Dealing with a complex urban object: planning the covers o transport infrastructures in urban areas.

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Our paper focuses on the complexity, in urban planning practices, to coordinate and urban development. This is the case for transport systems organized aroun infrastructures. Contrary to what we could imagine in a first approach, there causality between the construction of such infrastructures and urban devel territories. We mainly observe an intertwining of causal links, and an interpen evolution.

This observation has implications for public policy, whether to create new tr organize urban development. Interactions are still structured at one time or an fields of public intervention strongly related. Problems should therefore be joi planning and urban planning actions differ as much in their challenges as implementation. This generates problems of coordination between stakholders backgrounds, sharing neither the same interests nor the same objectives of action. possible in this context?

To highlight the difficulties of coordination, we focused our research on a interface between these two fields: urban development projects organized around infrastructures covers. There are many reasons to cover a transport infrastr nuisances, to create new available land, or to improve the transport system. W these projects are always at the junction between construction of the structural engineering object); operation of the transport infrastructure (production a transportation system); and planning of urban development project (creation of settlements, etc.).

In a first theoretical part, we will explore the complex links between transport development, and its consequences on public policies. We will then focus on th we ll see how they constitute spaces of confrontation and interaction between planning. We will explain how coordination of collective action between th nevertheless organized in the decision-making process and in the operational completed within the framework of an interdisciplinary research program ANR CANOPE on an organizational analysis of five cover projects in France, Belgium and Ge 2015): coverage of existing railway lines coming out of the Gare d'Austerlitz Gauche (France) ; enlargement of part of the railway network around Brussels (portions ; coverage of urban expressway and the construction of a tram line (Germany), burying the A55 highway in Marseille in EuromØditerranØe project an new urban areas (France); the coverage of an expressway section in Gennevilliers

1 – The infrastructure, product or motor of territorial transfo

1.1. The chicken or the egg? Infrastructure or territory?

There are many urban researches that theorize the articulation between transpo urban development. By creating a very schematic map of the main of them, and i that divide the natural sciences (in the study of human-environment report), we possible theoretical models to consider the links between infrastructure and ter

The first two take the form of causality in one direction or the other. We can called "deterministic" (Leheis 2011), in which the object determines its environ meaning it's the infrastructure that determines the territory. It is the oldes works that are mainly interested in the effects of infrastructure on territo example the first works of economic geography that explain the structuration transport system and travel opportunities, and thus infrastructure {like the mod Isard, Moses) on market areas (L sch, Hotelling) or land-use (Von Th nen) (see this model, transport infrastructures have a decisive effect on the territo relationship: they constitute one of the main vectors of urbanization and urban

This model finds its translation in the operational practices of the actors, and transport infrastructure. It is used in particular to support all analyzes based benefit (or model CBA Cost Benefit Analysis), which seek to justify the investm by calculating direct and indirect effects, monetized or not, of infrastructure o urban phenomena, however, are difficult to understand in this single prism. The controversies around the creation or modification of large infrastructures, whe territories crossed by the infrastructure are strongly opposed to the projects some cases it is even the inhabitants of urbanized areas with the creation of then are opposed to its expansion.

We have identified a second approach which is described as "evolutionary" (Lehe represented in urban research. In this approach, the environment determines the meaning that the territory transforms the transport infrastructure or netwo functional balance of the urban system (the same way that the principle of struc selection would according to some an optimal balance of the medium). This mo common. We find an application in the article by Luca Bertolini, about the ur conducted in Amsterdam since the post-war (L. Bertolini, 2007). He shows how policies evolved based on changes in the socio-demographic, economical, or land to him, we are facing a complex evolutionary system in the sense that: firstly periods of incremental change and radical change; on the other hand, the syste and finally, it is possible to identify transitions. The case study highligh economic and social transformations, and their effects on the urban transport sy changes have no effect, other times they produce side effects (the principle of produce a radical change, which involves the reorganization of the transport sys the urban transport system must be able to endure despite changes, socioeconomic a performance criterion). The system must also provide to adapt to changes. It i in a simple causal relationship: the characteristics and developments of trans determined by urbanization of territories crossed.

