Key Note Address

of

Shri A. P. Mishra, Member Engineering

&

President, IPWE(I)

On the Occasion of Inaugural Session

of

National Technical Seminar on

"Introduction of High Speed Through Upgradation of the Existing Tracks"

And

"Elimination of Level Crossings"

Being held on 5th and 6th January 2012 at Pune

Esteemed Audience

1.0 I consider it a privilege to deliver Key Note Address in this Technical Seminar of eminent Permanent Way Engineers. Both the subjects of the seminar i.e. **"Introduction of high speed through upgradation of the existing tracks"** and **"Elimination of level crossings"** are very much relevant for efficient and safe operations on Indian Railways in the coming years.

2.0 **"Introduction of high speed through upgradation of the existing tracks"**, is a challenge to Railway Engineers as it covers wide spectrum of railway track & vehicle design, monitoring and maintenance practices, special protection and warning systems etc. The deliberations in next two days will help in better understanding of various areas of concerns, e.g. design modifications, switching to modern technology and practices, new schedules and types of monitoring with new limits for various parameters etc.

3.0 UIC (International Union of Railways) defines high-speed rail as systems of rolling stock and infrastructure which regularly operate at or above 250 kmph on new tracks, or 200 kmph on existing tracks.

4.0 The speed on passenger corridors on trunk routes needs to be improved from existing 110/130 kmph to 160 to 200 kmph, so that important inter-metro journeys like Delhi-Kolkata and Delhi-Mumbai could be completed by overnight runs. Indian Railways **"Vision 2020"** envisages having more than 6000 kms of quadrupled lines with segregation of passenger and freight services into separate double-line corridors. This shall include Delhi-Kolkata, Delhi-Mumbai, Kolkata-Mumbai and Delhi-Chennai routes. All these routes would have separate dedicated freight corridors and high speed passenger corridors.

5.0 On the issue of High Speed train, approach of Ministry of Railways is two pronged; (a) to raise the speed on segregated passenger corridors on trunk routes using conventional technology in the range of 160 to 200 kmph. (b) to build state-of-the-art high-speed corridors for design speed up to 350 kmph. By 2020, at least four corridors of 2000 kms would be developed and planning for 8 other corridors would be in different stages of progress.

6.0 Indian Railways have identified six corridors for pre-feasibility studies for identifying the best suitable corridor to start the construction of high-speed rail corridors: i.e., Delhi-Chandigarh-Amritsar; Pune-Mumbai-Ahmedabad; Hyderabad-Dornakal-Vijayawada-Chennai; Howrah-Haldia; Chennai-Bangalore-Coimbatore-Ernakulam-Trivandrum and Delhi-Agra-Lucknow-Varanasi-Patna. Prefeasibility studies for four corridors are already in progress. A separate autonomous body named **'National High Speed Rail Authority'** is in the process of being constituted through an act of

Parliament. This body will look after the development of High Speed Rail Corridors.

7.0 In this technical seminar, focus is **on raising the speed on existing tracks to 200 kmph incrementally by upgradation.**

7.1 **High Speed Technology :** Recent advances in wheeled trains in the last few decades have pushed the Test speeds past 500 kmph, among the technological advances being tilting train-sets, aerodynamic designs (to reduce drag, lift, and noise), air brakes, regenerative braking, dynamic weight shifting, state of the art signaling and control systems, etc.

7.2 High-speed tracks would be maintained and inspected using automation to ensure required track geometry. Better inspection and compliance system has to be in place so that there is absolutely no compromise with safety.

7.3 Presently, all over the world, ballastless track is more acceptable option than the ballasted one for introduction of high speed trains. The French network mainly comprises of traditional ballasted track, whereas Japan and new construction in Europe primarily focussed on slab track. The main advantages of such structures are; Reduction of structure height; Lower maintenance requirements and hence higher availability; Increased service life; High lateral track resistance which allows future speed increases in combination with tilting technology and elimination of problem of flying ballast at high-speed.

8.0 IR is already running train at 150 kmph in Delhi-Agra Cantt. Section. A blueprint for running high speed services has to be prepared along with a well designed safety plan. The infrastructure for high speed services must conform to highest safety norms. Train operations at higher speeds of more than 160 Kmph will necessitate superior maintenance facilities and use of track side monitoring equipments to give advance warning regarding hot axle, hanging parts, wheel flats, brake binding and fire in coaches.

9.0 Issues connected with Track:

9.1 A plan for removing bottlenecks for achieving longer restriction free runs will have to be made and realignment of curves to flatter curvatures, increase in transition lengths will have to be done on a large scale. Pre-feasibility surveys, are, therefore to be carried out for all such routes. One such survey for Delhi-Mumbai route is in progress by a Japanese team.

