JOURNAL OF INFORMATION, KNOWLEDGE AND RESEARCH IN MECHANICAL ENGINEERING
ISSN 0975 – 668X| NOV 16 TO OCT 17 , VOLUME –04, ISSUE – 02

INNOVATION CHALLENGE FOR INDIAN RAILWAYS

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ABSTRACT

Modern express trains in India face the problem of having a higher floor level than the current platform level. It is also seen in new rakes and coaches that there is a substantial gap in between the train floor and the platform. This proves to be a challenge to some people who needs to climb a set of near vertical exterior steps to reach the train floor level from the platform level. Accidents occur when people misstep and fall down in the gaps too. Simple solutions can eliminate this problem. In India, the floor height of express and long-distance trains is not compatible with the platform height and changes. In most cases, the distance increases beyond comfort limit of the passengers. The problem becomes more prominent when people struggle to climb abroad and get down from trains on to the platforms because of steep exterior steps which often lead to accidents and injuries. This is mostly seen with small kids, women, elderly, people with arthritis and others and also while moving heavy luggage in and out of the train. In all the above cases, a simple construction of platform risers and gap fillers can make a huge difference. So from above problems, the solution is to use of platform based ramps, platform based lifts, vehicle based ramps, vehicle based lifts, vehicle based internal lifts, etc.

1. EASY ACCESSIBILITY TO TRAINS FROM LOW LEVEL PLATFORMS

The Central idea is to develop / obtain working solutions for Accessibility to AC 3-Tier Sleeper Coaches of ICF design from low-level platforms over Indian Railways.

1.1 Description of the challenge:

Presently, Indian Railways (IR) AC 3-Tier Sleeper Coaches of ICF design to CSC-1722 have a floor height of 1320 mm from rail level and have a customized design of complete entraining/ detraining arrangement including door with fixing arrangement, footsteps and door handle compatible with platform of height 760mm to 840mm from rail level in such a way that passenger during entraining from platform to coach floor uses a vertically straight parallel foot-steps and similarly during detraining from coach floor to platform.

The solution should include the design and mechanism of operation of a convenient method of train access from low level platforms in a failsafe mode. The participants may particularly look at opportunities of easy retro-fitment and seamless integration in the current design of coaches serving different age groups and physical capabilities. The Challenge aims to encourage creation of innovative, easy to use designs and solution that can enable convenient access to all kinds of passengers (of diverse ages and special requirements) without infringing the current constraints of fixed infrastructure at the station and along the trackside.

1.2 Introduction:

Many transit agencies and researchers recognize that the platform-train-interface (PTI) accidents are an important safety concern; however there has been relatively little research in this area. Incidents that involve the gap between the platform and train are not necessarily only dependent on the gap size. In fact literature review suggests that there may be many other contributing factors that could impact boarding and alighting safety. Various studies from around the world have considered portions of this overarching problem of gap safety in various rail transit modes. These documents have been reviewed and the pertinent information was extracted to insure that this study could effectively address issues surrounding the platform-train-interface. This paper is based on research that is currently being undertaken as part of the Transit Cooperative Research Program (TCRP) project.

1.3 Platform based ramps

The Ramp is stowed at the station usually on the platform in a folded position, and is carriedto the applicable coach when needed. Its operation is performed by the train personnel. TheBAS is usable by all passenger groups. Its application is limited due to the gradient of theramp and usable station platform width.

Figure1. Platform based ramp

1.4 Platform based lifts

The hydraulic or mechanical, manually operated lift is stowed on the platform and positionedat the accessible train entrance when needed. This type of lift serves all vehicle types. Duringits operation the entrance is occupied for the use of other passengers. Most operators onlyallow wheelchair occupants to use this type of BAS.

Figure2.Platform based lifts

1.5 Vehicle based ramps

The ramp is stored in the vehicle and unfolded from the vehicle when in use. The ramp isusable for all passengers, and is manually applied by the train personnel. A disadvantage is itslimited application due to the maximum gradient of the ramp and usable station platformwidth.

Figure3.Vehicle based ramp

1.6 Vehicle based lifts

The lift is installed into the vehicle and unfolded out of the vehicle for its operation. A greatadvantage of the lift is its nearly unlimited application for all platform heights, and also thepossibility of an emergency evacuation in-between station. Amongst all operators, its use isonly allowed for wheelchair users. The vehicle entrance is not available for other passengergroups during the lift operation. The boarding and alighting process is performed only whilethe train is not in motion and the lift is operated by train personnel.

