



## **Full Length Review Article**

### **TEST BENEFITS EVALUATION OF HIGHWAYS OF MOROCCO ON THE USER, THE COMMUNITY AND THE STATE**

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#### **ABSTRACT**

The activity of the seaports is a major economic and financial challenge for the economy. They are crucial points for the transfer of cargo and passenger marine mode fluvial or terrestrial mode. Transport is the lifeblood of the economy. Indeed, 95% of Moroccans are choosing the road to move, and 4/5 of goods carried out phosphates pass through the road. If transport infrastructure can not generate development when all other necessary conditions are not met, it is impossible to conceive without (qualitatively and quantitatively) the transport infrastructure to meet demand. This article is intended to:

- present the interests of the 1st and 2nd motorway program and its progress,
- describe and quantify the benefits of highways:
- user benefits,
- benefits to the community,
- benefits for the state.
- List the constraints of the motorway program and make recommendations for its completion.

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#### **INTRODUCTION**

In Morocco the road network is at a lower level in terms of construction compared to some countries. This situation is compounded by the growth of cars traffic, which does not mark to have saturation effects. Faced with this situation was worth it not better to design new routes and adopt to them the motorway standard in other countries like (Jardin A., Fleury P. 1973). These motorways should be funded by the state? or through private companies authorized to collect tolls (Guillemin, C. 1976). If it is clear that the law 4/89 and its implementing decree opt for the second term of the two alternatives. The private sector participation in highway funding has, however, difficulties and is unlikely (World Bank. 1997). Indeed, before the traffic growth and budgetary constraints, most states have initiated process of finding a formula legal, administrative and financial that can ease the burden of the state budget and improve management methods without undermine their prerogatives controls and guidelines for economic and social activities (World Bank. 1994 and 1997).

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A formula seems to address the concerns of the state, it is the concession, under which the state will in principle disengage in financing, operation and management while retaining control of powers and controller. This solution has prevailed in many Developed Countries (Spain, France, Italy, Portugal ...) for the financing, construction, operation and maintenance of a motorway network that could not be funded by traditional resources State (Jeanjean., P. 1975 and Jessua., C 1968) and for which there was a need for concessional loans whose expenses would be covered by tolls (C. Abraham, Thomas A., 1996). Similarly Morocco has begun experiments to the use of private financing. To understand the stakes of such an action in the motorway sector, we will try to respond aware of the case to three issues: That it is the interest of the motorway program and its progress? What are the economic effects of this type of infrastructure on the user, the community and the state? What are the constraints of the program? To do this, a brief history of highways in Morocco is needed to understand the origin, genesis and role of the public sector in this area. This role will be increasingly frustrates the insufficient budgetary resources. This led envisaged the introduction of private capital, the 4/89 Act was enacted in 1993 to allow the concession to the private highways.

But year beyond the imperative need to provide Morocco with a network of modern roads to support the expansion of mobility, the economic benefits of this program are very important. It remains to remove the constraints on this program to its successful completion.

### Presentation of the motorway program

Transport is the nerve of the economy (E Quinet., Touzey L., T. Tribble, 1982 E. Quinet, 1982, 1983, 1985, 1990 and 1992). Indeed, 95% of Moroccans are choosing the road to move, and 4/5 of goods carried out phosphates pass through the road. If transport infrastructure can not generate development when all other necessary conditions are not met, it is impossible to conceive without qualitatively and quantitatively, the transport infrastructure meet the demand (Veganzones V. 2000). The relationship between road traffic and GDP is universally recognized. According to the graph, below, constructed from data from the last decade of the 20 century, as spring an increase of 1% of GDP in constant values, is a 2% increase in road traffic. This relationship reflects the intensification of transport with the increasing wealth of the nation.

