THE EVALUATION OF FRENCH MAJOR HIGHWAY PROJECTS: RECOMMENDATIONS BASED ON AMERICAN EXPERIENCE

by

Alexis de Pommerol

Ancien Élève de l'École Polytechnique
(1992)

Ingénieur des Ponts et Chaussées
(1994)

Submitted to the Department of Civil and Environmental Engineering
in Partial Fulfillment of the Requirements for the Degree of

MASTER OF SCIENCE
in Technology and Policy

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

June 1995

Signature of Author ____
Department of Civil and Environmental Engineering
May 11, 1995

Certified and Accepted by ____
Professor Richard de Neufville
Chairman, Technology and Policy Program
Thesis Supervisor

Accepted by ____
Joseph M. Sussman
Chairman, Departmental Committee on Graduate Studies

THE EVALUATION OF FRENCH MAJOR HIGHWAY PROJECTS: RECOMMENDATIONS BASED ON AMERICAN EXPERIENCE

by

Alexis de Pommerol

Submitted to the Department of Civil Engineering
on May 11, 1995 in partial fulfillment of the
requirements for the Degree of Master of Science in
Technology and Policy

ABSTRACT

The context for infrastructure decisions in France has been changing since the early 1980's. Historically based on a centralized administration that provided all the necessary resources, the evaluation processes now face widening concerns on three important points: (1) institutionally, the Decentralization and European Integration processes no longer guarantee the quasi monopoly of the central government; (2) financially, deregulation and privatization call for increased participation of private investors; (3) socially, the numerous particular concerns that are to be taken more formally into account open the debate to new participants. These changes imply that French evaluation processes need more clarity, more risk analysis and more considerations of different points of view.

A particular consequence of this new context is that French decisions for future highways should be based on a negotiated debate rather than on imposed "optimal" solutions. Based on American examples, and innovative practices for local financing, this thesis shows how new procedures can be implemented in the French system.

The current French legal framework appears sufficient for allowing the recommended changes. The French system should emphasize more pragmatic than theoretic approaches for such complex issues. The recommendations for the French system therefore emphasize both a leadership shift inside the leading authority, the Ministère de l'Équipement and innovative use of existing regulations, to achieve a participatory process for highway-decision, which have proved to be very successful in a wide range of contexts in the United States.

Thesis supervisor: Professor Richard de Neufville
Chairman, Technology and Policy Program

TABLE OF CONTENTS

ACKNOWLEDGMENTS

I am deeply grateful to Professor Richard de Neufville whose advise and guidance before and during my stay at MIT have made my experience in the United States more interesting than I could have expected. His knowledge of the American, the French and other societies has always brought me new insights over the actions that engineers can lead in their organizations. I also want to thank him for having accepted my candidacy for the Technology and Policy Program that he chairs.

During this thesis, his warm support and remarks have really helped me to exceed my short-range knowledge over this subject.

I also want to thank the SCETAUROUTE Group which support made this year in the United States possible. The help and documents provided by Gérard Autheman were particularly appreciated.

I would like to express my gratitude to Tom Harcharick, in charge of the International Studies Department at the École Nationale des Ponts et Chaussées, who was really helpful in introducing me to the American Universities system.

Finally, I want to thank all my friends at MIT, especially at the Technology and Policy Program.

Foreword

Whenever money and policy are involved, evaluation procedures are necessary to justify building authorizations (for concessions) or more commonly the expenditures of public money. Infrastructure such as roads are often built on the basis of the public funds. Therefore, decision comes from a political level whose first task is to achieve goals it has been elected for and govern for the people. The choices and decisions need to be justified for the public and need also to be as optimal as possible.

There is no realistic absolute optimum in such decisions that involve multiple points of view. The reference for evaluating different projects is not any scale or measurement. In France, for example, the reference is the political goals set up by the State. For highway problems, goals are always very long-term and they are therefore usually not too sensitive to political changes.

Finally the decision on such critical questions (from the single financial point of view, they involve millions or billions of dollars!) are more and more on the scene of public debates. They constitute one of the few procedures that involve legally the participation of the public through the "Enquêtes Publiques" (Public inquiries) in France.

And for these kind of projects, engineers and technicians can help the public decision-maker because, as Wellington pointed out in 1887,

"[Engineering] is the art of doing well with one dollar which any bungler can do with two after a fashion."

This thesis is mainly based on the French highways primarily the intercity-ones. For the near French future highways remain one of the major challenges for the infrastructure builders and decision makers. There is still a lot of work to be done in very different political, social or geographical contexts. The urban problems are certainly more critical but also more difficult to generalize, since each case appears now as a very particular one.

If general ideas appear for the intercity-case one could then try to build a framework for future considerations of urban highways or other transportation infrastructure such as TGV (high-speed rail) or airports.

1 French highways

1.1 Historical context:

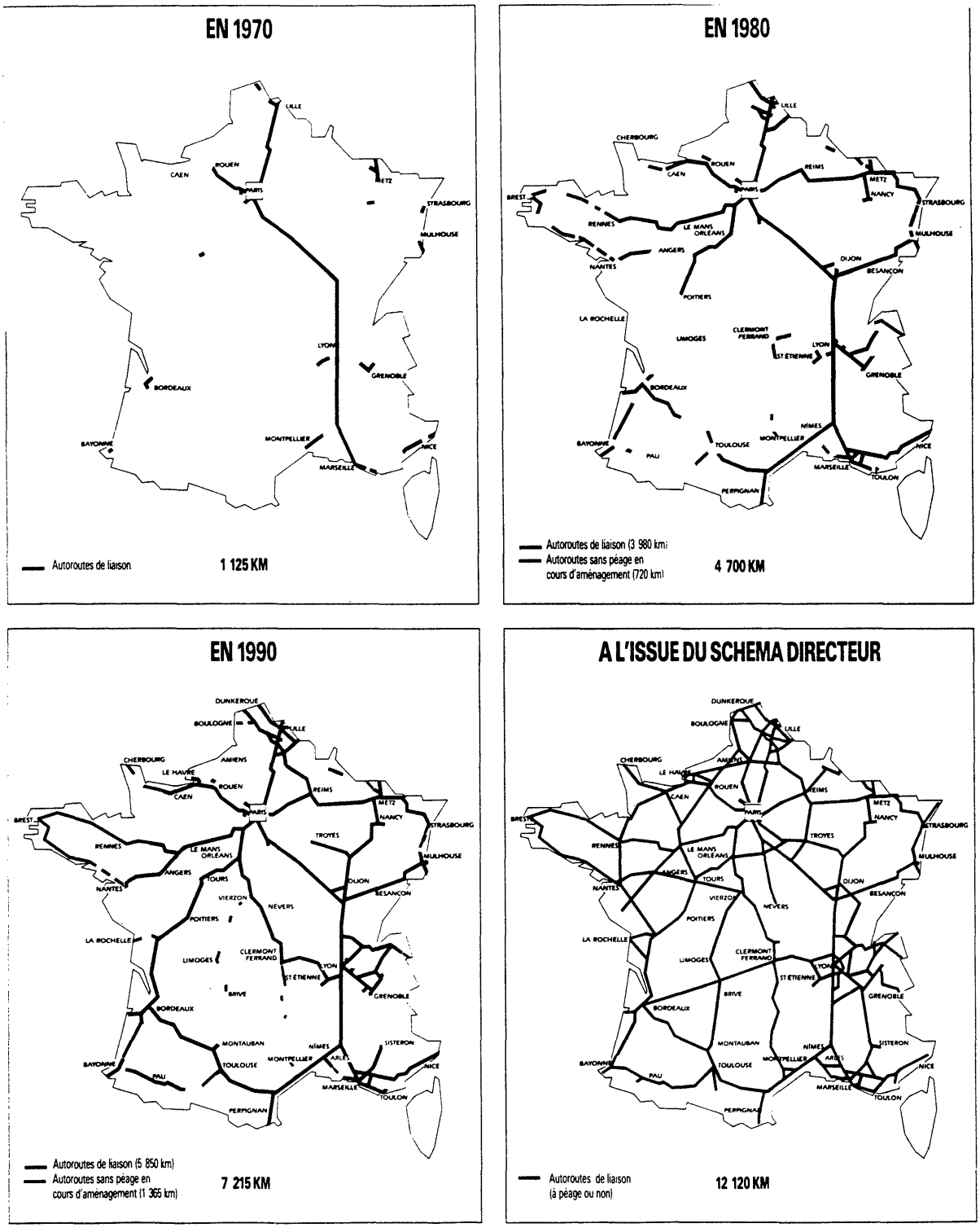
The different roads in France are classified based on their administrative status (i.e. regarding who is in charge of them). The "Autoroutes" are the largest roads in France, they are all operated by the State or by State-designed Concessionaires. The definition of an Autoroute is mainly based on technical characteristics such as the maximal authorized speed (130km/h), the fact that all the interchanges are protected or that both roadways are separated.

The French Highway network is rather young and recent compared with the networks in the neighboring countries of Germany and Italy. It was only developed strongly since the 1970's and is not expected to be completed as a real national network before 2010.

The first French Autoroute section was open to the public in 1954. It was the first part of the "Autoroute de l'Ouest" between Paris and Versailles and was about 20 kilometers long. There was, however, no big nationwide roadwork program at this period of time after World War II. The development of the personal automobile, the increased population and the new needs for traveling (supplying the major metropolitan areas or tourism and leisure) expressed however since then create a real big demand for transportation, in particular highways and any other major road improvement.

The first main axis to be completed was the 1000 km North-South Lille-Paris-Lyon-Marseille in 1970 and new sections have been opened to public each year since then. The network was 1,100 km long in 1970, 7,200 in 1990 and is supposed to reach more than 12,000 after completion, supposedly around the years 2005-2010 (see attached map of the network at different stages).

THE BUILDING OF THE FRENCH HIGHWAY NETWORK



Ministère de l'Équipement, du Logement, des Transports et de la Mer – Direction des Routes 1990

For a long time, the Autoroutes were built section by section and no clear concept of long term network had appeared. A masterplan, the "Schéma Directeur Routier National" (SDRN, National Road Masterplan) was not published until 1990, revised in 1992 (Minnistère de l'Équipement, du Logement, du Transport et de la Mer, 1990). A French Highway network is now under realization with competitive routes and itinerary-choices for the driver to be made. The SDRN focuses only on intercity highways and consists of links between major French cities, each link being included in one of three successive periods for completion date (see map page 12). It also describes three different levels of highways: "Autoroutes" those are supposed to be completed by the end of this Masterplan, GLAT (Grande Liaison d'Aménagement du Territoire, Big Link for the Country Planning) and LACRA (Liaison Assurant la Continuité du Réseau Autoroutier, Links allowing the continuity of the Motorway network). Both of the last two categories are supposed to be upgraded into Autoroutes in a next phase.

Since the beginning of this process and the expansion of the French network, public opinion has changed dramatically. In the beginning, and until the late 1970's, highways were not controversial on the major axes and there was also little concern about other options. Since then, a more systematic and effective opposition towards highways and all major public infrastructure (TGV [High Speed Rail], power plants, dams...) has developed. Environmental concerns are now much more important in the media and in the public mind than they used to be.

There has also been an evolution in the way the public authority (the State) tries to deal with such factors. The public decision-maker (the State through its Ministries and its agencies) is now aware of the new obstacles it must overcome in order to get projects accepted. The decision must now be able to stand up to public scrutiny. The media may

now cover the procedure that leads towards the decision, and an open public debate may take place.

1.2 The way the French highway system is ruled in 1995:

This chapter presents the two major characteristics that define the French Highway network and its rules: the Concession System and the administration.

Most of the intercity highways (4500 of 5000 km) are currently ruled under the concession system. In France, concessions are mostly extension of Government through funding and/or ownership of public infrastructure. The complete concessions (definitely private concessionaires with no state guarantee) are rather rare. This system is the consequence of the 1955 law that enabled companies, after approval by the State, to build, operate and eventually transfer highway infrastructure. The main motivation for this agreement was the lack of available funds in the national budget to complete the necessary huge achievements on the national network. (Société des Autoroutes Paris-Normandie, 1994).

It is important to notice that the current laws forbid the construction of any toll-highway so long there is no parallel itinerary that remains toll-free. It is however not specified which should be the distances between the two itineraries neither the quality of service on such roads. Finally this does not apply for particular infrastructure such as bridges reaching islands or mountains, tunnels, especially in winter where the passes may be closed because of snow-falls.

The Concessionsystem means that companies are in charge of the building and operating of the Autoroute for a first period (mainly 35 years) after which they are

supposed to transfer it back to the French Ministry of Public Works and Transportation. The financing comes from toll revenues, which are regulated by the State.

Most of the companies are public-private companies which the French government indirectly operates through the "Caisse des Dépôts et Consignations". The Caisse is the monetary operator of the State for all the major public goods like housing, roads... It may issue bonds or contract loans and collect revenues from tolls for instance. Under this system, profitable operations cross-subsidize other projects in this sector rather than in the national budget.

The three major public-private companies, SEM (Société d'Économie Mixte) are, after the mergers that were part of the 1994 reform:

- SANEF (Société des Autoroutes du Nord et de l'Est de la France) which acquired SAPN (Société des Autoroutes Paris-Normandie) in the North of France,
- SAPRR (Société des Autoroutes Paris-Rhin-Rhône) which acquired AREA (Autoroutes de la Région Rhône-Alpes) in the middle part of the country, and
- ASF (Autoroutes du Sud de la France) which acquired ESCOTA (Société des Autoroutes Estérel-Côte d'Azur) in the South.

The STMB (Société du Tunnel du Mont-Blanc) is in charge of the Mont-Blanc tunnel near Chamonix and of a short section of the A40 Autoroute in the Alps.

Part of the network is still managed by a majority privately funded company: COFIROUTE (Compagnie Financière des Autoroutes) which currently operates around 500 km of the network. COFIROUTE is owned by banks (some of them government-owned) and public works companies.

IN the past, there have been other privately funded concessionaires in the past like AREA in the Alps, or ACOBA (Autoroutes de la Côte Basque) in the South-West. These companies went bankrupt in the early eighties and the State had its more established concessionaires take them over and recapitalize them. This phenomenon reflects the

consequences of the imposed "perequation " system of the toll-tariffs: by law, there can not be large price difference among the different toll-highways. A financial redistribution system has then been implemented though the ADF (Caisse Nationale des Autoroutes de France) whose task is to redistribute excess profits from a highway or a concessionaire to those suffering from lower revenues. This has of course serious consequences for the efficiency and the motivation for running a Concessionaire company. On one hand, the possible deficits are guaranteed by the ADF (the survival of the company may even be guaranteed by the State authority) and on the other hand, the motivation for highly profitable sections are biased by the fact that benefits will primarily serve other companies. One can however think that the 1994 reform of the public-private Concessionaires, which resulted in the acquisition of the three less profitable companies, was partly driven by considerations of this kind.

A second particularity of the French Highway System can be found in the administrative institution at its foundation. Highways, as all other public transportation means in France are, directly or semi-directly, under the guidance and administrative supervision of the "Ministère de l'Équipement" which is often (depending on the cabinets) grouped with the "Ministère des Transports."

The Ministère de l'Équipement is a very centralized institution. This is the heritage of the "État colbertiste" of Louis XIV in the seventeenth century. Although a decentralization process started at the beginning of the eighties gave some power to the regional and départemental levels, all the major decisions concerning are still made in Paris at a national level.

The "Ministère" has not only an administrative influence on the projects, their funding and their planning, but also a major technical influence. It publishes reference manuals through its Technical Centers:

- SETRA, Service d'Études Techniques des Routes et Autoroutes, (Technical Roads and Highways Study Service),
- INRETS, Institut National de Recherche sur les Transports et leur Sécurité, (National Research Institute on Transportation and Safety), or
- CETE, Centre d'Études Techniques de l'Équipement, (Technical Studies of the Public Works Center).

Their manuals are used by work teams and later considered for evaluation of projects.

Finally, the "Ministère" has a strong technical and corporatist tradition through the official administrative corporations (in particular the Corps des Ponts et Chaussées) They have earned a well-founded reputation as highly skilled engineers in projects construction. They are also extremely technically oriented. Their former successes have contributed to cultural self-confidence the realization for infrastructure. Their behavior could once be characterized as really impressive. There are however some questions today about the ability of this structure to face public debates that are not especially focused on technical achievements.

The cultural importance of the Corps des Ponts et Chaussées in this field of highways can be presented in Table 1. It shows the principal positions held by Ingénieurs des Ponts et Chaussées in the institutions (administration or "sociétés d'Autoroutes") concerned with the subject of highway evaluation, decision or building. The list comprises all the possible institutions. Each year, around 40 graduate become Ingénieurs des Ponts et Chaussées which make this corporation relatively small.