Figure4.Vehicle based lift

2. INNOVATION CHALLENGE FOR 'NEW IDEA/ SUGGESTION TO IMPROVE THE WORKING OF INDIAN RAILWAYS'

The Central idea is to obtain New Idea/ Suggestion to improve the working of Indian Railways.

2.1 Description of the challenge:

Presently, Indian Railways operates an extensive fleet of about 60,000 Coaches, 2.5 Lakh wagons and locomotives to serve the transport and logistics needs of the nation and is the single largest provider of transportation services in the country and is rightly referred the lifeline to the nation. However, its position of pre-eminence has been eroded in the past few years when compared to other modes of transport. Studies have shown that for a country of India's size with nominal distances well over 400 Km, the road transportation may actually be detrimental to industry in general. Despite the obvious advantages of rail transport, the relative share of Indian Railways in the transport and logistics sector within the country is on the decline. It is a good time to pause and reassess our strategy for providing sustainable, assured and preferred logistics services to the nation and contribute towards nation building.

1. Improving overall customer satisfaction
2. Improving Reliability of Assets and Punctuality of Trains
3. Lowering unit cost of operation for passenger and freight transports to improve margins and providing room to maneuver competitive rates and services
4. Revenue enhancement by increasing modal share of Railways in Passenger and Freight transportation
5. Improving Cleanliness in Trains and at Stations
6. Enhancement in Security to prevent theft, pilferage and sabotage
7. Increasing average speeds of passenger and freight trains and reducing overall transit time
8. Improving efficiency including higher assets utilization, turnaround, failure mitigation and prediction.
9. Running of more trains with intensive utilization of existing assets and efficient management of constraints
10. Improving Speed of execution for customers and delivery channels
11. Improving Quality of Services and management of perceptions
12. Energy Conservation
13. Improvement in Organizational and Human Resource Management
14. Better Accounting and Cost Management

The above list of topics is not meant to be exhaustive and participants may either identify areas spanning one or more of above issues or identify a problem area themselves and suggest idea/ solution to address such problems within the overall aim of improving working of the Indian Railways. The idea/ suggestion may be related to a niche activity, major multi-discipline processes or response to external environment.

3. INCREASING PASSENGER CARRYING CAPACITY OF COACHES OF INDIAN RAILWAYS

The Central idea is the development of coach layout of Non-AC 3-Tier ICF design Sleeper Coach of ICF design for increasing passenger carrying capacity.

3.1 Description of the challenge:

Presently, Indian Railways (IR) Non-AC 3-Tier Sleeper Coach have a design of coach layout which was developed considering combined requirements of passengers in different category of trains. These passenger coaches are in service in different type of trains (overnight, long distance mail/express) and are fitted with the vestibules at each coach end and two body side entrance

It invites ideas to modify the existing layout design of Non-AC 3-Tier ICF design Sleeper Coach of ICF design in such a way that passenger carrying capacity is enhanced without compromising existing level of ergonomic comfort and passenger amenities. It aims to encourage creation of innovative, easy to use designs and solutions that can permit a higher number of Passengers without infringing the Passenger's travel comfort. The proposed solution should consider comfort level and ease of movement during normal operation as well as emergency evacuation.

Generally, coach dimensions are in conformance to Diagram-1D of Indian Railway Schedule of Dimensions (IRSOD) followed for Indian Railways coach design. For ergonomics design practice, Indian Anthropometric Dimensions published by National Institute of Design (NID), Ahmedabad can be referred. However, adequacy of information contained in the above publication should be examined prior to use.

1. Investment plans

Indian railway is urgent need of modernize and bring about generational change to its system to assure safety to the users, improve its productivity and make use of the advantages of advance technology. it is also in the verge to respond to the increasing demand and to meet the comprehensive growth aspiration of the nation.

2. Railway station development plans
The railway station has to develop in an extensive manner as the passengers using the railway stations are increasing day by day. Recently as per railway station development plan 400 stations have been identified by Indianrailways. These railway stations will be upgraded with the help of new technologies.