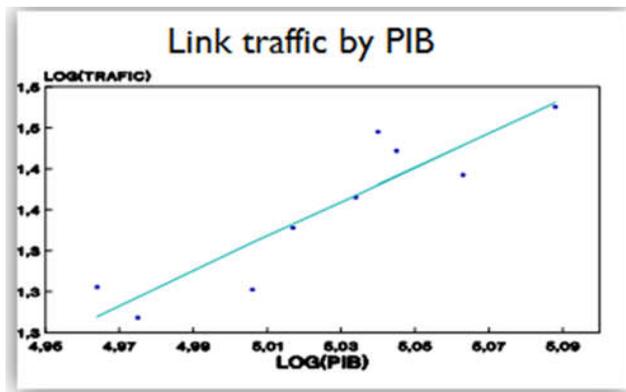


Figure 1.

Since 1988, the volume of traffic generated by transportation demand is considerable acceleration. The average annual growth rate of 7 to 8%, doubling every 8 to 10 years. This rapid traffic growth is accompanied by a degradation of the level of service offered to the user. Thus congestion situations occur in many parts of the road network generates one hand, the additional costs in the transport of goods and people and, secondly, a deteriorating security on these routes. The number of consecutive killed in road accidents increased from 2110 in 1983 to 3323 in 1995, an increase of 60%. The need to build a highway network linking the security requirements that a strong capacity has become a strategic area of economic development. Also, at the end of the 1980s, a highway master plan was developed by government bodies responsible for road infrastructure. This scheme included 1500km achieve by 2015.

### Interest of the motorway program

Beyond the imperative need to provide Morocco with a network of modern roads to support the expansion of mobility, the economic impact of the motorway program are very important.

It is interesting to push the analysis of the profitability of these facilities to determine to whom and how much they enjoy the most. A dirham invested in highways he enjoys more the user who uses it, the community in general or the General State Budget? It is primarily useful to remember for this typology of beneficiaries of the different natures benefits of these investments (Segone C., 1998). For the user, on the microeconomic level, highways provide savings in vehicle operating cost (VOC), time savings, improved security and greater comfort in traffic conditions. For the community, on the macroeconomic level, highways cause a rate of return reflecting the savings in terms of reduction of the CEV, overall time savings and reduction in the accident rate. These aspects include the elements mentioned above for users but are broader macroeconomic perspective of the community. For the state, understood as budget, highways provide tax revenues (VAT and IS essentially but IGR, through taxation), capital property income in the cases of ADM, the value of the highway at the time of return at the end of the concession and maintenance savings of parallel network due to traffic diversion to the motorway.

### Benefits Procures User

#### Earnings in the Vehicle Operating cost (EVO)

To illustrate this notion of EVO, we will consider the following example:

Is a vehicle worth 150,000 dh amortized over 7 years, covering an annual mileage of 20,000 km and consumes on average 10 liters to 100. In addition, the annual maintenance of the vehicle is estimated at 8,000 dh and tires to be changed every 30,000 km (price of a tire: 700 dh).

#### Box 1: operating cost of vehicles

The cost of operating vehicles (EVO) reported at a distance or individual unit cost unit is the sum of the various costs incurred directly by the user, vehicle operating costs (fuel, tires, lubricants, maintenance, vehicle depreciation).

#### EVO for a journey of 100 km on a highway

component of EVO	Cost dirhams in	
Fuel (super)	$10 \times 7,69 =$	76,90
maintenance	$(8.000/20.000) \times 100 =$	40,00
pneumatic	$(700 \times 4/30.000) \times 100 =$	9,33
amortization	$(150.000/(20.000 \times 7)) \times 100 =$	107,14
EVO		233,37

In conclusion, the user of the vehicle spends around 233 dirhams on a course of 100 km of highway. This calculation is intentionally simplistic. However, it has the merit of teaching and do well finger to the user all the costs that make up its cost per kilometer when using the vehicle. On a highway, the best traffic conditions result in a reduction of the EVO compared to competing national network. This decrease was, among others, by reducing the frequency of braking and acceleration, the radii of curvature sufficiently comfortable corners to be almost non-existent, etc ... These parameters directly affect fuel consumption, tire wear, thus leading to a decrease of the EVO.

