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Efficient Loading and Transport of Wagons Design for New Traffic Commodities

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ABSTRACT

Design of New Bogie/Wagon for Two wheelers, milk tanks, Fly ash with easy loading, Unloading &safe handling. New bogie can be used for these three purposes with slight modification as per two wheelers 100 vehicles can be accommodate per bogie on sliding plate rollers are placed on the base & slider plate is placed on it for easy loading & unloading of the vehicles, sliding plate can be removed if we want we can place milk tanks on the base & similarly we can place enclosed cabin for the Fly ash. Base of the bogie cast-iron material is preferred similarly for slider & rollers steel is used. We used catia software for modeling of new Bogie. Modern express trains in India face the problem of having a loading and unloading with proper rams while moving heavy luggage in and out of the train..

Keywords: ***Bogie/Wagon, rollers, cast-iron, slider rollers, Cati-A***

I. SPECIFICATIONS

1.1 DETAILS OF PROPOSED DESIGN

In this design we have considered the specifications as per the Indian Railways

Specifications of Bogie

Total length of Bogie = 21337mm

Total width of Bogie = 3050 mm

Total Height of Bogie = 2653 mm

Specifications of Two wheeler Hero Splender

Two Wheeler Length =1970 mm

Two Wheeler width = 720 mm

Two Wheeler Height = 1040 mm

1.2 Arrangement of Vehicles

No Of Vehicles Loaded in a Bogie = 100

Space between Vehicles = 133mm

No of Rows in lower Bogie = 2

No of column grooves = 25

Total no of vehicles in lower Bogie = 50

Total no of vehicles in Upper Bogie = 50

1.3 Elaboration on Utility of The Proposed Design

- In old Bogie only 50 vehicles can be accommodated but in New bogie 100 vehicles can be accommodate
- Loading & unloading is difficult in old bogie but in new one loading & unloading is easy & Fast it is open
- Proper space is maintained between vehicles
- Grooves will be present on the sliders for vehicles to be placed in the groove along with the belts on each grove to fix the vehicle

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Main advantage in new bogie vehicles can be loaded & unloaded from two platforms

II.Types of Wagons

2.1 Classifications of Wagon

- Open Wagon
- Covered wagon
- Flat wagon
- Hopper wagon
- Brake van wagon
- Tank wagon
- Container wagon
- Special purpose wagon

2.2 Types of goods wagon

The goods wagon are categorized here based on their main design features and in accordance with the international UIC classification system:

Open wagons were formerly referred wagons

1. These are divided into:
2. Ordinary classes (UIC Class G)
3. Special classes (UIC Class H), which are often distinguished by their large loading volumes.
4. Livestock vans (stock cars) for transporting cattle are no longer used.

2.3 Bulky Wagons

Freight wagons filled with limestone wait unloading, at sidings in Rugby; Warwickshire, England Bulk cargo constitutes the majority of tonnage carried by most freight railroads. Bulk cargo is commodity cargo that is transported unpackaged in large quantities. These cargo are usually dropped or poured, with a spout or shovel bucket, as a liquid or Solid, into a railroad car. Liquids, such as petroleum and chemicals, and compressed gases are carried by rail in tank cars.

2.4 Bulk Freight wagons

Freight wagons filled with limestone wait unloading, at sidings in Rugby, Warwickshire, England Main article: Bulk cargo Bulk cargo constitutes the majority of tonnage carried by most freight railroads. Bulk cargo is commodity cargo that is transported unpackaged in large quantities

2.5 Heavy-duty ore traffic

The heaviest trains in the world carry bulk traffic such as iron ore and coal. Loads can be 130 tonnes per wagon and tens of thousands of tones per train. Daqin Railway transports more than 1 million tons of coal to the east sea shore of China every day and in 2009 is the busiest freight line in the world Such economies of scale drive down operating costs. Some freight trains can be over 7 km long.

