parcel van can be attached with 24 coaches' rake.

19. Disaster Management –Role of Supervisors

The term disaster applies to an occurrence which results in huge loss of lives and property, injuries to people, dislocation to normal life etc.

Natural calamities such as earth quakes, Tsunami, Volcanic eruption, building collapses, wild fires etc, and avoidable occurrences like train accidents, gas pipe line fires, poisonous gas leaks from factories etc are examples of disasters.

In railway parlance, disaster refers to a major accident involving loss of lives and dislocation to through traffic. The art of handling such an occurrence without panicking and taking quick decisions with a cool mind to alleviate the sufferings of the passengers involved and restore normalcy of train operation with minimum delay even in the absence of communication facilities and without waiting for directions from higher-ups, is known as disaster management.

The Railway system is a time tested system and have at their command, the most sophisticated equipment for rescue and relief, medical assistance, re-railing and removal of obstructions, material handling etc., in addition to well trained personnel.

At the accident site, the Engine crew, Guard, TTEs or any Railway official travelling by the train on duty or off duty will be the first person to manage the disaster.

The Disaster management involves

Intelligent and meticulous planning

Prompt response to the situation

Adequate post-disaster measures

The objectives of Diaster Management in the order of priority will be:

Protection of the unaffected line.Prevent / Minimize loss of lives, immediate medical relief.Quick attention to the injured, transporting them to the nearest hospital.Protection to the belongings of the passengers.Provision of food, communication facilities and transportation to the stranded passengers. Protection of Railway property.Quick relay of correct information to all concerned including the next of kin of the dead and injured, media and Control office.Extrication of dead bodies and moving them to safe places.Quick movement of essential materials and personnel to the accident spot.Preservation of the clues at site.Speedy relief and restoration of traffic.

The Station Masters of the nearest stations, the Control Office and the Zonal Head quarters will act fast to communicate the information to Civil Authorities at various levels to mobilise medical relief from the nearest places, medical treatment at the nearest hospitals, transport to the stranded passengers and assistance from Police and Fire fighting wings. Assistance of Military and Para military forces will also be enlisted if necessary. The Station Masters of the nearest stations will also assess the extent of loss of lives, grievous injuries and damage to railway property and communicate to Control Office for arranging proper rescue, relief and restoration facilities with least delay.

THE GOLDEN HOUR

Golden hour is the first one hour immediately after an accident.

Bleeding and traumatised persons should be given specific medical attention within one hour of the accident to arrest bleeding, restore blood pressure and relieve the shock.

“If a critical trauma patient is not given definite medical care within one hour from the time of accident, chances of his ultimate recovery reduces drastically, even with the best of Medical attention thereafter. ”

Hence, the first and foremost objective disaster management is to save the lives of as many critically wounded persons as possible.

While the Disaster Management starts at the site with the first official taking charge and commencing the rescue operations within moments of the accident, the “official start” of the next level of disaster management starts with the sounding of siren at the Divisional Office and base stations of ARME & ART on both sides of the location of accident.

The Siren codes to be given by the Controller for ordering ART/MRT in case of accident

Description	Siren code
Accident at out-station, main line is blocked, ART/MRV both are required.	4 long and 1 short.
Accident at out-station, main line is clear, ART/MRV both are required.	3 long and 1 short.
Accident at out-station, main line is blocked, ART required without MRV	4 long
Accident at out-station, main line is clear, ART required without MRV	3 long

On hearing the hooter /Siren sound, the BD staff of different department should promptly report to the SM and sign in the ART register.

The Medical relief van should start from the base station within 20 minutes and ART should start within 30 minutes during day and 45 minutes during night. When passenger carrying trains meet with accident, normally MRV is moved first. Subsequently it may be cancelled en route if the injuries are trivial or nil. The line is kept clear for the passage of MRV/ART, by regulating the trains in the section.

On reaching the site, all departments will deploy their personnel in the rescue work at first. Once the entire injured are removed to safer places, all dead bodies will be removed and moved away from the accident spot, to be handed over to the next of kin. To extricate the injured and dead, cold cutting equipment only shall be used, in order to avoid risk of fire. MRV are equipped with under-water cutting equipment and pneumatic inflatable cushions to retrieve bodies from under water and under capsized coaches.

Emergency cells are formed at:

Divisional Control Office

Zonal Control Office

Stations on both side of the accident site

At the accident site

The emergency cells will be continuously monitoring and logging the events from the accident site and respond to the demands for assistance from the site. Movement of special equipment and gadgets, experts from various government and private agencies, recording the details of the dead and injured, the details of passengers under treatment in various hospitals and logging the rescue and relief operations in a chronological sequence.