Under French GAAP, the gain in EVO between a highway and a highway is 10%. In Morocco, the difference in quality between a highway and a major road is greater than that existing in France and therefore reducing the EVO is more important. In the case of Morocco, the coefficient is taken to be 15%. So on a 100 km motorway journey, the user benefits from a reduction in its EVO 35 passing dh 233 dh 200 dh.

A more comprehensive calculation based on CEV evaluated by HDM distinguishing light vehicles, trucks PL1 (<8t) and heavy PL2 (> 8 t) results, based on a reduction in the CEV the following results for 100 km route:

### Gain operating cost for a 100 km journey between a highway and a highway

	VL	PL1	PL2
EVO dh / km on a highway	2,4	4	8,7
EVO gain for a 100km course in dh	36	60	130

### Saves Time

Time savings are one of the major advantages of a highway construction. The possibility of increased speeds will provide time savings during trips, which can be valued in monetary terms on the basis of drivers and passengers hourly earnings estimates.

#### Box 2: Valuation of travel time

The valuation of time has been very little research in Morocco. Also, different approaches of developed countries were used. The most important are:

- The direct transfer of values of time used in developed countries,
- Time values based on income.

The latter approach is preferable because it recognizes that the time savings in work-related travel are invested in production. This approach recommends estimate the marginal cost of labor. The latter is equal to the wages or income including social charges.

The calculations made in the context of the study "National Master Plan for Transport" updated with the following results:

#### Hourly value of time by vehicle type dirhams per hour

Value of time	private car	Taxi	Autocar
hourly value	45	32,2	225,8

Source: Results of SNTD, updated in the interim report of the Economic Feasibility Study of Highway Casablanca - El Jadida - Jorf Lasfar by Dar Al Handassah, July 1996.

Considering that the average speeds on main roads and motorways for a passenger car is 70 km / h and 100 km / h respectively. Over a distance of 100 kilometers, the time savings is estimated at 25 minutes (0.4 hours), corresponding to a financial gain for the user of a light vehicle, 18 dhs. For a heavyweight, the hourly value of time is supposed to be twice that of a light vehicle and medium speeds on main roads and motorways are respectively 50 and 75 km / h (Plassar., F. 1997). Time gain on a journey of 100 km for a heavyweight, is 40 minutes (0.67 hours), corresponding to a monetary gain of 60 dhs.

### Road safety gains

The gain in safety on a highway is an important aspect for the user. It reflects the reduction in the loss ratio caused by better traffic conditions and doubling. The statistics in this field observations have shown that the accident rate is halved when going from the road to the highway. This report should reach a value of 4 to 6 in the example of what happened in countries with long tradition motorway.

Security benefits are based on the following parameters

- The cost of an accident is of 198.000 dh (val-1995), mainly reflecting the loss of production for the community. This cost means aggregating the VL and PL.
- The rate of accidents on motorways is 0.326 per million vehicle-kilometers,
- The rate of accidents on main roads is 0,736 per million vehicle-kilometers.

#### Box 3: cost of road accidents

The cost of an accident to the community reflects the shortfall by it due to the disappearance of one or more of its members or injury that have been brought to them.

The safety gain, over a distance of 100 km, represents the difference between the mathematical expectations of the potential cost of an accident on road and highway, either:  $(0.736 - 0.326) \times 10^{-6} \times 198,000 \times 100\text{km}$

This calculation results in an expectation of financial gain, due to increased security on highway, valued at 8 dh on a journey of 100 km. The following table summarizes the gains to a user borrows a motorway route with a length of 100 km and this route compared to the same length in a national network.