Table 1: Positions held by Ingénieurs des Ponts et Chaussées in the institutions directly involved in the building of French Highways

INSTITUTION		Chairman President or Director	Executive Chairman or CEO	Deputy-Director or Deputy-CEO
Ministère and Public Authorities	Ministère, Direction des Routes	n.a.	X	X
	Caisse des Dépôts et Consignations			XX
	INRETS	X	n.a.	XX
	SETRA	X		XX
Highway Companies	AREA	X	X	
	ASF		X	X
	COFIROUTE		X	X
	ESCOTA	X	X	X
	SANEF	X	X	
	SAPN		X	
	SAPRR	X		X
	STMB		X	

Source: *Association des anciens élèves de l'École Nationale des Ponts et Chaussées, (1994).*

As all the other French Ministries, the "Ministère" is subject to the decisions of the whole government, in particular those of the Ministry of Budget and Finance which ultimately decides the financial allocation to each Ministry.

1.3 Current highway evaluation basis

The current procedures regarding the decisions of building the highways are driven by two main forces. The first is the economic concern, either directly through the revenues of a toll-system, or indirectly through consumer surplus theory. The public utility of the infrastructure remains the major argument in favor or against a particular project. The other major driving force is land-use planning.

In practice, this means that all the regions of the country who all participate to the national development have the right to benefit from the public expenses made through the highways.

1.4 Current evaluation procedures:

The latest official document concerning highway evaluation in France is the 05/05/1994 "Circulaire du Ministère de l'Équipement" which sets the rules for all operations prior to investments in the national public road network. This document in itself is more like a summary of the administrative measures and controls which should lead to the final proposal. It however refers to previous official documents, mainly the 1991 "Circulaire relative à l'élaboration et l'instruction des avants-projets d'itinéraires" for the studies of intercity highways, which in turn is based on the 1986 version presented later in this chapter.

According to the 1994 "Circulaire", the final legal decision-making is to be done in three steps. The first is the preliminary study defining the anticipated cost of the investment and its future form. This is done at a national level through the central "Direction des Routes" (DR, Direction of the Roads.) The second step is the APSI (Avant-Projet Sommaire d'Itinéraire or basic itinerary pre-project), generally approved at a national level when the case is a highway or long-term highway-to-be investment. The third step is the "Enquêtes d'Utilité Publiques" (Inquiries about the Public Utility of the Project) through a "dossier d'enquête publique", prepared at a local level and then, upon approval by the DR, presented to the public.

The public is invited to critique through these "Enquêtes d'Utilité Publiques" which were reinforced in 1983 (Bouchardeau law). After possible modifications following the remaks of the public, the project is finally set up through the "Déclaration d'Utilité Publique" (Official Declaration of the Public Utility of a precise Project) which is posted after discussions at a central level. This is the most important mandatory step without it, no project can legally proceed.

The final process, at a local level, is the practical realization of the project, which focuses on the cost and on the agreement with the previous decisions. This building phase is undertaken by the State local technical services for free highways under the direction of the Concessionaire for toll-highways. This is not a real decision-making step, it is more managerial for the practical realization. One can notice that highway money -except for the case of COFIROUTE- usually comes from the State.

It is worth to note that the important decisions are always taken at a central level. Therefore, political concerns are extremely important in the French decision-making process.

The importance of the evaluation procedure is therefore reinforced by the fact that it must be presented at a high level which is not always well informed about local

questions. However, the decision-making body is inherently independent from local pressures, this making it more objective in setting priorities for the expenditure of national public money.

The current official evaluation techniques are based on the 1986 "Circulaire relative aux recommendations pour le calcul économique et l'évaluation des projets dans le secteur des transports. Instructions relatives aux méthodes d'évaluation des investissements routiers en rase campagne et en milieu urbain" ("Circulaire" expressing recommendations for the economic calculation and evaluation of transportation projects. Instructions for the evaluation methods for road investments in rural and in urban areas). This document states, in its introduction, that there is a need for an homogeneous framework for the evaluation methods in the domestic transportation business. It is based on a multi-criteria analysis using a classical micro-economic study complemented by a review of the effects of the investment on the Aménagement du Territoire (land-use planning) and on the macro-economic equilibrium of the country. The determining factor for these decisions, as a political objective, is the economic and social efficiency of the project.

The "classical" micro-economic analysis is based on Net Present Value using a standard social opportunity cost of capital. A correction (the cost of public funds is increased by 50%) is used to penalize the benefits of relatively large projects (over 1 billion French Francs) whose Net Present Value would be too high compared with maybe less significant projects from the only financial point of view. The use of standardized administrative macro-economic models such as TES (Tableau Entrées Sorties, Input Output Tables), AVATAR (Analyse Variantielle du Tableau d'Affectation des Resources) or DEFI (Débouchés, Emplois, Filières Industrielles) is also recommended to obtain the gross effects on employment or the balance of payments with the foreign economic partners of France. These tools are not exclusively applied to transportation, they are

generally used by the central administration under the direction of the Finance Ministry. They then show some global considerations for the national budget and help the choice of investment in the different sectors where the French State intervenes.

A multi-criteria analysis should also be used as to figure out a way to present and compare the external and all the non monetarized consequences of the investment. The following effects are presented for all transportation investments:

- Effects of the project on the regional economy and on the "Aménagement du Territoire."
- Compatibility with the other National Infrastructure Masterplans.
- Incidence on the other modes.
- Effects on the security of the people and of the goods.
- Accessibility to the transportation network of the previously disadvantaged regions.
- Time-savings and increased quality of services for people and goods.
- Diminution of damages and improvement of the environment as well as of the quality of life.
- The priorities or needs of the National Defense.

The list is detailed for all the kinds of transportation projects, including the intercity highways. The effects to be taken into account are not much more precise but, once again, they do reveal the real policy concerns of this Ministry. Therefore, they are very important.

This list seems rather vague and does not precise address concerning the way they should be studied. This is however the transportation policy of the country, which covers a lot of ground. It is another example of the variety of stakeholders in the transportation infrastructure. The issue quality of life for instance can cover anything.

Practically, ten criteria should be taken into account for intercity highways:

- Effects of the project on the regional economy and on the "Aménagement du Territoire."
- Safety.
- Users' advantages.
- Environment and quality of life.
- Exceptionally difficult initial situation.
- Intermodal study and influence on the other modes.
- Direct employment effects.
- Energy expenditures.
- Financial analysis for the public owner (State or Concessionaire).
- Cost-Advantage analysis of the monetarizable effects.

The Circulaire" recommends that these ten criteria should be used in the following way :

1) All the effects depend on the real potentials of the concerned areas. All local considerations be taken into account. Synthesis criteria should include geographical data (distances, relief) and past evolution to figure out the effects on the employment and on the migration flows. The highway effects are then characterized as very favorable, favorable, neutral or unfavorable regarding development.

2) The safety evaluation uses historical data, traffic forecasts and the planned geometrical figures of the project. Results are given by comparing the numbers of killed, injured or number of accidents with the current situation, when possible.

3) The users' advantages focus on the time saved, increased comfort, savings on the use of the vehicle and the eventual toll-cost. These numbers are transformed into monetary value through the use of transfer prices: the value of life is estimated at 1.6 MFF (1985 French Francs), the revealed (through inquiries on toll roads) value of time is 50FF per hour. The

comfort penalty are computed on a vehicle/kilometer basis, such as 0.09FF for a trip on an unseparated two-way road, 0.03FF for a road with unprotected interchanges, etc.

4) Concerning the environment, the text states that the use of a single aggregate indicator is still impossible because of the multiplicity of environmental aspects of such projects. The importance of the local concerns is also mentioned. The specific aspects that should be studied according to a quoted 1978 "Circulaire" include the soil, air, water, fauna, the flora, noise and pollution, landscape, cultural and scientific patrimony, forests, agriculture and rural developing as well as urban development and improved access to the different centers. Only the most ecological/environmental aspects such as the air-quality and the noise-levels, are actually taken into account in this part of the evaluation. The other external aspects are usually considered in the first criterion.

5) This refers to exceptionally difficult situations, such as, for example, high congestion, or noise-level, and natural risks for existing roads. There is however no precise diretcive on how to deal with these issues.

6) An overall cost-advantage benefit analysis is undertaken, concerning the society as a whole, the transferred passengers as well as the other transportation modes' companies.

7) Direct employment effects include the jobs directly linked with the building or the maintenance of the highway.

8) The global energy evaluation includes the global energy costs of constructing and maintaining the highway, and any change in the users' gas consumption. There is also an evaluation of the new foreign currency equilibrium through the effects of the oil-consumption as well as those of the eventual tourism variations.

9) The financial analysis of the Public Authority computes the difference between the economic cost of the infrastructure and the revenues linked with the variations of the VAT, of the gas taxes... For the concessionaire societies, the average balance sheet of

their whole network is considered (most of the future highways will not be entirely cost-effective and will need the resources of the older money-making ones).

10) A final cost-benefit analysis of the monetarizable aspects of the investment is computed through the use of standard values. This analysis concerns the costs as well as the users' benefits which are the easiest to quantify and most often transformed into currencies. The use of standard values (time, life, injury) is justified by the fact that the State uses them for helping the decision and do not seek to reflect the exact reality. For instance 76FF per hour is the standard value of time for the cost-benefit analysis computed by the State, 50% higher than the revealed value used to compute the users' advantages (50FF per hour).

The appendix on this subject describes some particular financial criteria mainly used by the infrastructure decision-makers.

It is worthwhile to notice that -except for the first criterion- these ten criteria do not precisely take into account local considerations.

The evaluation procedure presented here is currently used by the French "Ministère de L'Équipement", among others. However, for a long time there have been some doubts within the French administration, especially from the "Direction de la Prévision". Inside the French Ministry of Budget, this Direction is responsible for auditing all major expenses of the other Ministries who spend national public money. Its task is twofold: to provide the State Government with a common basis for measuring different projects such as stamps, colleges or infrastructure; and secondly to provide a critical internal evaluation of the different Ministries.

The suspicions expressed over the last decade by the Direction de la Prevision have led this Direction to end up building its own "neutral" (from the Direction de la Prevision point of view) model for highway and road investments and oppose its results to the ones expressed by the Direction des Routes (Boiteux, 1994).

The administrative debate around the evaluation procedures remains open today and confirms the difficulties yet to be resolved.

The current evaluation procedure used for French highways raises some issues. There is a need for the public authority to compare projects on a financial basis. There are numerous effects of the investment that are vague, uncertain and difficult to define. Some are only mentioned with a simple +/- ranking procedure. Various schools of thought think ranking procedures are insufficient or certainly not as efficient as they could be and therefore need to be changed.

1.5 Disputes around infrastructure

In France, the debate on the infrastructure has evolved in the last decade.Mainly through media coverage, the political impacts of infrastructure have risen dramatically. The public sensibility has evolved over the last years. Infrastructure is now a real political issue.

The demonstrations of environmentally sensitive associations have been much more publicized in the last years than in the former decades. For instance the 1995 ecological Presidential candidate Dominique Voynet focused on combined road-rail projects during most of her 1993 legislative campaign. In 1994, one of the major ecological events in the European election campaign took place at the Somport Tunnel in the Pyrénées that is supposed to open a faster and more practical passage between Pau (F) and Zarragoza (SP). The public has discovered certain (formerly widely-ignored) aspects of the impacts of infrastructure, regarding the fauna in particular. On the other hand, some of the negative effects have sometimes been exaggerated in such demonstration.

As a first consequence, projects are usually delayed because of these powerful demonstrations. Good examples are the TGV Méditerranée between Lyon and Marseille, the A83 highway in the National Park of the Marais Poitevin, the A85 highway (Angers-Tours, West from Paris). Most have become major political issues and surpassed the single field of technical concerns. The local considerations have therefore gained national publicity while the national interest, basis on most of the projects, has not been able to succeed in the same way.

It seems that, while the technical progress has been obvious in traditional fields, the transportation evaluation and planning methods have not shown sufficient improvement to establish a feeling of confidence between the technicians and the general public. This is in particular true for the neighboring non-users of the highways who often suffer the most from their implementation.

The local stakeholders also have the feeling that their personal interests are not taken into account in the evaluation procedures and their reactions confirm this. For example, the public authority (the State) is very rarely inclined to favor the building of an underground highway because of its costs. The public knows, however, that this technical possibility exists and will do its best to have it chosen because it is better from their point of view than a classical highway. One of the last famous examples is the decision set by the Minister of Équipement Bernard Bosson in the Fall of 1993 regarding the doubling of the A4-A86 urban highways East of Paris. The initial project was based on a supplementary viaduct but the final choice was a tunnel. Since the costs are from the range of 1 to 2 times more money (or even more), the entire Parisian Metropolitan Area Infrastructure Masterplan is now likely to cost much more than the already expensive and hardly accepted projected amount. This means serious troubles for the local administrations who do not know how to deal with such questions. This happens because

the current debate -resulting from the situation- is so intense that the positions of the different actors are very contrasted.

The negotiation process appears therefore to be quite impossible. An example can be presented that characterizes the difficulties for an administration to deal with particular cases. In Bordeaux, there was a project of building a third lane on the congested urban ring highway. The question of noise became then very public and critical. The technical services argued that the traffic forecasts and the local physical characteristics would lead to a higher noise level but still under the regulatory standards. The inhabitants of the suburbs however wanted to use the opportunity of roadwork to have the noise level reduced or kept at a lower level. The debate around numbers appeared ineffective, the neighboring associations arguing about their real living while the technical services could not base their assumptions on anything else than the regulations. On that particular case, there was a real need for discussion and a priori explanation of what the levels meant and what the rules were countrywide.

Studies have been recently undertaken to reveal the impacts of highways. The best examples are the "Observatories" established around the building of the A71 and A39 highways. Their purpose is to study in real time the precise differences in the overall project environment. The A71 Observatoire, directed by the Laboratories of the Clermont-Ferrand University, was set three years before the opening of the new section to the public and covered different areas such as tourism, real estate or agricultural concerns at several dates. The A39 Observatoire is supposed to operate on the same basis. But it appears, from a scientific point of view, that the results of such studies are certainly not transferable from one particular region to the other. The Observatoires therefore can help smoothening the debate but can not be considered as real proofs. They also constitute an example of what is really feasible in certain fields.

The inherent difficulty of such exercises is due to the numerous possible points of view and the fact that the public often does not know how to deal with the results. As previously mentioned, there is no single evaluation scale. The aggregation process for such exercises is still very difficult. In such processes the use of numbers such as monetarized results would be of a great practical help. Since this is not objectively feasible from a scientific perspective, the media and the public would rather focus on subjective stories concerning the negative impact of the construction process.

The very critical environmental issue nowadays is related with two problems. The first one consists of the global effects regarding the planetary environment (the ozone layer for instance). Such effects are officially not taken into consideration in the current infrastructure debate. They are considered in the energy questions with the tax-policy but this kind of are also raised when it comes to infrastructure. The second issue is the consideration of very local concerns such as noise protection measures, physical barrier effects and so on. Most of the neighbors feel that their interests are not sufficiently considered in the projects. There exist practical ways to reduce the noise levels produced by a highway but it is very difficult (when an underground construction is not chosen) to reduce the psychological and landscape issues related with a new highway.

On the other side of the panel, the pro-infrastructure argue that the benefits to neighbors of former itineraries, to firms or to the tourist expansion are also poorly considered.

2 Emerging context

As presented in the former chapter, the present evaluation and realization procedures in France concerning infrastructure and in particular the highways are definitely very centralized from all points of view: the institutional, the financial and the social. This chapter shows however that a new context is emerging currently in France, in particular in each of those three factors. It presents how the current framework can appear outdated in a "post post-war" context. Until the 1980's, the economic needs were obvious to justify the infrastructures that are now completed. Over the last decade, regional and European needs have developed and changed the considerations over the projects.

2.1 Institutional context:

The 1982-1983 decentralization laws have been one of the most significant administrative achievements of the socialist governments which came to power in 1981. They provided both the legal framework and the financial opportunities for integrating the local representatives in the decision processes.

There are now in France four successive administrative levels. There are the Commune, the Département, the Région and the State. Other horizontal organizations (such as districts, Communautés Urbaines or Syndicats Inter-communaux) are also very common, in particular in large metropolitan or in very rural areas. To this list, one should now add the European level which now has more powers for the case of infrastructure. The European Community (now the European Union) had for instance established international infrastructure masterplans which involve numerous projects among different nations.

Considering the 22 régions, 95 départements in metropolitan France and over 36,000 communes, the number of elected people in the French population amounts to around 550,000 (de Closets). The Presidents of the départementale and régionale assemblies appear now to be very powerful elected people whose wishes and decisions do not always match those of the centralized state.

