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# ROLLING STOCK DIGEST



**INDIAN RAILWAYS INSTITUTE OF MECHANICAL & ELECTRICAL  
ENGINEERING, JAMALPUR**

## **FOREWORD**

A large number of Articles / Papers appearing in National and International Journals and Publications are of interest to Mechanical Engineers on the Railways.

'Rolling Stock Digest' has been compiled with a view to disseminate relevant information in the form of 'Synopsis' of various Articles. Certain Articles appearing in Publications issued by RDSO have also been included for benefit of Zonal Railways. For greater details, the original Articles (reference of which has been indicated) may be referred.

We present this Digest with a hope that it will be of some use to Mechanical Engineers on Indian Railways. It may also be accessed on the IRIMEE Website [http:// irimee.tripod.com](http://irimee.tripod.com).

**Arvind Mathur**  
**Director, IRIMEE**

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# DIESEL LOCOMOTIVE

## DSL – 1

**“Microprocessor based Control System for WDG2 Diesel Electric Locomotives – by Shri M.K.Agrawal”, Jt. Director / Motive Power, RDSO”.**

**Ref: Indian Railway Technical Bulletin, Vol. LVI (Number: 294), Aug 2000 (PP 24-26)**

This paper presents the benefits of Microprocessor based Control System over the conventional E- type Excitation system and its applicability in DLW makes 3100 HP WDG2 (AC-DC) Locomotive. Such system already exists in WDG4 Locomotive with AC-AC transmission.

In E - type Excitation Control System Excitation control, Propulsion control, Wheel Slip, Dynamic Braking, Starting and Safety functions were controlled through major components like Master Controller, DC Exciter, and Pulse Width Modulator etc. In the Micro-processor based Control System besides all these functions being more precisely controlled, some additional functions like Wheel Slip / Slide Control are introduced to increase adhesion. In addition, fault logging for automatic recording and down loading of faults for diagnostic purposes and performance of Locomotive is displayed on the Drivers Display Screen. It further includes a ‘fail safe’ feature for bringing the system into SAFE MODE during system failure; Self Test Feature for testing of Locomotive or any component and ‘Get Home Facility’ to bring back the Locomotive with fixed safe excitation in the event of failure of the Control System.

The Microprocessor based Control System consists of the following modules integrated together to perform the above functions:

- Excitation Control Module
- Propulsion Control Module
- Wheel Slip Control Module
- Data/ Fault logging, diagnostics and Display Module.

Mounting this system in the Locomotive involves minimum alteration in the physical layout of the existing System. Fitment of Microprocessor based Control System has been started at DLW.

## DSL-2

**"Development of Micro-controller based Speed Recording cum Indicating System"**

**Ref.: Indian Railway Technical Bulletin – Nov'2001**

This papers covers brief history of evolution of Speed recording and Indicating instruments for Locomotives of Indian Railways, starting from initial VDO Speedometer for recording data of one day to seven days on circular sheets to Hasler Speedometer with a strip of paper, which suffered problems either due to sensing arrangement or recording needle. Introduction of M/s Medha or M/s Autometer make instrument with mutual inductance type sensor could not solve the problems relating to recording arrangement on paper.

Additional soft memory type Meters introduced in late 90s also passed through phases of development starting from 30 minutes to 3 hours short-term memory. The development of Micro-controller based Speed recording cum indicating system could avoid recording on paper and the data is recorded in a compact credit card sized memory card of 2MB, which could store the data for 60 days and does not require any battery supply. This memory card can be connected to a PC for downloading and using data analysis software provided with this unit.

The papers gives overview of the system equipments and functioning of Speed Sensor, Recorder cum Indicating Unit, Junction Box, Connecting cables with connectors, Memory reader unit and Evaluation software. The Recorder cum Indicating Unit consisting of Micro controller card, Speed indicator, Memory card, Input card, Power supply card, Mother board for recorder, Alpha-numeric display, Data entry keyboard and Additional speed indicator have been described for understanding the principles of working of the system. Recording modes include Time-based recording, Distance-based recording, Speed-based recording, Event-driven recording and Intelligent mode recording.

The Data analysis procedures and procedure for transferring/presenting data in soft and hard form have been elaborated. Memory Freeze Operation by Driver (Operator) in case of accident has been described. The advantages of this System over conventional Systems and its future prospects for better and more reliable locomotive control have also been elaborated.