This model also finds some translations in the operational practices of the acto the engineers who make the transport infrastructure seek to size according to

areas crossed to adapt supply to demand. But the logic of this type lead to le
spillover effects on urbanization: the creation or improvement of transpor
generates new needs due to improved transport times. We can even make the h
continuous improvement of a heavy infrastructure system could in some cases lead
saturation.

1.2. The infrastructure as a technical object: crossed interactions betwe urban planning

It is possible to identify a third approach, which can be described as "interac
which the object and its environment (or the transport infrastructure and urban
the most recent examples include the work of (Graham and Marvin, 2001) whose m
highlighting the link between network evolution and social and physical fragment
these authors, the liberalization of infrastructures and development of new te
possible new infrastructural landscapes more segmented, leading to differentiat
infrastructures. In other words, the network transformation is part of a global
technical object and of the social, economic, political, or geographical dynamic
the idea that the infrastructure can not be understood without taking into
relations with the territory in which it is part (analyzing these relations unde
angle the network).

We find the foundations of this interactionist model in the theory of scienc
literature called STS (Science and Technology Studies or Science Technology an
relates the evolution of the society with technical developments. At the origin
the work of history and sociology of science and technics from Thomas Kuhn or
(Bijker, Hughes & Pinch, 1987). These works highlight the multiplicity of dia
(from symbiosis to break) between techniques and societies that produce them. Th
transformation process, they highlight the tensions and resistance forms bet
evolution.

The STS approach is dominated by three major trends, highlighted by (Bijker, Hug
In the "social constructivist" approach based on the sociology of scientific kno
to consider that the technical objects can be analyzed as social objects, t
sociology may therefore apply to it. The Tomas P. Hughes approach then conside
system, that is to say a combination of material elements but also representa
Finally, the approach of Michel Callon, Bruno Latour and John Law, at the Ecole
which technical and social-between is defined by combination or interconnectio
humans (of where the use of the network concept), is better known under the t
network. Without repeating the details of these different approaches, simply ret
lead out of a vision in which technical objects are considered a given. At the
the technical object is defined as a "socio-technical compromise." These app
relationships "environment" within which the technical object evolve. They were
first time in the work of Gilbert Simondon (Simondon, 1958) with key concepts
"associated environment", which allow him to describe an interactive process
transformation and evolution of technical object (Akrich, 1993).

The STS literature is particularly suited to analyzing the relationship between
and urban development, transport infrastructure is seen as a socio-technical ob
transformations can not be understood without taking into account its interac
system, but also with urban territories in which it is inserted. This third

emphasizes crossed causal links between transport infrastructure and urban area
considered as a social construct contributing to change their environment and in

This theoretical approach has consequences for public policy thinking around tr
It is not possible to simply describe the process of transport infrastructure p
only as responses to urban transport demand, or only through their expected effe
crossed. The action takes place in fact in an environment where the infrastruc
territories crossed evolve jointly. Any new production or infrastructure change
the interaction between transport and urban development, and therefore in t
dissociated logics of action. This situation forced collective action and
coordination problems between the protagonists acting at the intersection of
representations, or the calendars of both public intervention fields.

This is particularly true in the case of infrastructure coverage projects. A co
fact at the interface between transport and urban development. It is part of th
the transport infrastructure, particularly in urban areas where it limits the b
road or railway. At the same time, the cover is also an urban object, which tak
urban renewal operations for example, by bringing a new urban ground. Covera
interface between urban planning and transport. It crystallizes, more than o
interaction between territory and infrastructure.

2 - The transport infrastructure covers: urban objects at t between development and transportation

2.1. Interactions with the transportation field

Covers projects are a key issue in urban transport infrastructure planning. The
structured between the construction of the cover on the one hand, and management or mod
the covered rail or road infrastructure. They take different forms.