9.2 Formations, sleeper-fittings and bridge approaches will need to be specially designed and upgraded. Thick-web switches and moveable nose crossings will have to be provided on these routes.

9.3 All AT welds shall need to be replaced with Flash Butt welds and repairs will have to be done in situ by portable flash butt welding plants. Railway Board is considering to provide one mobile FBW Plant to each division.

9.4 Extension of rail life by grinding and rail lubrication will become a necessity. Improved types of switch expansion joints (SEJ) would be required to be used.

9.5 Cost effective options for mechanized track maintenance shall have to be explored. There has to be complete mechanization of track maintenance activities. A decision support system such as **Track Management System (TMS)** will be in place to optimize material, machine and equipment and manpower inputs for track recording-cum-monitoring on the entire Indian Railway network (including Ultrasonic Flaw Detection Cars) capable of recording precisely the location of track irregularities. Suitable techniques for data management will be developed so that track maintenance philosophy shifts from present **"Find and Fix**" to **"Measure and Predict."** Permanent-way engineers shall also be provided with **Personal Digital Assistant** (**PDAs)** for recording inspection inputs.

9.6 All the maintenance and construction activities related to track shall be mechanized. Trackmen will be equipped with small track machines also**. Rail Mounted vehicles (RMV)/Rail-cum-road vehicles** would be increasingly used to facilitate movement of maintenance units.

9.7 All the maintenance units will have communications from worksites in block sections to the control offices. Maintenance blocks shall be taken by P.Way and Bridge Engineers through mobile phones by software encoding. Integrated assured blocks shall be made available so that a culture of zero defect and "no surprises" exists during operation of trains. It is envisaged that by 2020, the health monitoring of assets should be completely mechanized.

9.8 Lubrication of rails will be done with mechanized means to reduce friction between wheel and rail and reduction of rail wear on sharp curves.

9.9 Existing Bridge Sleepers, both Wooden and Steel Channel, are to be checked for fitness else new designs have to be developed. Steel or composite Sleepers may be thought of.

9.10 All through fencing of track is essential to prevent trespassing and to eliminate instances of cattle run over, which may lead to derailments with serious repercussions due to high speed. To begin with, fencing can be provided in stretches to be identified by the Zonal Railways as prone to trespassing/cattle crossing. Zonal railways should also provide subways at suitable locations to avoid trespass and ensure effectiveness of fencing provided. Suitable cost effective, vandal and theft proof design of fencing will have to be developed.

9.11 The track geometry standards depend upon interaction of rolling stock with track. Standards will have to be revisited with new type high speed rolling stocks and a lot of R&D effort will be required on the subject.

9.12 Frequency for track recording/ monitoring may have to be increased to ensure proper track geometry at all times. Depending upon number of high speed trains, parameters and frequency of monitoring will have to be fixed.

9.13 A firm definition for identifying weak formation has to be developed so as to take up rehabilitation/strengthening works in those identified patches. Stretches of existing weak formations, if any, will have to be rehabilitated / strengthened beforehand.

10.0 Issue related with Bridges

10.1 Condition of bridges shall have to be monitored through a Bridge Management System. Deflection settlement monitoring sensors will be fixed on all important bridges to directly transmit data to computers.

10.2 Further, bridges will have to be monitored for resonance tendency during **Confirmatory Oscillograph Car Run (COCR)**. Bridges having resonance identified by COCR will have to be covered with suitable speed restriction to check the tendency of resonance.

10.3 All new bridges on High Speed Rail lines will have approach slab to provide smoother transition. These approach slabs are to be designed and their behavior is to be understood.

11.0 Other related Issues:

11.1 Development of multiple-unit rolling stock with tilting technology will be required if section has considerable number of curves and where it is not feasible to ease the curvature due to constraints such as non availability of land, habitation etc.

11.2 Provision of Train Protection Warning System will be required on safety considerations.

11.3 To meet the requirement of braking distance for high speed trains, either second distant signal or automatic signaling shall have to be provided.

11.4 Where automatic signaling is not provided, means for verifying complete arrival of train by provision of **Block Proving by Axle Counter (BPAC)** is necessary on high density routes and for stations provided with central panel interlocking as per provisions of Signal Engineering Manual.

11.5 **Wheel Impact Load Detection Systems (WILD)** and other Rolling stock defect monitoring systems have to be installed at closer intervals to control the entry of defective rolling stock into the high speed network.

11.6 Heavy catenary system for OHE, in which entire system is given higher tension than conventional OHE systems, will have to be used so as to reduce catenary displacement caused by the uplift of the pantograph.