3. Improve infrastructure
Modernization of stations is freight terminals are important to provide complete advance infrastructure, service and facilities.

4. Optimize train operations
The train operation have to be improved provide capability for productive, safe and secure passenger and freight trains with an emphasis of excellence and expansion.
5. Using modern signaling technologies.
Modern electronic signaling technologies have to be used extensively to maximize track utilization and provide high speed operation with safety.

6. Increase the speed of train.
The speed of trains can be increased by renewing tracks, constructing more number of railway bridges , developing accident proof coaches , providing with better signaling facilities. When the innovating plans are implemented fully the rate of train accident will go down. Considerably and speed of trains will improve, and passenger and costumer facilities will progress .quality of service will shut up and railway revenue will also increase.
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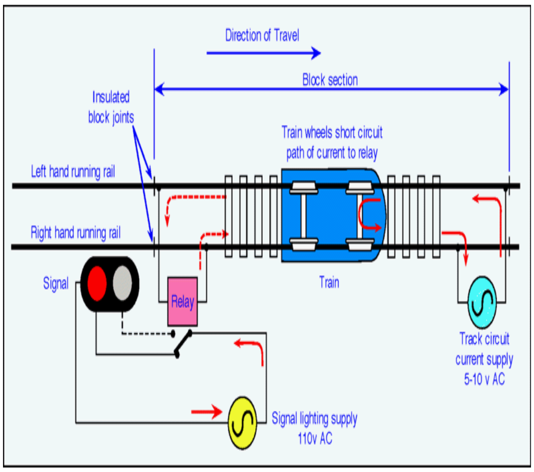

Figure5.Signal for railways

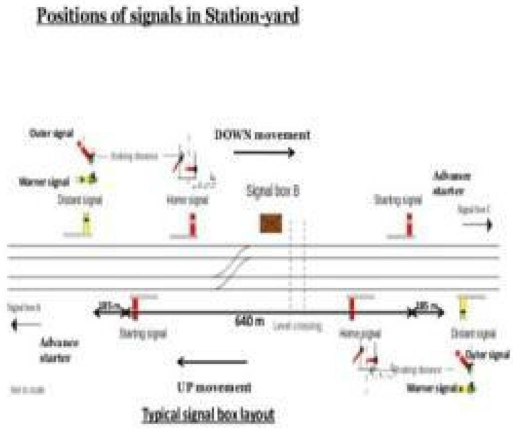

Figure6.Signal Layout

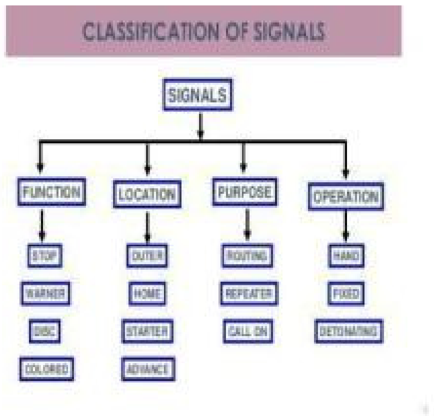

Figure7.Classification of Signals

4. DEVELOPING NEW DIGITAL CAPABILITIES AT THE STATIONS OF INDIAN RAILWAYS

The Central idea is to develop working solutions for management and dissemination of information at Railway Stations and associated premises to enhance the customer satisfaction using new and novel digital insights.

4.1. Central Idea & Description

The Central idea is to develop working solutions for management and dissemination of information at Railway Stations and associated premises to enhance the customer satisfaction using new and novel digital insights. The ideas should be scalable to cover wide variety of stations based on passenger volumes and diverse geographical locations. The Challenge aims to encourage creation of innovative, easy to use products and solutions that can enable and drive access to services linked to passenger touch points right from entry to exit from the station related to convenient and seamless travel. Some of these critical services are ticketing, guidance, circulation and access.

