CostOS Estimating for Bridge Cost Estimating and Pre-Design Optimization

Project Summary

The Ionian Highway and the E65 are the two major Build and Operate initiatives, operating under a Public - Private Partnership (PPP) where Nomitech was asked to support the tender process on behalf of a consortium of companies that was eventually successful for these major programmes. Among the companies involved were, Ferrovial SA, Dragados SA and GEK Group who are the most well known and high profile of the organizations involved. The total budget of these two projects exceeds €3.0 billion.

The Ionian Highway is a €1.4 billion programme between the Greek Government and a Greek-Spanish consortium consisting of Actividades de Construcción y Servicios (Grupo ACS) of Ferrovial SA and Dragados SA, and the GEK Group of Companies SA, Terna SA, Cintra SA. The winning consortium, now operating under the name "Nea Odos", will build and operate the road, receiving toll fees for 30 years, while investing a combined €1.15 billion into the programme. The rest of the funds will be provided by the European Union.

European route E 65 is a north-south Class-A European route that begins in Malmö, Sweden and ends in Chaniá, Greece. The road is about 4,400 km (2,700 mi) in length. The part of the highway currently under construction, and where CostOS was utilised starts from the Northern Borders of Greece within FYROM and ends at Athens. Its total length is 232KM and its budget is €1.6 billion. Following the successful deployment within the Ionian Highway programme, the 'Nea Odos' consortium then applied the same principles and toolsets to the E65 programme, with CostOS again used to support the cost estimating process of bridges. Once again, the consortium was successful with the E65 programme bid.

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Application of CostOS

By the time the decision was made to participate on the tender for the 2 PPP projects, Nomitech CostOS was already appointed by Terna SA to undertake the estimates of the bridges and culverts of the two highways with a total budget of €500M . The Ionian Highway was the first project on which CostOS would be applied and the initial concept was to develop a knowledgebase which would be additionally used for the bridges and culverts for the E65 programme.

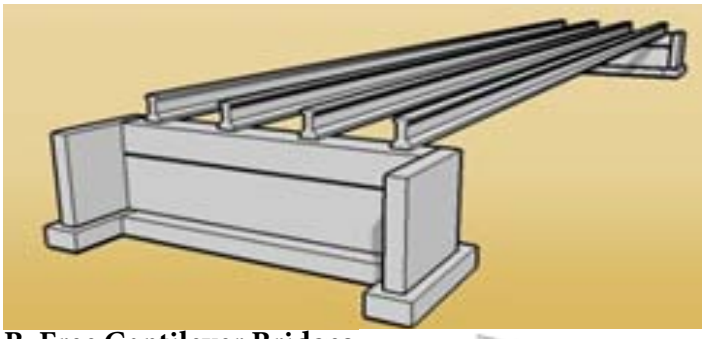
Stage One - Basic Engineering

At the early stages of such large roadways, a continuous interaction and co-operation must exist between the estimators and the designers. The pre-defined route of the new highway greatly affects the total cost of the project and with the consortium placing their own money in the project, the optimum and the most cost effective solutions should be identified.

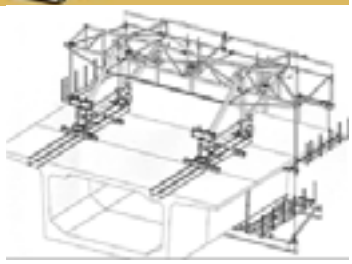
After finalising the route of the Ionian Highway, a definite list of required bridges with their spans were developed and designed. It was now the estimators' job, together with the designers, to identify the most cost effective solutions.

A smart assembly / cost model was developed within CostOS to model the different types of bridges that would be used. Due to the local methods of construction, 3 individual methods for the bridge construction were selected:

A. Precast Beams



B. Free Cantilever Bridges



C. MMS Overhead

The consortium's estimators exchanged basic engineering information with the designers such as the maximum span that could be achieved for the different types of bridges. Equations were formed to model the sections of the foundations, the piers, the deck etc depending on the method of construction, the span, the height of the bridge the soil conditions etc, all within the CostOS system.

Since the majority of the bridges would be made of precast beams, the designers performed structural analysis to calculate different dimensions of precast beams required for different spans with a look up table being imported into CostOS to automate the BOQ Items production.

The unit rates of the output BOQ Items of the smart assembly were based on the estimators own experience and previous knowledge.

Stage Two - Optimization of the Engineering

Having created the list of required bridges and the supporting smart bridge assemblies, the next stage was to optimize the selection of the types of bridges to be used and get an initial view on cost. The ability to modify assemblies within CostOS, made the process of comparing bridge types easy and simple as well as deciding on further details such as bridge spans in the specific case of long precast beam bridges. By using the smart assemblies, detailed BOQ Items were produced for all bridges and an initial budget was extracted in double quick time.

Stage Three -Increasing the accuracy of the estimate

The next stage of the estimating process was to increase the accuracy of the estimate. Requests for quotes were created and sent to the major suppliers and subcontractors that would be involved in the project.

Such infrastructure projects heavily rely on the large civil equipment that will be used and for this reason prices of new equipment were acquired (Excavators, Pile Drivers, Bridge Forms, etc) and their capital depreciation and average consumption were modeled within CostOS as equipment resources.

A list of salaries for all labour that would be used on this programme, was created and handed over by the consortium's team of accountants to the CostOS team in an Excel format and imported as labour resources into the CostOS Database.

The responses to the RFQs were automatically imported in the Database as Subcontract and Material resources, and they were used together with the labour and equipment resources for pricing the BOQ Items.

Several scenarios were easily run, such as the ability to construct the two lane bridges with one Crane, or the ability to fabricate the beams on site etc, in order to come up with the most cost effective solutions during construction.

Stage Four - Synchronization with the Schedule

Having large European Banks funding the Project, meant that an accurate and realistic programme schedule should be produced, and it should come up with a realistic and accurate cash flow. The consortium's planning team was using at that time, Primavera P5 for the planning and this provided the opportunity to intergrate directly with CostOS.

All bridge estimates in CostOS, which already included durations or productivities, were exported to Primavera P5. Two major cantilever bridges, were on the critical path, and were subsequently causing delays on the total duration of the Ionian Highway. The estimating team, were informed of this concern by the planning team, and a solution was soon found to purchase and depreciate one additional Free Cantilever Form, and have an additional crew working in parallel. On closer analysis in both primavera P5 and CostOS, total cost of the form was far less than the 60 days delay that it would have otherwise-caused.

Stage Five - Application of the Knowledge Base to the E65 Highway

All work that had been performed for the Ionian Highway, was stored as a knowledge base within CostOS and applied for the E65. It is worth mentioning that the optimization and the estimating of the E65 bridges was performed at 40% of the time required for the Ionian Highway and the estimating team had an increased confidence of the accuracy of their estimates.