Meanwhile, transport is arranged for the stranded passengers for their onward journey. This may be in the form of road transport or rail transport depending upon the circumstances.

Unaffected portions of the accident involved train may be moved, but only after checking the stock for safety and recording all tell tale clues on the stock. The movement of unaffected

portion has to be authorised by the DRM and the stock should be kept in the nearby stations for inspection by CRS, Police and forensic experts.

Once the primary objective of minimising the loss of lives and mitigating the hardship of the stranded are finished, the relief operation shall commence. This will be a two-fold operation, taking care of recording the various clues and parameters of the track, signalling equipment rolling stock etc and the other attending to removal of obstructions and restoration of track.

By now, a reasonable assessment of the probable time of restoration can be made and the emergency cells updated with the information, for regulating, cancelling, rescheduling and diverting the trains which cater to the section.

The pre-planning and preparation for Disaster management team

Relief equipment viz Medical Relief Van(MRV) and Accident Relief Train (ART) should be located at strategic points and should be accessible for immediate despatch.

Station staff must maintain an up to date list of Medical facilities available near by and how to get assistance when needed.

Brake Van Equipment Viz Emergency lighting equipment, portable field telephones, stretchers, Fire extinguishers must be available on trains and staff must be familiar with their use.

A list of First aiders must be available with the SM for calling them in case of emergency.

Mock drills must be conducted periodically to test the effectiveness of the relief operations and to know and correct the short comings.

ART/MRV must be inspected monthly by the DMO, SMR, ADEN, ADEE and ADME along with the in charges of ART/MRV.

The responsibilities of Railway staff in the event of accident:

Responsibilities of the staff in the event of accident varies with respect to their departments and their role.

Crew of the accident involved train;

The crew of the train involved in accident must promptly communicate to the controller and the nearest SM giving the essential details of the accident and the assistance required.Use the portable field telephone/VHF for faster communication.Halt the train running on adjacent lines and send memo to the nearest SM through the Driver/Guard.Detach the train engine after taking adequate precaution to secure the load, to reach the nearest station.Send assistant guard/assistant driver to the nearest station by foot when all other means fail.

Senior most official available at the accident spot;

Promptly convey the information to the control and the SM on either side about the details of the accident and the assistance required.Collect the railway men and volunteers and allot duties to each of them to assist the passengers.If there are doctors and nurses on the train, get their help and expertise. Get help from the police, military, RPF personnel if available on the train for rescuing the passengers and for protecting their property.

Guard of the accident involved train;

Arrange to protect the adjacent line/lines if necessary and the line to which the accident has occurred.Send information through quickest means to the control and SM on either side.Take action to save lives and render first aid, with the help of the first aid box available in the Brake van.Call for the doctors on the train and seek their assistance.Seek assistance of the railway men on the train for attending to the injured and for other relief operations.Post a railway employee to man the field telephone to ensure regular flow of information to the control.Make a quick assessment of the assistance needed and advice control or Nearest

SM.Preserve and safeguard all clues to arrive at the possible cause of Accident.Arrange protection of property of passengers and railway property through RPF, GRP and other railway staff.Do not leave the site till you are permitted by a competent railway authority.

Station master of the section

Protect the affected section.Issue caution orders to trains going on adjacent lines (on double line/multiple line section), to exercise caution.Inform control about the time of accident, location, nature of assistance required.Arrange to dispatch medical aid to the injured passengers with the help of First aiders and local doctors.Maintain liaison with the accident manager at the spot.Order ART/MRV as per needs with more backup assistance.

Section Controllers

Order ART/MRV as required, duly getting approval from the competent authority. Pass information to all concerned.Arrange clearance of unaffected portion of the train from the site at the earliest. Plan its onward dispatch.Arrange transport of injured/Stranded passengers to hospitals/Stations. (Where drinking water and catering facilities are available). Arrange regulation/Diversion/Cancellation of trains.Keep in touch with the Accident Manager of the site.Must have road map, Locations of Major hospitals etc, over their Railway system for ready reference.

The responsibilities of various departments during Accident:

COMMERCIAL DEPARTMENT

Taking care of passengers & their belongings. Arranging transportation for the stranded. Collect the names, addresses and ticket particulars of the dead/injured Passengers.Taking care of catering needs of passengers and staff working at site. Arranging ex-gratia payment to injured. Processing application for claims in case of casualty from the kith & kin. Updating the details of casualty/injured from hospitals and places where treated. Pass on the updated information to emergency cell from time to time.