11.7 On Japanese high speed system, 2000 kgf tension is given to catenary wire vis-à-vis 1000 kgf tension being given to the catenary on Indian Railway system. The conventional hard copper contact wire has been replaced with copper clad steel contact wire (with a steel core) or a copper alloy contact wire. Polymer insulators in place of ceramic insulators are being used. Thus, for high speed compatible design of catenary, contact wire, insulators, Pantographs of new rolling stocks, etc. will have to be adopted.

11.8 Standards and levels of acceptability have to change to successfully introduce and sustain high speed on IR. This will call for total change in our attitude and maintenance regimen.

11.9 Vigorous R&D efforts have to be made to achieve the objective with real time testing of components of track.

12.0 The second topic of the seminar is "**Elimination of level crossings"**. There has been manifold increase in rail/road traffic and level crossings initially provided have neither remained absolutely safe nor

economical on life cycle costing basis for all end users. A manned level crossing, though improves safety of rail/road users, remains a painful waiting location for road vehicles. Level crossings are affecting Railway operations resulting into revenue loss and causing heavy detention to road traffic. **Level crossing accidents account for 40 % of total accidents/dashing and 70% of fatalities on Indian Railways**. There is **recurring financial burden of approx. 2000 crores per annum on Railway's earning** on account of Operational & Maintenance cost of having 32735 nos. of level crossings.

13.0 Elimination of level crossing by provision of **Road Over Bridge (ROB), Road Under Bridge (RUB)** and Diversion Road is financially beneficial and operationally desirable step. It provides seamless movement of road vehicles and trains. Vast improvement takes place in safety of road & rail users and relief to ASMs/Gateman. Importantly, **elimination of level crossing is possible at Zero Cost to Railways, since 100% funding for construction of ROB/RUB comes from Central Road Fund (CRF).** Present policy of Railways is "Elimination" of level crossings; with manning to be done if & only if the level crossing cannot be eliminated by any other means.

14.0 Adequate money can be made available through CRF for Road Safety Works. However, results are not quite encouraging. Railways have manned 1589 (including 596 ready for manning) unmanned level crossings but eliminated only 334 by subways & diversion road since 01.04.2010 till November, 2011. Progress of Subway and diversion is only 20% of manning. There is need to put in sincere effort to reverse this trend.

15.0 There is a view that water-logging free road under bridges cannot be made in the low embankment area. With proper planning, even in the low embankment area, we can design & construct all weather motorable under-bridges of adequate vertical clearance which can cater to plying of all type of vehicles.

16.0 On IR network, huge investment to the tune of ' two lakh crores is required for construction of about 4000 ROBs in coming years. This cannot happen without the active support of State Govts., NHAI, Municipalities, Planning Commission, Urban Development Ministry and tapping all possible resources, like, Northeast region development funding, Member of Parliament Local Area Development Scheme (MPLADS) and National Rural Employment Guarantee Act (NREGA), PPP, BOT, Annuity, Commercial Utilization of land and infrastructure, etc. Railways will have to attract external investments for construction of ROB on deposit terms fully at the cost of sponsoring agency. I am informed that about 500 Detailed Estimates & GADs are awaiting approvals. This translates into hold up of investment of approx. 25,000 crores in ROB sector. I expect that Railways shall positively act like any corporate business house and devise a single window system of clearance to facilitate such investments. Railways must work hand in hand with sponsoring agency to complete ROB project on priority.

17.0 I am also informed that Railways are imposing Speed Restriction for longer duration and asking large no. of traffic blocks to carry out ROB & RUB works. Construction methodology should be so devised that it aims at minimum Traffic Blocks and Speed Restrictions. We must make use of modern construction Technology & Equipments like, heavy duty cranes, excavators, pre-cast PSC or pre-fabricated steel girder, cut & cover insertion of RCC boxes of RUB, etc. Railways should also plan such works at multiple locations in the same section for simultaneously working in one Mega Block.

18.0 I am also informed that large numbers of new level crossings are being routinely added every year in New Line constructions. Sincere efforts need to be made to reduce introduction of new level crossings during Gauge Conversion and Doubling. Requests are being received for approving dispensation regarding provision of unmanned level crossings. This is not an appreciable scenario. All of us know that the day New-line, GC or Doubling Projects are commissioned, such level crossings come under the purview of elimination & upgradation, which is 3 to 4 times costlier compared to the cost incurred for elimination during construction.

19.0 Even at the risk of repeating, I would emphasize that we must maximize elimination of level crossings, through grade separator diversion roads, being one time investment. Elimination of level crossings, particularly unmanned level crossings, by March 2015, is very much within our physical and financial capabilities. This offers win-win situation to all i.e. State Govt. and Railways.

- I sincerely hope that this Seminar will help in building up of the ideas, improve the knowledge of Railwaymen and other participants to successfully overcome the challenge of running of high speed trains by upgrading existing track and expeditious elimination of level crossings from the railway system. I wish the participants and organizers a great success.