MIT ESD

Massachusetts Institute of Technology
Engineering Systems Division

ESD Working Paper Series

Uncertainty and Inter-jurisdictional High-speed Rail Planning: Insights from Portugal and the United Kingdom

Naomi Stein
(corresponding author)
Masters of Science in Transportation
and Master in City Planning, 2013
Massachusetts Institute of Technology
Email: negstein@gmail.com

Joseph M. Sussman
JR East Professor of Civil and
Environmental Engineering and
Engineering Systems
Massachusetts Institute of Technology
Email: sussman@mit.edu

ESD-WP-2013-15

August 2013
updated November 2013

esd.mit.edu/wps

Uncertainty and Inter-jurisdictional High-speed Rail Planning: Insights from Portugal and the United Kingdom

Naomi Stein
Affiliation at the time of research:
Masters of Science in Transportation and City Planning Student
Massachusetts Institute of Technology
77 Massachusetts Avenue
Building 1-151
Cambridge, MA 02139-4307
Current affiliation:
Planning and Policy Analyst
Economic Development Research Group
155 Federal Street, Suite 600
Boston, MA 02110
Phone: 617-338-6775
Email: negstein@gmail.com
Corresponding author

Joseph M. Sussman
JR East Professor of Civil and Environmental Engineering and Engineering Systems
77 Massachusetts Ave.
Building 1-163
Cambridge, MA 02139-4307
Phone: 617.253.4430
Email: sussman@mit.edu

Word Count
Abstract: 241 words
Text: 6,495 words
Figures: (2) 500 words
Number of References: 35
Total: 6,995 (Excluding References, including Figures, Abstract, and Titles)

ABSTRACT

Within public policy and academic discourses, high-speed rail (HSR) is presented as a way of achieving "smarter" or more sustainable forms of growth. Realizing this promise requires coordinated policy efforts across levels of government and at different moments along a project's timeline. The research presented here makes use of a systems perspective to study the barriers to- and opportunities of inter-jurisdictional HSR planning. The paper draws on interview material with officials involved in the Portuguese and United Kingdom HSR planning processes.

Uncertainty is found to be of significant relevance to the manner in which national and local or regional governments interact. Those interactions in turn affect the realized physical reality of the HSR network and its integration into existing land use and transport systems. The paper examines two sources of uncertainty—uncertainty of outcomes and the uncertainty of a multi-actor inter-jurisdictional system of control.

Case studies are used to explore how existing processes and evaluations mechanisms affect the level to which local knowledge and initiatives are incorporated into iterative HSR system design. The research additionally reveals how initial conditions can be important determinants of HSR success by shaping a system's ability to adapt to realizations of currently uncertain futures.

The paper concludes by offering two approaches to building a HSR implementation process that successfully incorporates HSR-supportive local and regional policies. The approaches combine formal inter-jurisdictional planning commitments with informal coalition building, to together enhance HSR's ability to achieve its full potential.

INTRODUCTION

The spatial and distributional sustainability agenda of HSR

Within public policy and academic discourses, HSR is presented as a way of achieving "smarter" or more sustainable forms of growth (e.g. *1*, *2*). Adopting the 3E definition of sustainability, HSR's potential can be described as follows:

- Economy: this is most often the starting point for advocates of HSR. The goal is to relieve congestion within larger urban areas, overcome distance, and build competitive networks of cities that act as functional economic units in the global market (*3, 4*);
- Environment: environmental sustainability acts at (at least) two spatial scales. HSR can reintroduce incentives for compact urban growth, locally, which in turn can benefit regional ecosystems by helping to preserve habitats and protect watersheds in the interstitial, less developed, spaces of a region (*5*). Independent of land use impacts, HSR can also be more energy-efficient than competitive modes.
- Equity: this may be the most difficult goal to define and achieve. Understood in spatial terms, the ambition is as follows: by connecting central and peripheral areas, a more efficient economic system can be built that will bring benefit to all parts of a region, even including smaller cities and those without direct HSR service (*6*).

As in other complex spatial planning regimes (e.g. environmental, metropolitan transportation), successful achievement of each aspect listed above requires coordinated policy efforts across levels of government and at different moments along a project's timeline. And while much can be learned from the literature on inter-jurisdictional planning at the metropolitan or regional scale (e.g. *7*), HSR demands a scale of analysis that is yet more extensive (*3*, *5*). For example, station location is largely determined at the national (or sometimes international) level of government and fairly early on in the process of system design. The selected station location—whether external to a city or more centrally accessible—will then be a major driver of subsequent decisions and sustainability outcomes. Land use policies that can be used to support compact station-oriented development or transit access to stations, on the other hand, are primarily under the control of local authorities, and will likely need to evolve over time as local demand responds to the improved accessibility provided by new HSR service. Still, the universe of options available for land use and transportation planning at the local and regional levels is constrained by higher-level decisions regarding the location of a station relative to the urban area being served.

HSR as a complex system

Because of its multi-scalar and multi-actor nature, HSR is best understood as a complex system that includes both its physical components and the institutional sphere within which it resides (*8*). The research presented here makes use of a systems perspective to study the barriers to- and opportunities of inter-jurisdictional HSR planning. Working from the understanding that technological change must be coupled with institutional change (*8*), we investigate multiple scales of both the physical environment and institutional sphere and address the importance of uncertainty as a driver of system behavior.