### **DSL-3**

#### **Centrifugal Oil Cleaners on Diesel Locomotives**

**Ref: Article by Director (MP) / RDSO [Indian Railway Technical Bulletin, Vol LVII (No. 298) , Aug 2001 (PP 16-19)]**

This paper has covered the conventional full flow Filtration system on the existing ALCO Diesel Locomotives, concept of 'Full flow' and 'By-pass' filtration system, barrier/centrifugal cleaning of By-pass filtration, operating principles and theory of self powered Centrifugal Oil Cleaner and application of Centrifugal Oil Cleaner on Diesel Locomotives.

In conventional ALCO Locomotives, barrier type 'Full flow' filtration exists. This has the limitation of reduced filtering efficiency by trapping debris of comparatively larger size and not capable of controlling combustion debris of finer quality, resulting in quicker degradation of lube oil and blocking of Filter elements and finally reduces the life of Engine components by increasing their wear rate. It has been noticed experimentally that a Centrifugal Oil Cleaner in by-pass Filtration Mode in conjunction with the existing full flow barrier filtration improves filtering efficiency of the System and, thus, extends the life of full Flow Filter, increases Lube Oil changing interval and also life of Engine Components. Thus it has proved to be economical and environment friendly.

In WDM2 locomotives self-propelled type Centrifugal Oil Cleaner is fitted in the bypass loop of the main Engine Lube oil system having inlet connection from the Oil pump delivery line after Relief valve and outlet connected to the Sump. About <10 % of the supply of Oil pump is bypassed in this system reducing lube oil pressure by 0.2 to 0.3 kg/cm<sup>2</sup> at Engine idling with water temperature 80°C and at higher notches it does not have any significant effect on lube oil pressure. In Centrifugal Oil Cleaner the pressurized oil flows from spindle to the Rotor through transfer chamber. The oil while leaving the Rotor creates a reaction force at the nozzle causing the Rotor to spin. Due to high speed spinning of the Rotor , the centrifugal force developed in the contaminants separates them from oil by depositing at the inner surface of the Rotor wall. Finally contaminant free oil returns to the sump.

The use of Centrifugal Oil Cleaner has increased Engine life, Oil life and life of full flow Filters and hence reduced the bottleneck of increasing Schedule intervals. The pay back period of Centrifugal Oil cleaner is 3 years. Indian Railways have decided to fit Centrifugal Oil Cleaners on all new locos manufactured by DLW and on rebuilt Locos by DCW / Patiala.

#### **DSL-4**

#### **Development of heat resistant, high axle load rolled wheel for BG locomotives**

New Wheel design for BG Locomotives (named S6Mod2) has been finalized by Motive Power Directorate of RDSO . Profile of the new design gives almost 50% less thermal stress and up to 15% less mechanical stress compared to existing straight plate wheel. This new design will permit lowering of condemning diameter to 1006 mm , thereby, allowing an additional 3 to 5 months wheel life for the existing loco. This design is also optimized to go up to 1010 mm dia (condemning limit)with increased axle load of 22.5 T and can take up 24 T axle loads at 1016 mm dia. (condemning limit) .

The advantages of this new design are as follows :

- More heat resistance capacity and ,thereby, increased factor of safety.
- Reduced mechanical stress and, thereby, increased factor of safety.
- Condemning dia of the existing locomotive (having axle load upto 21 T) can be reduced to 1006 mm from 1016 mm.
- Axle load can be increased to 22.5 T and simultaneously condemning dia can be reduced to 1010 mm from existing 1016 mm for future locomotives.
- Axle load can be increased to 24 T keeping condemning diameter 1016 mm for future locomotives.

In a nutshell the new design will increase safety and life for the existing locomotive wheels and will be capable of meeting the future needs of heavy axle load.

## **DSL-5**

### **Self-Cleaning Automatic Engine Lubricating Oil Filter**

Paperless Self-cleaning automatic Engine Lubricating Oil Filter (Moatti filter) has been developed by M/s Alfa-Laval in consultation with RDSO suitable for use on IR Locomotive. This Model was evaluated at RDSO through laboratory trials.

This Filter has filter elements with very fine metallic mesh and no paper or similar media is required. The test results have indicated that the cumulative efficiency and the pressure drop characteristics of this Filter are far superior to the existing paper Filters. Other advantages of 'Moatti' Filter are:

- Low-pressure drop across the Filter
- No Filter bypass
- Sealed lube oil circuit need not be opened for 18 months
- Environment friendly
- Simplified maintenance

Detailed Field performance of these Filters is being planned by RDSO.