These four administrative levels all have the right to impose taxes. And their competence fields are naturally characterized by the law whether any investment is mainly profitable for the nation, the region or the commune in particular. Thus, in practice, major projects are undertaken under multi-participation (which means multi-financing) procedure among these four actors.

There are in France three administrative levels of road-classification. There are national roads, financed, built and managed by the state, "départementale" roads under the regulation of the départements, and "communale" roads under the regulation of the communes. In the past and until very recently, the technical services of both the département and small communes were those of the state that were leased to the local authorities. With the decentralization process going on, the powerful and rich départements and many big cities have decided to implement their own services. One should notice that there are currently no regional roads on the network nor European ones (even if the European Commission has classified and named some major European itineraries). The région remains however a very powerful partner as soon as financing is involved. Major transportation infrastructure projects are thus more at a regional scale than at a départemental scale.

Thus, in many places the state is now only an advisor which may provide advises and services in different fields such as technical or legislation. On the other hand, in rural parts of the country, the State remains the de facto unavoidable major participant for most of the aspects of the projects. But the regulation and the mandatory evaluation procedures

and frameworks are only put together at national levels. No lower administrative entity can formally implement its own rules and expect the state to agree with them. On another hand, there is a need for a certain consensus. The local authority can hardly finance its own projects alone and neither can the state. The breakdown of power is largely in favor of the state which remains the biggest financing authority with the largest possible reserves.

The key document for all the infrastructure expenditures in a region is the "Contrat de Plan" (Planning Contract) which is a negotiated agreement between the state and the region for five-year periods. In this document, the allocation of resources among the different départements and projects is decided. One must however notice that this document is not only dedicated just to the infrastructure business but also involves all the major governmental aspects of the region so that the negotiation process does not depend only on the infrastructure patterns.

The interest in highways has until now always responded to national concerns. The elaboration of masterplans has nearly always been a state-based and state-initiated procedure for which the studies were made by the local state representatives. In the last few years however, in particular within the 1993-1994 Grand Débat National sur l'Aménagement du Territoire local pressure has been more and more effective concerning new highway projects. The nationwide debate about land planning took place in the first months of the Balladur Cabinet in 1993 for rethinking the global equilibria as well as the Masterplans for the next 15-20 years in France. A law was passed in February 1995 that proposed new measures to mainly boost economic development of rural areas that suffer from the always increasing weight of Paris and other major metropolitan areas. The local pressure succeeded for instance in the case of the A160 and the A26 highways in the grand South-East quarter of the Parisian Metropolitan Area. They have been mainly pushed forward by local elected people. Their "inscription" on the Masterplan could not

be justified on the ground of national perspectives only. But the final decision always needed to be backed by the central government through the official announcement on the masterplan. This is more likely to happen in the future since, as has already been mentioned, the most major obvious projects from a nationwide economical point of view have already been realized.

From an historical point of view, after rebuilding the country in the years following World War II, the local authorities have started to improve, step by step and more significantly since the decentralization process began, the different elements of the countryside. As far as improvements are concerned, the next steps for départements or regions could be the realization of plenty of new freeways or even toll-roads under particular conditions. These would not necessarily be based on the strict economic grounds but could find part of their justification in political wills like the distribution of potentials for future realizations or maintaining a certain activity level in a region. A local authority may find justified to provide potentials to some economically declining region through a new freeway and therefore reject a more "rational" (from an economic point of view) solution.

Finally, the future European evolution of the different EU countries should be considered seriously. Harmonization, standardization but also deregulation are very likely to change subsequently all the different rules of the games played by the different administrative partners.

Decentralization, recently emerging European future as well as the feeling that the most important national projects have been completed, these three trends are most likely to move away the decision process from a single central administration.

2.2 Financial context

The road infrastructure business is very expensive. "Small" projects may still involve some hundreds of million of French francs. But this business is not always profitable. However, on some corridors as in urban areas the operations can really be worth financially. The examples of the Paris-Lyon TGV, the highways A6 (Paris-Lyon), A54 (Nîmes-Salon) or A10 (Paris-Bordeaux) and the urban areas new toll-operations forecasts where the profitability could be high from a pure financial point of view create certain interests for the market-investors.

This enables us to notice a current and somehow natural trend expressed by the customers of the infrastructures. The justification of the toll-systems had been the financing of the roads and it was legally clear at the beginning, so at least was and is the current understanding of the public, that the roads would be free of payment as soon as the financial cost of the infrastructure has been covered. Several concerns are now expressed concerning the oldest, most traveled sections of the national networks as Lille-Paris-Lyon-Marseille for instance. It is obvious that these sections have already been paid and the costs widely covered. But there are still a tolls on these highway and rates increase as on other sections. And as the end dates of the first Concessions nearest, it is very likely that the toll will not disappear. Practically, the Concessionaires are periodically granted new sections to build, operate and transfer and a new 35-years period starts at this time for the whole network conceded to this particular company. Even if the official reasons for this situation is reasonable, some doubts and questions are commonly raised by the public as a whole. The official explanations are, among others: (1) maintaining the toll restrains the access to the infrastructure, limits the traffic on it and keeps a satisfactory level of service, (2) it also pays for the managing and maintaining and, (3) the most important reason, the profits of some older highways cover the building and operating costs of

financially non profitable ones which have been decided based on the Aménagement du Territoire. And it is important to notice that, even if some highways are located in the mountains where they face higher building and operating costs (because of the winter-treatment in particular), the concessionaires are not allowed to charge higher prices than national average ones decided by the Ministries of the Budget and of the "Équipement" based on the "perequation" system.

In a parallel, it is worth noticing that the current trend in France is the privatization, mainly in industry and services but also in some infrastructure projects where the interest for private participation is more and more explicitly expressed by the state authorities. It is here important to study what the real situation of the private input in the infrastructure business is. There is currently in France only one but successful private highway company (COFIROUTE) for intercity highways. Some particular projects such as the urban Prado-Carénage tunnel in Marseille or the Eurotunnel involve mainly private funds, officially without the guarantee of the state. One must however notice that there were once other private highway companies in France, such as ACOBA or AREA that have however not survived the increasing operating costs and the disappointing traffic levels. There has been a State intervention through public highway companies to acquire these companies into larger, well profitable ones. The State has expressed its guarantee through this recapitalization. But from this example, one may conclude that the current traffic, revenue and risk estimates do not fit the actual needs and risk-levels of private companies.

Currently, the highway companies are mostly in the State-influence for many reasons. The financing comes from the Caisse des Dépôts et Consignations which funds are used for the public intervention in some market sectors. The Caisse also has natural strong links with the Finance and Budget Ministries. The management of the highway

companies (the concessionaires) is also mostly assumed by highly ranked civil servants like the Ingénieurs des Ponts et Chaussées (see table in previous part) who have been working directly or indirectly for the Ministry for all their carriers. The decisions regarding the financing of the highways and the trends proposed for the operational decisions of the Minister are then expressed by groups from the same culture and in some way the same interest. There is no real challenge for such people and no real threat of financial restrictions because, in some way, it is culturally assumed the state will always be ready to rescue some projects as have been shown by past examples.

The doubts expressed officially by the Direction of the Prevision regarding the evaluation models used by the Ministère de l'Équipement reveals that the current procedure is certainly not the most accurate and easily understandable for finance-dealing people.

In some cases, infrastructure are desired by local authorities while the centralized state does not find a particular interest in such project. Local authorities on another hand are also often asked to participate in administratively national projects based on the -true- argument that this local project will also benefit their residents. The power of financing is usually strongly linked with the power of deciding and more and more requests are expressed concerning the way the decisions are made and the fact that the local concerns are not taken into account for their own precise stakes. It is also not totally unlikely that one day more private financing parties could join local authorities for concessions on a local scale like what happened in Marseille (the new Prado-Carénage toll-tunnel is ruled by the Société Marseillaise du Tunnel du Prado-Carénage, a company that has used private funds for the construction), in Le Havre (the Pont de Normandie was built and is operated by the city Commerce and Industry Chamber) or what is proposed for the MUSE project

in the Hauts-de-Seine Département immediately West from Paris (the Département will concede the 30km long underground highway to private consortia).

The context of privatization is motivated by different factors. First, the current political trends in France are more likely to pursue the global process started in 1986-1988 and reinforced since 1993 by the Gaullist governments. Second, the deregulation process in place in the European Community affects nearly all economic sectors of the country and it is also likely that highway will interest different investors since it appears in some cases to be a very profitable business. And since these projects require usually large amounts of money, the natural trend is now to let those that seem profitable managed by the private sector. But the current rules for the financial aspect of the infrastructure do not seem to be sufficient, considering the risk factors for instance, to assure a sufficient profit level to private investors.

The financial context of infrastructure is nowadays changing because of both the increasing role of independent (from the central State) local authorities as well as the national and European trends towards privatization.

2.3 Social Context

The predicted evolution of the evaluation context which we have already described will most likely lead to a move from the central decision to a participatory decision with non central actors who act from a different perspective as well as in a different cultural world.

For highway builders (as for other infrastructures), the current concerns are mainly the environmental aspects that threaten the projects. But it seems also that, more than the pure environmental concerns, the personal and social concerns of the people are felt not taken seriously enough into account. The process that leads to the decision of building a highway appears mainly obscure to the majority of people who will suffer from it. The emphasis among the associations and neighbors committees is naturally placed on the drawbacks and the disadvantages of the project. The very different -as will be presented in the next chapter- stakeholders of the infrastructure should have the right -and even the duty- to present their local considerations in an early step of the debate rather that what currently happens where they feel that the project is presented to them in its very last stage where quite nothing is to be changed de facto.

The local considerations are formally taken into account in the decision process through the Enquêtes d'Utilité Publique but the real feeling of the populations is that projects are imposed to them rather than discussed with them. This trend is known and understood by the authorities. As former environment Minister Huguette Bouchardeau pointed out in her report to the current environment Minister in 1994:

> "The dialogue around the big planning projects is insufficient since it does not appear early enough in the decision process. Consequently, the general public happens to discover them in their very last phase and therefore rejects them often *en bloc*". (PCM 1994, #6)

P. Roqueplot of the CNRS (Centre National de la Recherche Scientifique) expresses also the point that the evaluation process needs to take into account inherently new stakeholders when he says that

> "Even when the study is open, the study-team remains the same. I suggest that different kinds of experts -whose positions would be officially biased by the party they represent- should argue as in a court-room." (PCM 1994, #6)

Even if some extreme measures are unlikely to happen, the ideas expressed by such high-level representatives of the policy as well as the academic world are worth considering seriously. One should finally notice that the use of the media in such conflicts has

increased and sometimes threatens the whole credibility of the project since administrative people are not used to deal with them.

Thus Claude Martinand, Director for Economic and International Affairs in the French Ministry of the Équipement acknowledges that

> "the current debate around the global transportation policy in France is insufficient. Everybody argues based on the general interest but even between different Ministries or between the local and the European levels, there are contradictions... The debate should first focus on the stakes rather than on the solutions." (PCM 1994, #6)

New tools are to be proposed for these concerns and it is somehow obvious that a pedagogical need for clarity is needed for the future. But as Claude Martinand Ingénieur Général des Ponts et Chaussées himself recognizes, the pedagogical work must both take place for the public and for the civil servants:

> "Considering the 'culture Ponts [et Chaussées]', we must also learn how to listen and have doubts about our own positions. Communication means exchanging ideas with the risk of changing ourselves, and we are not used to this process." (PCM 1994, #6)

These different new aspects -institutional, financial and social- of the evaluation needs appear critical enough for justifying a new framework that could be implemented in the French context.

3 The new needs for the evaluation procedures

The emerging context presented in the previous chapter has a certain influence on most of the evaluation process and in particular on the new needs of this procedure. The current one is certainly centralized, rather obscure (or at least perceived so) when it faces the public scrutiny and does not take into account the financial concerns like in a market-oriented economical context.

Regarding precisely the evaluation process, the need is to "assess, weigh and evaluate social, cultural and environmental factors in addition to economic factors in determining a preferred investment strategy" (Perara) that must be coherent with the actual long-term transportation strategy that the State -initially and the other decision-participants eventually- support. But, whatever the chosen process, it requires indeed goals and objectives: "Goals are generalized statements indicating the direction in which the society is to move. An objective in the other hand, is a specific statement that is the outgrowth of a goal." (Perara.)

Given this preliminary review of the real needs of the evaluation purposes and of the current disputes, we can now develop the new constraints and goals of the French evaluation procedures as a response to the changing context that has been presented in the previous chapter.

3.1 Clarity

The clarity of the evaluation could have been the result of a large monetarization and aggregation process but no service has really succeeded in elaborating a widely acceptable process for such aggregation purpose.

As has been presented, the current evaluation procedures are rather intern in the French Ministry of Transportation. Even the Enquêtes Publiques appear as presentation of results and not as explanation of the actual procedure. In a country that is now more and more covered by the media, the clarity and the fact that the procedures as well as the results can be understood by a large number of different stakeholders is very critical. This is an absolutely necessary step for responding wisely to the increase of participants in the formal decision process, such as new financing parties or the local authorities. This is all the more necessary because the increasing number of stakeholders with different interests no longer allows the central government to claim that it still has all the possible answers to any question.

And these participants are sometimes not familiar with the current procedures used by the administration. Nor are they engineers whose objectivity is culturally biased by the fact that their own education leads them to the building process. Engineers may for instance be usually less interested in the financing questions or the very local concerns. Until the recent years, highway engineers have been working in a world where the necessity of the infrastructure and its financial equilibrium were guaranteed by the State. The engineers however can overcome this "natural" drawback by improving the quality and the clarity of all their evaluations and studies. Without this clarity improvement it is thus likely that a natural mistrust towards the engineers' results will emerge.

Clarity is here meant in a wider sense than the simple public expression of the tools and standards used for the evaluation (cf. the Bordeaux example presented in chapter 1.5).

Finally, the necessity of clarification of the evaluation is a real necessity as soon as the decision is to be shared among different administrations and even associations. As Jean-Pierre Pronost, planning director at the SNCF (the French National Railway Company) explains:

> "The example of the TGV-Méditerranée expresses the difficulties of building a project which general utility had not been enough claimed at the beginning by the national and regional authorities."

The 1992 so-called Bianco-Circulaire (this is the latest official document regarding the enquêtes publiques) requires a "preliminary debate concerning the major utilities of the project in order to better clarify the commitments of the State and of the SNCF."

Considering the different steps of the legal framework regarding the Enquêtes Publiques, it is worth noticing that the State always legislated when there were public demonstrations. The first French Environment Ministry was implemented in 1972, the first text mentioning the "Enquêtes Publiques" was the 1976 law, which had been inspired by the American way. Its purpose was to facilitate the problems related with the expropriation (it nearly only dealt with this aspect of the problem) which increased on that time, especially regarding the nuclear power plants. The 1983 Bouchardeau law which developed the scope of the Enquêtes Publiques was a response to the questions related with the highways. The Bianco "Circulaire" was itself the response to the problems that occurred along the TGV Méditerranée between Valence (south of Lyon) and Marseille in the Rhône Valley. Finally, the latest environment law of 1994 which requires a preliminary multimodal study in the region allows local authorities to take real power in such a process. The State never really initiated independent research that was used to avoid major conflicts. It took France nearly twenty years to identify this question and to gain a control

degree (from the national one to the possible local one and from the monomodal question to the multimodal one).

3.2 Risk

As has already been explained, the former projects have been conducted in a very safe environment guaranteed by the State. The introduction -through privatization- of private funds in the business will lead to a totally different context. The quantification of financial risk will be a critical point, such as the different time periods that ought to be considered in the evolution of the expenses and the revenues.

From an environmental prospective, there are also risks that should be considered and, since the final outcomes are not known, a risk-quantification analysis is to be expected.

Locally there is also a risk concerning the infrastructure. Its impact is nearly always significant and the outcome can be very wide and modify strongly the aspect of the local society. One can consider the suburbs of metropolitan areas which have became "sleeping-cities" as soon as they were linked with downtown or the new tourist areas that have been developed through new infrastructure.

These single points are very important since they imply that the decision process may involve really uncertain outputs on very different scopes such as the financing aspects, the local industry.

The risk implies also dynamic strategies and preservation of the future. For instance, the A104 project in the Western Parisian Metropolitan area. The land had been officially reserved (through the urbanism plans in each commune) for this highway project for more than twenty years. But the roadside residents had been used to consider them as

parks. Therefore, when came the time for building on these pieces of land that it owned, the State faced violent local opposition. The whole debate has had to start again (Poulit in PCM).

