Career Profile of

Er. Shashikant Tambe
Former Secretary (Roads), Govt of Maharashtra, PWD

Recipient of S.B. Joshi Memorial Award for Excellence in Bridge & Structural Engineering for the year 1998, cited by Alumni Association of College of Engineering, Pune.

Date of Birth:

- Born in 1939

Educational Qualification and Training:

- BE (Civil), University of Pune in 1960
- M.Sc (Engg), Hydraulic & Dam design, Pune University

Professional Experience and Training:

- Work experience of 35 years in PWD, Maharashtra at various posts as Assistant Engineer, Executive Engineer, Superintending Engineer, Chief Engineer, Secretary for Govt of Maharashtra.
- Developed innovative, economical, durable design of number of bridges.
- Implemented crash programme of rural roads and buildings in Maharashtra.
- Responsible for construction of Thane Creek Bridge II and maintenance of Thane Creek Bridge I
- Number of flyovers in Mumbai
- Introduced BOT for Expressways

Publications:

- Published number of technical papers in journals.

Honors & Awards:

- Outstanding Engineering Professional Award by IEI.

Affiliation with Professional Bodies:

- Fellow of IRC, ICI, IIBE, IEI.
- Life Member of Indian Building Congress.

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4 EXPERIENCES IN BRIDGE ENGINEERING

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4.1 Introduction

Bridges are very important in the life of a community. They can change the whole pattern of its life. There are Historical Bridges in Maharashtra. The Bridge near Nagothane built in 1550 by Kaji Allaudian is a bridge of Moghul era. Another one is bridge across Kodavah near Rajapur built in 1610 by a Gujrati merchant. In 1657, Shri Shivajimaharaj constructed a bridge near Pratapgarh.

In today's world of infrastructure development, bridge engineering and bridge experts play the key role. A bridge-project is a challenging task for engineers. Successful completion of a bridge right from its beginning to its operation needs excellent team work of technocrats from public-sectors and private sectors. It is essential to have knowledge, experience and expertise in the field of bridge engineering. Inspiration, training and guidance from eminent bridge engineers are necessary to work in this field.

The author, being in charge of bridges in all parts of Maharashtra, noted that much of the credit for the magnificent major bridges being constructed in Maharashtra by the PWD goes to the dedicated engineers carrying out their work silently behind the scenes. Right from designing the bridge initially, these engineers provide all the expertise and guidance required on the PWD side to invite tenders for the works, evaluate them, provide working drawings and do the problem solving during execution. However, many a times, the outside world is not even aware of their existence.

While working in PWD in different capacity, the author had opportunities to learn many things from eminent engineers and knowledgeable seniors, through their interaction and guidance. The author's experiences with some memorable bridges and bridge works are presented in this chapter

4.2 Thane Creek Bridge

The foremost is the 2 road bridge across the Thane Creek. This perhaps is the largest bridge work carried out by the PWD so far. It is 1837m long and carries six lanes of traffic and it has been constructed in very considerable standing creek water in very adverse conditions. It has a vertical navigational clearance of 9.15m above the highest tide. It stands in polluted creek and in corrosive atmosphere and is subjected to acid rain also. The special durability measures adopted on this bridge proved to be precursors of similar durability measures adopted by the IRC and also the Railways on similar bridges.

For the first time the concept of appointment of a reputed international consultant as Proof Consultant was adopted for this bridge. The Proof Consultant suggested several additional measures to improve the durability, the safety and the sturdiness of the bridge.
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The bridge has main slides spans of 107m. The total length is made up of six continuous units constructed by cantilever construction method. Laying the foundations in the dry was one of the tender conditions. This was achieved by the ingenuity of the contractors and their consultants. The cantilever construction equipment was designed by a Swedish firm and all its pins and bolts were got tested by ultrasound and magnetic powder methods. The equipment itself was tested for full load on the ground before actual use on the bridge. A full scale mock up of the pier head and a segment on each side was constructed on the bank to know beforehand all the likely difficulties in the concreting of the superstructure at site. This was also a first attempt in Maharashtra PWD.

Special airtight godown with temperature and humidity control was established to store the high tensile steel in this corrosion prone area. The HT Steel came from the factories, coated with water soluble oil and wrapped in waterproof covering. Pre-stressing ducts were manufactured at site out of thicker sheets, (0.5 mm thick) in a protected shed with concrete flooring. Special vapourphase inhibitor was got developed from a chemical laboratory to protect these ducts during storage and in the structure till the, ducts were grouted.