4.2. ACT – the key to smart ticketing

ACT is a proven leader in designing, building and managing smart transaction systems, including solutions that speed commuters through public transport, help shoppers earn rewards, provide access to public services and make it easy for visitors to explore new places. In the transport sector, ACT provides leading UK commercial transport operators and public transport bodies with interoperable smart ticketing platforms that join up regional and national services The company also offers this vast experience in industry-compliant smart ticketing systems as a supplier to major UK train operators including London Midland, FirstSectorial, Southern Rail and c2c. London Midland, which runs more than 1,300 train services a day throughout the heart of England, connecting London, the Midlands and the North-West, supports more than 50 million passenger journeys each year. Aiming to put passenger convenience at the heart of its service while keeping ticketing overheads down, the train operator asked ACT to provide the technicalplatform for a smart ticketing scheme compliant with the UK Government-backed ITSO specification. (ITSO specifies the secure technical, electronic platform on which UK smart ticketing schemes can be built.) The convenience of online ticketing services and a single interoperable smart card has made it easier for passengers to manage their travel and payment arrangements. In turn, London Midland benefits from having more passengers prepaying and arriving ready to board with their valid ticket, which helps speed up boarding times, reduce retailing costs and lower ticket administration costs. ACT provided all the central applications, including its HOPS transaction-processingengine, Customer Management System (CMS) and Retail Fulfillment Service (RFS). It co-ordinated and integrated all the third-party systems, including gates, ticket vending machines, platform validators and a web-based consumer portal to support journey planning. On an ongoing basis, ACT back-office systems manage the card lifecycle, including the issuance of the smart card, called "the key".Cargo Cap is a German company with an innovative idea: transporting freight within and between urban areas using underground pipelines. The system relies on intelligent, individual pods or caps, and is independent of aboveground traffic congestion and weather conditions. The caps are aerodynamic and powered by electric. The benefits include low energy consumption, low initial costs, a long lifespan, and low maintenance needs. Another freight pipeline concept as part of the GRID (Green Rail/IntelligentDevelopment) project in Southern California, envisages freight containers being loaded onto trains in underground pipelines (using massive pipes originally designed for long-distance water transmission). The electric and automated trains would shuttle containers to and from the twin ports of Los Angeles and Long Beach. The increase in container transport capacity this would provide means that several very expensive, environmentally and socially damaging freeway expansions could be cancelled

4.3. Driverless freight train

In Western Australia, mining company Rio Tinto is planning to use driverless trains to deliver its iron ore to ports in what will be the world's first automated, long-distance, heavy-haul rail network. This is expected to increase rail throughput significantly - shortening journey times by eliminating stops for crew changes - and reducing energy consumption and CO_2 emissions through more efficient operation. The fully automated freight trains will begin their progressive rollout in 2014.

4.4.Technology Description

PCP (Pneumatic Capsule Pipeline) is the modern and high-tech version of the "pneumatic tubes" used over half a century ago in New York City and many other major cities around the world for underground transportation of mail, parcels and many other goods. The current advanced PCP systems, used successfully in Japan, utilize wheeled capsules (vehicles) to transport freight through large-diameter underground pipes of the order of 1-meter diameter. Air is blown through the pipe to move the capsules. The system can transport hundreds of cargoes—anything of a size smaller than the pipe diameter. By using modern technology such as high-speed computers and special scanners, the system is highly automated and efficient. Two types of PCP have been developed and used successfully in Japan, one using circular pipes and the other using rectangular conduits—see respectively (a) and (b)In this study, both the circular and the rectangular types of PCP have been considered for possible use in New York City. The circular type is more suitable for smaller diameter PCPs that use pipes up to approximately 1 m (3.28 ft) in diameter to transport small objects such as crushed minerals, mail, small parcels, groceries and solid waste (garbage). On the other rectangular type, using conduits of approximately 1 m by 1 m or larger cross sections, is for transporting packaged large objects including boxes, creates and pallets. As will be seen later in this report, large objects such as the containers carried by trucks, and even the trucks themselves, can be transported by PCPs of very large cross section. This study also explored a third configuration of PCP: a hybrid system that uses box-shape capsules moving in underground tunnels of circular cross sections. This hybrid system is practical only for underground tunnels of circular cross sections, constructed by using modern tunnel boring machines, which result in tunnels of circular cross sections.