a/ The coverage project may itself result from global modifications of the trans
cover is then one of the elements necessary for a larger project related to
covered. This is the case for the Brussels RER, where the few railways cover
firstly to facilitate technically network extension (putting four-way lines), a
acceptance of the works in some cities that might oppose it, by offering sensibl
noise and improve crossing the tracks. This is the case of Kombilosung in K
burying of KriegStrasse helps to report one part of the trafic from the tram
surface and reduce the congestion. This is also the case for Paris Rive Gauche though a
the coverage of railroads is mainly induced by the urban development project,
realization of a new RER station and metro line 14. In these examples, the fi
infrastructure is integrated within the transport project: it would not have bee

b/ Even in cases where coverage is not the primary objective in a transportat
object can nevertheless interact with the challenges of transport when its reali
potential or actual - on projects transport current or future related to the
EuromØditerranØe and Gennevilliers, the covers of motorway lanes create tunn
extremely strong regulatory constraints in terms of security, and thus in c
infrastructure. In Paris Rive Gauche, coverage of railroads necessary to
neighborhood area involves a reduction in the number of tracks, which has impl
the Gare d'Austerlitz operation as it exists today, but also on future opportuni
therefore, on potential changes in the rail network.

These interactions also take the form of strong contraints generated by the realization of coverage. A major constraint is that the infrastructure remains coverage works, as is the case in Paris Rive Gauche or Brussels for the rail Karlsruhe and for Gennevilliers motorway routes. The complexity that it generat in terms of costs and therefore feasibility and programming surface projects. generates constraints on the possible structural supports of the cover, as in Pa detailed plan of structural supports was imposed by the infrastructure manager project.

c/ The cover opens possibilities to reorganize the surface mobility. The covers surface rail or road links. In Paris Rive Gauche, this will physically connect th existing city. For EuromØditØrannØe, coverage of coastal highway creates new p the new districts, and more largely the city of Marseille, to the sea. In KriegStrasse, an highway road that currently separates the station area fron significantly improve urban connections between these two parts of the city coverage RN315 is the opportunity to get a tram to the surface.

In the same way, covering operations offer opportunities to organize connection and infrastructure. These connections are typically associated with changes in conditions, for example in the case of railways creating new stations or modify reorganize traffic. We have already mentioned the case of the new RER station in district of Paris Rive Gauche, which is essential in its service by public trans conditions to implement the new stop and create new exits for travelers, etc. Th are organized mostly around a redevelopment of railway stations. Additional gr cover is used in particular to organize intermodality with buses and cars.

2.2. Interactions with the urban planning field

Similarly, covers projects are at the heart of urban development issues in the Therefore, interactions between projects are structured to surrounding developm and the construction of the cover on the other hand. They take also different fo

a/ The covering project can be part of larger projects development of an urban one of the elements necessary for the overall development project. This is th Gauche where coverage of railways in the Gare d'Austerlitz, as we have seen, district to the rest of the district, which is well connected to banks the Seine new facilities in Marseille EuromØditerranØe district has its immediate access is made possible by the covering of the coastal highway: the project leader reconquest of the waterfront. The case of Kriegstrasse coverage in Karlsruhe is of the project of "Kombil sung" (combined solution) by the people in a refer indeed that it is both a transport project and a project urban development: co central element in the redevelopment of downtown and in the development of attractiveness. In all these projects, the main stakeholders involved in the pr as an essential element to achieve the urban development objectives. Consequ coverage based mainly on the overall development project.

b/ Even if the cover objective is to improve transport infrastructure, urban de are still often added. Under the Brussels RER, although the covers are designed four-way lines extension, urban development issues were quickly raised, espec municipalities and local authorities. The cover of the RN315 in Gennevilliers

reducing pollution generated by the infrastructure, but the surface was then spaces.

c/ The cover opens up possibilities for urban development on the surface above t covers are creating developable land. In Paris Rive Gauche, volumes of slabs a who construct housing or offices buildings. The proceeds helps to fund the cove creates public facilities and public spaces on the slab. In Marseille, it is realized on the cover, above the coastal highway. In Brussels, the land created stations, a garden, shops, a sports field, parking, etc. And the new surface constraints on the cover. A major constraint is due to leveling of the above, organizing traffic and roadway surface and thus determines the thickness of th Gauche, leveling the Avenue de France, main avenue crossing the new district ar the maximum height of all other adjacent covers. This setting led by unusual pl solutions in order to cover: the developer carries out hedging office buildings to carry out intermediate cover slab. Another constraint is expressed in terms the cover, which must be sufficient to support arrangements from the surface, mo to buildings like the Left Bank in Paris or some covers of RER Brussels.