An unusual feature of the bridge is the introduction of an extra pier to support the tips of the cantilevers of adjoining units instead of provision of hinges or suspended spans, In order to ensure that these free ends of tie cantilever resting on this pier do knock additional load of 300 tons was placed inside the superstructure box to ensure a large positive reaction all the time. Another unusual feature was the extra attention paid to the grouting of the pre-stressing tendons and ducts. There was strict control on the water cement ratio of the grout its temperature and consistency. Ice and plasticizers were used for this purpose and the grouting was carried out with electrically operated pumps to ensure uniform unbroken flow. Grouting operations were supervised by senior level supervisors from contractor’s as well as department’s side. The department had appointed a very senior bridge engineer as a technical advisor.

Considerable amount of instrumentation has been carried out on this bridge to look out for any signs of deterioration or corrosion, etc. All in all, this bridge has the benefit of a very large number of senior experienced engineers on all sides. The author considers it his good fortune to have been in charge as the Chief Engineer of the bridge almost from beginning to almost completion. A mention must be made of the grit and determination of the contractors who completed the bridge despite considerable adversity.

4.3 Mochemad Creek Bridge Near Vengurla

Another remarkable experience is about the Mochemad creek bridge near Vengurla. This bridge faces the sea directly. It. has 5 spans of 42 m pre-stressed concreted boxes, The earlier contractor had left the bridge work half way. A new agency was appointed and started work sometimes in December 1975, As you know the monsoons set in, in that part of the State very early in June. However, within the span of about 6 months the agency

completed the remaining work on the well foundations and also concreted the 5 pre-stressed box girders after getting their own design approved from the department. For the first time in the State, HTS strands were used in bridge work. After nearly 22 years of its completion the bridge is still in a very good condition even though it faces the open sea and even though no special durability measures have been adopted at that time. It is indeed a tribute to the efficiency and excellent quality of the contractors.

It is often said that exploration of sub soil conditions for the foundations of the bridge is the most important factor and no doubt efforts are made. However, one comes across instances of bridges having to be totally redesigned during the course of execution because the foundation investigation was not enough or was done by inexperienced persons. In the then Ratnagiri district, a bridge across Mond Creek had been designed on the assumption of comparatively shallow foundations based on the trial bore data then available. The bridge was to have spans of about 40m on well foundations. When the work was started one or two foundations on the northern bank could be rested at the anticipated levels. However, on the southern bank the abutment foundation well kept on going deeper and deeper and ultimately rested at a depth of around 40m below the bed level, The entire bridge design had to be. recast because other foundations on that bank also proved to be deep and ultimately we had a bridge with spans of about 95m.

4.4 Bridge Across Terekhol Creek

In another bridge on the border of Goa and Maharashtra, across Terekhol Creek, the reverse was the case. The design was based on the bore data available which showed fine sand almost from the bed level down to a great depth. When the work was started it was found that the wells struck late rite rock at a very shallow depth. Further investigations showed that while carrying out wash boring the finer particles in the bored material were getting carried away and the sample collected consisted only of the remaining black hard particles in the latrite rock. This must have given an impression to the engineer in charge of the boring that the substrata consisted of fine sand. Fortunately the original design having been made on the assumption of low bearing capacity it was not difficult to adjust the design for latrite rock foundations.

4.5 Collapses of Centering

One hears of collapses of centering during construction of bridges and other structures now and then. The author experienced such collapses because of complacency than due to any basic defect in the design of the centering, it is rare that the centering collapse would occur on the first span of the bridge. It is usually the 6th or the 8th or 10th span when the centering collapse occurs. One can think of several examples where the collapses have occurred after the first few spans have been cast successfully. Probably the construction staff becomes complacent and fails to pay the same kind of attention to details that is needed. One interesting case was of a 25 x 25m span bridge with R.C.C. beam and slab superstructure. The centering of the superstructure got washed away after the webs of the girders were cast but before the slab concreting was started. We had to work out the location and the amount of the up thrust to be applied to the main girders before the concreting of the slab, so that in the final stage, the stresses would be permissible everywhere.

