

Cost Reduction and Low—Cost Construction Consultant's Contribution – Most Effective Role

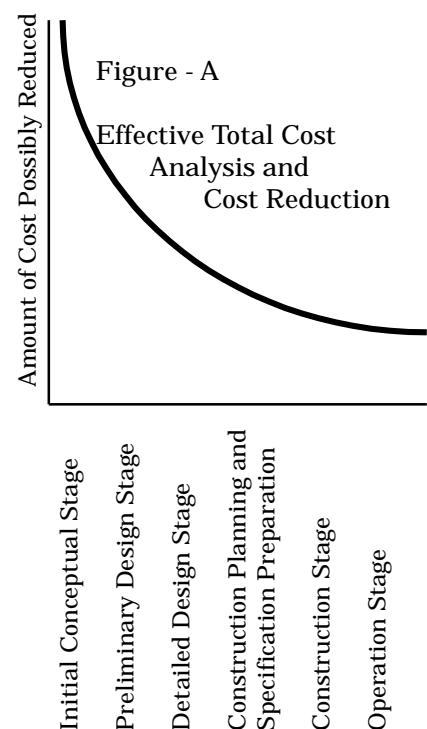
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TOTAL COST REDUCTION

Consciousness on cost of any social infrastructure is always in a mind of any engineer. It is not only the cost of initial construction but shall also include the life cycle cost of operating, maintaining, rehabilitating if necessary and demolishing at the end of the service. Balance of those cost items involved is affected by local economic situation and steadiness of area or country where the facility is situated. Interest of loan, for example, affect the balance of initial cost and running and maintaining cost. Where the rate is very high the initial cost could be low and making running and maintaining costs slightly higher. In a case of Japan where the interest rate is very low and is expected to stay low for a foreseeable future, the initial construction cost could be slightly high to make running and maintaining cost low. Life cycle assessment and total cost control is a vital key to a successful planning of social infrastructure.

CONSULTANTS' INVOLVEMENT

Initial conceptual planning becomes very important when a total cost reduction is targeted since the cost reduction is most affected by pre-construction planning in many cases. Figure – A shows a schematic illustration of a relation between various stages of pre-construction and construction and amount of cost, which could possibly be reduced through engineers analysis and efforts at those stages. There is no doubt that the earlier engineers start making efforts the more costs could be reduced on total life cycle bases. Consultant is called in at pre-construction stages and makes those efforts. It is one of most important roles consultant plays to analyze the total cost reduction and to make the project attractive to owners and taxpayers. Cost of involving consultant is relatively small when it is compared with the total cost of a social infrastructure and possible cost reduction by effort paid by consultant. Other players to making cost appropriate are value engineers and construction managers for fast truck delivery. When enough time and remuneration are spent on consultant work then there usury achieved very reasonable appropriateness of project.



FACTORS AFFECTING COST

When a new highway construction is taken as a case, there are many factors, which have to be taken into for studying during pre-construction stages. Some of those are natural and others are artificial and many of them shall be treated very carefully to make the life cycle cost to be reasonable. Very typical ones are summarized in Table – B to be subjects for discussions.

Table – B Factors on Cost for Studying Stage

Study Items	Factors	Points to be Taken	Remarks
Route Location	Topography, Geotechnology (incl. Fault, Soft Ground, Unique Soil, etc.), Hydrology, Lake/Pond/River, Towns/Villages, Religious Items, Rail, Road/ Highway, Other Hazard, Traffic Projection	Some of Factors are not convertible to cost but have to be avoided at all cost	Cost/Benefit also important according to route
Alignment Design	Adding to above – Highway Rank, Design Speed, Design Traffic Volume, Number of Lane, Carriageway/Shoulder/Central Margin Width, Horizontal/Vertical Curvature, Sight Distance, Overhead Clearance, etc.	Harmony among alignment factors also an important consideration.	Rank as well as speed should vary according to conditions.