## **DSL- 6**

### **General Motors EMD Expands in Europe**

**Ref.: International Railway Journal, (October-2000) (PP 24-25 )**

This paper presents the strategies adopted by General Motors' Electro-Motive Division (EMD), United States, to increase its influence significantly in Europe's Diesel Locomotives market.

Rail Networks in 19 European countries presently use GM Locomotives. This includes 400 Locomotives in Britain and Ireland, 500 Locomotives in Central and Western Europe and 400 in Eastern Europe and expected to increase more in near future. Most of them are built by local manufacturers under license to EMD. However, in the longer term the company will be able to establish its own manufacturing bases in Europe. As per Director of GM/EMD's International Business Division, their business philosophy is based on two pillars - tailoring the technology to local needs and working in partnership. In Europe their focus is on providing innovative products, services, and financial solutions. In the wake of revitalisation of rail freight and passenger traffic alliances with others will be the key to expanding their European business.

In German and French Railways their locomotive has negligible fleet. However, they hope their market will improve once their Class 66 Locomotive gets Safety Certification of operation in German. To offer full transport solution in European market their strategy will be to lease fleet of locomotives, to deliver a range of full maintenance service and to provide genuine components and superior technical assistance to the customers, as they need. In Eastern Europe they expect offer for re-powering which will be an economic method of modernizing their fleet. To cope with the harsh environment conditions at CIS they have designed Tera 1 Locomotive in collaboration with Russia for greater reliability, in which EMD has incorporated diesel engine and traction packages together with Russian bogie technology, structural design and safety technology.

# CARRIAGE AND WAGON

## CW-1

### **Design of an efficient crashworthy Lifeguard for current and future Electric Multiple Unit Bogies**

**Ref: Author by E.C.Chirwa, E.J. Searancke and SMP Wong (Proceedings of Institution of Mechanical Engineers Vol. 215)**

This paper presents an experimental investigation into crash worthiness and failure phenomena of steel Lifeguard for Class 465 EMU Bogies. Lifeguard, an energy-absorbing device (absorbs 65 % more energy), fitted to leading edges of train bogies, deflects obstacles away from wheel/rail interface and, thereby, absorbs impact energy through plastic deformation. Under quasi-static loading, Lifeguard can withstand a load of upto 35 KN applied horizontally in global longitudinal axis of train. Difference between static and impact loading is in the collapse mechanism. Typical dynamic loads are between 3.5 and 3.8 times the quasi-static loads. The results of experimental work, Mechanism of deformation using quasi-static and dynamic tests and Finite Element Analysis show good correlation. Overall collapse mechanism absorption can be carried out in three distinct process Yielding, Plastic hinge formation and rotation, followed by global plastic hinge formation near bolted joint.

## CW – 2

### **On the Optimum Design of Railway Passenger Vehicles**

**Ref: Author G.R.M. Mastinu and M.Gobbi (technical university)  
[Department of Mech. Engg. Politecnico di Milano (Technical University), Milan, Italy)**

What architecture of a railway passenger vehicle would guarantee the lowest possible Life Cycle Cost? How long should a railway passenger vehicle be ? And how many wheel sets should it have? What is the optimum inner layout? These basic questions seem to be difficult to answer, especially if responses derived from rigorous reasonings are required.

A method is presented for the concept design of railway passenger vehicles .The method requires adequate mathematical modeling for describing quantitatively the many relationships between vehicles parameters and vehicle performances indices. The main purpose of the method is defining the layout of the vehicles in order to obtain the lowest possible Life Cycle Cost. LCC method is based on Multi Objective Programming (MOP), a branch of Operation Research. By the proposed method, optimum design of railway passenger vehicles can be performed in a theoretically correct and rigorous way.

The optimum design of urban, suburban and Intercity (IC) passenger vehicles is performed in order to obtain the best compromise between conflicting requirements such as maximum payload, minimum tare weight and axle load, minimum track deterioration, maximum ride comfort etc.

It is shown that, with respect to modern vehicles, a major improvement in Life Cycle Cost (LCC) would be gained if shorter vehicles and newly designed wheel sets and bogies could be adopted. Should this happen, new families of passenger vehicles with two or three axles would be the optimal solutions to be built? The main contribution of the Paper is the presentation of a reliable and effective method for optimizing main layout parameters of railway vehicles.

