The Greater Paris: Towards a New Era of Mass Transit Systems

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1. MASS TRANSIT IN THE PARIS REGION: FROM THE ORIGINS TO TODAY

Up to the nineteenth century, the cities, even the most important ones, were not widespread enough to afford and justify the implementation of truly public transportation systems. By the early second half of the nineteenth century, in order to be able to face the needs of the drastic traffic increases in the rapidly and ever growing demography, industry, and business of the Paris area, the organization and structuring of transportation facilities and media was to progressively gain a paramount importance.

The new railway techniques available at the time, a first illustration of the appropriateness of which was in essence illustrated by the operation of the link Paris – Le Pecq in 1837, appeared to bring solutions to cater for such growing congestion issues. Half a century almost was however needed from this acknowledgement to end up on July 19th 1900 to conclude the decision making processes by opening into revenue service a first line between Porte Maillot and Porte de Vincennes. Those first kilometers which were built in some sort of a record time lapse between March 1898 and July 1900 were early birds to many additional ones.

Let us quote hereby a few stages for the development of the Paris network starting from that date.
- At the start the growth is pushed towards the limits of downtown (“Paris intra-muros”), with quite a sustained rhythm: 32km (1905), 70km (1910), 92km (1915), and 108 km (1925):
- The Master Plan of urban development for the Paris area in 1965 plans a regional network and in 1969 the first section of line A for the regional express network (RER) is put in place between Nation and Boissy-Saint-Léger
- 1977: Inauguration of central sections of lines A and B of the RER
- 1998: Opening of the METEOR line between “Bibliothèque François Mitterrand” and “Madeleine (Line 14)
- 1999: Opening of the EOLE line of the RER, which includes an underground central section between two distant stations Magenta and Haussmann-Saint Lazare thereby connecting directly two sets of formerly distinct railway stations: “Gare du Nord” and “Gare de l’Est ”with “Gare Saint Lazare”.

2. MOVEMENTS IN THE PARIS REGION: A DIAGNOSIS OF THE PRESENT EXISTING SITUATION.

The trip numbers and conditions needed by the metropolitan area inhabitants can be illustrated by a few figures:
- 35 million trips a day,
- 1h30 average duration per daily trip per inhabitant, and for 20% of them more than two hours;
- 170 million kilometers run every day, out of which more than 100 accomplished in private cars;
- 180 km of accrued traffic jams every morning;
- Railway system use increase since year 2000: +18% for the metro, +16% for the RER and suburban trains.
The following statuses/conclusions have been identified:
- A considerable increase of movements from suburb to suburb: within the last thirty years, this sort of trip has more than doubled and today represents 70% of daily movements. Projections made at nearby 2015/2020 close horizons do show that the needs are going to become even more critical, particularly in the suburbs closest to downtown.
- A very unbalanced mass transportation offer between Paris and its suburban metropolitan sections: a gap break at main Paris downtown entrances in terms of mass transportation offer, mass transportation accessibility, and transportation time necessary to the workplace through mass transit. Suburban areas do actually endure unfavorable conditions.
- A mass transportation network which stands very close to saturation: because of its radial design structure, such network imposes orbital connection needs between suburbs to be satisfied with partially radial transfers in or under downtown Paris. The resulting conditions for transportation and above all the level of service quality they result in can only be hardly kept satisfactory with very little margins of flexibility. Consequently as well, there is reduced social benefit opportunities in extending radial already existing lines.

3. AN AMBITION FOR DEVELOPMENT OF THE METROPOLITAN AREA “LE GRAND PARIS”

Taking the opportunity of the inauguration of the “Cité de l’Architecture et du Patrimoine” on September 17th 2007, The President of the French Republic has expressed the wish for a “new wholesome project of development of the Grand Paris” to be able to come to reality. At the beginning of year 2008 an international consultation was launched and set under the Authority of a Control Committee which included Administrative national and territorial instances in charge: the French state, the City of Paris, the Ile de France Region, and the Association of the Region City Councils Mayors. Starting June 2008, approximately ten architectural and urban consulting outfits worked on the two scopes for the consultation tender: « The twenty first century post Kyoto Metropolis” and the “Progressive diagnosis of the Metropolitan area”. On April 29th 2009, at the “Cité de l’Architecture et du Patrimoine” in Paris, the President of the Republic has inaugurated a show presenting the “Ten views of the future Grand Paris” designed by the ten consulted multidisciplinary outfits.