Some observations of recent projects seem however to prove that a new tendency is about to appear in the resolution of conflicts regarding infrastructure. The A86-highway in Rueil-Malmaison appears as a worthwhile example of a dynamic strategy chosen for the future. The decision was made in order to guarantee a future evolution. Even if the current forecasts would not justify an underground solution, it appeared that there was still some risk (environmental but mainly roadside residents' opposition) that the evolution would require the originally classical planned highway to be rebuild in a tunnel. The adopted choice was then a covered trench (Tavernier, la Jaune et la Rouge) which provided all the major guarantees at the lowest cost.

The evaluation procedures must then provide both static (comparison of solutions) as well as dynamic answers to the infrastructure problems. The decision-maker should be able to understand what the consequences of an investment or of a non-investment will be in different future contexts. The study of the different possible outcomes requires a risk-quantification process.

3.3 Different points of view

It is worthwhile to remember here that the official evaluation procedures are decided at a national level. Even if it is stated that the particular local interests should be considered, this point is only one of the 10 listed. The rules, the standards, the references for possible comparison are all decided at a global level.

For any kind of big infrastructure project like highways, the number of different stakeholders and their variety is a very important factor for understanding the role the actors play. The next paragraphs present roughly a classification of the stakeholders.

There are first the users and the non-users of the highway. Drivers may enjoy the time-saving, the safety or they may be furious about the congestion and definitely not like the trip. Non-users may be living along the highway and when the traffic does increase, the noise does also, they then suffer from the highway. On the other side, people living along former itineraries may enjoy more quietness linked with a new parallel by-pass. From a wider prospective, one may consider people who enjoy shorter delays for the shipping of their packages or fresh products. Such non-users can leave very far from the physical location of the infrastructure but still benefit from the improvements it brought. A precise point here is that the same person can be user and non-user depending on the time of the day for instance. What should be its reaction, concerning any change there? For instance toll for paying the noise-protection or new taxes or also new distribution of the taxes... The major aspect of this question is that most people themselves do not know precisely what their own reactions should be.

There are also the geographical locations of the different stakeholders. On an intercity highway, there are people using it everyday for commuting or delivering products and there are people using it once a year for their holiday trip. They may not expect the same thing from this highway and they may not value it at the same level. Firms can sense the effects of a highway very indirectly, in particular if the new section is critical for the network and provides new alternative itineraries. Suppliers would be likely to relocate their warehouses and this could lead to lower prices for a firm, miles away from the newly opened section.

There is finally the time-period which is considered. Some effects are still sensitive before a highway is open to the public (the fact that there is a new obstacle that you can

not cross anymore as easily as you used to for going from one side to the other) and others are only felt after more than a decade. New highways can increase the access facilities to some region which, year after years, gets a good reputation for settling down. This can lead to a real estate boom over there. The point is not here to say that the highway did lead alone to the boom but that it helped it in some way. The major difficulty remains to determine what the precise effect of the highway alone may be, or at least to get an idea of it.

All the major considerations of the different stakeholders of the project should be considered as much as possible for enabling a public debate that could be characterized as fair by most of the currently frustrated parties which have the feeling that their own interest is not taken into account right now. The points of view that should be emphasized, studied and explained are mainly those of the local neighbors of the project, of the users and of the financial participants. What is particularly important in this consideration is the fact that all these parties seem to reject in a large measure the concept of a possible economic optimum that has founded the decisions of the central administration during the last decades. This theory does not bring satisfactory and easily understandable results while one has for instance to explain that the durable increased noise-level at one point is compensated by time saved for people who only cross the region momentarily. As Michel Rousselot, the President of AREA, explains:

> "The contesting of the projects proposed by the public authority shows the recession of traditional values such as the nearly hierarchical respect of the administrative institutions and the primacy of the general interest above the particular ones".
> (in "La Jaune et La Rouge")

3.4 The need for a new process in responding to such needs

The natural answer that a very technically oriented central administration such as the French one would give would be very likely a "Circulaire" based on a model or on an econometric estimate of different effects. This process would certainly require a long period of time. But, in addition to this, there are two major drawbacks to this approach which definitely does not seem appropriate for the problem that is currently faced by the parties.

Fundamentally and also historically, the models have failed to explain and present the evolution of transportation needs and uses because of what Maldonado characterizes as the "inherent uncertainty in the Transportation business". In fact, models have failed both technically -the results they provide are too often wrong- and conceptually -even if the use of a model is accepted, then the debate takes place around the different inputs of this model, instead of around the project itself. The appendix on this subject provides a longer analysis of these two phenomena.

Finally, the technicians have earned a very bad reputation of technocrats who can not explain nor present objective reasons: the projects justification they seem to present appear unfair and biased at the very beginning. One could expect from a model to help analyzing considerations regarding the risk of different futures, especially from a financial point of view. It is however utopian to emphasize the particular aspects of each of the actors through a model or to bring clarity in the debate. Models would be very complex from a technical point of view if they are to take into account all the different aspects that we have presented here. Therefore, they would always be considered as a black-box with which the debate would be very difficult.

3.5 The late innovations in the highway field.

Considering the three major aspects that have been presented in the following parts, one can however notice through some examples that French practices are currently evolving from the "black, centralized" image that one could get by considering former practices.

Local concessions

From the legal point of view, the Départements since 1979 and the Communes since 1986 are allowed to transfer some transportation infrastructure to a Concessionaire. Even if these laws were directly related to particular projects at the beginning (in particular for the 1979 law that was passed before the decentralization reforms); this practice is now used more commonly nowadays. In Marseille, the city let the Société Marseillaise du Tunnel du Prado Carénage build and operate the new underground infrastructure downtown. This company was then allowed to issue bonds for the financing of the operation and may fix its own prices for the toll level. There is here no question of perequation because the central government is not the major participant in this process. (The central administration is still involved, at least for the safety regulations and the signalization rules).

From the financial point of view, there are now more (and there will be more and more) improvement projects on the départemental network rather than on the national or highway network. It is important that there do not be too much quality difference between two consecutive networks which are complementary from the point of view of the driver. The participation of the state in such operations is very important today, from the financial point of view as well as from the regulatory point of view. It may be perceived as too important because of the conditions on the layout stated by the state, but this depends on each particular case. The point is here that it is more difficult for the state rather than for

local authorities (even if France is not a federal country and is much smaller than the USA) to have a clear vision of the local concerns. The technical services transfers and creations in the départements that followed the decentralization processes have lowered the direct implication of state representatives in the local questions. The state funding remain however very critical to the success of most of the operation. Totally private funding such as the Prado-Carénage experience or the Pont de Normandie (which is ruled by the Chamber of Commerce and Industry of the city of Le Havre) are however most likely to be the exception than the common rule because of the few axis that could provide a sufficient traffic (and revenue) level on départementale roads.

From the social point of view, two new processes have developed in the last years. The first is the so-called "Procédure Bouchardeau". It has been included in the last law concerning the environment. Its purpose is to prepare the public to accept the utility of a project before its nature and its final precise physical localization has been decided. For a new large project (a TGV-line for instance), there is a mandatory commission that conducts preliminary hearings in all the concerned regions and then expresses officially and publicly the reasons for the choice of a particular mode or shape of the project: improving the existing tracks or building a new parallel highway for instance.

Local referendum about infrastructure

The other tool that has been used experimentally in the last decade and which remains very debatable, in particular for intercity projects, is the so-called "Communal" referendum. It was first used in 1983 by Alain Carignon, the mayor of the Alpine city of Grenoble, for a streetcar project. The referendum was a success for the project which was then realized in the following years.

The case of the November, 15 1992 referendum concerning the highway by-pass of the city of Angers (the current A11 highway uses urban arteries that can not support any more

in a reasonable way both local and transit traffic) is really different. The consulted people in the city of Avrille were to chose between two versions of the project which concerned different geographical areas. One of the options would have deeply separated the city in two parts. The referendum was organized by the mayor of the city and he could reasonably argue that 94% of the people (or 51% of the registered voters) had voted against the project. There has been a lot of claims that this particular referendum did not take into account major interest groups such as the other communes that were concerned by the alternative itineraries, the users, the trucking industry or the future concessionaire of the section. But the major question remains the usefulness of such an operation. In this case, it had at least brought some publicity in the national media around these concerns but the result was certainly not surprising. Finally, since such consultations have no legal power for any enforcement, as soon as there is no expressed majority expressed by all the different parties in favor of an option, they remain somehow useless and can not be taken into consideration. Such referenda involve also the risk of emphasizing the roles of "losers" and "winners" which does not seem to be the sought purpose of the decision-makers trying to find a participative negotiated solution. When a strong majority appears however, the success and the dynamism of the project may be seriously boosted. The lack of any legal framework and of any historical "jurisprudence" in this field makes it very difficult for any decision maker to handle with: it is a double-edged tool!

4 Examples of American procedures

4.1 Local interests and administrative innovations

The Interstate Highway System.

This part is based on discussions with Prof. Fred Salvucci of the center for transportation Syudies at MIT. Prof. Salvucci is also a former Secretary of Transportation in Massachusetts.

This major highway program in the American history was initiated by President Eisenhower in the late 1950's (the first bill was passed in 1956) in a period where, combined with the automobile development, there was still a big need for reconverting the war industry. It was also justified as an essential National Security project.. The program was then called the Interstate Highway Defense System. The Federal Government had edited some principles for the coordination of the different sections and for the norms that should apply to the highways nationwide.

The Federal Government has levied a tax of 4 cents per gallon of gasoline in order to fund part of the financing of the program. The federal government participated financially at a very high level (90% on average but, in some regions, it reached 95%; on the other hand, the fundungs were limited in real values in certain parts of the countries, such is the Boston Central Artery Tunnel Project for instance in 1995) to the expenses related to the construction and maintaining of the highways. This allowed this program to be mostly financed on a pay as you go basis rather than through debt-financing. There was then no leadership imposed by the Federal Government in the local decision process, nor in the study of the different options, which only had to meet certain set of criteria, mainly technical. The interest was definitely national but the implementation was decentralized. The different states also used their own contracting mechanisms in order to get the highway completed.

One should notice however that the consensus was all the more wide on this program that all the benefits were internal, regarding the American economy as a whole. In more recent years where the US now import half of their oil and certainly a larger share of their automobiles, where one is more sensitive to the environmental disbenefits of the cars, the consensus around the highway system is much weaker.

This program is certainly one of the most remarkable experiences of federalism in the case of national transportation and provides an example of successful operation of a national program based on local administration. The fact that the federal government did finance at such a high level the total cost of the program without interfering in the local decisions expresses the most possible power delegated to local authorities. These knew that they had the ability, for each dollar invested to generate 10 dollars of mostly local activity.

What is also worth noticing with this experience are its practical implications. The federal government roughly provided each state with the funding and the options for the national network. The decisions were taken at the local level by the Governors and the authorities in charge not only of the local transportation needs but also of the welfare, and the economic development. Those people were certainly more able to feel the regional demands and expectations than any Washington administration. The solution, on this local basis, was then more likely to result in a participative "win-win" option. The short duration of the elected mandate really gave the electors decision influence power. The national Interstate system was then built with a very high consideration of its local possible use (and integration) within a region and it was also de facto the result of a wide dialogue with the local authorities as well as with very local considerations expressed by the people. Finally, this process abstracted a detailed highway evaluation of each particular section at a national level. The evaluation was then decentralized to each local state and the Federal Government paid for some highways that would otherwise not have been justified by their

own (like in New-Mexico, between California and Texas) that were however justified by the national coherence as well as by very local concerns. Since it is widely acknowledged that highways, as any transportation infrastructure, provide a potential for economic development, the Federal Government was then able to provide equally distributed opportunities for all the different states.

Innovative administrative entities

The traditionally public American highway system has developed a set of relations with the private sector. These relations were originally mainly driven by financial concerns. Meanwhile, however, it appeared necessary to propose new (different from the conventional public toll authorities) participative structure where the private sector could have a real degree of incentives and control in the final decisions. Three principal sorts appeared, according to a study carried out by Lockwood (1995).

Transportation Development Corporations are non-profit corporate entities acting for states and local governments for the purpose of highway development. These have been formed at the initiative of private parties that wished to advance a project and carry out some of the operations (engineering, planning, land acquisition) at their own expense. Therefore, the highways are being built (by the state or any other local authority) at reduced costs for the State. Some of the Corporations have been allowed to construct the highway themselves using bond financing backed by a state agreement to buy back the facility after completion.

Road Utility Districts and County Road Districts were also founded on the basis of private initiative to expedite highway improvements. In addition to the options allowed to the Transportation Development Corporations, they can raise funds through property assessments in specified districts.

Finally, the Independent Highway Authorities are applicable to projects where the original traffic forecasts appear insufficient to guarantee a possible classical toll-financing. Therefore, their main purpose is to raise funds through different possible techniques. In such authorities, the involvement of the state is legally limited in the financial part, so that private entities participate in the financing of public infrastructure.

4.2 Financial interests. The American experience in public-private partnerships.

The main considerations that can be learned from the American experience in this particular field covers two different sectors. First, there is the commonly accepted recognition of the possible participation of private investments in any project on the market. Second there is the idea, widely developed over the last decades, participation of the private sector in the particular context of highway financing. Saglio's (1995) deals precisely with the options of public-private financing in France and in the United States.

The possible involvement of the private sector in any profitable business

The United States are often presented as one of the most market-oriented country. There is certainly the possibility of investing in any possible project.

The American system has naturally generated "Rating agencies", such as Moody's. They analyze any kind of project submitted to them and then issue a practical recommendation to the general public. The ratings are quite simple: for example, Aaa being the best, Aa, the second best,etc. These signs express a reasonable expectation of a financial possible interesting return. Unlike the French system that rarely calls for wide public financial participation in infrastructure, this system allows, along traditional investors, the particular persons and companies to take some participation in the projects. This system is widely developed and Moody's and other well-established companies have

earned their reputation based on such evaluation. The interesting particularities of this system is that the methods are essentially financially based. As stated in the Moody's on Airport (1992):

> "Moody's rates airport debt in the same manner as it rates other kinds of debt obligations. The rating -that is, the determination of credit quality, or the risk of full and timely repayment- is based on the assessment of a number of critical factors. These factors include legal pledge or security supporting the debt instrument, debt structure and level, economic base, financial structure and performance, and administration..."

Such analysts are also developed in Europe, in England mostly, and since they are market-driven, it seems likely that as soon as projects would be proposed on the market, they would grade them from the financial market point of view in the same way as for ay other project. Moody's among others has also graded bonds issued by some national French companies such as EDF or the French Railway operator, the SNCF (especially for the TGV projects) or also bonds issued by local authorities like the Conseils Régionaux or the Conseils Généraux (which run the Départements).

One issue often raised regarding the participation of the private sector for the financing of infrastructure is that there is a certain fear for too large involvment of a public authority in controlling or setting sandards and that these standards (and then the rules in a certain way may change). This often institutional control along with the requirements of market-oriented private investors was not very attractive. However, the beginnings, both in France and in the United States, of the concession system, has permitted a change in the practical happenings and the rules for highways do not change so often. Martinand (1992) provides a very interesting state-of-the-art description of the French achievements in this field, even if they are limited and may often appear as isolated prototypes. What may remain a disadvantage in France for attracting a wide range of investors around the world is that the big banks that are available on the French market-place as advisors for any concession project and for the call for funds are nearly all state-owned. Therefore, some

outside observer could feel some doubts regarding such institutions which are too nearly linked with the highway-builders.

The main conclusion of this brief overview is that highly market-driven investors may be interested by public infrastructure projects as soon as the famous rating agencies give their green light to the projects. It appears also that, while such experiments of mixed or totally private financing on the sole French level will always remain rare or even prototypes, the European space may be a right level of possibilities for the development of both a market and a "savoir-faire".

The search for new funding for the highway-building

As Stephen Lockwood (1995) points out:

"There has been an on-going commitment in the Federal Highway Administration (FHWA) to experiment with a more flexible application of federal aid and, more recently, the potential for new legislation embodying additional programmatic reorganization has been strengthened. (...) Over the last 20 years, a range of innovations has focused on ways of drawing on sources of revenues other the increases in the conventional fuel and vehicle taxes. The innovation has focused on three areas:

1. New revenue sources -other than traditional tax sources: principally tolls, value capture and cost-sharing with benefiting abutters, combined into new mixes with conventional revenues;
2. New roles for the public and private sector that support tapping of new resources, financial and entrepreneurial; especially increasing roles for the private sector beyond design and construction to include sharing in development, finance and even ownership;
3. Financing structures and techniques that maximally leverage existing revenue sources and encourage private investment, both equity and debt."