This research project uses a novel concept or approach to solve traffic congestion and security problems in large cities—an approach hitherto not seriously considered or studied by any transportation agency in the United States. The study is innovative because of the new technologies used in designing and planning the best system of PCPs for New York City. These new technologies include the most modern and advanced PCP systems used only in Japan so far , an electromagnetic pump (linear induction motor) which is an improved capsule propulsion system developed recently at the Capsule Pipeline Research Center (CPRC)[1] of the University of Missouri , trenchless technologies for constructing PCPs [1], and use of RFID (Radio Frequency Identification) systems and other modern high-tech equipment for monitoring and automatic control of PCP systems. Success in this study enables the New York City to use the most advanced PCP systems in the world for future freight transport, benefiting the City and the State.

4.5 CURRENT R & D

Current R&D in PCP is centered in Japan. The Sumitomo Metal Industries, Ltd. in Japan has developed and used PCPs of both round and rectangular cross-sections for transporting minerals , for constructing long tunnels for bullet trains, and for highway-related projects . The Company’s current effort is focused on developing and using a vertical PCP system to transport and dispose of solid waste deep underground, and ways to improve current systems used in Japan. In the United States, research in PCP exists in three places: The Capsule Pipeline Research Center (CPRC) at the University of Missouri-Columbia is studying the use of linear induction motor (LIM) to power PCP. Note that LIM is the same technology used for powering magnetically levitated high-speed trains, and for accelerating modern roller coasters. The current PCP systems use blowers (fans) to blow air through pipes; the moving air in turn propels the capsules. Use of LIMs instead of blowers to propel capsules has many advantages such as it simplifies the PCP system design, reduces system costs, and enables capsules to move r hand, the) in Figure 1 below.

5. DESIGN OF WAGONS FOR EFFICIENT LOADING AND TRANSPORTATION OF NEW TRAFFIC COMMODITIES

The Central idea is to develop design of new efficient wagons for upcoming transportation commodities like fly-ash, agricultural produce, milk, two wheelers etc. for Indian Railways

Presently, 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 to cater to such emerging markets; Indian Railways requires new designs of wagons to ensure that the emerging business is not lost to other modes of transportation.It is necessary to original innovative design solutions for Wagons for efficient loading/ unloading and transportation of new traffic commodities. The solution should include the design and efficient method of loading and unloading of commodities for safe handling and swift turnaround duly maximizing the transport of commodities per unit time and cost, taking into account the current constraints of fixed infrastructure

5.1 Bulk

Figure8.

Figure9. Bulky Wagons

Freight wagons filled with limestone await 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 commoditycargo 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.

Bulk freight car scales at the MMA Mack Point yard, ME.
Hopper cars are freight cars used to transport dry bulk commodities such as coal, ore, grain, track ballast, and the like. This type of car is distinguished from a gondola car (US) or open wagon (UIC) in that it has opening doors on the underside or on the sides to discharge its cargo. The development of the hopper car went along with the development of automated handling of such commodities, with automated loading and unloading facilities. There are two main types of hopper car: open and covered; Covered hopper cars are used for cargo that must be protected from the elements (chiefly rain) such as grain, sugar, and fertilizer. Open cars are used for commodities such as coal, which can get wet and dry out with less harmful effect. Hopper cars have been used by railways worldwide whenever automated cargo handling has been desired. Rotary car dumpers simply invert the car to unload it, and have become the preferred unloading technology, especially in North America; they permit the use of simpler, tougher, and more compact (because sloping ends are not required) gondola cars instead of hoppers.

5.2 Heavy-duty ore traffic

The heaviest trains in the world carry bulk traffic such as iron ore and coal. Loads can be 130 tons per wagon and tens of thousands of tons 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[15] Such economies of scale drive down operating costs. Some freight trains can be over 7 km long.

5.3Types of goods wagon

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

Figure10. Goods Wagon

• Open wagons (US/Canada: gondolas) were formerly referred to in Germany as *O* wagons; today the international standard types are:
• Open wagons of standard design (UIC Class E) with at least 85 cm (33.5 in) high walls, with side-doors, and without self-discharging equipment

JOURNAL OF INFORMATION, KNOWLEDGE AND RESEARCH IN MECHANICAL ENGINEERING
ISSN 0975 – 668X| NOV 16 TO OCT 17 , VOLUME –04, ISSUE – 02

- Open wagons of special design (UIC Class F) – especially self-discharging wagons (see photo) of type Fcs092.