The cover also allows to open new development opportunities for the land on infrastructure, by reducing pollution - actual or potential - related to infr example. Burial of the coastal highway in Marseille facilitates spatial Eurom open the new area to the sea. In Paris Left Bank, the creation of the new RER t 14 on the cover railways ensures an essential public transit service to urban district.

2.3. Coverage in the heart of the interdependencies between transpor planning

An infrastructure coverage is, as we see, an urban object interacts with both infrastructure and the development of the surrounding urban areas. It plays an technical object between transport and urban planning at the interface between these two fields of public intervention between which it organizes interd interdependencies are structured in several dimensions.

a/ The first physical interdependencies are: formal and functional characterist linked to those of the transport infrastructure as well as those of surfa surroundings. Its leveling, width, length or location of support points, are c and functional characteristics of the existing infrastructure and urban develop the characteristics of future projects. For example, the locations of the suppo Paris Rive Gauche are determined by the locations of the existing track and structures capable of supporting buildings. But the covers of support points wi possible developments of the infrastructure (they limit the number of tracks it and developments in surface (the supports are designed for specific building difficult to change once the realized coverage). Note transitivity of these leveling of the infrastructure will constrain including the height of the cover, the leveling of the surface. Leveling the Avenue de France in Paris Rive Gauche is dete height of the covererage that is determined by the leveling of tracks. But now t completed, its leveling determines those of all future covers added or related.

b/ Interdependencies are structured between the actors involved in collective a those who realize the coverage, those managing the infrastructure and those wh

development in surface. Given the physical interdependencies between what they r
each of them has consequences for those of others. It is also common that some m
others to achieve their own projects. The developer who wants to build in Paris
do that if the developer has covered the tracks beforehand to create a new
Conversely, the developer needs sponsors because the coverage is at least parti
of land to build, and construction above the railway also constitutes one of the
project.

These interdependencies between actors can be analyzed in terms of resources.
first. For the Brussels RER, many covers are funded under the overall envelope
project. None of them could have been funded otherwise. The actors that take a
facilities – mainly municipalities – are therefore dependent in this respect th
RER project. In general, infrastructure covers rarely find their financial balan
transportation or development. The resources of the actors in Paris Rive Gauche,
is the railway operators that hold most of the developable land, either on the
The developer has to deal with the logic specific to these key players, logi
functioning of the infrastructure to cover land valuation. Resources can then b
Railway operators that carry the RER project should thus deal with the tow
infrastructure in the three Belgian regions: municipalities have indeed the abil
four way up the planning permit operations this is likely to cause substantia
railways is with this in mind a key argument promoting local acceptance of the p
the approval of permits.

c/ Finally, interdependencies exist between transport, urban and coverage p
intrinsically linked from a temporal point of view. The achievement of urban d
intervene only once the constructed coverage. Some items can be blocking. For t
RER in Brussels, as the upgrade to four tracks has not been carried across the a
be operated. Now the works to four tracks of the railway infrastructure require
works covering in a few specific areas of the network because these works are essen
tax base on rails in particularly constrained contexts. Other elements may inst
schedule. At the start of Paris Rive Gauche project, the first commercial offi
were determinant to trigger the realization of the Avenue de France which was ne
service of these offices. The Avenue de France from above the tracks, it was nec
first Infrastructure covers. This example also shows that interdependencies int
project process, from design and implementation phases of the various elements.
France realized, his leveling was then a major constraint to the other covers a
surface facilities. Moreover, the first covers railway lead the actors to que
possible to condemn to build the supports of the future covers. This led them t
manager" directing the futur of the entire rail network output from the Gare d
account of future rail projects.

3 – Coordinating collective action in circumstances o interdependences between transports and urban development

As we can see, the cover projects are intrinsically linked to the field of tr
planning, two interrelated fields of action but whose logics and action fram
different. This situation raises questions from the perspective of collective a
driving these projects can coordinate and manage these interdependencies? How

action at the interface between the two fields? We have identified four types characterize how the action is organized.