3.1. The business and activity growth

During this show, the President of the Republic has defined the target goals for the development of the Metropolitan area, and delegated its implementation under the authority of Christian Blanc, Secretary of State. The President’s and its Government’s ambitions are to allow the Region to ascertain the exceptional status it enjoys throughout the world, while taking full advantage of its potentialities to address the challenges of the twenty first century. Through this trigger and its subsequent roll-on effects, this Metropolitan development would decisively contribute to the prosperity and social well being of the entire country. These developments will be supported by a handful of major pillars among which focusing both on a set of “Project territories”, and initiating an extended new Mass Transit programme.

3.2. The “Project territories”

In particular, supporting a number of excellence clusters with worldwide connections and influence would sustain those development objectives. The list follows:
- Confirm and extend the positioning of the La Défense district, as the true Financial District for the Grand Paris in terms of excellence in high added value services
- Set up the metropolitan port at the convergence point of rivers Seine and its affluent the river Oise.
- Emphasize the existing scientific and technological platform on the Saclay Plateau focus, so as to ultimately turn the area into one of the most reputed and considered ones the world over.
- Merge the often clustered existing academic and industrial environments in the southern metropolitan area to reach a status of “Biotechnology Valley”.

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- Place the “Cité Descartes” within a new urban outfit around the Marne river, with the main objective of promoting the existing scientific cluster focused on eight disciplines to one of the reference widely known world clusters in the fields of construction, of maintenance and of services to the concept of “sustainable city”.
- Promote the “Plaine Saint Denis” as a reference cluster for creative industries and numeric arts
- Develop the former Le Bourget airport into a renewed excellence pole focused on aviation and business mobility.
- Reinforce the status of CDG airport as an international exchange hub as well as a pole for industrial logistics developments.
- Upgrade and regenerate the urban structures of the cities of Montfermeil, Clichy sous Bois, Livry-Gargan, Sevran and Aulnay sous Bois.

3.3. The need for a Mass Transit programme of investment

The Metropolitan area today faces a major Mass Transit investment need because traffic congestion nowadays can reach levels never experienced before. Those investments represent the necessary condition for the Metropolitan area to turn back into a much more dynamic economic growth.

A new class of considerable major investments is therefore needed in order to cope for the creation of a new primary network, which as a dorsal spine merged with the existing network would structure both addresses to downtown traffic congestion emergencies and projections into the future.

4. THE MASS TRANSIT PROJECTS FOR THE “GRAND PARIS”

4.1. An important regional network of driverless automatic Metros

The public transport Network for the “Grand Paris” is made of an automatic high capacity and high speed metro linking the downtown Metropolitan area with the main urban, scientific, technological, business and cultural clusters of the area, as well as the high speed railway network and international airports. Objectives are clearly related to national well being development goals (Fig.1).

Fig.1 – Public transport network established by the State Secretariat

![Public transport network established by the State Secretariat](image)

Objectives are, while at the same time ensuring a powerful transportation offer, to structure the areas at stake so as to allow some concentration and densification of inhabitants and
employs in the vicinity of the poles serviced. To face the requested magnitude of the transportation offer, the technology used – an automatic driverless metro – is mandatory because the system shall have to be quick, reliable, high capacity, and be able to be operated day and night. Its design shall guarantee a very high level of safety to patronage and reduce the risk of operating disruptions. The proposed network includes 130 km of new driverless automatic lines. The target goal is to make possible from Charles de Gaulle airport, to reach La Defense or Paris City downtown in less than 30 minutes; or else to provide a 25 minutes link between Orly airport and “Gare de Lyon”, or another 25 minutes link between Villejuif and Noisy Champs and a less than one hour link between the two international airports. It has to be noted that from Charles de Gaulle airport it will become possible to reach by direct link La Défense or Paris downtown through Quartier Pleyel in St Denis, a future metropolitan hub where a High Speed TGV station is envisaged in the middle of the Plaine St Denis territory and located 10 minutes from La Défense using the new network.

4.2. The “Arc Express” and the “Grand Paris” public transportation projects

The orbital service around Paris is of major importance for service provision to the neighboring suburbs. It deserves both specific mention and clarification because at the present time two design concepts will have to be merged:
- The first one is part of the wider Grand Paris transportation Programme,
- The second promoted by the Ile de France Regional Council is called “Arc Express”. It is an adaptation of the project named “Métrophérique” proposed by the RATP.