### **CW – 3**

#### **Dynamic Effects of Vehicles on Tracks in the case of raising Train Speeds**

**Ref.: Author W.M. Zhai, C.B. Cai , Q.C.Wang, Z.W. Lu and X.S.Wu [Proceedings of Institution of Mechanical Engineers Vol 215 Part F]**

There is a general trend to increase the train speed of railway transportation all over the world. In India, the speed of passenger trains as well as goods trains has been increased in recent times. At such high speeds it becomes essential to study the Rail-Wheel interaction as with the increase of train speeds Rail-Wheel interaction will unavoidably be reinforced and the dynamic effects of trains on tracks will inevitably be enhanced. The paper is an effort to study the dynamic problems with the existing track structures in Chinese Railways caused by raising Train speeds. The authors have dealt with in this paper the four major dynamic problems that are faced at higher speeds:

- Impacts and vibrations at turnout structures
- Impacts between wheel and switch
- Dynamic problem in Bridge – subgrade transition Section.
- Dynamic effects of Wheel-flats on Track.

### **CW-4**

#### **Review of Contemporary Freight Car Bogie Design**

**Ref: Author B.T.Scales [Institution of Mechanical Engineering Proceedings 1996 ( No. C511/8/027/96)]**

There is much interest at present time concerning the design and performance of freight car bogies. Innovative designs are being developed and tested. Modifications are being made to three-piece bogies in attempt to overcome problems experienced in service. The selection of most suitable bogie depends on capital cost, maintenance cost, operational requirement, safety and risk of derailment.

Review covers three-piece bogies and 16 innovative bogies developed during past 30 years. Operating problems of three-piece bogies are described as introduction, followed by requirements of ideal bogie. Bogies are classified into four categories according to structure, suspension and features. Each category has been described generically with illustrations and advantages, disadvantages and practical examples. Test undertaken are referenced and results have been summarized. The author concludes with examples and advantages that Radial primary suspension bogie can meet all the requirements of ideal bogie.

## **CW-5**

### **Development of a Crash Worthy rail Passenger seat**

**Ref.: Author C.Browmer, The Engineering Link Limited, Derby, U.K. [Railway Rolling Stock I.Mech. Seminar Publication 1996-97 (Page11-16)]**

A considerable amount of R&D has followed the Clapham accident of 1998 when one MKI passenger Train ran at speed into the rear of another MKI Passenger Train. A Project to develop crashworthy rail passenger seat has been taken and this project has used experience gained by undertaking accident investigation and use of computer simulation and instrumented tests. In order to establish the cause of passenger and staff injuries sustained in collision, the interiors of rail vehicles involved were initially examined for evidence of damage and passenger impacts. An investigation was under taken to establish the number of recorded injuries to specific body regions, which could be attributed to impacts with seats.

The improvements made in seats are changed seat back characteristics, failure initiator, unidirectional seating configuration etc. The result of the test conducted on new crashworthy seats confirms predicted injury levels within the proposed limit of passenger injury criteria.

## **CW-6**

### **Lightweight Structures meet tougher Crashworthiness standards**

**Ref: Author Simon Leutengger, Alios Starlinger and Jurg Zehnder [Railway Gazette International (February 2001)]**

Modern rail vehicles are designed so that a stiff and strong passenger saloon is protected by energy-absorbing crumple zones. With high-energy collisions the structural concept is much more important than the choice of the material. Aluminium alloy bodies, which normally consist of double skin extrusions, fail by rupture in the weakest zones of the structure. Steel bodies, which are usually single skin or thin sheet double skin, will fail by global or local instability of the shell. In comparison to Steel, Aluminium has lighter weight which leads to energy saving and hence lower life costs. Comparison of calculations and pictures of real collisions show that there is a high probability that a double skin Aluminium passenger structure, before failing by rupture in the weakest zones, has the potential to absorb more energy than a steel design before failing through global instability.

Given two shells of comparable weight, one is steel and other Aluminium, the lower specific mass of Aluminium means that the elements of this structure will be thicker than those of the steel body. In terms of buckling phenomena, the low and , therefore, better slenderness of the detail Aluminium structures usually dominate the lower Young's modulus due to the squared influence of slenderness. So the Aluminium structures start to buckle at higher forces than detail steel structures of same weight because of the higher buckling stress and greater cross-section. The light weight design is essential partly to keep the kinetic energy low and partly to permit the best use of efficient energy-absorbing zones where no passengers are present.

## CW-7

### **Don't smash the Biscuits! (Specialised Wagons)**

**Ref: Rail Investment 2001.**

Trucks are getting heavier and more fuel efficient, and, leaving aside road congestion, their service is getting better. Barges too are becoming more efficient than they were. Governments are refusing to tax trucks or barges appropriately; so the Railway industry must compete by pushing its technology as hard and as fast as it can.