2.6 Covered type Tank Wagon

These are mainly used to transport the Milk, Diesel, petrol, Kerosene and gas products

Fig: 1- Covered type Tank Wagon

Fig – 2: Open Wagon

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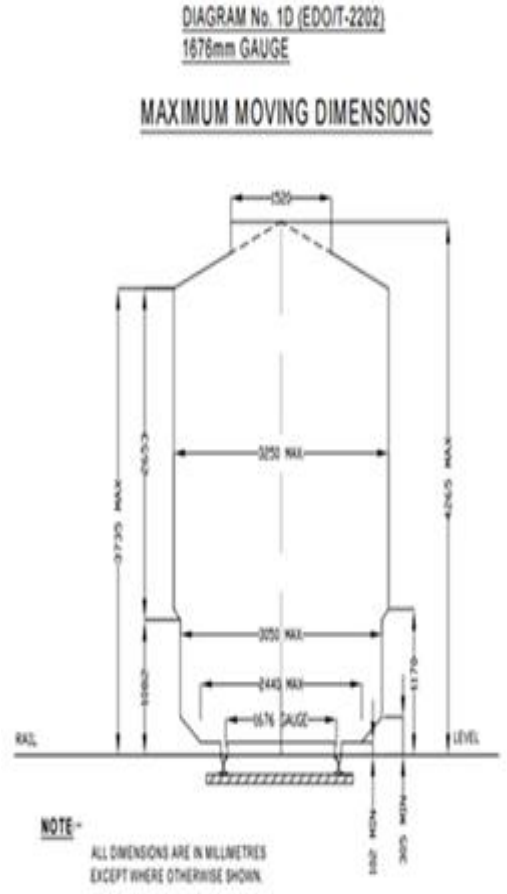
2.7 Flat Wagon: These type of wagons are used to transport cars, bikes, fly ash and coal etc

Fig – 3: Fly ash, coal

III. DESIGN

3.1 INDIAN RAILWAYS ORIGINAL DIMENSIONS (CONFIDENTIAL)

Front view of bogie



Top view

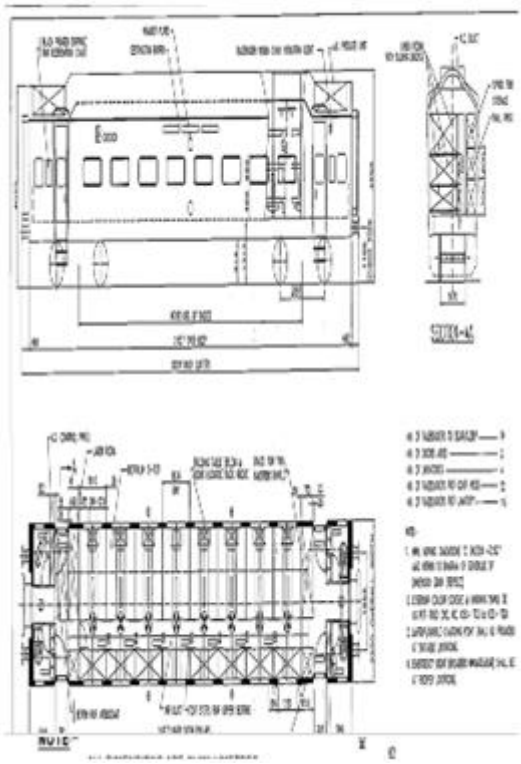


Fig – 4: Side View

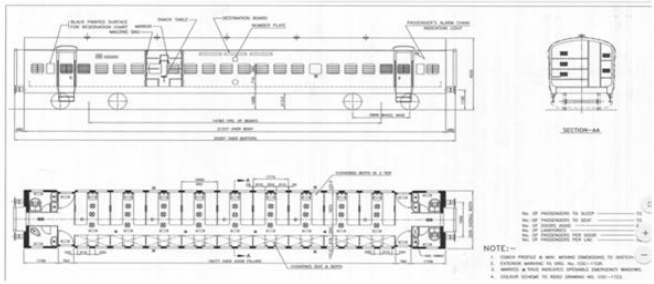


Fig – 5: Proposed design 2-D drawing of New Bogie:

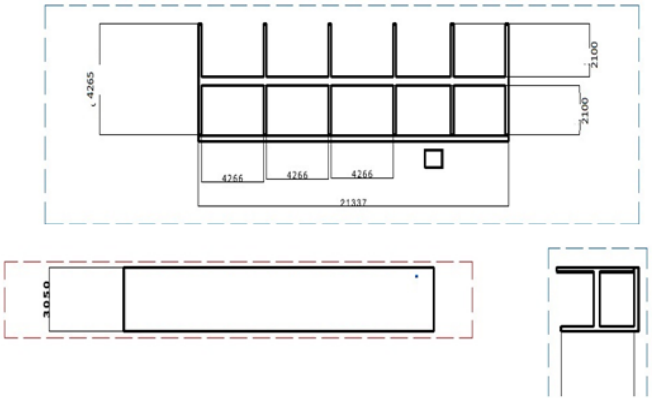


Fig – 6: 3-D view of new bogie in Cati-A

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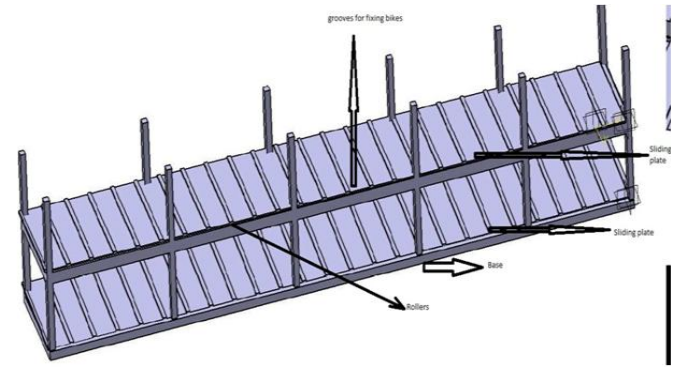

Fig – 7: Bike Stand in the groove

Fig – 7: Bike balancing rod

3.2 BOUNDARY CONDITIONS

Axle load of wagon = 22.9 tonnes
Weight of each vehicle = 120 kg
Total vehicles =100
Total weight =100*120=12000 i.e 12tonnes
From this new bogie design satisfied the factor of safety with respect to weight.
Maximum Rake length should not exceed 626 m
Speed potential to be not less than 100 kmph in loaded and empty condition
Maximum Track Loading Density should not exceed 8.355 tonne/m for 22.9 tone axle load.

3.3 Broad Design requirements

- The design should preferably envisage use of following components to Indian railway standards
- Bogie
- Brake system
- Coupler and draft gear
- The design should facilitate efficient loading and unloading
- The pay to tare ratio should preferably be comparable to equivalent national/international wagon designs
- The minimum fatigue life of the design should not be less than 3 million cycle
- The design should be comply with one of the standards/international design criteria (AAR - Association of American Railroads)

3.4 Originality of the Proposed Design

All the dimensions are taken from INDIAN RAILWAYS SYSTEM as that of old Bogie.
Rollers are present below the slider plate so that it can be slid able forward & back word according to the loading & unloading position
For safe loading total vehicles weight in each bogie is less than the axle loading i.e; 12tonnes of vehicle weighs for 21.9 tonne axle loading
Proper distance is maintained between the vehicles for safe loading & unloading Vehicles are fixed in the grooves so that in train motion also there will be no movement or bending of the vehicle will not takes place

3.5 Integration of the Proposed Design

(a) Case-I

For loading in Manual process
Vehicle will be loaded in the lower compartment & in the compartment a sliding plate will be present on that vehicles will be placed on the grooves present on sliding plate with the help of stand
In upper bogie same sliding plate is present which is slidable on rollers a ladder is presnt for the upper compartment for easy loading & unloading

(b) Case-II

For loading & unloading automatically by Fork lifting machines
In this by using this machine vehicle can be easily loaded & unloaded safely & very fast so that running time can be saved

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Main advantage this design is based on dimensions of old bogie only therefore it can be connected to express trains also by fork lifting m/c we can save the time in intermittent stations & out of 100 vehicles any vehicle can be loaded and unloaded safely without disturbing the other vehicles

3.6 Cost Effectiveness of Proposed Design For Setup And Operation

There should be fork lifting m/c which may increase the cost but for safe and fast loading it is preferred
Otherwise manually also we can easily loaded &unloaded any vehicle easily
If the base design of bogie is made of steel, weight will be reduced strength will be more & also wear resistant & life is improved effectively

3.7 Proposed Design Facilitates efficient loading and unloading of new commodities

In this design proper space is provided between the vehicles so that new vehicles are free from scratch when loading & unloading Sliding plates are provided so that not only two wheelers, four wheelers are also easily loaded & unloaded in the grooves present in the sliding plate

(a) Possible Constraints Anticipated In Deployment of the New Design

We have designed for open bogie but it can be covered with doors for more safety. Indian Railways requires new designs of wagons to ensure that the emerging business is not lost to other modes of transportation.
Innovative design solutions for Wagons for efficient loading/ unloading and transportation of new traffic commodities.