In the United States, unlike in many industrialized countries, the fuel and other motor vehicle taxes paid by the vehicle/highway users, are traditionally not considered as general purposes taxes but are dedicated to the highway network extension and maintainance. This guarantees that transportation related tax-levels are directly set in relation with transportation policy investment policy. Currently, about 65% of revenues

used by the public sector in expenditures on highways is derived from these user taxes through federal appropriation to states and specific project allocation at state and governmental levels (Lockwood, 1995). Therefore, at the federal and state levels, highway investment levels are set by what is raised from the users. The complements are derived from special fees or taxes paid by non-user beneficiaries (so-called impact fees or property assessments paid by abutting property owners) or from payment by the general public as indirect beneficiaries.

The innovations implemented in the United States over the last twenty years are briefly presented in the following paragraphs.

Toll.

In the beginning of the nineties, 6.5% of the Interstate Highway System was operated under toll facilities. This represents 37 roads and 44 bridges in 29 states, coming up to an approximate total length of 5,000 miles. One should notice that the oldest "Intertsate-like" highways like the New-Jersey or Pennsylvania turnpikes have been financed through this system. This technique had however a difficult start after the implementation of the mostly toll-free Interstate Highway Program and is not that much developed since it appears that the people were not ready to pay such fees, especially because of the competitive itineraries and the low prices of gasoline that make these particularly attractive. Recently, however, it seems that the United States are under a path to more tolls, especially in urban areas. In 1995, there are about 1,000 miles of new toll roads nationwide in various stages of development (Lockwood, 1995).

Public/Private Cost-Sharing.

These options were developed in the regions where it became obvious that the traditional, previously mentioned, highway funding resources would not be sufficient for the completion of the project. The cost-sharing process operates either through the property development process or by assessing the beneficiaries of new infrastructure for a

participation in the improvement costs. The practical option is a value capture tax (or fee) assessed on the increased private property value induced by the public access improvement. This is made possible because local governments possess considerable power for such negotiations through their land use and zoning controls. It is here worthwhile to notice that the initiative has not always been initiated by local governments. Since access improvements often increase the value of land that can be developed, private entities have initiated cost-sharing arrangements.

Practically, the land-owners can contribute by advancing land for the right-of-way or even cash against the cost of the new public facility. Contributions are generally the result of a voluntary action from the property owner in order to advance the priority of a project by reducing its public cost, enhance a private land development project or improve the access to an existing or under construction facility.

Some states have established legal procedures to regularize systematic cost-sharing based on three options.

1) Benefit assessment districts where limited-purpose public authorities are established with the power to levy additional fees on property within their area to finance specific improvements. Revenues are typically collected on a recurring basis and are used to fund bonds for highway construction or to pay for operation and maintenance expenses, such as in Fort Collins, Colorado.

2) Traffic impact fees are charged to property developers on the basis of the specific attributes of their developments such as the amount of traffic generated (in the Palm Beach County, Florida, for instance).

3) Tax increment financing districts in which local government entities are permitted to divert regular ad valorem property or sales taxes to pay for all or part of specific transportation improvements. The available revenue is the increase in tax receipts over a pre-development base year level, as in Iowa on the I-74 Econoomic Development Area.

Unlike impact fees, the tax increment is shared by all property owners in the region and not only the new developments; unlike the benefit assessment districts, there are no additional taxes.

These financing methods can play an important role in land use control but they also introduce important public policy management concerns since some may see cost-sharing as an extortion. On the other hand, this wide palette of tools can be used in a varying strategic way on a sequence like (a) area-wide taxes followed by (b) corridor impact fees followed by (c) classic tolls in order to meet the different financial deadlines in an optimal manner to minimize the costs of debt-financing.

The two interesting aspects of these measures are first the search for a negotiated agreement based on voluntary contributions that minimize costs and increase the development of the project, and second, the ability to build the financing part of the project on a strategic multi-tools basis.

The innnovative considerations in the financing of highways have also led to conceive new ruling structures based on such public-private partnerships. Examples described in the previous part were the Transportation Development Corporations, the Road Districts or the Independent Highway Authorities. The latter option is currently used for the San Joaquin Hills corridor in California where the $1.2 billion project combines a $1 billion of toll road revenue bonds, $111 million in State funds, $97 million in investment earnings, $39 million in subordinated debt to the (private) construction contractor and $31 million in private development impact fees (Lockwood). This cost-sharing was necessary because the traffic forecasts were insufficient to guarantee the funding of the project by tolls alone.

Privatization.

The measures associated with the development of the real financial involvement of the private sector in highways are based on the conclusions of different FHWA (Federal Highway Administration) studies sa quoted by Lockwood (1995). These indicate that, for the first part of the 1990s, the annual public capital investment of $40 billion was insufficient to cope with all the identified needs (building but also preservation). There was a suggestion to call for 20-30% increase in the financial requirements. Since mixing, possibly increased, fuel and general taxes did not appear to be sufficient, the search for alternative forms of highway financing increased significantly.

The principal characteristic of the privAtized projects is the total separation from public financial support or guarantees. The financing companies are project-based and their returns are taxableunder current state and/or federal laws. The concession holders are specially constituted mixes of investor, design, construction, management and technology companies. In Virginia, the concessionaire of the Dulles Greenway is a regulated utility whose toll-rate is subject to state-review. In California however, toll rates on the SR 91 corridor in the Orange County are left to the concessionaire as a market matter while returns on investment are subject to regulation.

The possible forms of private participation are the classical build-operate-transfer (BOT) or build-transfer-operate (BTO). One may be preferred to the other depending on fiscal considerations such as advantageous forms of government ownership, or limited tort liability for the consortium. In the BTO case the consortium, after having built the infrastructure, leases it from the local authority for the purpose of operation and thus avoiding the payment of property taxes. The most advanced private operation is the BOO model, build-own-operate which is currently used in Virginia for the Dulles Greenway (Lockwood, 1995).

4.3 Social and environmental interests. The practical American experience through the NEPA

The opposition against the ground infrastructure is often driven by environmental concerns, in the widest sense of the word. This is true in nearly every country and certainly more in industrialized ones. For dealing with this problem, the American congress has enacted the National Environment Policy Act of 1969 (NEPA) as other countries (like France) have also passed legislation in this field. This act requires that an Environmental Impact Statement be realized on all projects. This impolies public inquiries, information and negotiation. Beyond the theoretical framework, what really matters is the practical way such studies and statements are performed in a rather constructive manner.

> In the 1969 Act, the Congress first presents the general statement, recognizing "that each person should enjoy a healthful environment and that each person has a responsibility to contribute to the preservation and enhancement of the environment." and "that the Nation may (1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations; (...); (4) preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice; (5) achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities (...)" (United States Congress, 1969)

After this global introduction, the text presents the general framework for the process that is also valid for concerns that are not only ecological-environment driven but that can apply for any project that causes concerns to its future neighbors. The following requests are then mandatory.

> "All agencies of the Federal Government shall (A) utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decisionmaking which may have an impact on man's environment; (B) identify and develop methods and procedures, (...) which will

ensure that presently unquantified environmental amenities and values may be given appropriate consideration in decisionmaking along with economic and technical considerations; (C) include in every recommendation or report on proposals for legislation and other Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on (i) the environmental impact of the proposed action, (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented, (iii) alternatives to the proposed action, (iv) the relationships between local shorterm uses of man's environment and the maintenance and enhancement of long-term productivity, and (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented; (...) (E) study, develop, and describe appropriate alternatives to recommend courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources; (...) (G) make available to States, counties, municipalities, institutions, and individuals, advice and information useful in restoring, maintaining and enhancing the quality of the environment; (H) initiate and utilize ecological information in the planning and development of resource-oriented projects; (...)"

This theoretical framework that also inspired the French regulations of 1977, 1983 and 1992, can be considered as classical since the global spirit is widely accepted nowadays: take into account the global and particular environment for the present time but also for future generations, study different options, publicize these results and make them available to the general public. (From a discussion with Michel Giacobino, at the French Environment Ministry at the end of the 1970's, in charge of reforming the French Environment Protection legislation). It should be stressed that a particular emphasise is placed on the alternatives, and in particular the "do nothing" alternative.

What is particularly interesting, however, is the way these regulations are implemented inpractice and problems discussed in daily life. It appears that the current trend in the United States is towards the successful negotiation. One can see this as one of the influences of the private sector in this particular business, since this is mainly a profit-oriented practice. A delayed or stopped project over a long period can have a strong negative influence on profitability and success, both financially as socially.

The United States' trend towards a negotiated agreement that will not be rediscussed after setting, is widely different from former French practices that took place in a real conflictual environment. In France, the parties were not prepared to discuss; this is one of the consequences of the characteristics of the French system as presented earlier. The first requirement is to find partners for discussion, or at least, to publicize enough the project so that possible considered parties can express, sufficiently ex ante, their own concerns. This is one of the major reproaches against the current "Enquêtes publiques" in France where the public hearing procedure is often felt as hidden or useless since it does not take place sufficiently early on for considering widely different options. Culturally, in France, it is also easier to be against a project and demonstrate with wide media coverage than to engage any discussion with an "Enquête Publique" which failures or abuses have been sometimes presented. And since such public demonstrations have proved to succeed in the past, there are really not many incentives for joining a negotiation.

In the United States, the authority --either public, private or a mix of these-- in charge of the project often seeks the debate with local organizations or associations. Negotiations then start in a somehow open environment, assuming that nearly everything is possible. Since this procedure has been implemented a long time ago and since a lot of different results have come out (from the canceling of the project to its wide acceptance) the outcome is not a priori set and the negotiating climate is rather serene.

In Massachusetts, a negotiation mainly conducted by the powerful Conservation Law Foundation has resulted in having the State DOT reaffirm its public transportation policy and even increase its transit investments in spite of the large amount projected for the Central Artery Tunnel project (put underground the 8 miles of highway in downtown Boston, a project evaluated in 1995 around 8 billion dollars) (CLF, 1994).

In the city of Boston, in a case of airport noise complaints, Massport (the authority in charge of the Logan Airport) financed the neighborhood association to pay consultants

who were then able to "mediate" and "translate" the local concerns about the noise in technical decibel requests that the Massport technicians were more able to take into account in the practice. This action was also educational for the people, who were confronted, on a neutral chosen basis, with the technicians, their measures and all the pros and cons of these projects. This educational task of the authorities in charge of transportation infrastructure in the case of protests (or concerns) is something rather unknown in the French experience. (From a discussion with Prof. de Neufville).

For the Dulles Greenway in Virginia, there has also been a wide negotiation around the infrastructure. The outcome were some supplementary protections for hydraulic concerns in a wetland, especially by widening the piles of a bridge. This led to an increased cost for the $7 million bridge by $1 million (over a total for the project of $300). On the other hand, however, it guaranteed that the project would not be stopped or suddenly heavily criticized by all the major local associations. And since the time constraint was very heavy for this particular highway because of loan reimbursement plans, this agreement was certainly not against its global management. Other examples could certainly be found all over the United States. (From an interview with Suzann Conrad Public Relations of the Dulles Greenway Project).

These participative, agreement seeking, procedures that enable wide discussions or considerations around the projects are based on two basic assumptions. First, the transportation authorities do not know every aspect of the context and therefore need the participation of local people. Second, loosing (from a certain point of view) time and money at the beginning of a project in order to guarantee its realization in set options and delays is certainly worthwhile. In the same time, it provides some education to the people that can be useful for future debates. The education is both for external parties as well as for internal engineers and technicians who certainly learn from each experience and are then able to implement new creative options.

The different examples of the American experience show that the decision and evaluation of building highway (or improving any transportation) infrastructure can be really based on wide participative processes that, even if they take time at the beginning, guarantee success for the following implementation. A dynamic, improving on any project, experience can then be gained under such system, for the administrative, the financial as the social aspects. The American experience is a proof of successful management, negotiation and decision at local levels that appears to be efficient, even for widely national policies.

5 Recommendations for French highway decision-makers

Lessons can be learned from the American examples but they are not definitive. These two industrialized countries are similar but critical structural distinctions are not to be forgotten.

5.1 Foreword

This chapter presents two sets of recommendations regarding highway decision-making in France. The first is practical and is divided into the three aspects studied in this thesis: institutional, financial and social. The second set is conceptual, inolving suggestions for the current authority in charge, the Ministère de l'Équipement, whose attitude and leadership are critical to highway decisions. Changing their general attitude is mandatory if the other proposed changes are to take place successfully.

The geographical scale of the two countries is not the same. In France, all points can be reached by car in a day from nearly any other origin. Competition between the different modes (air, train, high-speed train and car) thus occurs on all the origin-destinations pairs. The size and the density of the network is also not the same, and the national highway networks have not been built in the same period. Likewise, car-ownership in France is 400 cars for 1,000 inhabitants, much lower than the 600 per 1,000 in the US.

The different administrative levels do not have the same relations and the same powers in the two countries. France is not a federalist country and even the deepest decentralization process would not lead to something like the current American administrative separation of the authorities.

The study of the current French procedures, the practical ones and the theoretical ones can let us draw some conclusions for our particular subject and for the way a reasonable evolution in the future is expectable.

5.2 Practical recommendations

If things are to change practically for the planning, the funding, the debates, the decision and the realization of highways or any other ground transportation infrastructure, some steps are necessary.

Decentralization and institutional changes

Administratively, the examples of the last "Autoroutes" accepted during the "Grand Débat sur l'Aménagement du Territoire" by the Direction des Routes are quite significant (see page 32). The early initiative for these highways was really a local matter and the arguments were sufficiently well presented so that the local considerations could lead to a national decision.

A recommendation for both the State and the local authorities (Départements or Régions) is then that, as has been done for maintenance by transferring authorities to the Départements, the State could favor some local highway authorities for the Régions or Départements that feel that it is needed.

This decentralization of the planning authority would certainly lead to greater participation of the local authorities which are already in charge of mass-transit systems or intercity regional transportation services (bus or train). The current national authorities could then play a "consultant" role with a high technical background and very different experiences.

Regarding the national network, the State remains the main actor, especially for the technical regulation. Départements and Communes can initiate actions to modify the Urbanism Plans and prepare new roads. The only thing local authorities can not yet do is to build and manage "Autoroutes". These major highways remain the exclusive property of the State. The practical implication is that départementale and communale roads will be limited to 110 km/hr speed but this has not been a limitation so far. The evolution brought to the "Enquêtes Publiques" by the laws of 1983 and 1994 and the "Circulaires" following the laws enable more participation in the debate (ex ante for large operations, for instance) and could avoid some delays and passionate debates.

Financial concerns

From the legal point of view, the current framework seems sufficient for the financial questions. Concessions can be decided and attributed by local authorities. Mixed concession where the local authority is financially partly involved in a toll operation to support insufficient revenue forecasts to allow a 100% privately funded operation is even legally possible (Journal Officiel of 1/06/1988). But it appears, more through practical realiites than the legal system, that current procedures are not sufficiemtly convenient to bring spontaneous and personalized participation of diverse private entities into the highway building process. For instance, it remains today very difficult, both from the legal as from the practical (negotiations with the authorities in charge) standpoints, for a supermarket or a mall to improve the interchange linking its facilities to the local highway.

The financial recommendation is that the regulations and the practical realizations call and let the door open for private funds and any other financial initiative from private entities. This implies a change in the risk-analysis processes that will have to meet the requirements of private investors as well as those of the State.

Private investors in the latest proposed projects have been very cautious since the 1991 financial disaster of Orlyval, the originally 100% privately funded fixed link between Paris and Orly-airport. For this particular project, the traffic forecasts had been greatly overestimated and the State once again (through the RATP, its Parisian Transit Authority) had to take over the bankrupt company that was supposed to earn profit through the operating. This had quite a terrible effect since the project had been heavily publicized, both for its technical achievements and for its financial structure.It appears that neither the technical considerations nor the financial structure was deficient but that the risk-analysis had not been well undertaken, from marketing and financial points of view. Since then, the new operation of the link has started to cover its operation costs after a serious review of the demand and of the potential customers. Somehow, a new management of French transportation infrastructure has developed in this case.

More recently, the rather successful early beginnings of the Prado-Carénage tunnel in Marseille, and of others in France or in Europe, may bring more enthusiasm in the minds of potential investors. Such projects are 100% privately funded and for most of them, they have no formal guarantee of any public authority.

A second financial recommendation is that the French Highway projects, as well as other infrastructure, should involve international participation, at least using European funds. This could help French investors if they suffer from certain "low" periods and also provide examples abroad of the French achievements in Highway building and financing. A similar trend exists outside France where French groups lead or participate in private highway projects. The achievements of Transroute in this field provide examples of such possibilities: it is the international subsidiary of the Scetauroute group and operates in more than 40 countries. At least a dozen of French groups participate in private financing of highways, tunnels or bridges, such as in Hungary, Malaysia and Australia.

