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Improvement of Passenger Seating Capacity and Other Facilities in Indian Railway Coaches

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ABSTRACT:
Among different modes of transportation, travel through train is very comfortable and enjoyable especially for people travelling long distances. Population of people increases day by day and hence the requirements also increases in par with the population. Due to increase in population, most of them are not getting the seats at times. In order to overcome this, number of seats could be increased without modifying the outer dimensions of the coach which will be helpful and beneficial for the required people. The proposed idea is to increase the passenger carrying capacity of coaches of Indian Railways from 72 to 84 per coach. 12 seats per coach are increased when compared to existing non-AC 3-tier sleeper coach. Separate ladder provisions for climbing on to the upper compartments, additional windows, power socket for each seat are also provided.

KEYWORDS:
Passenger carrying capacity; Comfort journey; Frequent journey; Railway coach

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1. Introduction

A vehicle is a good technology and necessary for human life to save their time. There are different types of vehicles; wagons, bicycles, motor vehicles, railed vehicles, water craft, aircraft and space craft. In this manner only, the passenger carrying capacity vehicles are progressed from wagons to spacecraft. All these vehicles will have some advantage and disadvantage and also specifically made for some particular purpose. In that way, one can say the train also has the particular purpose of travelling for the passengers and carrying goods. The train transports are cheaper and faster. They reduce CO_2 and the passengers can have a remarkable and more comfortable experience. There is no waiting time for train unlike air travel. Another important thing about train travel is that it is free to use electronic devices, do not require wearing seat belts which enables the passengers to move and stretch, giving a smooth ride with no traffic which allows the passengers to save time.

On the other hand, the passengers feel uncomfortable due to the unavailability of seats during the peak time. Based on the survey made in Europe, travelling by rail survey was taken in the below two categories:

- Frequency of journey by rail in Europe and in various countries;
- Most frequent purpose of journey by rail in Europe and in various countries.

In the frequent journey percentage of passengers, several divisions are classified to find the percentage of the passengers in Europe alone. The same procedure is applied to find the frequent journey percentage of the passengers in various countries and is shown in Fig. 1.

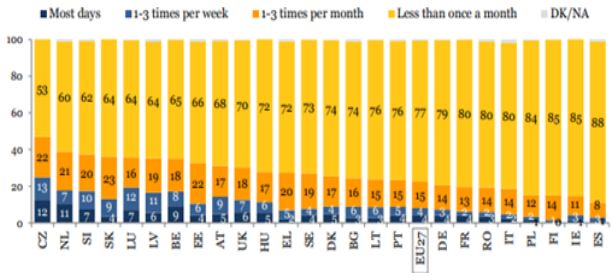

Fig. 1: Frequent journey % of passengers in various countries [1]

Several divisions are classified to find the frequent purpose of journey percentage of the passengers in Europe through leisure, business trip, to work, to school, to university and others. This is shown in Fig. 2. In this also, same procedure is applied to find the frequent purpose of journey percentage of the passengers in various countries. Rajeshwari et al [5] clearly stated the reasons of preference of using the rail transport which was made Coimbatore region. Anuradha [6] explained the survey made in Erode junction and also explained that the rail transport is the best means of transport for all classes of people namely the upper, middle and lower classes of people. Based on this survey, there exists a need to increase the seating capacity in the sleeper coach of the train so that the passengers can get better comfort. On the other hand, the main intention is to enhance the facilities of the train. The suggested changes in the design of the train with the actual compartment dimensions remaining the same are given in the Table 1.

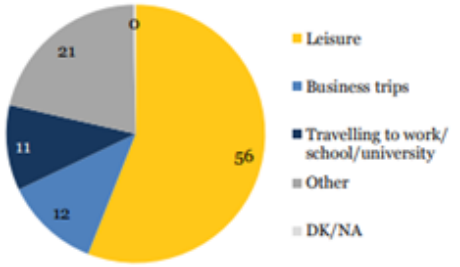

Fig. 2: Frequent purpose of journey % of passengers in Europe [1]

Table 1: Proposal concept outline

Facilities	Increase in number
No. of passengers seat	12
No. of fans	11
No. of fluorescent lights	07
No. of ladders	14
Steel rod and bolt	28
Charging port facility	70
Snacks table	14
Side window	14