3.1. The unthought or unmastered coordination

One might think that collective action goes with the coordination between part shows many situations where collective action is not or poorly organized, and between the different elements of the system is little or no thought. The ste transport and those related to urban development are disjointed: the actors without seeking to establish a dialogue. The question of coordination between arise, at least not a priori. Although there are interdependencies between obj disconnected. The lack of coordination is particularly strong in cases where co one of the two fields, either transports (eg expanding the infrastructure or causes) or urban planning. The action is then little linked with the other fi Gennevilliers, where infrastructure is primarily intended to cover the accepta project supported by the State towards local authorities. Urban development does objective for anyone, and are postsponed.

The lack of coordination in the decision process is most of time unfavourable to su developments, which generally come last, once the infrastructure and coverage case of the creation of the Littoral Boulevard in EuromØditØrannØe project in responsible for public spaces only starts once the cover slab (made by the man infrastructure) is achieved. The cover has structurally « always one step ahead development, which restricts the possibilities for coordination of the action, This is also the case with the RER in Brussels, where most of the covers nee infrastructure to four tracks are sized and sometimes flufilled well before the precise idea of their expectations about surface urban developments.

In this configuration, everything related to the other field of action is po posteriori, being the adjustment variable. For EuromediterranØe where burying affects the whole urban project with the creation of the Boulevard du Littoral, project results in many surface growths that become constraints to manage and i the surface facilities. The actors of urban development, who are coming in las "make do."

3.2. The organizational devices for coordination

In order to manage projects, stakeholders are building organizational device structuring coordination between transport and urban planning.

We first find contractual devices: partnership agreements, memoranda of under disposals, etc. The regulation of collective action between transport infrastru development goes on here by a formal clarification of the roles, skills and res of Paris Rive Gauche thus precise the division of responsibilities between the operators, which are also owners of the land above and around the tracks. In oth specifies a priori what refers to urban development and what refers to tra opportunities for actors of the two fields: rail operators take on selling la accept in exchange to follow the requirements of rail operators to enable th business. Such theoretical division of roles is to define each responsibilities it actually often leaves a place to blur, interpretations of rules and games wi example of the question of the division of land properties, mostly treated afte

and not specified in the contracts. At Gennevilliers, property lines had to be after the project: the use and management of lands do not necessarily go to pla realization.

Coordination tools can also be hierarchical, and refer to the construction intermediary to the various elements of the system. Their action covers ei infrastructure, its coverage and surface facilities. The same formal organizatio action. It manage and pilote several elements of the overall project: both th cover (MPM for EuromediterranØe, DIRIF in Gennevilliers, KASIG Karlsruhe); both and surface facilities (SEMAPA in Paris Rive Gauche); or even infrastructure, surface facilities at the same time (TUC Rail Brussels RER). In this situation internally to the structure, between staff of the different services. Some structures can be created for the occasion (SEMAPA in Paris Rive Gauche, EPA E the KASIG in Karlsruhe). All of them are explicitly entrusted with a mission to project issues between those related to transport infrastructures and thos development. This mission for instance involves piloting preliminary studies tha the overall project and built the beginnings of the division of roles. The int also have a role to boost the project or to push its progress. In Karlsruhe, t the tramway project in the planned time frames. According to the project mar calendar at best despite the difficulties is one of the main prerogatives of t the intermediate structure can finally consist in solving all the technical di discussions (including the antagonisms between transport and planning) arising stakeholders.

However, coordination difficulties in collective action between issues of tr development are relatively similar whether there is or not an intermediate stru project shows that the responsibility of a stakeholder in coordinating matters give him the possibility to force the action of others. Each project owner k interests, its terms of action and its own temporalities. Thus, far from defining a st between the protagonists, these devices work more as common frameworks in whi play, and that they contribute simultaneously to change.

3.3. Coordination throught the technical design

When the temporalities of project processes overlap between infrastructure, th development project, coordination can go through the design work of these tech interact one with eachother. The actors discuss and negotiate the characteristi In other words, the coordination of action suppose to agree and to modify the c so that they are compatible. The cover slab is at the intersection of transport development: its characteristics (the fact to cover or not, the length of th leveling, its lift, etc.) are often taken as adjustment variables between above the debates and are the subject of socio-technical compromises. In all our case the slab have at one time or another been discussed at a political level, eithe the elected representatives of partner institutions to stabilize funding of the controversies on whether or not to cover (Karlsruhe and Brussels), on the length (Karlsruhe, Paris Rive Gauche, Brussels), on its positioning, etc. We can see political renegotiation of cover characteristics punctuate projects, and can c project process.

