Delhi Metro — A trend setter project : E. Sreedharan

ICJ: **First of all, hearty congratulations to DMRC for successfully conducting trial commissioning of the Shahdara-Tis Hazari section. What, in your opinion, are the broad achievements of DMRC till date?**

ES: Our achievements are mainly in the area of bringing to the country the state-of-art technology in all areas of metro working. In this effort we have succeeded in ensuring transfer of technology to a large extent with the result for further extension of Delhi Metro or for taking up Metro Systems in other cities. The country will be almost self-sufficient in this regard. Another notable achievement of ours is compressing the whole implementation period for Phase-I from the originally planned 10 years to 7 years. We have also been able to set up certain bench marks in regard to quality and safety in constructions. The public have appreciated the way we are executing this project with the least inconvenience to the city and ensuring high standards of environmental protection.

ICJ: **What were the main hurdles faced by DMRC and how they were overcome?**

ES: We have not faced major hurdles in executing this project apart from the usual difficulties in obtaining land, re-settlement of jhuggies, permission for cutting trees, clearances from various city agencies for carrying out constructions, etc.

ICJ: **While you were at the helm of the Konkan Railway Corporation Ltd, you had encouraged adoption of number of innovative technologies to**

Padmashree E. Sreedharan

Padmashree **E. Sreedharan** has had a brilliant academic record in civil engineering. After holding a number of important assignments with Indian Railways, he was on deputation to the Ministry of Shipping and Transport as Chairman and Managing Director of the Company's premier shipyard at Cochin since 1979. On repatriation to Railways, he was Chief Engineer (construction), Southern Railways, incharge of all major projects from 1981-1985. In 1987, he was promoted to General Manager, Western Railway in 1987 and elevated to the post of Member Engineering, Railway Board and Ex-Officio Secretary to the Government of India in 1989.

On retirement in June 1990, Mr Sreedharan was put in charge of the prestigious Konkan Railway as its Chairman and Managing Director. On completion of the Konkan Railway Project, he jointed the Delhi Metro Rail Corporation Ltd on November 5, 1997 as its first Managing Director.

Mr E. Sreedharan is a Fellow of the Institution of Civil Engineers, UK, the Chartered Institute of Transport, UK, the Institute of Railway Transport, India and the National Academy of Engineering, India.

Mr Sreedharan is the recipient of a number of prestigious awards. These include: **Railway Minister's Award** for restoring the Pamban Railway Bridge in 46 days, 125 spans of which were washed away in a tidal wave in December 1963; **Engineer of the Year,1993** from Institute of Engineers (India), Palghat Centre, in appreciation of his outstanding contribution to the engineering profession; **S.B. Joshi Memorial Award, 1995** for excellence in bridge engineering; **Person of Pride** title from the Chaturang Pratishthan, a registered Trust in Bombay engaged in Social Cultural and Educational activities, for the gigantic task of bringing the Konkan Railway dream come true; **FIE Foundation Award, 1995** for outstanding contribution for efficient implementation of Konkan Railway Project; **ICI – Forsoc Award, 1996** for the Most Outstanding Concrete Technologist; **Bharat Ratna Sir M . Vishweshwarayya Award, 1996** for Best Engineers and eminent performer who has brought the Dream of Konkan Railway into reality from Engineers Forum Kolhapur;
Best Design Engineer Award, 1999 given by the Institution of Engineers, India and ***Padmashree*** **Award in 2001** for Nation Building.

achieve quality and speed in construction. How far you are successful in adopting such technologies for the DMRC works?

ES: As I mentioned earlier, we have been able to bring to the country a number of new technologies hitherto not known in the country. These are: driving of tunnels with earth pressure balanced mechanical shields, ballastless track technology, high speed turn outs, sophisticated signalling system with automatic train protection, sophisticated telecommunication system between the trains and the operation control centre, new design features for highly economical and light weight metro coaches, a foolproof ticketing system using "Contactless Smart Cards", etc.