Wagons specifically developed to meet shippers' need can increase railway revenues, lower the shippers' cost and improve efficiency. Some examples of specialized freight wagons are Coal hopper, Center beam bulkhead flat, Bulkhead hopper, Pressure differential hopper or Tank, Covered hopper, Multi-unit wagons, Double-stack wagon, Hi-cube box, Grocery wagons, Refrigerated wagon, Multi-purpose wagons, Steel Coil Wagon etc.

Specialized wagons do not increase the proportion of route run empty. With a good wagon, designed to permit back hauls where possible, and modern methods of movement control, some wagons can have loaded Km in the order of 65% and in limited case as high as 80%. Net-tare ratio has to increase and cost of empty back haul has to reduce. Our endeavor should be to transport fragile and heavy items to their destination at a competitive price.

## MISCELLANEOUS

### MISC – 1

**Design, Fabrication & Testing of Heat Recovery System from Diesel Engine Exhaust**  
**Ref: Article by AD Desai & Prof. P.V. Bannur ( Journal of the Institution of Engineers (India) Vol-82, April – 2001)**

The paper is about conservation of energy through heat recovery from Diesel Engine Exhaust. There is an urgent need to reduce specific energy consumption as compared to other countries and with energy prices going up and fossils depletion, this is one recourse which is very important. Process heat recovery from wastes discharged to atmosphere requires capital expenditure and feasibility study is required. Sources of waste heat are Exhaust air, Flue gas, Hot condensate, Refrigerant hot gas, Solid waste & Engine exhaust.

The paper discusses in detail about Engine Exhaust. The author has indicated details regarding design of Heat Exchanger in a) Thermal and b) Mechanical Aspects . Mass flow rate, temp and pressure etc. at inlet and outlet of water and exhaust air are measured and performance of Heat Exchanger is tested. The Heat Exchanger works satisfactorily with thermal effectiveness between 80 % and 82%. As the pressure drop in the Heat Exchanger is very low, the backpressure of exhaust is not found and working of engine is not disturbed.

The above experimental Model shows the way to conserve energy in specially larger Engines of Process Plants. Most of the industries these days have large Diesel Engines as D.G. set. The waste heat of such engines can be recovered to the extent of 12% to 15 % of total waste heat. The effectiveness of the Heat Exchanger is > 80%.

### MISC-2

**World trends in the development of Railway Electrification.**

**Ref: Article by:**

- (i) Professor Alexander Kotelnikov, VNIIZht Moscow & Member of Russian Transport Academy.**
- (ii) Anzor Glonti – Professor, University of Wilmington, Member of the National Academy of Georgia, OSJD Committee, Warsaw. [Rail International - (Aug – Sept- 2001).]**

Out of about 1 million Km Track length of the world, 25% is electrified while volume of traffic carried by electrified route is about 50%. Average volume of freight carried by Electric trains is three times that carried by Diesel trains. Highest proportion of electrified track is in Europe (45.7%) followed by CIS (24.3%), while American continent (North & South America) has 1.7% electrified route of their total track length, although much greater volume of goods is hauled in USA & Canada. In absolute length, Russia has maximum electrified route (40,300 Km) followed by Germany (18,800 Km) and South Africa (16,800 Km).

High proportion of electrified lines in Europe is due to (a) dominance of passenger traffic requiring higher speed and acceleration (b) Environment related problems in densely populated Europe.

The details regarding type of electric traction used is tabulated below: -

Type		%
AC	25KV/50Hz 15KV/16-2/3 Hz	40.5%
		14.6%
	<b>Total</b>	<b>55.1%</b>
DC	3KV	35.2%
	1.5KV	7.8%
	<b>Total</b>	<b>43%</b>
<b>Others</b>	50 KV/50Hz,11-13 KV/25Hz 0.75 KVDC & 0.6 KVDC	2%

In the CIS 41% of Railway lines are electrified which account for 71.6% of traffic (Ukraine, Kazakhstan etc.). Armenia & Georgia are entirely electrified, while Azerbaijan is at 60% level of electrification. Russia with 9% of World Rly network possesses 17% of the world's electrified lines (40,300 km). Its 46.8% of the track is electrified, which carries 77.7% of the traffic. The cost of transport is 1.5 to 2 times lower on certain electrified lines in Russia than on lines worked with Diesel Locos.

From the statistics, it clear that all industrialized nations except American Continent have gone for electrification and they carry disproportionately high traffic. The expert view is that for a developed Railway network such as Russia, the optimum traction mix will be 50-60% electrified route which will carry 80-90% of rail traffic.