The length of coverage is one of the main adjustment variables between the infrastructure and those related to surface development. Discussions can also

interfaces between the slab, the surface and the infrastructure. Connections b
(end of the tunnels created, infrastructure emergences to the surface, etc.) a
Their positioning in space, and their technical and architectural treatment,
coordination between the logics to the transport infrastructure and those
development.

The difficulty of reconciling the challenges and expectations can push the acto
the technical or in the organizational innovation. Coordination then comes fro
solutions, new objects, new features, which allow to take all requirements
especially the case when heavy technical constraints prevent collective action.
can find solutions by modifying the design of the cover slab. The games with
tunnels, extremely demanding in terms of safety features, are particularly indic
the case of the second phase of EuromØditerrannØe, the proposed solution largely
posed by the tunnel laws (most binding as soon as the tunnel is long and compl
new form of partial coverage open hillside. Technical innovation can also
innovations in the organization of the steering action. This is the case in
"bridge building" that doesn t need any slab cover : the building itself is co
and so there is a single project owner for all.

3.4. Coordination through constraints

The last mode of coordination is what can be called coordination through constra
the very strong interdependency situations put the stakeholders in project d
constrained by transportation infrastructure and urban development issues. It
the constraints. These systems of very strong rules, which apply to everyone,
only at the margin. In defining what is feasible drastically or not, they frame
reduce uncertainty and stabilize the game. They thus contribute to the coordinat
to constraints then constitutes a large part of the project activity of the
structures theirlogics of action: actors that drive the cover projects very
identifying ant adaptating to constraints.

Some of these constraints, as we have seen, are related to the contractual and
which collective action is organized. Others refer to technical rationality, jus
negotiable. For example, security constraints for the sites over the railways a
various constraints tend to cumulate on the same situation of action. This is t
Gauche project : constraints on the construction of the slab come both from the
of the slab, than from the infrastructure (the release of rail volumes) and from
(the requirements of the city and elected representatives). These situations
construction at the heart of discussions on the management of projects, as
constraints may challenge them. Technical discussions on the implementatio
particularly strong in the negociations between stakeholders and in the develop
The difficulty is to enable the execution of works despite all the difficulties
Gauche, the accumulation of constraints led to the proposal of complex, costly
work methodologies, which commit the project feasibility. These questions
(technical, phasing, workflow,) often tend to invest the political sphere and deb
space.

However, the constraints are not completely fixed. The stakeholders have leew
constraints fields that organize collective action, and that seem to impose on
phasing, by playing on programs or on steering structures, they manage to cha
them. To do so, players first can change the content of the projects, and so t

interdependencies. In Karlsruhe, the fact of linking the rail project and the
within a single project enabled to build a coalition for the action, which
transportation and urban development issues. This evolution allowed the both to

Whatever the configuration might be, the stakeholders who design a part of the
or a part of the urban development regularly have to choose between fixing cons
the following (including them), or instead let up options open for those who co
is then to find when it becomes appropriate to define constraints that will free
In dooing too much ahead, there is a risk to confront the following to pro
anticipated, and which one must then manage the consequences. Conversely, t
anticipate problems before freezing constraints is limited by the uncertainty in
place. Contexts can evolve even more that the action takes place over very long

Conclusion

We highlighted how the dynamics of interactions between transportation infrastr
development do materialize on any public action at the interface between these
we have analyzed transportation infrastructure covers as objects at the junctio
have shown that they were in the heart of interdependencies between the infras
covered, and the development of the surface. By questioning the modalities of
stakeholders from below and from above, we could then highlight the existence of
organized forms of cooperation, and test their limits.

It follows from this analysis a reflection track to question the practices
coordinate, and with which tools, to design coherent projects which combine se
particular transportation and urban planning? With the particular case of infra
see that highly structured forms of cooperation, organized from regulatory and
show their limits in the implementation and in the way stakeholders seize them.
collective action is structured in large part at a technical level: coordination
urban development requires a particular capacity of operational stakeholders (e
and in transportation) to test the limits of their practices, and to reconc
technical constraints.

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