# The rajiv gandhi sea link construction essay

ASSIGN BUSTER

The Bandra-Worli Sea Link, also officially the Rajiv Gandhi Sea Link, is a cable-stayed bridge with pre-stressed concrete viaduct approaches, which links Bandra and the western suburbs of Mumbai with Worli and central Mumbai, and is the first phase of the proposed West Island Freeway system.

The Sea Link reduces travel time between Bandra and Worli from 45-60 minutes to 7 minutes. The link has an average daily traffic of around 37, 500 vehicles per day, about half the pre-opening estimate of 70, 000.

PROJECT PHASES:

Organizations generally divide a project into various phases for obtaining better control over different project activities. All the phases combine to form project’s life cycle.

A project phase comprises of different project activities. Following are the different phases of project life cycle:

Phase A- CONCEPTION

It is the first phase of project life cycle. It consists of following:

Need for bandra worli sea link:

Before the development of this link Mahim Causeway was the only connecting way between suburbs and south Mumbai. Due to this reason Mahim cuaseway was loaded with heavy vehicular congestion in the peak hours. Bandra worli sea link now provides an alternate way for diverting vehicular traffic to South Mumbai and thereby redusces congestion. It also

reduces the travelling time to just 8 – 10 minutes as compared Mahim causeway which takes almost 50 minutes.

## Bandra Worli sea link goals:

Savings in travelling time and reduction of vehicular traffic

Reduction in air and noise pollution near residential areas of Mahim , Prabhadevi , Dadar

Reduction in no of accidents by upgrading the road transportation network

## Bandra Worli sea link risks and assumptions:

Since the link is built over the sea , risk of non clearance by environment ministry , coastal zone management caused delay in commencement of project. Also issues related to fishermen along that area needed to be addressed properly.

## Feasibility studies on Bandra Worli sea link:

The project is designed by DAR consultants who have made the feasibility report for the same.

Feasibility studies have taken into account technical feasibility which considers the capability of the contractor (Hindustan construction company in this case) in terms of hardware, software, technical expertise and equipments required for the project.

Economic feasibility for evaluating development cost, operating cost of the sea link and cost benefit obtained due to diversion of traffic and reduction in travel time.

Operational feasibility to determine whether the proposed system actually serves the need of reduction of vehicular traffic near Mahim causeway and finally schedule feasibility to find out whether the proposed system can be completed within time.

## Phase B: DEFINITION

Once the project inception has taken place the next step is project definition. This stage is nothing but the analysis of the solution because it is at this stage that the solution is scrutinized.

This phase has basic two objectives determination of final, detailed system requirements, and preparation of a detailed project plan.

This phase can be divided into three main parts/steps:-

## STEP 1: User Requirements

In this step all the crucial elements in the requires should be listed . These requirements are listed in the order of priority so the can be easily referenced. The sea-link project held the following requirements-

Additional connectivity from city to suburbs.

Redcution oftravel time from 1 hour+ to only 7 minutes.

Decongestion Mahim Causeway- 125, 000 vehicles a day.

Avoiding 29 traffic lights.

Saves vehicle operating cost

## STEP 2: System requirements

An 8-lane bridge.

The sea-link should link Bandra and the western suburbs of Mumbai.

Modern toll plaza .

An intelligent bridge system should include efficient-

Survellience

Traffic monitoring system

Emergency support

Power supply

Road lighting system

## STEP 3 : System Specifications

They provide direction for the project. The system specifications include:

8 Lane bridge out of which 2 are specially assigned for buses.

The length of the bridge is required to be 4. 7 km over the sea-surface and the weight is almost 670000 tonnes.

The massive structure should be held together by main towers of height 126 metres, which is roughly 43 storeys.

Single Tower Single tower supported at 500 meters long Cable Stayed Bridge at Bandra Channel.

Twin tower supported 350m Cable Stayed Bridge at Worli Channel for each carriageway.

There should be toll plaza of 16 lanes which should have automated toll collection which should include CCTV’s, traffic counting, emergency telephones. Also payment mode by cash as well as smart card to be provided.

The bridge system should have state of the art equipment to maintain traffic monitoring and support.

There should be emphasis given to light protection at bridge tower and control building room

The entire project is to take 5 years for completion.

## PLANNING

After 3 steps have been completed the project team is formed and attention to the low level details are paid attention such as schedules, procedures, job descriptions, support documentation, subcontractors, areas of risk, quality plans and documentation plans.

Some of the main plans can be classified as:

Project Plan- Building the cable strayed bridge.

Resource Plan- The construction to be handled by Hindustan constructions and project management handed over to DAR consultants.

Financial Plan-The project is to be approved at the cost of 1600 crore.

Quality Plan-

High performance concrete (grade M60 with micro silica slurry) will be utilized for the structure.

40 mm thick high performance overlay will be provided over the pre-stressed deck to function monolithic with the deck.

Coal tar epoxy painting will be provided below the high tide level splash zone for the sub – structure.

A “ State – of – the – art” electric system for the ITS.

Project Leader- Hindustan Construction Company.

HCC has been building large and complex structures for the last 80 years.

Known for taking giant strides in technology and innovation, it is recognized as a spearheading force in engineering construction, both in India and the rest of the world.

HCC has been entrusted with the construction of high value projects across segments like transportation, power, marine projects, oil and gas pipeline constructions, irrigation and water supply, utilities and urban infrastructure.

## Phase C: EXECUTION

The entire project was originally conceived as one large project comprising, different components, but in order to accelerate the overall construction schedule, the project has been divided into five construction packages. These packages helped, to an extent, to make the project meet its deadline.