SECURITY DEPARTMENT

Cordoning the affected area. Protecting the belongings of the passengers. Controlling of the crowd. Render help to the stranded passengers. Facilitate fire fighting arrangements etc,Check for possibilities of sabotage & their Clues, if any.

S&T DEPARTMENT

If signaling equipment are involved as probable cause of the accident, the block instrument & relay rooms will be sealed after recording the positions of levers, knobs, slides, indications etc.Repairing & restoring to service after recording the parameters.Providing portable & emergency telephone sets, Satellite, BSNL, & Railway lines with STD facilities at Site, mobile phones, fax and internet facilities for use by railway officials and stranded passengers. Providing hot line between site & divisional HQ and Zonal HQ. Providing PA system at the site.

MEDICAL DEPARTMENT

Setting up temporary hospital & rendering First aid. Providing medical treatment to save the lives of the injured. Surgical attention if necessary in the temporary operation theatre of MRV. Getting assistance from nearby hospitals, health units. Visiting the hospitals where injured are undergoing treatment and arranging furthertreatment for them.

ENGINEERING DEPARTMENT

Joint inspection & recording of parameters and clues at the site; Preparation of site plan. Removal of damaged P.Way materials from the vicinity for laying of track. Assisting the Mechanical staff for preparation of surface for propping, removal of vegetation to facilitate smooth working. Repairing/ laying new track to restore traffic. Arranging heavy duty equipment such as bull dozers, tipplers, road cranes. JCB etc for assisting the repair work;

TRACTION DEPARTMENT

Switch off the overhead power for crane working. Removing the damaged power lines. Lowering & slewing the power lines for crane working. Earthing the power lines, where ever required. Restoring the power lines, after the crane work. Ensuring the restoration of the over head power lines

ELECTRICAL DEPARTMENT

Providing sufficient lighting arrangements at the site, including focusing lights, generator sets etc. Providing charging facilities for stabled ARME & ART. Providing uninterrupted power supply to computers, Fax machine etc

OPERATING DEPARTMENT

Quick movements of MRV & ART to the site. Arrangements for relief trains for the stranded passengers for onward journey. Quick movement of materials for as needed by individual departments. Assessment of the probable time of restoration in consultation with other branches and arranging for rescheduling, diverting etc

SAFETY DEPARMENT

Coordinating the work of recording of clues, track parameters, rolling stock parameters etc. Collecting the statements of Engine crew, Guard and other railway staff on duty on the train. Arranging to freeze the maintenance records of the concerned departments

Arranging for Medical examination of the train crew. Arranging for video graph and photographs of the track, coaches etc. Collecting the event recorder/speed recorder from loco and decoding the same

MECHANICAL DEPARMENT

Joint inspection & recording of parameters and clues at the site. Planning the re-railment /removal of obstruction from both ends, using cranes and MFD equipment. Removing trapped persons/ bodies using cold cutting equipment, Hydraulic rescue device etc. Assisting other branches for moving bulky objects like girders, using crane.

STORES DEPARTMENT

Arranging supply of spares urgently needed for the equipment involved in rescue/relief work. Ensuring availability of stationery, computer peripherals etc. Procuring life saving drugs for the critically wounded.

Information to the press should be given in a clear unambiguous manner giving factual information. Divisional Railway manager normally deals with press persons.

Responsible officers must reach to the site of accident as early as possible by the first available means, viz. rail, road or air.

It is important that Doctors only, should normally categories death/Serious injury/Minor injury after their examination of passengers.

Medical officers in charge must maintain records of injuries, treatment given to the patients.

20.Marshalling of trains

20.1 Coaching Stock:

Marshalling of the coaches is mainly done taking into consideration the safety of passengers during collisions.

In case of SLRs, which have passenger portion on one side and luggage cum brake portion on the other the SLR should be marshalled in such a way that the luggage and brake portion is trailing outermost in the rear or in front next to engine. If for any unavoidable reason the above is not possible, the passenger portion should be locked. In case of new design SLRs with passenger portion in the middle this can be positioned in any convenient way.

Marshalling of 3 coaches in front of and in rear of SLR on short trains is permitted provided they have working brakes and subject to further condition that the two front most and rear most coaches are Anti telescopic. An inspection carriage may be attached as 4^{th} trailing coach on such trains. This does not however apply to trains running mainlines/trunk routes.

VPs, LRs, WLRRMs and other coaching vehicles which do not carry passengers may be marshalled as operationally convenient however as far as possible these should be preferably marshalled as outermost vehicles at either end to absorb the impact of collision energy.