2. Proposed design

In existing non-AC 3-tier sleeper coach, the following systems are there [3-4]. Number of passengers to sleep /seating are 72, door aside are two, number of lavatories being four, and passengers per door is thirty six. Number of passengers per lavatories are 18. Twenty seven fans, twenty six fluorescent lamps, two Gangway lights are there in the present design. In the new idea proposed for non-AC 3-tier sleeper coach, number of passengers to sleep/seat is 84, number of doors aside is two, lavatories are four and number of passengers per door is forty two. So number of passengers per lavatories is twenty one. Totally thirty eight fans, thirty three fluorescent lamps, two Gangway lights and fourteen ladders are proposed. Comfortable and safe travel is the need of the passengers. The issues with the available design are lesser number of seats, less air circulation due to lesser number of fans and reduced visibility.

The next important difficulty is to climb on to the upper seat through the available small ladder, insufficient power sockets for customer usage. Among these the first and foremost issue to be solved is to increase the seating capacity available. In order to increase the seats from 72 to 84, the proposed design suggested has been arranged in longitudinal manner with the train axis which will be more helpful for to increase the number of seats and also make the passengers happier in the way of comfort. Feasibility of implementation of seats in the longitudinal axis with the train axis is possible with the accurate dimensions. Centre of gravity is also perfect, so implementation is not a big task and also very easy to implement. Secondly, the air circulation needs to be increased. More passengers are very uncomfortable due to insufficient air circulation in the upper seat. So, more fans are needed and number of fans is increased to increase their comfort zone. Twenty seven fans are there in existing type. Here, only eleven fans are to be increased with the existing dimensions.

Finally, one side window is added extra for free air circulation for the passengers in the upper sleeper seat. Next issue which is to be concentrated is the lighting. People love reading books. For those who read books, they feel uncomfortable. Similarly because of poor lighting in vehicles, things are being stolen in the train. Taking all these factors into consideration, number of fluorescent lights has to be increased. In the existing model, twenty six fluorescent lights are there. In addition to this only seven more fluorescent lamps need to be increased in the proposed design. Next problem faced is climbing the ladder easily is not possible for elderly people in the present model. In order to overcome this, ladders on one side are provided. The ladders are placed on one side and attached with the seat. This arrangement will not disturb the passengers. Charging facilities are also increased in this system. They can charge both the laptop and phone at the same time. Additionally, the snacks table is fixed near the seat, which is more comfortable to take breakfast, lunch and dinner while travelling for a long distance.

As far as seats are concerned there is no risk to push or pull the seats up and down to sleep. Three to four passengers can occupy the seat while sitting. Similarly for fans the constraint suggested should be that it has to be placed at the top with minimum height (300 mm). The lamps should be placed in-between the two sides of seats. It is suggested that it would better to use LED lamps for better vision. Ladder should be placed at the side of the seats. Strength of the ladder should be more for maximum load. Long steel rod is bolted with the seats. This steel rod does not disturb the passengers. The materials suggested are given in Table. 2.

Table 2: Material suggested for implementation

Facilities	Material used
Passengers seat Fans Side window Ladders Steel rod and bolt	Steel, both mild & stainless and aluminium.
Charging port facility Snacks table Fluorescent light	Variety types of plastics and some composites.

The 3D model was done using CATIA V5R20 based on the reference book quoted in [2]. Fig. 3 is the isometric view of the train. The overall dimensions of the train remain the same with the existing one in the Indian Railways. Fig. 4 shows the position of windows in the proposed design. In existing non-AC 3-tier sleeper coach, the number of fluorescent light is increased in new idea proposal as shown in Fig. 5. Ladder has been introduced to get through their seat easily. Fig. 6 gives arrangement of seats and the charging ports inside the compartment. In existing non-AC 3-tier sleeper coach, the left side seats are placed in longitudinal axis and the right side seats are placed in lateral axis with respect to the train axis. There are two seats in left side and six seats are there in right side. In left side, lower seats are in adjustable type and upper seat is fixed. In right side, lower and upper seats are fixed and middle seat is in adjustable type.