3.8 Air Brake system

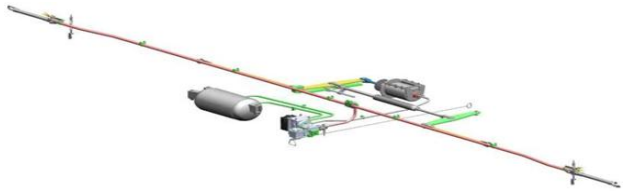

Fig – 8: Air brake system of Wagon

A railway air brake is a railway brake power braking system with compressed air as the operating medium. Modern trains rely upon a fail-safe air brake system that is based upon a design patented by George Westinghouse on April 13, 1869. The Westinghouse Air Brake Company was subsequently organized to manufacture and sell Westinghouse's invention. In various forms, it has been nearly universally adopted.

The Westinghouse system uses air pressure to charge air reservoirs (tanks) on each car. Full air pressure signals each car to release the brakes. A reduction or loss of air pressure signals each car to apply its brakes, using the compressed air in its reservoirs

Salient Features	
Types	Single pipe & twin pipe graduated release
Air pressure (Empty/Loaded)	2.2/3.8 Kg/cm2
Brake rigging	Under frame mounted / Bogie mounted
Hand brake	Side / end operated screw type

Table: 1- Salient Features of Air brake system

3.9 Efficient loading and Transport of Wagons Design for new traffic commodities

The non-containerized payload carried by Indian Railways is largely dominated by Coal, Iron Ore, Cement, Steel Products, Fertilizers, Petroleum products, etc. These lines of businesses are stagnating and Indian Railways is considering alternate commodities for transportation across the countries. Some such commodities are

3.9 (a) Basic Design Requirements

Commodity to be transported
Material of construction

(b) Design Development Process

Coupling Height
Bogie Centre
Track Loading Density
Selection of material
Finite Element Analysis of the model and material optimization

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(c) Inspection & Testing Procedure

Quality Assurance Plan
Welding Procedure Specifications
Check sheets
Material, Stage & third party Inspection
Load test on payload and 25% extra of payload
Brake force test
Squeeze load test
Wagon weighment certificate
Functional Test

3.10 Different Wagon Designs

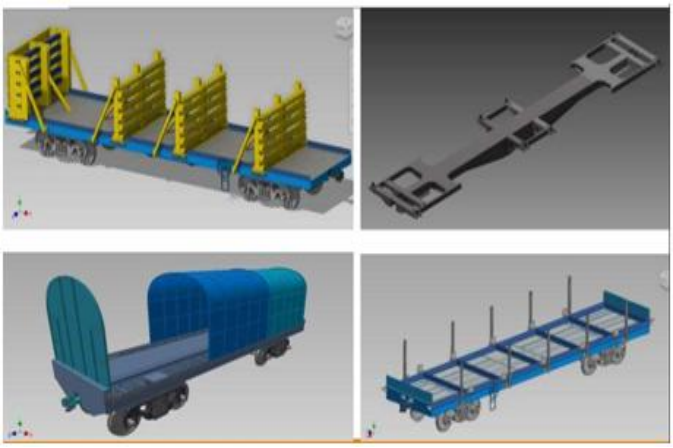

Fig – 9: Different Designs of wagons

Conclusions

- Both the availability of wagon for intermodal stakeholders has been improved in recent years
- With 60‘/80‘ wagon for maritime traffic and 45‘/90’ and 104‘wagon for continental traffic a series of modern types has been developed and became operational
- Innovative ideas such as the flex freight system and the 80’ single wagon will find their market application, too
- For a given variety of loading options and train parameters the most efficient wagon can be selected by the decision criteria presented above, and coupled to a wagon train, thereby respecting the maximal train parameters on the rail route concerned
- Stakeholders can request such wagon at competent manufacturers, leasing companies or railways – depending on their respective business model, or directly ask the transport of one or multiple loading units from the intermodal operators/railways
- As previously discussed, platform size and shape has safety. In general, as the size of the platform increases the possibility of crowding is reduced and thus overall safety improves
- Certain gap mitigation technologies have started to be used more frequently, and these include; gauntlet tracks, movable platforms, and rubberised platform edges.
- In each case, the gap fillers need to be approved by the host railroad for compatibility.
- Which technology is employed is largely a function of mode type and specific platform characteristics.

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