#### gains and expenses associated with motorway driving from the road path = 100 km

Composantes	Earnings and tolls IN dirhams		
	VL	PL1	PL2
EVO (1)	36	95	
Value of time saved (2)	18	60	
Security Gain (3)	8	8	
Toll (VL: 0.25 dh / km) (4)	25	38	
net gain (after toll) (1)+(2)+(3)-(4)	37	125	

It emerges from this analysis, this simplified example, a user traveling in a passenger car realized a net gain after toll 37 dh 100 km journey if Borrow a highway instead of a national road trip identical in length. For a heavyweight, this gain amounted to 125 dh

#### Assessment of benefits for the community

The benefits to the community are taken into account are gains CEV, time and security as well as the balance of positive and negative external economies. This is in the latter category near, the same benefits for users. However, the analysis is conducted over a period that can be the life of infrastructure, the duration of the concession or a year, for example to give a demonstrative exercise.

It is this latter period that will be adopted to analyze the effects on the community. For this, we will consider a motorway 100 km section which handles an average daily traffic of 7,000 vehicles, consisting of 80% light and 20% of heavy vehicles (10% of PL1 and PL2 10%).

### Earnings in EVO

The gain in CEV was previously calculated on a journey of 100 km; it is estimated at 36 dhs. This gain is estimated at 60 dhs for a PL1 (<8t) and 130 dhs for a PL2 (> 8t). According to the results obtained in I.1, the gain in CEV for the community day is:

$$7.000 \times (0.80 \times 36 + 60 \times 0.10 + 0.10 \times 130) = 334,600 \text{ DH} / \text{d}$$

### Saves time

Remember that for a light vehicle, saving time on a 100 km route is 25 minutes (0.4 hours) and the value of time is estimated at 45 dhs / h. For a heavyweight, the gain was 0.67 hours, 40 minutes, the time value is 90 dhs / h. The valuation of daily time savings gives:

$$7.000 \times (0.80 \times 0.4 \times 45 + 90 \times 0.20 \times 0.67) = 185.000 \text{ dh} / \text{d}$$

### Road safety gains

Using the same assumptions for valuing those of point I.3, the community for daily profit due to the reduction of accidents is:  $X 7.000 (0.736 \text{ to } 0.326) \times 10^{-6} \times 198,000 \times 100 = 56,000 \text{ dh/d}$ . The table below summarizes the benefits generated for the community for a year on a 100 km motorway section. daily and annual benefits for the community on a motorway route 100 km

Type of benefit	Daily gain (In kdh)	Gain per year (In kdh)
EVO	334	120
Gain in travel time	185	67.525
Security Gain	56	20.440
total earnings	575	207

Thus, under the assumptions taken in this analysis, the community has an annual economic benefit estimated at over 200 Mdh for each 100 km motorway section. For comparison, the toll levied by the dealer stands at nearly 70 Mdhs per year, representing 35% of the benefits to the community. Thus, the first objective of the development of highway infrastructure is generally improve traffic conditions: reduction of vehicle operating costs (EVO) reduction in journey times, improved comfort and safety drivers, etc. But beyond these primary effects, the construction of a new highway has many economic and social effects, direct or indirect: increased productivity of road transport operators, growing market areas of industrial, tourism development, agriculture, industry, urban development, etc. which are difficult to quantify.

### Evaluation of the benefits for the state

The calculation of benefits for the community was made to a 500 km program granted to ADM. This calculation takes into account the contribution of the state to finance this program through participation in ADM of capital up to 20% of the construction cost.

The financial analysis of this program.5 shows that:

- Tax revenue (mainly corporate tax and VAT on toll) generated for the state over the life of the concession (35 years) amount to about 2.6 billion dirhams (discounted to the year basis at the rate of 10%);
- This amount is compared with that of the investment required to implement the program in question, which amounted to about 5.9 billion dirhams (discounted to the base year at 10%).
- This means that for an investment of 100 Mdh in the motorway sector that requires 20 Mdh dirhams of the state in the form of participation in the Dealer capital, the state levies a tax flow Mdh 45, more than twice its contribution and almost half of the investment.
- The flow of capital income for the concession of the program in question amounted to 930 Mdh (discounted to the base year at 10%). Assuming above restraint, the state receives 743 Mdh values of the base year.
- The salvage value of the motorway network, refurbished at the end of the concession, amounts to 1274 Mdh in 1994 values, assuming that the entire network is returned to the state in 2027 ( end of the concession). In the case of a refund, section by section, according to their date of concession, which is more realistic, the calculations give Mdhs 1160 as current value, expressed in 1994, the motorway network to return to the state.
- Gains in maintenance costs of parallel network due to the allocation of a portion of the traffic on motorways can be calculated under the following assumptions:
- the opening of a motorway section halved the traffic on the parallel network is supposed to be the same length as the said section. This assumption is very conservative because the traffic diverted over the long term often exceeds 50%.\*
- this reduction in traffic resulting spacing maintenance of abandoned roads. Assume for simplicity that the maintenance period is doublée.8
- the maintenance cost is estimated at 1 Mdh / km at 1994 prices and optimal maintenance period is estimated at 8 years.