Participatory processes

The first recommendation for participation, as it is acknowledged by most of the parties involved in the process, there should be a long term goal of cooperation. This was expressed by Patrice Legrand, President of the highly representative and powerful federation France-Nature-Environnement, comprising nearly 1,000 different environmental associations in France, in a debate with Ingénieurs des Ponts et Chaussées:

> "I am happy to hear tonight positions which are likely to reconcile us with representatives of the Administration because tensions have been quite heavy in the past. There should be an open debate between you (the technocrats of the administration) and the associations that defend the nature. I regret, however, that despite the legal framework, things today still have not changed that much. (...) Working together, we could do more"

Responding to this, Michel Rousselot, on behalf of the Association of the Ingénieurs des Ponts, added:

> "I will gladly keep in mind Mr. Legrand's proposition of meetings of Ingénieurs with associations, this kind of dialog is to be carried on." (PCM Le Pont, 1994).

This cooperation, that could hardly be expressed ten years ago, now appears to be a possible reality in the future. Although it will certainly take time, meanwhile processes are still engaged.

One should not forget, however,that the legal framework, however good and efficient it might theoretically appear, does not provide all the definite elements for a successful set of operations and negotiations. This is certainly critical because it concerns the way the projects and debates will take place in the very near future. The long-term discussions will also be influenced by the current practical happenings under the new system but, as we have seen in the previous chapters, the global legal framework is more or less in place for allowing more participation from the administrative, the financial and the social points of view around projects.

Socially, the latest laws reaffirm the commitment of the State to the theory of the Public Utility of a project. The Procédure Bouchardeau (1994 law) requires however that

for "big" operations, preliminary public meetings be held to plenty justify the modal option chosen by the State, or whichever the leading public authority is. And the example of the choice of a covered trench for the A86 highway in Rueil-Malmaison (see page 44) suggests that really negotiated solutions can be reached between the public authorities (in this case the State) and the local parties which enable the actions to end in win-win outcomes.

A second recommendation is that the French authorities should profit from the opportunity expressed by organizations like Michel Legrand's and try to start both a dialog and an education process with such organizations. What is at stake is to guarantee from the beginning that the process will be completed, as negotiated and agreed on, in the proposed schedule. The challenges related to this issue are more in the practical processes than in regulatory texts. Currently the most harmful damages are those caused by sudden delays and reconsiderations and eventually modifications of projects. The example of the A14 interchange right La Grande Arche de la Défense in Paris, that had to be destroyed for esthetic considerations after being completed at a cost of 1 billion French Francs, created a real feeling of disgust for most observers.

5.3 General attitude for the Ministère de l'Équipement

The legal framework appears sufficient to implement most of the recommendations. The most important point remains however its application, first in theory through the "Circulaires" and then in practice through early realizations.

Implementation of a new "Circulaire"

The "Circulaires" have real legal power. They strongly influence the way things are done in practice by the competent administrative agents. If the procedure followed for a project does not comply with the "Circulaire", then it is possible to start a claim at the local administrative court. The procedure remains however rather vague since the documents are written globally for the entire network. What matters most is the "Spirit of the Circulaire", the way it is understood and applied in practice. Therefore, the latest practical examples matter as much as the text.

Given the leadership of the Ministère de l'Équipement in highway-building and evaluation, any progress from the current position will have to come from its initiative. Its corporatist structure is not necessarily a drawback for change since information may thus be carried through the hierarchy more quickly and formal or informal dialogues and debates may then take place spontaneously.

Whatever is decided, the next and mandatory step to change things in practice is certainly in the regulatory process, and it is most likely that there will be, at least in the beginning, a new Circulaire for such purposes. A Circulaire is usually signed by the Minister in charge but is generally developed under the supervision of the Direction des Routes. In the particular case of highway evaluation, a new Circulaire is likely to be the result of a study group led by the Direction des Routes and comprising representatives of the:

- Ministère de l'Équipement:
    - DTT, Direction des Transports Terrestres (Direction of the Ground Transportation, in charge of the rail, the bus and transit issues),
    - DAEI, Direction des Affaires Economiques Internationales (Direction of International and Economic Affairs),
    - CETE,

    - SETRA,
    - INRETS,
- Concessionaires,
- SCETAUROUTE group, their usual working and building arm,
- Caisse des Dépôts et Consignations,
- Ministry of the Budget/Direction of the Prévision,
- usual local authorities' Bank, the Crédit Local de France,
- local authorities, Conseils Généraux and Régionaux,
- Ministry of the Environment,
- environment groups (these persons could be the most difficult to identify because of the wide different aspects involved and their non-official representation process).

And eventually, this task-force would certainly consult representatives of the:

- European Community,
- traditional investors,

One must however keep in mind that the Circulaires are important documents, published infrequently. It may take some time to complete them. As procedures that are based and launched on such basis have an average duration of five to ten years, it is not reasonable to modify them significantly on a yearly basis. A reasonable way that has already been used in the past is appendices or complements to existing documents. These considerations emphasize certainly the need for a very wide negotiation among all the different parties that also should enable local considerations.

Experimentation and risk-taking

A recommendation is that the emphasis be put on example projects which were successful on a participatory basis. It is an excellent way for an administration to build credibility.

It appears that there are really two ways to modify the actual system. The first is to push for and to participate in the edition of new "Circulaires" which are the basic written reference for the projects and which "translate" the law into practice. The second, which may be the most important in a Corporatist administration, is the success of practical innovative examples.

This is exactly where some ways used and tested in the American transportation administration can be especially useful for the French future.

This means also that there will be a certain risky process for the Ministère de l'Équipement since this means a deep change in their leadership from a technical leadership to a technical/policy leadership.

Three main ideas that can be taken from the American experience. First, it is possible to build a coherent, nationwide, system, responsive to national policy needs through decentralized institutions. This highway system can be built by local authorities although funded by the national authority. Second, there is a wide range of possible options for private participation in the financing or cost-sharing of highway infrastructure. It appears that in a deregulated European environment, the investors could be present as soon as the projects (or parts of them) seem reasonable compared to any other possible investment. Third, it appears (but this particular point remains the most debatable since it involves social and cultural characteristics) that a constructive and participatory discussion with environment-driven organizations is feasible, that these discussions can lead to a reasonable win-win solution, which is highly satisfactory since there is a consensus around

the fact that the debate and negotiations around the infrastructure projects are the most successful practices nowadays, both in the United States and in France.

From the legal point of view, as has already been presented, there is not that much that any French government need to do. It should however allow easier access in practice of the private sector to the financing or the cost-sharing of infrastructure. It is currently difficult under both the French tradition and legislative rules for a mall or any abutters to participate in the financing of its nearest interchange, for instance to give land to accelerate the process. On the other hand, there should be no real fear of the participation of private investors: they could be interested in any likely profitable project and take some burden out of an authority facing financial problem. What is definitely lacking, maybe more in the current practices than in the current regulations, is a participatory option for external parties in the highway development process.

A constructing action in France could be based on different parallel options. De facto, the key-element of such a process would be the Ministère de l'Équipement. The recommendation is then that the Ministère acts internally and externally, on the legal function as well as on the managerial aspect.

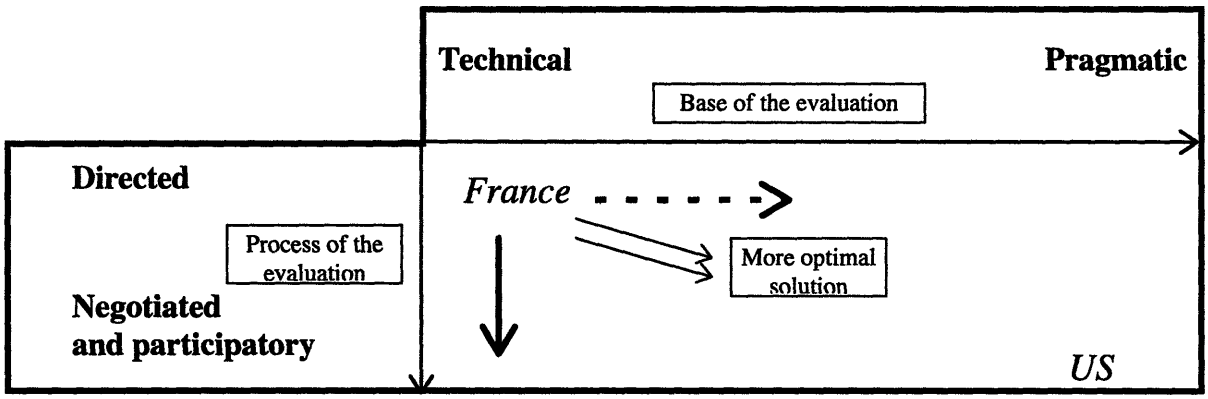
Internally, the French Ministry should continue on the discovered path of assuming its leadership and modify it based, among others, on some of the participatory processes that have proved to be successful in the United States.

Its corporatist structure and basis should be able to change its image to the public, even if this requires some public acknowledgments. The experience and wide knowledge acquired by the different engineers should not be lost or constrained by the current environment. From the managerial point of view, this is certainly a field where a lot of challenges could be overtaken. The Ministry should also use the decentralization process that some may think lead it on a way out of the highway decision business. Since this process is unavoidable, the Ministry could use it to reinforce, in the minds of the different

actors, the necessity of local decision processes and of local negotiations. Its knowledge and an expressed goodwill in those fields would certainly be appreciated and useful for all the parties. Without loosing their technical skills but presenting themselves with a new hat like a consultant or a mediator both knowing how to use a very wide range of tools and being ready to participate financially in the completion of the project, the agents of the Ministry could develop and smoothen over the years a participatory process.

The Ministère de l'Équipement may also suffer from its negative image based on some really non-optimal achievements. But, in the same time, some examples of local participatory structure have appeared that could be emphasized to make this image evolve. The French system has long suffered from a lack of creativity or even some fears of innovation, for instance in the case of financing through private initiative. However everything is not that negative and things could easily evolve, based on debates and clarity which former "black-box like" models, close-minded and other caricatured aspects of the administration did not bring.

The following scheme summarizes the relative positions of France and the United States regarding the Highway Evaluation process. The arrows show the possible evolution for the French system: the plain one represents a quasi-natural move for a highly technical administration, the dotted one is more hypothetical, and the double one represents a recommended move.



Before we conclude, it is important to notice that, beyond the geographical scales of the two countries, a very critical difference remains which is the use and availability of space in France. In the United States, it appears that, except in very dense urban areas, finding right-of-way is not so impossible while this is certainly the basis of most of the problems in France where, after thousands of years of settlement, people are certainly more attached to the land. Finding different options for short sections of highway (compared with the American system) can turn out to be nearly impossible.

5.4 Conclusion

The highway-decision process in France is at a critical point for its future. Experience in the United States shows that a system based on heavy local participation in decisions can succeed. Considerations of the current situation in France show that, however perfect a project may be, from a technical point of view, its success depends on the outcome of a wide negotiation between very different parties. Part of the outcome is also very likely to involve innovative options for the practical financing, building and realization of the infrastructure.

The French Ministère de l'Équipement could therefore emphasize and help the local processes and, by the same time, operate a managerial leadership shift from the technically based corporatist structure towards an open-minded, innovative, and efficiency driven one that would enable participatory debates involving administrative and social local entities as well as private financing sources to take place successfully.

APPENDICES

A The Use of Models for the Purpose of Highway Evaluations

This appendix focuses on the use of models in the field of highway evaluation and more precisely on econometric models which are the ones some wish to see developed and used. The first part shows the principal advantages and the efficient fields of such tools, and the next two focus, in relation with the topics of this thesis, on their technical, and conceptual inefficiencies.

A.1 The principles of models and their efficiency

Models are often used in technical fields. The purpose of a model is to give an accurate idea of what may happen under given hypotheses. One must never forget that an important part of the process belongs to the assumptions and all other hypotheses made at the beginning.

A main advantage of models is that they represent some aspects of the reality through more easily transformable and explicit tools, mainly numbers. All scientific courses and procedures are based on equations and numerical figures that try to most accurately reflect, if possible, how things work in reality and how variations of one may influence the others.

In transportation , models are used for many purposes. Traffic forecasts and infrastructure management are those most currently needed for the planning and estimates of highway projects. The purpose of such models is to provide ideas of how things work together, what are the influences of decisions, of investments, of policies on several fields, what are also the numerical or even monetarized effects of these. Models try to figure out

the possible "links" -direct or indirect- and the importance of such "links" between different kinds of activities.

A preliminary precision is necessary. The econometric models considered here do not pertain exclusively to economics, which narrow-minded ones could limit to the relations between purely economic data. Models are here understood in a more wider sense that includes relations between incentives, behaviors, and costs or expenses, etc. As according to Intriligator (1983),

> "Econometrics is the branch of economics concerned with the empirical estimation of economic relationships. (...) While this definition is oriented to economics, the econometric approach is not confined exclusively to economics; it can be applied to other disciplines, especially other social sciences (...) or areas of public policy, including health, education, transportation, housing and environmental protection."

We therefore consider any kind of transportation models used by technicians or decision-makers that involve considerations of financial or economic costs with behavioral aspects of citizens.

Another important aspect of econometric models is that they cover two main fields, which are also the two main inputs of models, namely theory and observations. As Malinvaud (1980) explains,

> "the art of the econometrician consists in finding the set of assumptions that are both sufficiently specific and sufficiently realistic to allow him to take the best possible advantage of the data available to him."

These two main characteristics which reveal the particularities of each set of models are therefore very critical. In order for technicians to combine these two fields, Intriligator emphasizes the use of the "statistical theory and econometric techniques."

All the major econometricians are aware of some doubts related with their own science. As Belsley and Kuhn (1986) say about such concerns, "Criticisms are possible."

But Fischer (1992) emphasizes the natural limits of their models and the fact that hypotheses must ever be kept in mind:

> "Identification in simultaneous equation models typically proceeds by using restrictions on particular equations. But econometric models are approximations, and so are such restrictions. If prior restrictions are not fully correct and variables excluded from equations belong in them with small coefficients, does this not also mean that structural equations are truly underidentified and consistent structural estimations impossible?" The answer he provides is "while approximate models only give approximately true results, those results will still be satisfactory and useful if the approximations involved in the model are good enough."

The remaining questions are then the definitions, or more likely, the common understandings of "satisfactory" or "approximate."

As has already been mentioned, the highway questions involve several groups which can be characterized as the users, the non-users and the public authority. The major and the most commonly used expression of the users' behavior is the traffic. Therefore, one may still conclude that precise, or at least accurate traffic forecasts remain critical.

The econometric models are usually used for several tasks, all of them rather related with the same three points Intriligator (1983) characterizes as: "Structural Analysis, Forecasting and Policy evaluation." Such steps are also used in the transportation fields but, however, forecasting is the most common one, especially with traffic.

Intriligator describes the models as "representation of an actual phenomenon such as an actual system or process, in order to explain it, to predict it, and to control it." Models are necessary because they avoid conflicts with the "real-world complex phenomena which are so complex that they can be treated only by means of a simplified representation, through a model." The point that needs to be emphasized here is that

models are a simplified representation of the real world and therefore their results should - may be- not be taken for sure at a precise and local level.

> "A model represents a compromise between reality and manageability (...) which involves various processes of idealization, including the elimination of "extraneous" influences and the simplification of processes. (...) A "good" model is both realistic and manageable."

The data are very critical in an econometric model. Intriligator describes them as

> "the summary of the facts concerning the phenomena under investigation. These facts may be of different types, and they may be derived from different sources, with the theory underlying the phenomena used to choose among the different alternatives. They may be fundamentally quantitative, fundamentally qualitative, or a mixture of both types. Whatever their type, source, or nature, they are expressed in a quantitative way in carrying out an econometric study."

He further points out that

> "an econometric model requires, for its estimation, data on all of the variables included in the model. Values taken by endogenous, exogenous, and, where appropriate, lagged endogenous or exogenous variables, are necessary in order to estimate the parameters of the model. Indeed, the first and often the most serious pitfall in performing an econometric study is simply the lack of data. (...) In general the data are either not available or not available in the form wanted."

This opinion shows all the interest but also all the difficulties of estimating the impacts of very complex systems such as the environment of a transportation infrastructure. The concern about the availability of the data is important; it emphasizes one of the inherent - but still known and accepted- defects of the models.

Another critical issue concerning the models is their scope, the field on which they do provide results. Usually, economic models give results and appreciation (result, variance, means, forecasted errors and sometimes a possible sensitivity analysis) on very few "items". Transportation evaluations, as they are needed now --not only for large (regional) groups or the administration but also for local impacts-- are expected to provide

precise and very diverse results sometimes on very limited geographical scales. Models are usually global and the more detailed results expected, the more data needed.