Key Words : Life-Cycle, Total-Cost, Cost-Reduction, Benefit/Cost, Country Situation

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Road Structure Design	Adding to Above – Material available for Embankment/Pavement (Subgrade/Lower Course/Upper Course/Top Coat), Available Workmanship/Construction Machinery/ Finance Source, Climatic Condition, etc.	Settlement/Expansive ground and Other Ground Conditions play major roles.	Finishing of surface is vital to serviceability.
Bridge Design	Adding to Above – Material available for bridge construction such as cement/gravel/ reinforcement/Cables/Tendons/Additives, Construction Technology, etc.	Type of Bridges requires special consideration for maintenance also.	Technology Transfer to local engineer vital.
Affiliated Facility Design	Signals, Signs, Road Markings, etc.		
Others	Traffic Safety Moral of the Area,		

Each one of those factors affects others and careful analysis is required. Maintenance-ability plays a major role for analysis of life cycle cost. Any facility is transferred from construction agency to local administration regardless of either the case of international assistance or domestic social infrastructure development. When the local agent responsible for operation/maintenance lacks in enough capability, the cost of operation/maintenance may sometimes goes up due to miss understanding to what shall be really done. Overdoing costs also.

Outside assistance, in a form of consultancy in operation/maintenance, in some cases seems to appear attractive for bringing down the life cycle cost.

CASE STUDY OF PLANNING AND DESIGN

It is not, in reality, very clear in general cases how much the cost has been reduced by going through each of stages, however the works have proceeded very careful or not. Engineers' duty is there to pay at most attention in their professional manner permissible regardless of the outcome.

There had been a detailed design of a Bridge – Road project completed recently and this was a kind of typical case where the relation of engineer's effort and cost reduction is not so much clear. The project involved a crossing by a bridge of an international river, which is approximately 1.600 meters wide and navigable by a fair size boat, connecting roads on both sides of river until suitable existing roads and facilities on both sides each for clearing international crossing of people and goods.

The scheme of this project has been talked about for quite sometime. Some actual studies had taken place during the last ten years or so. Route locations had been studied several times, also involving traffic analysis. Location of the crossing have been identified at several points some hundreds of kilo-meters apart since the new crossing would be only one of few which should be crossing the river at several hundreds kilo-meters away from each other. Initial construction costs of these routes located varied very much since the crossing bridge length changed depending on the natural condition of the crossing point, the connecting roads lengths changed depending on how far the crossing point was from any existing roads. A final selection of the crossing was identified making the total length of bridge – road very short, bridge as a reasonable length and making it nearer to township, original crossing point of the river by a ferry services to make people operating and maintaining the facility commuting easier. Total initial cost had been reduced and possibly the operation/maintenance cost also was made reasonable but to say how much was difficult. The analysis made so far was involving traffic pattern changes of very wide area and economic benefit/cost will have to be analyzed in those cases, not simply the project cost.

A preliminary design was carried out involving topographic, geotechnical, hydrological, sociological, environmental and other necessary surveys at the identified route. The final alignment of the bridge and connecting roads as well as the location of the international border crossing facilities were set while avoiding local inconveniences, natural hazards, artificial objects such as important facilities etc., and with environmental considerations.

Terrain was rolling gently, population very scarce, and river almost straight making the spot rather ideal. There was a most influential finding to cost. The bearing strata for the bridge foundation were identified a few meters below the riverbed rather than a supposed larger depth larger during other stages. A careful analysis to utilize this fact was carried out making several alternatives of bridge construction materials, types, methods, configurations, and other related items such as connections to the bridge, embankment or viaduct or what. Much effort was made to reduce the initial construction cost as well as operation/maintenance cost.

CONCLUSION

There is no need to discuss whether the cost reduction is more effective before or after a construction stage. People involved in the project require good explanation as to the appropriative-ness and engineers must retain good accountability at anytime.