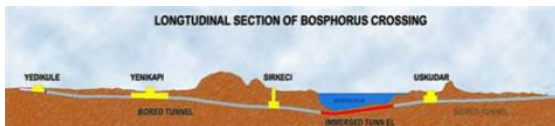


Assessing the Economic Benefits of Marmaray

11 December 2013



Marmaray, inaugurated in October 2013, connects Asia with Europe for the first time in history, through a railway tunnel under the southern end of the Bosphorus (Istanbul) straits. Part of a larger urban railway line project connecting Asia and Europe in Istanbul, Marmaray is currently considered one of the most ambitious transportation infrastructure projects in the world.



Source: Marmaray Official Web Site

The overall project comprises a 76 km long, rehabilitated and newly constructed railway line, of which the Marmaray segment is 14 km long including a 1.4 km undersea tunnel. The tunnel, starting at Kazlıcesme surface station in the European side of Istanbul, goes underground at Yedikule Station, continues through Yenikapı and Sirkeci underground stations, linking to Üsküdar on the Asian side of Istanbul, and ends up on the Asian surface station at Söğütluçesme.

PGlobal has extensive experience in applying economic and econometric analysis to projects and programs and has led the way with innovative approaches to economic impact and public policy analysis, including the assessment of transportation projects. This brief note reports

PGlobal's analysis of the economic impact of the Marmaray railway tunnel investment.

The Framework

PGlobal's economic analysis consists of identifying and quantifying the economic benefits of Marmaray and gauging these benefits against the investment costs. The results indicate that Marmaray's economic benefits highly justify the investment costs.

Social cost/benefit analysis: A primer

All investment projects generate benefits which accrue to the project sponsors as well the general public. Commercial or financial projects are assessed based on their impacts on the project sponsors (owners). The decision to undertake a commercial project is conditioned upon the "feasibility" of the project for its owners, that is, on the commercial benefits (cash flows) of the project compared to the investment costs to the owners.

On the other hand, the impact of public projects, which enables public officials to make informed decisions regarding public investments in terms of both economic and social impacts, including infrastructure projects, is measured from a social (or

public) point of view. In other words, the impact that undertaking the project will have on the entire society is considered. In such projects, many benefits that the society receives directly or indirectly need to be identified and quantified. For example in a (non-toll) road project, the public entity constructing the road does not reap pecuniary benefits from the road. Thus, tax money is diverted to the project without collection of any user fees. The indirect benefits of the project thus will have to be calculated and gauged vis-à-vis the investment costs in order to calculate the net benefits to society.

Identified benefits were subsequently converted into monetary values.

Three scenarios were developed; best, medium and worst cases. These scenarios were defined by the projected number of passengers, which acts as the main driver of the underlying model. Projection assumptions were developed for ten years when the stabilized annual passenger numbers are reached. Each scenario specifies a different stabilized level at the end of ten years and different speeds of convergence.

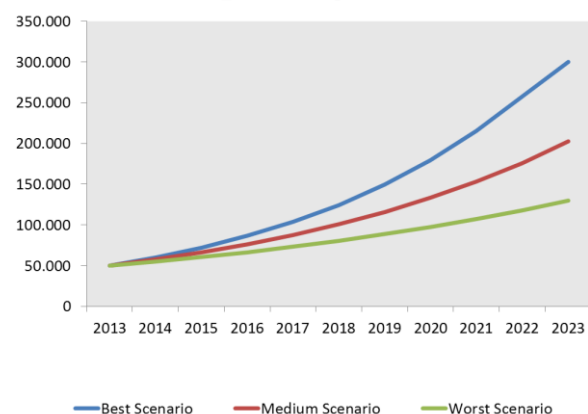
The passenger scenarios were developed based on conservative principles. Other passenger scenarios could be used in the same model to analyze corresponding derived benefits.