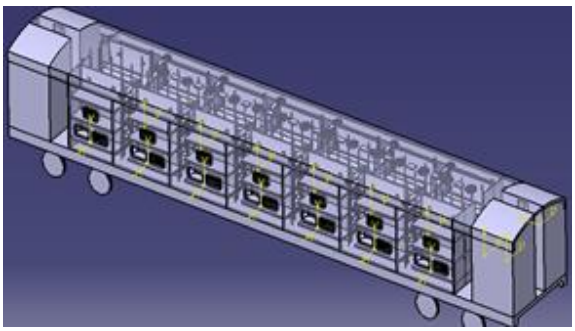

Fig. 3: Isometric view of the train

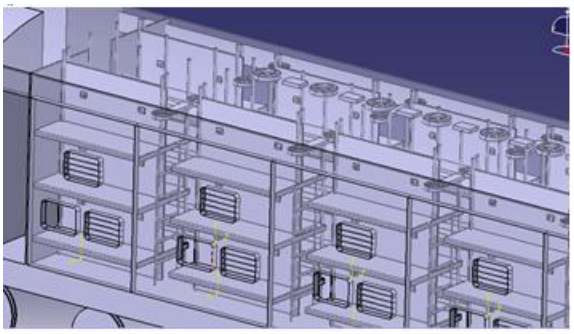

Fig. 4: View of window arrangement

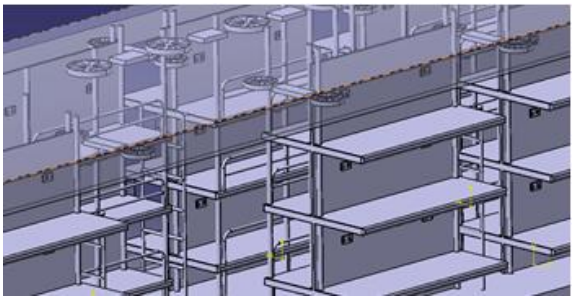

Fig. 5: Seat, light and fan arrangement view

In proposed new idea, all the seats are in longitudinal axis with respect to the train axis. All the seats are fixed. So, twelve seats are easily increased in proposed new idea when compared with existing non-AC 3-tier sleeper coach. Steel rod is used for support and to provide mechanical balance for the seats and passengers. The complete view of the compartment is shown in Fig. 7. Generally, coach outer dimensions are in conformance to one dimensional diagram of Indian railways which was obtained from the official website schedule of dimensions (IRSOD) followed by Indian railways coach design. The location of centre of gravity is shown in Fig. 8.

Fig. 6: Charging port view

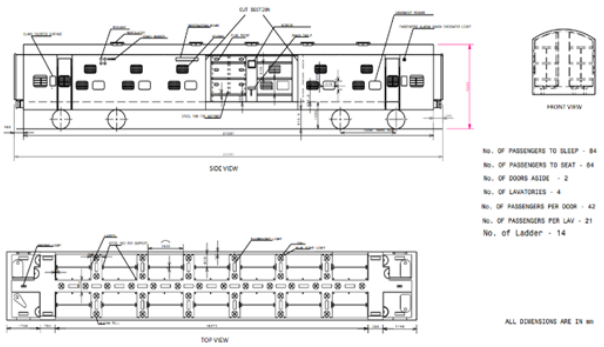

Fig. 7: Complete view of the train

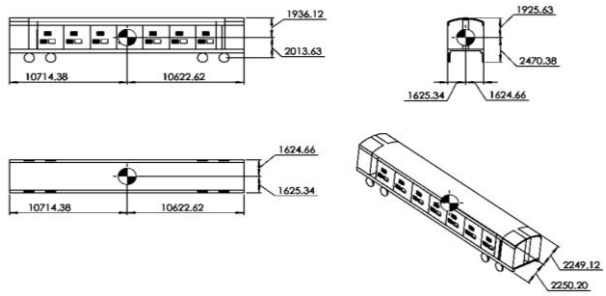

Fig. 8: Location of centre of gravity

3. Conclusion

Opinion poll based on the comfort and discomfort was obtained from different passengers at Coimbatore Railway station. In such a way the difficulties for the passengers were identified. Based on the suggestions the proposed design was obtained. In this proposed idea non-AC 3-tier sleeper coach, the seating capacity was increased to 84 instead of 72.The seat arrangement in the longitudinal axis with the train axis is clearly defined. Support for the seats is provided. Fan, light, charging facility is enhanced from the existing. Totally thirty eight fans, thirty three fluorescent lamps, two Gangway lights and fourteen ladders are designed in this proposed model. Charging either the laptop or mobile phone is possible since only one power point is provided. Here charging facility for passengers to charge both phone and laptop is provided. Hence the proposed design provides better comfort and overcomes the existing issues.

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