We know for a fact that this period more than doubled since the truck traffic, which is the main pavement deterioration factor is completely hijacked on the highway because of the cost / benefit of the highway that is very supportive this type of traffic. It is assumed that the annual benefits of users (210 Mdhs to 100 Km) increased 6% in proportion to traffic. The price discount rate is 10%. The formula that is presented for the calculation of the updated weight maintenance (see previous page). Under these assumptions, the gains due to maintenance on the road network economy induced by the circulation of a 100 km section of motorway are estimated at 120 Mdhs for a period of 36 years (duration of the concession: 35 years). These gains are measured in 1994 (base year). To homogenize the calculations, we note a budget saving of 600 Mdhs, for granted to ADM network. Benefits for the state of the construction and operation of a 500 km motorway program. The state budget is the main beneficiary of the implementation of this program and should be therefore be one of its main promoters. 4 dirhams invested in the motorway sector, the State takes a direct benefit valued at 3.4 dirhams.

Furthermore, for the same investment, the Community has a profit estimated at 13.41 dirhams. For comparison between the different beneficiaries, it is necessary to reduce everything to the same unit of time and length. The calculation basis will be 500 km (network length granted to ADM).

Nature des avantages	Montants non actualisés	Montants actualisés à l'année de base (Mdh)
Coût de construction (1)	10.000	5.915
Flux fiscaux (2)	39.500	2.600
Revenus du capital (3)	10.433	743
Valeur de récupération (4)	-	1.160
Gains en maintenance (5)	-	600
Total avantages Etat (6)	-	5.103
Rapport (6)/(1)		86%

#### Comparative advantages for the user, the state and the community (500 km / 35)

Beneficiary	Advantages
all users (VL) before toll	19.830 Mdhs <sup>10</sup>
State	5.103 Mdhs
Users) / (State + users)	80%
(State) / (State + users)	20%

This rate (20/80) meets here in part to the question asked at the beginning of this communication and which focused on the relative shares of gains accruing to the various beneficiaries of the motorway program.

#### Recommendations for completion highway program

The major constraints on the achievement of the motorway program are twofold:

- **Respect of the increase calendar of ADM capital** for the implementation of sections which are allocated to it,
- **The role of the state in granting concessions to the private sector.** This is the debate on the public / private partnership in this type of infrastructure and risk-sharing between the two partners. This aspect involves the remaining sections of the program, including traffic levels for the use of private financing on acceptable terms for the state.

#### Conclusion

Public Authorities in Morocco are trying to build a highway policy based on a simple idea: the motorways should normally be funded by the users and not by taxpayers through the toll constitutes an incentive for private companies.

#### This idea follows itself a political choice

The share of public expenditure across the national network was considered too high, avoid the increase. Anything that can increase national wealth without recourse to budgetary benefits the nation. On the other hand, it is clear from the analysis of the economic effects of motorways that highway construction is beneficial to all parties, both for the state and the community on the macro-economic and User on the micro-economic level. However, it is particularly interesting that the state budget is the main beneficiary of the implementation of this program for about 100 Mdh invested in the motorway sector, corresponding to a State's commitment to 20 Mdh it

last gains an overall advantage of 86 Mdh, almost four and a half times its commitment.

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