4.6 Peculiar Phenomena on Bridges

(a) One comes across very peculiar phenomena on bridges. It was asked to take over one road from the Zilla Parishad. As the Executive Engineer, the author carried out the inspection of each and every structure on the road and found that one major bridge under which the water flows at great velocity carrying lots of boulders etc. There was a big pit on one side of pier covering about 3/4 the length of the pier The pit happened to be quite deep and clean so we jumped down into it only to find that we could come out on the other side of the pier through the pit. How such a big hole had been created under the pier resting on solid hard black basalt is a mystery to this day.

(b) In another case we had to restart the work of a bridge with well foundations which had been abandoned long ago by the contractor. When a new agency started the work on the wells it was found that all the wells had been filled up with very large stones and boulders. Some of the boulders quite safely could have used as lintels for very large doors. It was difficult to believe that the water current would have moved such large and heavy boulders and rolled them into the wells whose steinings were a little above the bed. It was also found that one or two wells had developed fairly large window like openings in their steinings below some distance below the bed level. Even allowing for the fact that the stream had swift currents and river bed was boulder. These phenomena are difficult to explain.

(c) Many a times the bridge decks have to be lifted up for various reasons. For example the fairly large pre-stressed spans on the bridge across river Narmada had to be raised by l3ft to take care of the higher floods. It was a two lane bridge. However, recently in Maharashtra a 4 lane bridge deck was raised by about 4 meters successfully. It was remarkable because the deck has several girders and great care had to be taken to ensure that the lifting was uniform.

(d) One of the fastest work in the author's experience was the widening of the old 236m long arch bridge across river Ghod on Pune Ahmednagar. A very innovative method was adopted. The work was executed in a mere 90 days, 3 days less then the planned schedule. As a part of the World Bank Project, several old and narrow arch bridges have been widened, each with a different method. This widening has eliminated traffic congestion at these locations. Bridge across river Shima is a prime example. In each case the old arches were analyzed to see that the stresses remained within limits.

4.7 Flyovers

Flyovers on busy roads of metropolitan cities are specialized class of bridges. The uncertainty of location of underground service lines and lack of working space are the major problems and an added problem is the management of traffic during construction. At many places, local traffic restrictions during certain hours of traffic add to the cost of work. Many a times the locations of foundations have to be changed or the foundations have to be redesigned to overcome the problems posed by the discovery of hitherto unknown service lines.

Faster the construction of flyovers the cheaper it is in terms of total social costs. Due to shorter duration of the disturbance to traffic innovative clauses have been added to the tenders to induce speedier construction. However, the general environment obtaining in the cities many a time does not permit fast construction.

PWD built some flyovers in Mumbai 2 or 3 years ago. In general they were criticized for bulky appearance. Some of engineers of PWD had an opportunity to visit a few countries like Indonesia, Malayasia, Singapore, Thailand, Australia, USA and U.K. and see flyovers there. They were all impressed by the sleek and light designs there. The Govt. therefore, appointed a study group to review the design criteria followed by Maharashtra. Now the new flyovers are being built as per those new rules and promise to be sleeked. The availability of modern rotary pile driving machine and ready mix concrete plants should also speed up their construction and reduce the clutter at the site quite considerably.

4.8 First Thane Creek Bridge

Perhaps the most challenging work was that of the first Thane Creek Bridge which had suffered corrosion damage due to the polluted atmosphere. The engineers from PWD and construction agency must be saluted for the great work of rehabilitation for that bridge. They devised the methodology and design for the repair work. Engineers had to carryout the work despite constant criticism and fear psychosis created by several Indian and foreign critics. Engineers are also to be admired for their decisions to keep the traffic moving on that bridge. Had the bridge been closed to traffic, the road traffic to Nashik and Pune would have collapsed.

During that time there were many false alarms and frantic calls for suspected emergencies. Once at about midnight while it was raining cats and dogs there was a call from the Hon. Minister to the effect that he had received information that the first Thane Creek Bridge has collapsed. After verifying the actual state of the bridge, it was reported back to the Minister that the bridge was intact and the call was false. The real challenge was to keep up the close monitoring of the bridge continuously for several years without becoming bored or complacent.

4.9 Conclusion

The subject of Bridge Engineering is vast but interesting and challenging too. Sharing of experiences is certainly the lessons to be learnt by fellow engineers. There are many gigantic and famous projects of Bridge Engineering in the world. These bridges really make one feel humble. It is concluded that though a lot is achieved, there are still bigger things to be achieved.