ICJ: **Both the Konkan Railway and the Delhi Metro projects have amply vindicated that the use of precast concrete leads to better quality and aesthetics. In spite of this the country has not utilised the potential of this material. What, in your opinion, are main reasons for this and how can we rectify the situation?**

ES: Precast concrete definitely leads to better quality, aesthetics and is the most appropriate choice for any fast track construction. This has been adopted on a large scale in the viaduct of Delhi Metro project. In my opinion, the main reason for not utilising the potential of precast concrete in this country is that the initial cost of infrastructure required to implement the precast concrete technology is high as compared to other construction techniques and it can be made economical only in case the project cost is large and standardisation of structural components is possible. Further both the client and the contractor should realise the advantages and potential of precast concrete construction. This appreciation is lacking in our country.

ICJ: **We understand that the phenomenon of early deterioration of reinforced concrete is being witnessed of late in the Delhi region too. What specific measures were taken to ensure the long-term durability of concrete in the DMRC project?**

ES: To ensure durability we have taken the following special measures.

- Providing adequate cover to the reinforcement

"Our achievements are mainly in the area of bringing to the country the state-of-art technology in all areas of metro working"

- Considerable stress has been laid on ensuring the impermeability of the concrete. We have specified permissible limit for the permeability of concrete and we are getting these limits tested on all sites.
- Minimum strength of concrete and a maximum limit for water cement ratio.
- Minimum cementitious material content.

"Precast concrete definitely leads to better quality, aesthetics and is the most appropriate choice for any fast track construction"

- Limiting the design crack widths based on environmental and exposure conditions.
- Providing protective coating on the reinforcement bars (inhibited cement slurry coatings) before embedding them as reinforcement.

Having done all this, I have special quality assurance team, which is independent of the field executives. I would rather call this is a third party "Quality Audit".

ICJ: **Delhi Metro has a number of innovative features like the automatic ticketing and signaling, air-conditioned coaches and station buildings, etc. Can you please elaborate a little on the measures being taken to ensure passenger safety?**

ES: Delhi Metro is an extremely safe system of travel with special features such as automatic train protection which will ensure safety during train operation. The standards of safety being followed by Delhi Metro include all the guidelines prescribed by the National Fire Prevention Association (NFPA) which are extremely stringent. All metro trains will have closed doors to ensure passengers' safety during running.

There are other safety features, which include the following.

- An automatic feature is provided to detect and release obstructions within the gap between door leaf edges up to 15mm.
- Train cannot move unless all the doors and cab side doors are closed and locked.
- If accidentally any door opens while train is on run, brake will apply automatically bringing train to a halt.
- Reduce fire risk due to special design features and materials like stainless steel.
- Emergency evacuation facility through emergency front door.
- Facility for passengers to talk to driver in emergency.
- Emergency announcement in the train from driver and by operation control centre.

- Communication between operation control centre and the driver.
- Emergency illumination and ventilation in case of power supply failure.

ICJ: **We understand that the high-tech coaches for the Delhi Metro are designed by a consortium of Mitsubishi, Japan and Rotem, Korea. How many coaches will be required by the DMRC? Can the Indian Railways not fabricate these coaches indigenously?**

ES: Total 280 coaches are required by the DMRC for Phase –I. Out of the 280 coaches, 60 coaches will be manufactured off-shore in Korea and balance 220 coaches are to be manufactured in India with progressive indigenisation.

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ICJ: **Can the DMRC project be a trend-setter in the country? What is your advice for overcoming the traffic problems in other metropolitan cities of the country?**

ES: Delhi Metro Project is indeed gong to be a trend-setter in the country in terms of technological standards, safety, reliability and environmental protection. This project is also trend-setter in regard to timely completion and quality in construction.

For overcoming the traffic problems in our major cities Metros are the ideal solution. To start with, all the cities with a population of more than 3 million must have a Metro System in the Tenth Five Year Plan. In the second stage the Metro culture should be taken to cities of more than 1 million population in the Eleventh Five Year Plan. This is the only way to reduce road congestions, roads pollution and road accidents.

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