Package I: Construction of flyover over Love Grove junction at Worli

Package II: Construction of cloverleaf interchange at Mahim intersection

Package III: Construction of solid approach road from the Mahim intersection up to the start of the Toll Plaza on the Bandra side and a public promenade

Package IV: Construction of Cable-Stayed Bridges together with viaduct approaches extending from Worli up to the Toll Plaza at Bandra end, Intelligent Bridge System (IBS).

Package V: Improvement to Khan Abdul Gaffar Khan Road

Package IV is the largest and main phase of Bandra-Worli Sea Link Project that has been awarded to HCC that includes cable-stayed bridge, viaduct approaches extending from Worli up to Toll Plaza at Bandra end and Modern Toll Plaza.

## Engineering Challenges –

Before undertaking the construction and execution of the project, there were several major challenges to be addressed namely

The foundations of the bridge included 604 large diameter shafts drilled to lengths of 6m to 34m in geotechnical conditions that varied from highly weathered volcanic material to massive high strength rocks.

The superstructure of the approach bridges was the heaviest spans in the country to be built with span-by-span method using overhead gantry through a series of vertical and horizontal curves.

A one-of-its-kind, diamond shaped 128m high concrete tower with flaring minor legs, converging upper legs, unified tower head housing the stays and a throughout varying cross section along the height of tower.

Erection of 20000 MT Bandra cable-stayed deck supported on stay cables within a very close tolerance of deviations in plan and elevation.

All the above challenges faced were taken up single handedly and solved until their termination by the skilled handling of the Project Managers.

## Other Problems faced and their Solutions-

The Maritime Board does not allow marine traffic in monsoon season. Thus, work was halted mid-May only to re-commence in October, effectively reducing the work schedule to only seven months in a year. To overcome this hurdle and to use this time to speed up the construction activities at Bandra Pylon, HCC put forth the solution in the form of an innovatively designed temporary bridge. This bridge had a total length of 325 meters. It had the facility of a walkway, a concrete pipeline, an electrically operated trolley mounted on rail, water line and a pipeline. It paved the way for successful continuation of work during the monsoon season when the sea was rough and the winds were strong.

Another challenge was ensuring effective supply chain at all working locations spread across the alignment in the sea and formulating measures to ensure the same. A diligently worked out logistic plan was put into action to ensure that commodities were handled at dedicatedlocation and dispatches monitored meticulously. State-of-the-art electronic devices were placed on the barges to cut down on idle timings. During peak construction

activities, innovative procedures and specialized equipments were required to enable high accuracy. Expert crews had to also exercise good judgment in assessing sea behavior and priorities during foundation/ substructure constructions and finalplacement of concrete in situ.

Navigation and transporting 19 precast segments in 24 hours at different open sea locations was a challenge. Secondly, concrete consumption at the peak had been at the rate of 50cum/hr. Under marine conditions, the consumption rate has been in the order of 700cum per day. To add to this, maintaining adequate food supply for around 2500 people (in a shift) working in the sea at over 30 locations was a big challenge. These complete requirements were met with an effective utilization of a fleet of 30 marine vesselsincluding 13 barges for concrete, segments and material transport, eight steel boats for material and workers transport, three tug boats and six smaller passenger boats.

## Phase D: OPERATIONS

Operation phase is that element of a project, which evaluates the performance of a project, and changes made if a problem occurred while functioning.

## Maintenance of the completed Project: BWSL

There will be automated systems, which authenticate the toll pass in a matter of seconds, and the bridge is also installed with 12 cameras, which will be used to monitor the movement and ensure safety on the bridge.

The BWSL is also well lit as a reliable and dependable power supply has been arranged for the bridge.

There are house diesel generator sets and auto -mains failure panels to cater to critical load such as the monitoring, surveillance, and communication equipment and aviation obstruction lights.

## Issues

The initial cost of the bridge was estimated to INR 300 crores and the completion in 2004, however, the actual cost is now estimated to have crossed INR 1600 crores (almost 5 times the estimation) and this number dwarfs the amount of savings and hence the benefits of the sea-link by a great deal.

Also, according to various traffic experts, though the bridge will reduce the travel time from 40 minutes to 7 minutes, this duration is just from the end points of the sea-link. Since the impact and the handling of the traffic congestion at the Worli end is not thorough of yet, the actual travel time will be as high as almost 25 minutes, which kind of negates the very purpose of the bridge.

The last and surely not the least point that we have to consider here is that a toll of INR 50 is going to be collected for each one-way trip on the sea-link, which per se, is going to dissuade many of the commuters, unless they see a real improvement in time.

## Changes post completion

With temporary dividers, a driver losing control of his vehicle risks crashing into oncoming vehicles on the adjacent lane that can end in a pile up. Considering this the speed limit is 50 kmph when you are driving straight and reduced it to 30 kmph when a car is taking turn.

The paint used to demarcate the lanes reduces traction leading to accidents, which increase in the rains. Also speed bumps and chromatic speed reducers and traction increasers have been installed on the road surface.

Authorities immediately replaced the temporary dividers with permanent ones so that in case a vehicle loses control, it doesn’t cross over and go on to the other lane causing a head-on collision.

Even the number of policeman monitoring the bridge is increased so to fine a charge on commuters who are breaking the law. Till now a total fine of around 10 lakh INR has been collected.

## Conclusion –

The Bandra Worli Sealink Project has been completed in its first phase from Bandra to Worli and is operational to the public on a day to day basis. The project that was planned to be completed in a particular time period was delayed severely by a number of factors and issues that took longer than expected to resolve. The budget too was overshot by a large margin which is now leaning towards losses for the contractor. However, mechanically the project has turned out precisely as planned with high quality standards and is regarded as one of the monuments of the city. Care must now be taken while undertaking the remaining projects of the Sealink (from Worli to Haji Ali) to make sure that the issues faced don’t crop up and cause delays and wastage of money.