Quantifying the economic benefits of Marmaray

Even though Marmaray's impacts may be perceived as fairly evident, their quantification is particularly important so as to compare Marmaray's benefits with the public money spent. PGlobal has developed a full-fledged economic impact assessment model in order to examine the following categories of benefits:

- Time savings,
- Reduction in CO² emissions,
- Energy,
- Reduction in fatalities.

Projected number of passengers



It is noted that since the model is very sensitive to the number of passengers, higher results can be achieved with different passenger scenarios.

Economic Impact of Marmaray: The Results

Time savings: The primary goal of the Marmaray project is help alleviate the transportation burden in Istanbul. The primary benefit of the project is thus considered to be *time savings*. The model estimates the time savings by projecting the number of passengers who would be diverted from other modes of transportation. That analysis also required assessment of the passenger type and the value of time saved for each category. The results indicated that, indeed, Marmaray would generate a considerable value in time savings: TL 382 million per annum in the best (highest) passenger scenario, while in the medium and worst scenarios, results are savings of 288 and 216 million TL/ year respectively.

Energy Savings: Savings in energy are a key benefit for society. For example, Turkey, a rapidly growing economy, imports a significant amount of energy every year, in the order of USD 55 billion. Considering the substantial benefits of mass transport systems in terms of energy expenditures, Marmaray will have a significant positive impact in terms of energy savings. To gain insight into these energy savings, the fuel consumption of Marmaray was compared with those of the other modes of transportation in use, and the difference between them has been converted into monetary values by multiplying by a conversion factor. Different fuel segments have been examined, i.e. gasoline, diesel, etc., and best, medium and worst scenarios

produce average annual benefits of TL 64, 48 and 36 million.

Our model demonstrates that utilization of Marmaray would result in the elimination of a total of 25,430 car, bus and minibus trips, leading to a significant amount of savings in energy.

Environmental Savings: Road transport accounts for the largest share of total emissions of carbon dioxide (CO²). These emissions increased by nearly 23 percent between 1990 and 2010 in the EU zone; this trend is likely to further increase in the near future. Transport is the only major sector in the EU and Turkey where greenhouse gas emissions are still on the rise. PGlobal calculations indicated that Marmaray may contribute to the reduction of emissions in Istanbul. These benefits are monetized TL 1.9 million TL per annum.

The model forecast that 5 lives will be saved each year for the next 10 years.

Savings in Lives: There were 15,082 traffic accidents last year in Istanbul resulting in 247 deaths and 268,079 injuries. In addition, a remarkable number of financial losses (1.4 billion TL last year in Turkey), caused by accidents, occur each year. PGlobal estimated the economic value of these accidents under each of the three scenarios. The average annual value to be derived from fewer accidents over the period of

10 years (between 2014 and 2023) for worst, medium and best scenarios is calculated at TL 52 million, TL 39 million and TL 29 million respectively.

Overall Savings from Marmaray Project: In sum, our economic impact assessment model reveals that Marmaray may generate substantial non-monetary benefits, amounting to TL 387 million per



annum. And, like other transport projects, Marmaray, may generate other positive impacts not included in our analysis.

FINDINGS AND ASSESSMENTS

Benefits generated by the project comprise monetary revenues (i.e. ticket revenues), in addition to non-monetary (social) ones. Costs, on the other hand, include initial construction, as well as operational costs (maintenance and operational expenses); labor costs are not considered among operational costs as they represent revenues for staff. Construction cost amounts to USD 5.5 billion over nine years, according to publicly available information.

PGlobal has consequently calculated the IRR of the Marmaray project at 16.2 percent (in real terms). That figure is quite high for a public infrastructure

project and also indicates the significant social viability of the project.

Our model also shows a cost/benefit ratio of 2.22. Moreover, in assessing the various other social factors, including less stressful journeys, healthier commuters, on-time arrivals, etc., one can conclude that social benefits also significantly exceed cost.

A Publication of PGlobal Global
Advisory and Training Services
Ankara, Turkey

Contact: info@pglobal.com.tr

The views expressed in these articles
are solely the author's opinion.