The advantages & disadvantages of electrification are given in the following table:

Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• Maximum power of Electric Loco (6000-10,000 HP) as compared to Diesel (4,000- 6,000 HP).</li> <li>• Smaller consumption of components subject to wear.</li> <li>• Less noise &amp; environmental pollution.</li> <li>• Smaller Loco Fleet required.</li> <li>• Less dependence on fluid hydrocarbon &amp; lubricant.</li> </ul>	<ul style="list-style-type: none"> <li>• Creation of substantial infrastructure of power supply, substation, overhead lines, signaling system changes &amp; other equipment to maintain &amp; serve the above installation are required.</li> <li>• Critical Traffic Volume above which cost of transport will be lower of electric traction will have to be determined.</li> <li>• Heavy investment in Infrastructure.</li> </ul>

Case Studies of USA, Italy, South Africa, Scandinavian Countries, and South America & Russian Railways indicate that it is local conditions like Volume, Critical freight traffic volume, required investment on massive infrastructure etc. which electrical traction is technically and economically efficient.

In some countries of South America (viz Brazil, Chile etc.) de-electrification has also been resorted to.

### MISC-3

#### Diesel emissions of European Railway Vehicles

**Ref: The Environmental policy of the UIC by Hans Paukert, ERRI Project Manager for Diesel Engines. (Rail International Feb – 2002)**

- As European Railway is mostly electrified (85% of Traffic) and Diesel loco is mainly used for Switcher services, the Main line locomotives above 2,500KW power are rarely available. Hence, not much attention to the exhaust emission of Railway vehicle was given. However, with increased awareness about pollution and European Switcher working in yards situated in densely populated cities, the demand for regulation is building upon Railways.
- UIC Leaflet 623 was developed in 1980 and includes Exhaust emission limits in addition to detailed procedure for type testing diesel engine. But this is only of recommendatory nature and not mandatory. An investigation in 1999 showed that about 75% of European Railways do not have even detailed information about their vehicle emissions.
- A new mandatory UIC Leaflet 624 using steady state 'F' Cycle of ISO 8178-4 was drafted and the limits are given below:

Pollutant	Permissible level upto 31/12/02 (g/kWh) UIC I	Permissible level from 1/1/03 (g/kWh) UIC II	
		P≤560 kW	P>560 kW
Power Range		P≤560 kW	P>560 kW
CO	3	2.5	3
NOx	12	6	9.5 (For n>1000 U/min.) 9.9 (For n≤1000 U/min.)
HC	0.8	0.6	0.8
Bosch Index	1.6 (2.5)	-	-
Particulates	-	0.25	0.25

- Measuring Exhaust emission of Diesel Electric Loco is comparatively simpler than that of Diesel Hydraulic Loco. In case of Diesel Hydraulic loco, emission testing of the Engine at Manufacturer's Test rig was accepted as norm.
- Although Diesel traction is responsible for less than 1% of air pollution in dense European continent, Railways do not want to lose their reputation as environment friendly mode of transport.
- Pollutant limits for 2008 have already been envisaged to comply with ever decreasing Exhaust gas emission limits.

#### **MISC-4**

##### **Status and prospects of Fuel Cell Vehicles**

**Ref: Automotive Electronics and Alternate Energy Vehicles by Bali S. Batra VS and A. Mathur [TERI Information Digest on Energy (Vol. 10) – December 2000.]**

Fuel Cell Vehicle is a leading candidate to meet the challenge of providing performance of today's vehicle with significantly reduced emissions; under certain conditions it can be categorized as a 'zero emissions vehicle'. In Fuel Cell vehicles, the internal combustion engine is replaced by a traction motor, which drives the vehicle wheels by using electricity generated by a Fuel Cell. The Fuel Cell electrochemically converts chemical energy of the fuel, typically hydrogen, to electricity at high efficiency, with no emissions. Since hydrogen can be obtained renewably, the dependence on fossil fuels is also reduced. The main hurdles are the initial cost and the lack of infrastructure for refueling. In this paper, the status of this technology has been reviewed. The authors highlight that the earliest commercialization is likely to be in the urban bus sector. Promising markets for Fuel Cell buses are in countries such as India, which have large urban population and serious air quality problems and maximum benefits can be obtained at such places. To introduce this technology and make it a commercially viable option, a strategy will have to be worked out based on technological and economic assessment.