Inspection carriage whether anti telescopic/steel body or not and occupied by Railway officers may be marshalled as operationally convenient. However not more than one inspection carriage (occupied) shall be attached by mail/express trains at a time. (Rly Bd letter No. 88/coaching 01/34/2 Dtd: 16.06.2006)

Reserved bogies occupied by passengers and inspection carriages/ saloons occupied by VIPs should be treated as any other passenger coach and marshalled accordingly

Sectional/through service coaches if they are ant telescopic or steel bodied may be marshalled as operationally convenient. However whether feasible they should be marshalled inside the SLR.

While determining the position of marshalling of sectional/ through service coaches the fact that these coaches will be attached/ detached en-route leaving the train service coaches exposed as outermost should be borne in mind and therefore the marshalling order of sectional/through service coaches and train service coaches decided in accordance with all the other instruction above.

In case of POH/Sick coaches which are returned to shops for major repairs and are attached to passenger train, such coaches should be properly locked and windows secured so as to prevent entry of any passenger into these coaches. In that case it is not necessary to attach these coaches according to safety marshalling instructions and can be attached next to the train engine or rearmost as convenient. If for any reason it is not possible to lock these coaches such coaches should be treated like other passenger coaches in the train formation and should therefore be marshalled inside the required no of anti telescopic/steel bodied coaches.

If wagon is attached to the passenger trains for dealing parcel traffic, it should be attached next to engine if loaded beyond 20 tonnes. The wagon must be certified by a train examiner by like any other VPU or coaching stock, speed of the train to be restricted as per the permitted speed of wagon.

Movement of one dead Dsl/Elec locomotive is permitted with mail/express/passenger train provided the brake power of mail/express/passenger train is 100 percent.

20.2 Freight Stock:

Single 4 wheeler is not to be marshalled between two bogies or between a bogie and an engine. This restriction will be applicable to a banker engine attached at the rear.

While marshalling explosive wagons

Max 10 wagons by goods trains and three wagons by mixed trains can be grouped together.

Minimum support of three wagons containing non dangerous goods must be given from steam engine, brake van, passenger coaches and wagons containing dangerous goods. One support wagon is enough from Dsl/Elec loco.

For liquified gas any number of wagons can be attached, two support wagon from engine, Brakevan and passenger carrying vehicle must be given.

Highly inflammable liquids like petrol, kerosene etc. one support wagon from Dsl/Elec loco and brake van should be attached. Three support from dangerous goods and two support wagons from compressed gas wagons should be attached.

Damaged vehicle should be attached in rear of the rear most BV certified fit by C&W staff and C&W staff should accompany. Permitted only during day light hours.

Crane should be certified fit by the crane supervisor. Dummy truck should be attached for resting the jib. While proceeding to accident spot should be attached next to engine.

Livestock should be attached as far as away possible from the TE/banking engine. At least four bogies or seven unit support wagons should be given from all types of train engines.

To obtain effective brake power on goods trains, the following marshalling order of the wagons shall be ensured:

Next to the train engine a minimum of two braked wagons with brakes and brake cylinders in working order shall be attached.

In front of the rear brake van a minimum of two braked wagons with brakes and brake cylinder in working order shall be attached.

All other wagons shall be marshalled in any order subject to the provision that not more than 2 inoperative wagons are coupled together on trains.

Grouping of the inoperative wagons shall be done subject to the provision that for every group of one or more inoperative wagons marshalled together, an equal number of braked wagons are marshalled in front and in rear of such wagons.

In case of dead diesel/electric locomotive the vacuum/brake pipe shall be connected and the dead locomotive is to be treated as a inoperative vehicle and therefore at least 10 fully braked four wheeler units with effective brake cylinders shall be attached behind the dead locomotive.

A competent person not lower then an asst driver shall accompany the dead locomotive.

The dead locomotive brake shall be fully released. The brake pipe and the main reservoir pressure should be discharged or the vacuum fully destroyed. In case of diesel locomotive the MU2B valve shall be put in dead position 2” COC of VA1B valve (Banker COC) to be kept on closed position. GD 80D filter inlet to be covered and secured by a paper. COC of 28VB valve to be kept in close position.

The dead locomotive shall be attached next to train locomotive where double heading is permitted. The total number of locomotives including the dead locomotive shall not exceed two.

If the dead locomotive is not attached next to train engine, it shall be marshalled anywhere on the goods train, provided that the minimum distance between the dead locomotive and the train locomotive shall be equal or more than the largest span of the bridge in the section where the dead locomotive is to be hauled.In case of dead locomotive fitted with side coupling rods it shall be ensured that side coupling rods are in position.