Arc Express, supported by the State, the Region and the Syndicate for Ile de France Mass Transit (STIF), aims at serving efficiently and quickly those activity clusters whether existing or under development.
From 2006 to 2008, the first studies launched on the project have allowed to determine a set of four territories which would have to be served by four orbital “arc links”:
- A South-East arc link between Val-de-Fontenay or Noisy-le-Grand and Arcueil or Bourg-la-Reine, to be put into operations at the 2020 horizon.
- A North-West arc link between La Defense and St Denis, to be put into operation at the 2020 horizon.
- A North-East arc link between Val-de-Fontenay or Noisy-le-Grand and Saint-Denis, to be put into operation at the 2025-2030 horizon.
- A South-West arc link between Arcueil or Bourg-la-Reine and La Défense through St Cloud and Suresnes or Rueil-Malmaison, to be put into operation at the 2025-2030 horizon.
Both networks programmes “Grand Paris” and “Arc Express” are very close to one another on a considerable part of their intended alignments. The “Dossier d’objectifs et de caractéristiques principales” (“Goals and main characteristics file”) of the “Arc Express” project has been approved on July 8th 2009. This vote allows the public debate and conciliation phase to be initiated via solicitation to the National Council for Public Debate. The organization of a public debate has been approved under the conditions that, in the debate brief document, the “conditions of compatibility between “Arc express” and the “Grand Paris projected network” be explicitly debated. After public consultation, the outline will be set and the project may qualify for “public interest” prior to a potential start of the works. Given the procedural times at stake, the first sections of the Project could open in 2017.

Fig.3 – Priority projects according to the Paris Regional Council

4.3. Extending the RER line E (EOLE) to the West

This extension is one of the main Projects included in the Programme for the Grand Paris. The scope is to extend the present line terminal from St Lazare to Nanterre. The Project is being developed jointly by SNCF and RFF (Rail Network of France). Presently, this 56km line which includes 21 stations carries approximately 312,000 passengers a day and ends up at its Gare St Lazare terminal.

This major project will reinforce and improve transportation services at La Défense, while alleviating the central section of line A of RER from its heavy transportation offer requirements, as well as facilitate accesses to and from the clusters represented by Paris and La Défense from and to the areas where employment is lacking, and to ensure a link between the Western and North-Eastern employment clusters of the Metropolitan area. RER line E is also bound to be interconnected with other rail lines, liaison which will significantly contribute to both a capacity and quality increase on the radial link Paris-Mantes- Normandy.

The project detailed scope consists in boring an eight kilometers tunnel between St Lazare and Nanterre, via La Défense. Thus, both the eastern and western branches will be interconnected, as was the original intention reflected by the acronym EOLE “East West Express Link” translating
in “Est-Ouest-Liaison-Express”. Three stations are planned – “Neuilly-Porte-Maillot”, “La Défense-Grande-Arche”, “Nanterre-La Folie” with transfer connections to other RER and metro lines, or tramway lines.

The preliminary design studies on the project aim at gathering all the issues which will form part of the public debate. These issues will include among others:
- The extension scenarios from the present Haussmann -Saint-Lazare terminal towards the West of La Défense,
- The conditions of alignment merging and connection into the existing railway networks in the most complex zones,
- The fit out of the main transfer stations into the existing transportation networks while merging their adjustments and evolutions to come.

These studies will reveal and identify the development impacts, and will include an assessment of social and economic stakes for the various components of the project, and will draft the financing methods to be envisaged.

Works could start in 2012 and the common interest generated by this project illustrates quite well the will to act as fast and hard as possible in order to be able to deliver in 2017, a particularly ambitious requirement for a totaled installed cost of over two billion Euros.

4.4. High Speed Trains network (HST - TGV)

The new scheme is to make the HST network available to the Grand Paris Metropolis in 2020. This scheme requires therefore:
- To actually deliver an effective interconnection between South Eastern and western HST networks inside the Essonne district thanks to a station in Orly, which will become an HST-Airplane hub.
- To build up and open a new station at Saint Denis-Pleyel in the north;
- In the West to build an HST station at La Défense which thereby becomes centrally interconnected with Normandy and Roissy CDG on both sides while enabling fast and easy connections between business districts in London, Brussels, Strasbourg on one side but also Le Havre and Rouen as well.

Those new HST stations will not be terminals but pass-through stations interconnecting with the Grand Paris Network facilities. They will bring to the suburban territories a good level of accessibility to the totality of the major areas of activity for the Metropolitan areas, noticeably to its seven major development clusters.

With regard to the new stations, the ambition will be to let the city enter into the transportation space, by promoting an intensive collective use of the access places where services, leisure, offices and habitats merge together to reinforce the efficiency of the transportation link and where the volume attributions are clearly signaled and identified whether they be RER, Metro, HST or any other transportation medium in order to clarify underground pathways and spatial orientation. This new HST network is thereby superimposed onto the driverless automatic one. And the innovation could be to have HST units run this network thereby allowing direct connections between the business district, Le Havre, Rouen and the two airport clusters Roissy Charles de Gaulle and Orly.