#### **MISC- 5**

##### **Railways, IOC team up for green Diesel**

**Ref: The Financial Express, 13 September 2002.**

India's largest Oil Company and the single largest consumer of Diesel in the country want to come together on Bio-Diesel. IOC has approached the Railways for running trains on this new, eco-friendly Bio-Diesel (20% blend). The fuel can be produced from any vegetable oil, edible or non-edible. However, since there is a shortfall of oil seeds, the Railways have offered to collaborate with IOC to grow these on its land. *Jatropha Curcus* (a hard variety of non-edible wheat) can be easily grown on both sides of Railway track for the purpose. If 50% of 1,00,000 track-Km is available with 50 metres on both sides, one million tonnes of the crop can be grown every year.

## MISC- 6

### **Effects of poor Tribological Practices: A User's perspective.**

**Ref: Article by Kennets J. Brown (Fellow, Stle), Ontario, Canada. [Lubrication Engineering Vol- 49 No.10, Oct-1993].**

Poor Tribological designs and poor practices are costing industry millions of dollars. Many of the equipment failures and performance losses are preventable. This paper discusses the examples of Losses in various industries like power generation industry, their causes and solutions to reduce and even eliminate the tribological related failures. A need for improved tribological awareness is specially identified.

Out of various tribological issues, rolling bearing life has been studied and it is found that only 9% of bearings reach fatigue limit. At the time of design and selection, much time, effort and price is used for higher values of 'L 10' life of bearing and less attention is paid on other important aspects like lubrication and mounting procedures. As per the study the reasons for rolling bearing failures are as follows:

<b>Reason</b>	<b>Percentage (%)</b>
Improper Lubrication	43
Improper mounting	27
Fatigue Limit	9
Other Sources	21

To reduce failure of improper lubrication, the system of filtration, provision of flushing and oil sampling are considered important issues to be tackled. Lack of awareness regarding lubrication is one problem which has to be overcome to increase uptime of the Equipment.

## MISC- 7

### **Chinese Railway develops Traction to meet Market needs**

**Ref:Article by Xang Xiong, Asst. Vice President, and China Academy of Railway Sciences [Railway Gazette International – August'2000]**

The report indicates the efforts made by Chinese Railways (CR) in the last decade to develop its own Motive power, both for high speed passenger trains and heavy freight hauling on newly planned track, which was under construction. Chinese Railways Steam locomotive production started in 1952 and phased out in 1988. CR started producing Diesel locomotives in 1958 and Electric locomotives in 1960.

At the start of 1990s CR was running passenger trains up to 100km/h speed with an average speed of 48.3km/h. Research and development carried out at China Academy of Railway Sciences was instrumental in producing locomotives and coaches capable to run at 160km/h.

The programme of increasing train speed helped CR's scientific and technological progress. A record speed 212.6 km/h was attained at Test loop in 1997, which was followed by a further record of 239.7 km/h in 1998. This provided a good scientific base for proposed 200km/h speed dedicated passenger lines. Heavy haul trains grossing 5000 Tonnes are quite common in the field of freight transport on the main trunk lines of CR. The latest Chinese-built Diesel and Electric locomotives have a maximum Axle load of 25 tonnes.

The main research and development work will concentrate in three areas. First is the development of modern locomotive with AC asynchronous Traction motors. The first locomotive of this type was built in 1998, but series production did not start. The second field of development is high-speed trains capable of running on dedicated lines at 300km/h. The third area of development is new types of bogies for locomotive and freight wagons. This will be matched with development of 'Intelligent' locomotives and wagons equipped with microcomputer. Research into energy-saving Motive power with low noise emissions and Diesel locomotives with reduced exhaust will also be persuaded so that the Chinese Railways Technical system should catch up with other countries with much advanced technology.

## **MISC- 8**

### **State of Environmental Management as practiced by UIC member Railways.**

**Ref.: Article by Peter Hubner, Dr. Remy Chretien and Sabina Erny**

**[Rail International, November '2002 (PP20-25)]**

This Paper elaborates findings of the Survey conducted on 22 UIC Railway companies. Views indicated by Railway Companies in the field of Environmental Management System have been published in this Journal to attract customer, by showing environmental performance by Railway in the field of transport. Environmental Management is also justified on account of more legal security and cost savings. Environmental friendly operations offer a considerable potential for cost saving. In technical/construction field and operational/organization field, environmental measures are effectively implemented and its fruitful consequences are obtained to enhance the Railway system. The main culprits for environmental hazards are noise and energy consumption. Focus is also laid on waste, land use and vibrations, use of toxic substances, odour emissions and electromagnetic interference.