Concerning the scope of models, one should never forget that models are a pure creation, they do not have any initiative. Regarding the scope of results, this is a very important point. A model will never give out results or estimates of any effect it has not been asked to deal with. Therefore, one can never be sure that the results will show the actual reality and the broad scope of effects of a project. The best assumption is that they will give out good estimates regarding the effects that have been previously listed. For instance, no model in the 1960's would have been able to give any tangible result concerning the greenhouse effect or the Ozone-layer effects of the automobile traffic.

The models can however be very useful if they show -or are used with- some consistency. Let us consider the "Abraham law" for instance on the French highways. The Abraham law is used to study parallel concurrent itineraries. (Ministére de l'Équipement, 1991) The law expresses the way the traffic divides itself among the different possible itineraries based on the so-called "generalized" cost of the trip. This "generalized" cost includes time, comfort, car's usage as well as real monetary cost of the trip. This law has been used for a long time (it was first established in 1962) in nearly all the base-case traffic forecasting studies. Its advantage is that all the forecasts (as wrong as they may be) are seen and compared on the same basis. And, with the time going and the real happenings compared with the forecasts, the judgment may now be influenced. For instance, as quoted by Boiteux, a study has shown that a distinction in the exponent used in the law (currently 10 for all cases) would be more accurate concerning the two cases concurrential National Roads on one hand and National Road competing with Highway on the other hand. But there has been no realistic attempt to change this law and provide a new-one on which nobody would have had any proof of its "better" accuracy. One of the issues here is

that in practice the advantages and drawbacks of using a common or "conservative" model that people are used to work with and know the limits of, may be at least as important as the fact that a model gives accurate results. One must however notice, for this particular example, that the amount of induced traffic is very difficult to determine. The differentiation between former traffic, transferred traffic, normal-growth traffic and induced traffic is sometimes only a conceptual and mathematical figure!

As a conclusion regarding this brief overview, we may state that the use of models is widespread in many technical fields, among them transportation. The models seem useful for exploring different hypothesis as they provide numerical results that allow easy comparisons. Their scope and fields of application seem to be limited by nature in order to avoid too complicated and inefficient manipulations. Models are however very dependent on the data and the theory used in their achievement. This makes them sensitive and criticizable for some technically unfamiliar person studying these results.

A.2 The Technical Inefficiencies of Models:

Econometric models have some interesting advantages but also major drawbacks because of unreliable results. It should however be emphasized that the results were not "bad", they were more or less incomplete or, as has just been explained in the previous part, the assumptions were not accurate.

The problem with transportation models is that they have to take into account individual human behavior that people themselves do not know how to explain, especially with the intercity trips. For such trips on highways, details are very important for instance the signalization on the itineraries. On the estimated 1 million of intercity trips longer than 100 km covered by car each day in France (on average on a yearly basis) it is particularly

difficult to figure out what is the part of the "common" trips (covered, let us say, at least once a week) and of the "uncommon" ones.

One of the first purposes of an analysis of the highway is to understand, explain and finally model the reactions of users concerning their itinerary-choice, their mode-choice, their travel date-choice, ... Studies are very difficult since one must try to figure out why are people doing what. Understanding this requires a precise "behavioral" study. Most often people do not have a unique reason for using a highway and their reasons depend on many particular (sometimes personal) factors. But the same study expresses that there are plenty of other factors that intervene in the choice procedure and this leads to a very uneasy aggregation process for determining a single preference measure for future traffic predictions.

One of the most difficult point is the difference in the amount of information known by the user about the future itinerary and the possible alternatives. People are not ready to answer such questions about their behaviors. They do actually not know the answers themselves. Nobody is prepared to answer such questions as "What is your value of time?" From another perspective, it is also difficult to use the units. Consider the question of the noise, for instance. hardly nobody is familiar with the decibels that measure the noise level. It is a logarithmic unit of pressure. Current levels are 60 to 80 dB. Cutting the noise-level by half has nothing to do with dividing the dB-level by two. 30 dB is still a quasi perfect silence as in desert areas without wind! A question about the value to give to a 5 dB-cut in the noise level is therefore hardly understood (what would really mean a cut by 5 dB for my everyday-life?) by most of the people.

The current methods in order to provide such results -at least for the value of time that is the most comprehensible and the most studied social value in the highway field- have still not brought useful and satisfactory results that could be used on a wide general scope. (see the following table, on page 88, summarizing some results, by Quinet) The

problem is nearly the same as Heisenberg's principle: observing things, people or facts disturb them and therefore the observation does not reflect the "absolute" reality.

The inherent difficulty here with transportation related models is that they not only concern the monetary aspects (toll, gas, car costs) of this market. Non-monetarized aspects are very critical -the most common ones are time, comfort, congestion or safety- and therefore enhance the difficulties of the precise exercise. As pointed out in the National Cooperative Highway Research Program Report # 342 "the key assumptions in the [transportation] economic evaluations are the values of time, life..."

One of the main problems for highway evaluation models however now concerns the differentiation between the users and the non-users. The users' benefits have been more or less well identified and estimations have been undertaken in the past decades on which a possible agreement seems to appear, at least on the list of benefits to be considered. The use in the French process as quoted in the chapter 1.4 or the Synthesis # 201 of the National Cooperative Highway Research Program provide such examples.

The problem now is more precisely described in an example by Drew (1990):

> "Three alternatives have been identified. The decision will be based on the evaluation of user and non-user benefits for the two improvement alternatives. However, existing methodologies do not permit objective evaluation because they cannot measure socioeconomic impacts (...) that are the key to finding non-user benefits [and costs.]" And Drew can conclude that: "All economic models are limited in their ability to duplicate the complex reality of a dynamic economy. Selection of an economic model depends on the type of uses for the results and on the details of information sought. The strength of economic models lies in their theoretical soundness, whereas their pitfalls result from a lack of empirical data needed to support every theoretical intricacy. As a result, applied economic models are relatively unreliable in practice." (in TRRR 1274)

This is also more or less the idea expressed by Bell and Feitelson (1990):

> "Today, there is no generally accepted framework for explaining why, where, and how various transportation services are linked to economic development in the context of the new postindustrial economy." (in TRRR 1274)

These heavy conclusions about the use of econometric models for the evaluation of highways express a certain technical frustration but also a somehow realistic conception of such tools.

The use of such complete models is not easy nowadays and seems not feasible to implement given the technical and theoretical difficulties.

As Prof. Sussman claims in his teaching at MIT, "Models are always wrong but some may be useful." This analysis of the Chairman of the 1994 Transportation Research Board confirms the particular views expressed in this chapter. The models can be very useful for comparing, roughly, different scenario but should not be considered too precisely for very sensitive marginal analysis.

Another critical point concerning the possible reliability of the models is the difficulty to explain now what are inherent components of the system and what are the so-called externalities. The point is that the system "impacts of highways" is too wide and that nearly everything (time-period, location, income, motorization-level, trip-purpose...) can be included in it. There is still no precise answer to the question whether congestion is an internal or external impact of an Highway, it depends on the point of view: the presence of a vehicle may cause congestion to another. The debate remains open, even in the transportation economics scientific community. A definition of the concerned fields and a separation between internal or external effects is certainly missing now for a solid basis needed for future procedures. But, as Belsley and Kuhn (1986) warn, "the gain in forecast accuracy using more sophisticated outside information is not trivial." The following step is then to separate the necessary data and considerations from the unnecessary. On a precise, local, individual field, this seems definitely not trivial, while it seems more feasible (and it is still made through the variables chosen in the current evaluation procedures) at a global, governmental-like level.

The models could however prove to be very reliable if they were stable. Model results are dependent on the variations of the inputs. Some models are more or less sensitive and results are all the more comfortable to deal with when they show some stability if faced with sensitivity analysis. As pointed out in the National Cooperative Highway Research Program Report 342 "Economic studies [in the transportation field] are moreover subject to variations in key underlying assumptions." Therefore the technical models have failed to provide their users with strong results that could be indisputable.

Some examples are available of studies and models that did not provide accurate results. The preliminary study of the A-54 highway between Nîmes and Salon-de-Provence provides a good demonstration that models may be wrong and, in this case, lead to very inaccurate decisions. The purpose of this highway was to shorten a current trip and to provide a new (and complete the first highway direct one) itinerary between Italy and Spain. The missing link was then planed in the Provence. The forecasts used in the late 1980's by the French administration showed that there was no need, by 2010, to increase the capacity of this highway from 2x2 lanes up to 2x3 lanes. The highway was then approved and built with no easy possibility of widening. The problem is that, with the highway half completed, the observed traffic in its first years in service was already at the level of the 2010 forecasts! The improvement of the highway is therefore needed and it will now cost a lot more (land acquisitions, bridges...) than if this possibility had been included in the first project.

Another example of the difficulty of getting accurate results through the use of models is the CREDOC study of in 1988. (CREDOC data, ISIS study for the USAP [Union des Sociétés d'Autoroutes à Péage], 1991) The principle of this study was simple and clear. It would use all the data of the previous years and build a model that would show the evolution of the total traffic on the highways for the future. The model was intended to give precise and accurate results that agreed with the past observations over a

long period of time. The first years of observation showed however that the forecasts were all inaccurate compared to the observed reality. The question with such models is always based on the same assumption which is that the future trends will follow the past ones.

All these examples reflect what Maldonado (1991) defines as the "inherent uncertainty in the Transportation business". It is mostly related to the fact that it concerns very personal decisions and a very wide range of modes, motives and destinations.

Failures of models are known and acknowledged by most of the scientists dealing with such aspects. The current trend is however to develop the research in this field. Nearly all the articles end with sentences like "It clearly provides the motivation for more detailed study of these issues" (Belsley and Kuhn, p. 114 or Drew, 1990, in TRBR 1274).

Models also show important differences in their results when they are compared with each others. A critical issue concerns now in the transportation fields the so-called external costs of transportation. Numerous studies have been undertaken by different organizations. A summary of their results show uncommon differences in the numerical results. The following table present some summaries of these values, a wider both theoretical and pragmatical study of such results can be found in Quinet (1993).

Table A1: **Different estimates of the external costs of transportation**

Country	**Source** **Willingness to pay**	**Year of estimate**	**Result: Cost** **(in % of GNP)**
France	Lambert	86	0.08
Netherlands	Opschoor	86	0.02
former FRG	Wicke	87	2
Norway	Nielsen	87	0.3
Sweden	Haussan & Marckham	92	0.4
Germany	Weinberger	92	1.4
Switzerland	Jeanrenaud	92	0.3
Country	**Source** **Avoidance expenses**	**Year of estimate**	**Result: Cost** **(in % of GNP)**
France	Merlin	89	1.5
Finland	Himanen	89	0.3
Finland	Transportation Ministry	92	0.42
USA	The Going Rats	92	0.2
Germany	Dickman	90	0.2
Germany	Planco	90	0.15
Australia	NRTC	92	0.15
Switzerland	Jeanrenaud	93	0.3
France	CETUR-SYSTRA	90	0.36

Source: Quinet, (1993)

The variation scale ranges from 1 to 20 or even 100. The point is not here to say that they are all wrong but, once again, to emphasize the needs for a precise set of hypothesis for such studies. These results can not today be the basis for evaluations or investments. The differences are too big and models based on such results would be too sensitive.

The models have shown drawbacks and wrong results that lead to bad decisions. This chapter has provided some examples of false results issued by the models. One could also have shown, fortunately, some correct predictions given out by models Therefore one can not rely on models only for the evaluation of highways.

A.3 The Conceptual Inefficiencies of Models:

The technical difficulties and inefficiencies of the models are complemented and even supplanted by more critical conceptual difficulties that would remain even if an hypothetical model would be presented that could give out precise and local results for the real world, so that one would be able, based on this model, to characterize solutions as optimal in an evaluation procedure.

This model would suppose that the world has been modeled, rather easily! Drew (1990, in TRBR #1274)also points out that "to synthesize portions of the transportation-economic development process in a consistent manner without a formal technique is impossible." But it seems further more that such formal and global technique is not available now.

One of the points is that there is a problem in defining a useful time-period for the evaluation. Usually highways, as most public infrastructure, are thought and designed for very long time-period: several decades or even a century. Meanwhile, most concerns are short-term concerning the impacts of the highway. The non-users and the prospective abutters do not want any highway in their backyard. The reorganization (through

relocalisation) of industries are processes that take at least several years to be effective and measurable. From another point of view, the companies that are ready to bet or to develop strategies through big investments for more than 20 or 30 years are rare and often need guaranties from the state or any public authority for their loans. The Eurotunnel project for instance would only provide substantial revenues in the last 10 years of its 65 forecasted of under private management operations. The guarantees given by the states, even if they were not financial, were very important for the consortium of companies.

Another important point is that the econometric models are based on the past experience and there is no way to insure that past trends will be accurate for the next coming years.

One of the most famous examples in the world of transportation of the misuse of models for the evaluation of transportation infrastructure is the Third London Airport project. In the 1970's, the British authorities started a procedure for a choice of a third London-airport (quoted by de Neufville, 1994). The procedure was supposed to demonstrate the economic benefits of the infrastructure through a wide model. This model used the value of time as one of its major inputs. The debate focused then on this value of time, its estimate, its reasons... Millions of punds and plenty of time were wasted in this procedure which was finally unable to bring out a useful single result for the problem set.

On a smaller but representative scale, there is the Bordeaux infrastructure Masterplan started in 1992. This project was at least delayed for three months only because the local administration and the national one disagreed concerning the way to consider the two most important data that showed the traffic increases between two dates without any other information. One party argued that the growth was linear, the other that the growth was exponential. There was honestly no good technical reason why one option should be preferred and not the other one. Such an assumption was of course very critical

for the future while, in the same time there was no way to consider why one was more accurate than the other. The debate then focused only on this point, forgetting totally what the real questions were. Both parties tried to convince the other one with some rough models but there was finally no agreement and the heavily delayed study had to keep going with two base cases for the evolution. This example shows the importance of the numerical data and the way people easily focus on them without any further interest in what the real world deals with. It also shows a major drawback of models from which one is dependent and from which one may expect every result that one want, especially when the data are not numerous.

Another problem of the use of models and measures is the difficulty for the public to understand the reality of numbers. In Bordeaux once again, there was a project of building a third lane on the congested urban ring highway. The question of noise became then very public and critical. The technical services argued that the traffic forecasts and the local physical characteristics would lead to a higher but still under the regulation noise level. The inhabitants of the suburbs however wanted the noise level to be reduced or kept at a lower level. The debate around numbers appeared inefficient, the neighboring associations arguing about their real living while the technical services could not base any assumption on anything else than their regulations! On that particular case, the technical regulations and models could not be the first arguments that could be brought by the technical services. There was a real need for discussion and a priori explanation of what the levels meant and what the rules were countrywide.

The major problem in such a process is that the debate is transferred from a real technical understandable material highway to a model. The data, inputs and theories of the model need then to be confronted to public debates.

Some essays today about the value of life for instance show totally different numbers. In such studies the values are highly debatable, so are the ways to come to these

results. The estimation of values of life, as expressed by Kahn (1986) show also that perverse, unacceptable and definitely useless (for the transportation purpose) results such as negative values of life (for non-union members workers!) may come out of the process.

The problem of aggregating different values for different categories of users or non-users would also be very critical since some could argue that there should be particular values for different people (for business-related trips, students, seniors...) in a certain extent, one should then try to model anybody and its possible future changes, then aggregate it in some way and finally make it possible for this system to evolve in the future. The problem, once again, is that the concerns in transportation mode-choice are very complex and that plenty of particular behaviors are possible and expressed. The object of the debate would then be the model and definitely not the project any more.

The French evaluation procedure uses a standard value of time for the estimates rather than the revealed value of time, because it wants to reflect the problems and rank them compared with the policy decision-criteria that may not be the same as the market-efficient criteria. This procedure shows another aspect that makes the use of models difficult and conceptually inappropriate for the evaluation purpose. For instance, in the Abraham law, two different values of time that are used: one is the revealed value of time used for computing the cost or the trip, the other is the official, standard value of time used for computing the benefits in time saving for all the possible users and non-users. The former is really a personal value while the later is a more social, global one which tends to express the benefits for the society as a whole of time by a single person.

Whatever would be, an hypothetical model would transfer the debate. But, as comes out from numerous readings and practical experiences, there is no need now for any optimal solution the public decision-maker can impose with authority since the solution is now the result of a debate. This led in France towards the Bouchardeau-Law in

1983 that implemented the "Enquêtes Publiques" for the infrastructure studies. Public debates now take place along the projects, in particular for the TGV's in the last years, the TGV Méditerranée fro instance.

Another conceptual difficulty of the use of models for the evaluation purposes is that they often appear as complex and mysterious black-boxes that are difficult to appreciate. This is expressed by the Direction de la Prévision in Boiteux about the ARIANE program. "The outputs of the software do not allow now the necessary distinction between the different time saving benefits related with the improvement of the highway". On the other hand, it seems difficult to appear in public debates with hundreds of different outputs to be presented. Models should then be able to give out both very detailed and general aggregate results to please all the different kinds of publics.