Figure11. Open Wagon

- Covered wagons or vans (US/Canada: boxcars) have a fixed roof and are mainly used for the transportation of part-load goods or parcels. Today these are divided into:
  - Ordinary classes (UIC Class G)
  - Special classes (UIC Class H), which are often distinguished by their large loading volumes.
  - Livestock vans (US/Canada:stock cars) for transporting cattle are no longer used. In Germany they were called *V* wagons and were counted as a special class.

Figure12.Covered Wagon

- Refrigerated vans (Class I wagons), formerly known in Germany as *T* wagons (T = "Thermos") – are insulated covered vans which are either cooled by a cooling medium such as water or dry ice like conventional refrigerated vans, or are machine-cooled wagons with their own cooling system.

Figure13. Refrigerated Wagon

- Flat wagons (US: Flatcars) have no walls or low walls no higher than 60 cm (23.6 in). Today these include wagons with individual axles in UIC Classes K (standard) or L (special), bogie wagons of UIC Classes R (standard) or S (special).

Figure14. Flat Wagon

- Wagon with opening roof
- Wagons with sliding roof (UIC Class T) either have a flat wagon floor or equipment for self-discharging.
- Special wagons of UIC Class U include powder wagons and low-loading wagons
- Tank wagons (UIC Class Z) are suitable for a wide variety of fluids and gases.
- Spine cars to carry intermodal containers.

Goods wagons for special purposes include:

- Departmental wagons are used by railway administrations exclusively for their own internal purposes (such as the slag wagons of Class X in Germany which were mainly based on old open wagons of Class O),
- Ferry wagons with smaller loading gauges for traffic travelling to Great Britain, which were designated with a lower case letter *f*.
- the rarely mixed open, flat wagons of UIC Class O, which are equipped with folding sides or stakes and can be used either as flats or as open goods wagons.
- Mineral wagons

Railway post vans (Mobile post offices) are not counted as goods wagons.

The UIC's instructions were sometimes interpreted differently by the various railway administrations, so that it could happen that almost identical wagons were grouped into different classes. In addition wagons had occasionally to be reclassified after slight modifications. For example, an E Class wagon can become an F Class simply through welding on a door.

6. CONCLUSION

A number of technical design factors that are related to platform-train-interface (PTI) safety have been discussed based on stakeholder input and an extensive literature review. From the background information available some useful conclusions could be made. As previously discussed, platform size and shape can have a significant impact on safety. In general, as the size of the platform increases the possibility of crowding is reduced and thus overall safety improves. It was also determined that straight platforms present fewer problems in relation to horizontal gaps than curved platforms. It should also be noted that curved platforms are more often a problem on legacy systems and not recently constructed lines. 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. Through the literature review and interviews it was found that horizontal gaps tend to present more significant problems than vertical gaps between the platform and train. It has also been determined that gaps between cars or vehicles can be a serious safety problem to both visually impaired and distracted passengers.

7. REFERANCES

1. Rust, R.T., A. J. Zahorik, T. L. Keiningham (1995); Return on quality (ROQ): Making service quality financially accountable. J. Marketing 58 (2), pp: 58-70.

2. Gleave, S. D (2000); Rail Passenger Quality of Service Valuation, London.

3. Agarwal, R. (2008); Public Transportation and Customer Satisfaction. Global Business Review 9(2), pp: 257-272.

4. Vishnuvarthan S. and Dr. A. Selvaraj (2012); Railway Passengers' Satisfaction: A Study In Salem Division of Southern Railway, International Journal of Advanced Research in Management and Social Sciences ISSN: 2278-6236, December.

5. Railway Efficiency – An Overview and a Look at Opportunities for Improvement Discussion Paper No. 2013-12 Arne BECK / Heiner BENTE / Martin SCHILLING.

6. Reena (RamneekKaur) and Dr. Tejinder Sharma, "Assessment of Service Quality- A Conceptual Framework", International Journal of Marketing & Human Resource Management (IJMHRM), Volume 5, Issue 1, 2014, pp. 33 - 41, ISSN Print: 0976 – 6421, ISSN Online: 0976- 643X.

7. A.Elgin and Dr.V.R.Nedunchezhian, "An Empirical Investigation on Service Quality & Passengers' Perception –A Gap Analysis", International Journal of Management (IJM), Volume 2, Issue 2, 2011, pp. 167 - 175, ISSN Print: 0976-6502, ISSN Online: 0976-6510.