Environmental performance can be improved through technical and operational measures on one hand and organizational measures on the other. In the field of technical and operational measures, more emphasis was earlier given to water consumption and waste. Later on focus on other areas like air emissions, energy consumption in buildings, use of non-renewable resources and electro smog has been stressed. Organizational measures include documentation of Environmental Policy, identification and assessment of legal regulations and setting of responsibilities for environmental affairs. Most of the companies have set up an Environmental Management System. More emphasis is being given to Auditing, communications and suppliers. All these measures benefit the company in terms of complying with State regulations, creating improved conditions and increasing customer satisfaction.

The key success factor for Environmental Management System is support from all levels of management. Sustainability has to be ensured by incorporating into corporate strategy. Reports related to environmental measures should be published time to time so that work in this field can be reached to employees and other companies.

## **MISC-9**

### **Japan Railways Company Tackling Environmental Problem.**

**Ref: Article by: Yasutaka Mochizuki, Chief Manager, Technical Research & Development Railway Operation, West Japan Railway Company [Japanese Railway Engineering (No. 148) Journal Semi-Annual Issue 2002 (Page 10 to 12)]**

This paper highlights the approaches adopted by the JR West on tackling the global warming caused by the green house gases from different sources of Rail system. For this, the Company established a separate department named "Global Environmental Committee" to address the environmental problems and their solutions comprehensively

The company is going to adopt measures such as Energy saving techniques which include reducing the weight of Rolling Stock and introducing cars with regenerative equipped brakes, optimization of number of cars and train operation schedules for holidays, reducing the distance of feeders to the cars, installation of Solar Electric power generation System at Maintenance Centres etc.

Adoption of Waste management techniques for various types of scrap such as Passenger daily use Waste (i.e. paper, plastics), recycling of Commuter passes and standard Train tickets , Components from Railway Material and Electrical Switching Machines are overhauled and reused. The company is also making efforts for strict disposal policy and pollution control.

## **MISC- 10**

### **Approach of JR Central on Global Environmental Issues**

**Ref: Article by Nobuaki Nakazawa , Chief Assistant, and Central Japan Railway Company [Japanese Railway Engineering Journal (No. 148) Semi-Annual Special Issue 2002 (PP 5-9)].**

This paper enumerates the approach adopted by JR Central on global environmental issues especially global warming caused by greenhouses gases, in which transportation section has a great responsibility.

Railways compared with other means of transportation can be called an excellent conveyance with regards to energy consumption and green house gas emission. JR Central 'Global Warming prevention Voluntary Plan' envisages replacement of all Rolling stocks with an 'energy-saving' type until 2010, to be achieved through introduction of the best aerodynamic shape, decrease of car weight, introduction of regenerative brake etc. An endeavor is being made to improve the convenience, pleasantness as well as the pursuit of safety and stability to counter competition with aeroplanes so that burden to environment is reduced.

This approach also endeavors development and introduction of new energy and highly effective system through 'Solar thermal power generation system', 'Cogeneration system' and also through new innovative means like 'Ice Thermal-Storage-type Air Conditioning System', 'Pure Water boil/cooling type Silicon Rectifier etc.

## **MISC- 11**

### **Lithium batteries: an Environment friendly Fuel.**

**Ref: TIDE (TERI Information Digest on Energy) [Vol. 10 No.4 (Dec 2000)]**

Growing awareness of the seriousness of the pollution problem has resulted in the progressive introduction of low/Zero - emission vehicles such as those powered by batteries. There is an intensive level of activity around the world for the development of advanced battery systems suitable for automotive propulsion. Lithium batteries are considered as potential energy sources for Evs. These batteries show high voltage and high power besides being environmentally safe. In this paper an attempt is made to draw a rough panoramic view of the actual situation of lithium batteries technologies in the world, with an aim to gaining a better understanding of the present and future of the field. Many programmes concerning secondary lithium have been or are being funded worldwide by national or continental authorities in the United States, Japan, or Europe. The USABC (United States Advanced Battery Consortium) has already funded several big programmes on lithium batteries in order to power electric vehicles. The USABC has been investing heavily in lithium polymer, as it has been claimed for years in the United States that it could reach much higher performances than the lithium-ion system. The difference between the two systems has been diminishing and both systems have been improved. It has been shown that economically recoverable lithium world reserves are sufficient to meet the demands of current new consumer car world production and its anticipated growth in the next 50 years. Currently identified world reserves can power 2 billion cars with lithium batteries, which is four times the number of cars presently registered in the world.