The current models are very unlikely to take into account all the interests of the different stakeholders that have been mentioned. The technically based distrust that we also suggested is therefore very much more likely to remain concerning any new model. There will be a need of time for any model to be widely accepted and recognized as helpful for debates around the infrastructure projects.

Another drawback of the models is that they do not seem very flexible. The use of a model suggests that it is accepted and that all the future decisions will rely on it which does not seem to be a stabilizing process in the case that there are some doubts and questions around the projects!

The models are also not able no to take into account political goals such as "equity." The decision-maker may want to invest in a particular region -which also contributes through its taxes to the national income- and such investment may be totally out of comparison with other ones that are economically more profitable. The infrastructure debates face now more and more the difficulties of justifying the decisions of that create potentials. As has been expressed in many articles the transportation

infrastructure do not provide the economic development, they only act as a necessary help and bring a potential that needs to be used by local forces. The comparison with financially profitable highways is then difficult. At some point, the most rentable highways are in urban areas (high costs but very high traffic levels) and the investment in rural areas (medium to high costs and low traffic) would not seem "rational" on such scale.

Finally, if the need for further research appears in the modelization area and, in particular, in the transportation related fields, then this would take time and also money. One can not figure out what the cost of it would be, at least because the objectives are not very clearly set. A Delphi could help but one could also argue that the cost is not worth the purpose of the project through a cost-benefit analysis

The models are not able to provide the decision-makers with accurate answer and help now. Even if "good" models were to be developed starting today, it would however take a long time -at least several years in the best hypothesis- for everybody to agree on its advantages and reliability. The debates on highway investments will however take place now and in the following years. So the models are not ready to face public scrutiny and they do not provide today an accurate answer to the questions asked. Therefore a model-only based answer does not seem to be the most appropriate one for the concerns expressed by the numerous stakeholders of the highway projects. The use of only an universal global model in order to evaluate the impacts of highways would certainly lead to debates around the model itself rather than on the precise project which does not seem to be desirable, given the needs and expectations of the evaluation procedures.

B Financial indicators used for the evaluation of transportation infrastructure

Economic vs financial concerns of infrastructure

The evaluation process is basically concerned about summarizing as much data as possible about potential effects of a decision (or of a non-decision) and making them stand on a same point of view in order to compare them and possibly to rank them. The difficulties of any evaluation procedure for public infrastructure is at least twofold. One is that there are financial concerns and, by the same time, economic concerns that should not be confused or misunderstood. The other point is that there are lots of differences between the stakeholders for such infrastructure. There will be presented in the following paragraphs.

In such projects, there are two things: the price of the infrastructure, as far as man can know it plus the overall so-called indirect costs (or social costs), and benefits that people feel related towards the infrastructure.

One can summarize the differences between these two points by the opinion expressed by the mayor of the small French Alpine city of Pralognan-la-Vanoise about the imposing ice-ring especially built for the Curling-competitions of the 1992 Olympics: "I know how much it cost me, I will never be able to figure out how much I earned through it." The point here is this huge infrastructure will have other effects for the city than just bringing in paying spectators for all kind of ice-events. (From an interview with the mayor)

The financial cost of an infrastructure is the total price that the owner finally pays to the builder of the infrastructure. This price may also be actualized each year considering the operating expenses linked with the infrastructure. Most of the time, this price is counterbalanced with revenues that may come from the operating of the infrastructure:

tolls, using fees, selling hydro-electricity... Those internal incomes and expenses are easily accounted for in a balance sheet. But it is unlikely that most of the road projects in a country are only justified by financial considerations. A single look at the number of roads on which there are no tolls show that there must be other reasons for completing the projects than the single financial interest.

A public government is not primarily interested in any direct monetarized benefit from the infrastructure business, but it has to be able to justify its investments which are made with the tax-payers' money. Profit making businesses are more likely to attract private investors and to find a purely financial justification. The interests some people may find in a highway is that it saves them time, it reduces the risk of accident, it makes it easier for them to travel from one point to another. Those are things people value somehow. Some would maybe have paid more for using another faster mode while some would have not traveled because of the high price of the alternative. From another point of view, some can find that a new highway may be financially costly. A store in a city may have had some kind of monopoly on its customers, but because of the new road, most of the inhabitants will drive away to the big supermarket in the suburbs of the nearest big city. Losses to the small shop may counterbalance gains for the big one. There can be plenty of examples that show that the effects of a highway are much more than just financial for the building entity.

The role of a government is certainly to take care of the most possible impacts of the infrastructure it builds and to try to figure out what they may be and what may be the consequences of it through evaluation.

Criteria are the practical tools used in evaluation. They serve both to rank projects and to determine a timing for their implementation.

From a government perspective, the evaluation concerns totally different sectors such as welfare, education or national defense. Therefore the most currently used scale is

money. This appendix presents the most common financial and economic criteria and briefly studies their advantages and drawbacks.

Analysts most often use five different criteria for the evaluation of projects: benefit-cost ratio, net present value, internal rate of return, payback period and debt service coverage ratio. They are all based on the forecasted benefits and revenues -in terms of real money or of monetarized equivalent of the non-monetary factors, which represent at least most of the external ones.

These measures are considered over the life of the project. This is a critical point as it is very difficult to forecast the actual life of infrastructure. There are minimal limits which are often set by the administration and there are the real results over time which are usually longer. For highways in particular, it is not unreasonable to consider that they are built for several decades or even for ever if we consider that the future generations will maintain them. Major bridges in France are for instance built for an official period of hundred years. On the other hand, there are very few investors that are ready to invest over such huge period of time. The Eurotunnel story has shown all the difficulties of this kind of projects for which the payback period is around 50 or 60 years. Considering the realistic life of a project is nearly impossible. Therefore some minimal lengths are used (30 years at least for highways, even if, regarding the social cost of money, all expenses and revenues after 25 years are negligible) but the forecasts can not be relevant over such period. In France for instance, the most distant forecasts are those made by the French National Electrical Supplier (EDF) for the size of its nuclear power plants. Such forecasts hardly exceed 25 years and the numbers are very rough and, most importantly, they remain general at a national level.

For the case of French Highways, the financial analysis and criteria remain critical for all the concessionaire who have chosen to take this risk over a very large period of

time. From their point of view, highways can reach their small equilibrium (revenues cover the operating expenses and the cost of the financing) or their big equilibrium (revenues cover the former expenses and the initial investment). Practically , the guarantee offered by the French state remain very high because the private concessionaires which went bankrupted were absorbed by the solid private-public concessionaires. The same thing happened for the fixed link between Paris and Orly-airport, Orlyval, which was bought by the public operator of the Parisian transit and Metro System, the RATP, just before bankruptcy.

The different financial evaluation criteria.

This section is based on de Neufville (1990) and the 1991 Circulaire.

The Benefit-Cost Ratio represents the present value of the benefits divided by the present value of the costs of a project. It has been the most commonly used in the US for the projects requiring major capital investment. Its major advantage is the fact that it is easy to understand. One must however keep in mind that this ratio has never been used by industry planners or government planners of projects that involve high operating expenses. This is because the benefit-cost ratio is inherently in favor of massive initial investment projects. This occurs because this ratio uses the sum of all costs together, whether investment or operating costs. The benefit-cost ratio can not properly compare capital-intensive projects with other that have significant operating costs. This should be taken into account while comparing the building of a new infrastructure with the implementation of a modern traffic management system. One of the most debatable issue in the use of the benefit-cost ratio remains the fact that it needs to choose a discount rate. This choice is critical because it influences the importance of the future benefits of costs and very difficult to make for very long term projects. The governmental French discount rate is about 5% for infrastructure while the current industry discount rates are more likely to be

around 15%. In the US, the discount rate used by the Federal Highway Administration in the 1960's was even 0. Some projects involve endless discussions about the discount-rate.

The Net Present Value is the difference between the present value of the benefits and the present value of the costs. It is often presented as the best single measure of a project. This is the measure that is currently recommended and used by the French administration. Practically however, it is difficult to handle this tool with a public which is not familiar with the use of discounted cash flows. The measured value has no direct relationship with the actual current costs or benefits. Finally the net present value does not allow comparisons of the profitability of the project, the economic efficiency of the project is not taken into account. The important choice of an appropriate discount rate remains also critical for the use of the net present value criterion.

The Internal Rate of Return is the discount rate needed, constant over the years, to bring the net present value to Zero. Its use has increased in the last years because the development of spreadsheets has made this computation much easier than it used to be. It is also accepted that this rate shows the exact economic efficiency of a project but nearly only this efficiency. One of the major advantages of this rate of return is that it eliminates the discussion about an appropriate rate of return. This criterion mainly focuses on the economic efficiency of a project. A difficulty may appear whenever there are final costs that are involved with the project. Such cases are however rare and can therefore be avoided and predicted but the fact that they exist forbids to consider it as an universal evaluation measure.

The payback period represents the Capital investment divided by the monthly net benefits. It is widely used in industry business but rarely for government projects, mainly because its use deeply depends on the values associated with non-monetarized costs or advantages.

The public is also not quite prepared to agree on such demonstrations. An example of this phenomenon is the experience with SIRIUS, the traffic management system in the Paris metropolitan area mainly based on loops, video cameras and Variable Message Signs. The analysis explained that the time saved by the users and the satisfaction expressed by their immense majority led to a payback period of less than a year. In practice however, the public was unable to receive and understand such results, mainly because of the difference between economic benefits and financial costs (taxes!).

The major advantage of this criterion is that it often, depending on the project, avoids long-term speculative considerations because the computation process stops as soon as the expenses are covered. The immediate benefits are emphasized through this criterion.

The problem with highways or infrastructure regarding this criterion is that they mostly lead to long-term rather than short-term benefits. Another difficulty relies on the inherent assumption that the monthly benefits are more or less constant over time. This can not be true for the highway projects on which the traffic is the main variable and is now very sensitive to the network effects in France as the itinerary choices become more and more critical.

The debt service coverage ratio represents the annual revenues divided by the annual payments to bondholders. This may not be exactly appropriate for public infrastructure projects but it makes sense for most of the intercity highways which are ruled under concession. Its main advantage, in theory, is that it avoids the problems and difficulties of trying to determine the value of time, of safety, of noise or other so-called external costs regarding the highway projects. The problem is however not totally cleared since one should figure out how much people are prepared to pay for such benefits. The willingness-to-pay may remain inappropriate for such considerations as has been explained above. The major conceptual weakness of this ratio is that it is concerned exclusively with

actual revenues that can be used to repay the investments. Other factors such as environmental improvements do not count. From a governmental point of view, this factor remains then insufficient.

This small presentation of criteria has also shown that none of them seems relevant enough to be used separately for the purpose of evaluating alone highway infrastructure. A mix of them is usually considered by the analysts.

BIBLIOGRAPHY

- Adler, Hans A., 1987, "Economic Appraisal of Transport Projects, a Manual with case studies", EDI Series in Economic Development, The John Hopkins University Press.
- Association des anciens élèves de l'Ecole Nationale des Ponts et Chaussées, 1994, "Annuaire 1994", Paris.
- Belsley and Kuhn, 1986, "Model reliability", MIT Press, Cambridge, MA.
- de Closets, François, 1992, "Tant et Plus", Le livre de Poche, Paris.
- The Conservation Law Foundation, 1994, "Road Kill", Boston, MA.
- La Documentation Française, 1994, "Transports: Pour un meilleur choix des investissements", Groupe présidé par Marcel Boiteux, Commissariat général du plan, Paris.
- Fischer, Franklin, 1992, "Econometrics", MIT Press, Cambridge, MA.
- Friedlander, Ann Fetter, 1965, "The Interstate Highway System; a study of public investment", North Holland Public Company, Amsterdam.
- Intriligator, Michael, 1983, "Handbook on econometrics", North Holland Pub. Co, Amsterdam.
- La Jaune et la Rouge, 1995, "Environnement et Aménagement", Special Issue, February , n° 502,
  Tavernier, Jacques, "L'environnement dans l'enjeu au quotidien",
  Rousselot, Michel, "L'environnement, un projet de société", and
  Pronost, Jean-Pierre, "Du débat préalable à l'enquête publique".
- Kahn, S., "Economic Estimates of the Value of Life", IEEE Technology and Society Magazine, pp. 24-31, June 1986.
- Lockwood, Stephen C., 1995, "Public-Private Partnerships in U.S. Highway Finance: ISTEA and Beyond", in Transportation Quarterly, Vol 49, No 1, Winter.
- Maldonado, Jaime, 1991, "Strategic Planning: an approach to improving airport planning under uncertainty", Massacusetts Institute of Technology, TPP Thesis, August, Cambridge, MA.
- Malinvaud, Edmond, 1980, "Statistical Methods of Econometrics", North-Holland Pub. Co., Amsterdam.
- Martinand, Claude, 1983, "L'expérience française du financement privé des équipements publics", Economica, Paris.
- Meyer, John, and Straszheim, Mahlon, 1971, "Pricing and Project Evaluation", The Brookings Institution, Washington DC.
- Ministère de l'Équipement, du Logement et des Transports, Direction des Routes, 1992, Circulaire n°92-71 du 15 décembre "relative aux grands projets nationaux d'infrastructures", Paris.

- Ministère de l'Équipement, du Logement des Transports et de l'Espace, Direction des Routes, 1991, Circulaire du 15 novembre "définissant les modalités d'élaboration et d'instruction des avants-projets sommaires d'itinéraires (APSI)", Paris.
- Ministère de l'Équipement, du Logement, des Transports et de la Mer, Direction des Routes, 1990, Schéma Directeur du Réseau Autoroutier, Paris.
- Ministère de l'Équipement, des Transports et du Tourisme, Direction des Routes, 1994, Circulaire du 5 mai "définissant les modalités d'élaboration, d'instruction et d'approbationdes opérations d'investissements sur le réseau routier national non concédé", Paris.
- Ministère de l'Urbanisme, du Logement et des Transports, Direction des Routes, 1986, Lettre-circulaire du 14 nars, Fascicule spécial n°86-11bis, "Méthodes d'évaluation des investissements routiers en rase campagne et en milieu urbain". Paris.
- Moody's, 1992, "The fundamental of airport debt", Moody's Finance Department, 1992.
- National Cooperative Highway Research Program Report #342, 1990, "Primer on Transportation, Productivity and Economic Development", Transportation Research Board, Washington DC.
- National Cooperative Highway Research Program Synthesis #142, 1988, "Methods of Cost-Effectiveness Analysis for Highway Projects; A Synthesis of Highway Practice", Transportation Research Board, Washington DC.
- National Cooperative Highway Research Program Synthesis #201, 1994, "Multimodal Evaluation in Passenger Transportation ; A Synthesis of Highway Practice", Transportation Research Board, Washington DC.
- de Neufville, Richard, 1990, "Applied Systems Analysis, Engineering Planning andTechnology Management", Mac-Graw Hill, New-York, NY.
- de Neufville, Richard, 1994, "Economic and Complementary Criteria for the Selection of Investments in Airport Projects", Report prepared for the U.S. Federal Aviation Administration.
- PCM Le Pont, 1994, "La maîtrise des déchets", Special Issues, transcript of the debate "Infrastructures et Environnement, Conception et Concertation" June-July , n° 6, Paris.
- Quinet, Emile, 1993, "Les coûts externes des transports", OECD report, Paris.
- Quinet, Emile, 1994, French Transport Policy and the Perspectives of European Integration", in Transportation Planning and Technology, vol. 18, #4.
- Roe, Michael, 1987, "Evaluation Methodologies for Transport Investment", Aldershort, Brookfield.
- Saglio, Marc-Antoine, 1995, "Financing public infrastructure in the United States and France; a comparative analysis and policy recommendations", Massacusetts Institute of Technology, TPP Thesis, June, Cambridge, MA.
- Société de l'Autoroute Paris-Normandie, "A13, une Autoroute se souvient", Paris, 1994.

- Transportation Research Board Report, 1990, #1274, "Transportation and Economic Development, 1990", Transportation Research Board, Washington DC;

  Perara, Max, "Framework for classifying and evaluating economic impacts caused by transportation improvement",

  Drew, Donald, "Overview of the methodologies and conclusion",

  Bell, , and Feirelson, , "Bottlenecks and Flexibility: Key-concepts for identifying Economic Development Impacts of Transportation Services".
- United States Government, United States Congress, "The National Environment Policy Act of 1969".
- Wellington, A.M., 1887, "The economic Theory of the Location of railways: an analysis of the conditions controlling the laying out of railways to effect the most judicious expenditures of capital", rev. ed., John Wiley, New-York, NY.