5. IMPLEMENTATION OF PROJECTS

5.1. Organizational principles

After consultations with representatives of the Île-de-France region and the prominent elected decision makers, a draft law has been presented by Christian Blanc, Secretary of state for the metropolitan area development planning, to the Executive Minister’s Council during its October 7th 2009 session.

This draft law includes the first legislative articles necessary for the Grand Paris programme implementation. These articles mainly address the creation and ownership conditions for the Mass Transit Programme in the Metropolitan area.

This draft law’s contents:
- Strengthen up the consultation and public participation procedures and increase their efficiency,
- Create a “Grand Paris Company” Public Authority to be in charge of implementing the transportation systems impacting national decision making levels and with capability to implement developments or new constructions linked to the Grand Paris transportation network. This Authority will manage design studies, tendering activities, and necessary awards up to final delivery of the network.
- Organize the sets of procedural relations between the public establishment “The Grand Paris” and the “Régie autonome des transports parisiens (RATP)”, the “Société nationale des chemins de fer français (SNCF)” and the “Réseau ferré de France (RFF)” in the miscellaneous fields of responsibility enjoyed by each of those companies, in particular the ones with infrastructure management briefs.
- Highlight an ambitious urban Project with the requirement that architectural and urban specialists views drive the origins of such a symbolic project as the Grand Paris one.

After completion of works this authority will hand the works over to the “Syndicat des Transports d’Île-de-France” (STIF) for revenue Operations.

5.2. Financing

The accrued value of the miscellaneous projects at stake in the programme represents a TIC (total installed Cost) of approximately 35 Billion €, out of which 23 Billion € for the high capacity driverless system and the RER: a very heavy investment to be widespread over around ten years, but it only represents yearly 0.66% of the region’s GNP.
Miscellaneous funding avenues could be mobilized: toll fares, fares taxes on companies, a dedicated tax system, an added value tax principle on land and property added values after the system is built up and operated, including in neighboring beneficiating areas developments, State and local governing authorities funding.

The President of the Republic has mandated Gilles CARREZ, in close collaboration with the State Cabinet for the Metropolitan area with a brief to propose an overall financing scheme for the mass transit and transport projects. The work will be supported by a dedicated working group and a wide consultation process.

6. THE AFTES: FRENCH TUNNELLING AND UNDERGROUND SPACE ASSOCIATION

One of the focuses retained by AFTES has been to initiate a multiple meetings process with the political and operational decision makers with a view to take best societal and environmental standpoints for the underground areas. Our action for the “The Grand Paris Transit Plan” included initiating numerous meetings with the “Secretary State in charge of the Metropolitan area Development” because we insisted on some increased sensitivity efforts on our issues. This had never been tempted before.
The association intended to show that:
- The functionalities, efficiency, comfort, and potentially public satisfaction as underlined by the President of the Republic could be met by utilizing a mostly underground alignment.
- The “Grand Paris Transit Plan” could really represent a unique opportunity to acknowledge the considerable potentialities at stake with underground urbanization in a time when spatial volume needs do naturally drive into actions for increasing the “town densities” and when the sustainable development stakes tend to become more and more prominent.

6.1. A few thoughts on the items to monitor and success conditions

Our process has generated considerable progress because our association, which represents a privileged observation standpoint for techniques, methods, rules and nomenclatures developed in Europe and elsewhere throughout the world and in this capacity produces widely recognized recommendations, has been invited to share thoughts on specific points to monitor and conditions of success for the “Grand Paris transit Plan”.

It has thereby become possible to underline a certain number of items on which we definitely wish to focus decision maker’s attention, because they shall condition the success of the programme and the compliance with the agreed schedule:
- The system compliance with functionalities must come first,
- Underground stations must be easy to use and inserted in a newly designed underground environment
- An overall view for underground spatial volume value adding methods/techniques must be taken from start
- The use of modern tunnel boring machines in order to generate potential cost savings is advisable
- Costs must be properly controlled and the execution schedule must be fully compliant with plan thanks to adapted project control practices
- The best actors at all levels should be retained
- Sound management of administrative procedures should be adopted.

6.2. Potential expertise needs to assist the “Grand Paris” companies.

For this programme to meet success, the association has promptly reacted to the request made by the “Secretary State in charge of the Metropolitan area Development” to establish a list of highly qualified experts. About 50 specialists of all the best miscellaneous disciplines at stake within the association are to join the newly created Company. A restricted team should be in charge of establishing and ensuring the adequateness of the design studies and project delivery processes. On an other hand, we have highlighted that the accelerated fast procedural processes could be supported by a dedicated Technical expert Committee which would be in charge of producing scope assessments on such issues as project management, contract awards, construction method statements,…and this same Committee could then assist in contract awards, claims management, and conflict resolutions.

This was the focus that our association started for the first time for a project of such a magnitude.