Complexity and uncertainty are intertwined phenomenon that trace to a variety of factors including the existence of interdependencies and feedback loops in both a project's management structure and in the architecture of the product itself (for example, the feedback between changes in accessibility and changes in land use patterns). Lessard, et al. develop a conceptual model of complexity that treats *technical* and *organizational* complexity as project dimensions from which performance emerges. In a survey of 45 major projects, they found that "the interaction of technical complexity and organizational complexity had a more important effect on project project's performance than their independent individual contributions" (*9*). In that vein, this paper focuses on uncertainty at the interface between technical and institutional complexity.

Broad ambition, broad tools

HSR projects are unique in that they pursue socioeconomic objectives that extend beyond the direct transportation investment purpose of reducing travel time to indirect effects often not accounted for in traditional benefit-cost analyses. New mobility patterns and land use changes that are the target of HSR investment can be quite challenging to predict with any level of precision (*11*). Moreover, the policies that may be used to influence these outcomes are controlled by a wide variety of government entities, spread across sectors and between national, regional, and local jurisdictions.

These two sources of uncertainty—uncertainty of outcomes (technical complexity) and the uncertainty of a multi-actor inter-jurisdictional system of control (institutional complexity)—present challenges to the HSR planning process. The broad scope of HSR's ambition requires that existing methods of project evaluation and ongoing management at the (usually) national scale be expanded to make use of a diverse set of tools and forms of knowledge from other geographic scales of government. For example, a national infrastructure agency may be the entity with the most knowledge and background on how to deliver a rail system. However, national governments have not traditionally been involved directly in development schemes, and may have few precedents for dealing with the long-term uncertainties characteristic of land use related projects. In this realm, more localized governmental entities (e.g. municipal governments, regional transit agencies) have experience, knowledge, and tools to offer. Specifically, local and regional knowledge are necessary to ensure that a station integrates well with its urban context (e.g. via zoning or development schemes) and is consistent with existing or planned mobility systems. Outcome and institutional uncertainty cannot be eliminated, but they can be better managed through inter-jurisdictional planning and cooperative ongoing system management.

ANALYTICAL FRAMEWORK

Expanded commute-sheds and a focus on smaller intermediate HSR cities

This paper analyzes five different proposed HSR stops in two countries—three in Portugal and two in the UK.[1] Together these cases provides insight into specific types of uncertainty, the challenges these forms of uncertainty can presents for effective HSR planning, and potential

[1] Access to key government stakeholders in Portugal was provided under the umbrella of the MIT Portugal Program, a multi-year international collaboration that targets transportation as a key area for economic and social impact. Interviews and site visits in the UK were facilitated by collaboration between then MIT Transit Lab and Transport for London.

strategies for managing those challenges. We focus on smaller intermediate cities brought within one-hour's travel time of a larger metropolis (here, Lisbon or London) by planned HSR services. Mid-distance service (<250 km) has particularly strong spatial implications (*10*) as it can forge commuting relationships between cities and expand labor markets to the scale of new *discontinuous regions*— single labor and commercial markets that spans large distances but do not include all intermediate areas (*5,12, 23*). Portugal and the United Kingdom (UK) are planning HSR that will provide this type of service. Évora, Leiria, and Coimbra would each be brought within one hour's travel time of Lisbon by the proposed HSR network.[2] Similarly, Old Oak Common in the western part of Greater London and Birmingham City Center in central UK would both become part of the easily accessible London labor market should the proposed HS2 network be built.

Both the Portuguese and British projects are aimed at, among other things, using HSR to support network agglomeration at the inter-city scale. The planned Portuguese HSR network aims to create a functionally linked system of cities, each playing their own mutually supportive role, that can better compete in the global market (*13*). The UK project is posited as a way of addressing growth constraints in London while simultaneously encouraging growth in the rest of the country (*14*).

Agglomeration is the benefit that firms and workers gain from being in proximity to other firms and workers. Studies of agglomeration economies traditionally conceived of proximity *in space* as the enabling factor for these interactions. However, it may be possible to use HSR to benefit from network-based agglomeration economies (*15*) at the scale of a discontinuous region. Agglomeration increases with increased human interaction. To fully capitalize on this potential requires a focus on the human aspects of the interface between cities and the HSR network. Making the connection as seamless as possible, from initial origin to final destination, will remove barriers to interaction and maximize the realization of benefits from networked agglomeration (*4*). Therefore, benefits at the scale of the HSR network actually depend on *localized* issues of urban form and station accessibility, and therefore on the degree to which local considerations are successfully integrated into a national HSR planning process.

Secondary cities are an important subject of study for a number of reasons. In comparison to more dominant metropolises, smaller cities are often disadvantaged in terms of planning resources and advocacy power. They require explicit attention if HSR is to achieve its objective of supporting sustainable forms of future growth. In economic terms, good planning at the local level is necessary to provide seamless accessibility between a large metropolis and newly connected secondary cities, and to thus capitalize on agglomeration benefits. Regarding equity goals, smaller cities play an important distributional role in bringing HSR benefits to a broader area. Finally, in environmental terms, smaller cities are often the most at risk for sprawling forms of growth. Greenfield development is often easier and less costly than reinvestment in existing urban centers. City-center locations need other qualities to be competitive with more suburban locations. In big metropolitan areas like Lisbon, the benefits of agglomeration economies—clustering of important firms, labor pooling, and high quality local transportation and urban quality—can be enough to tip the balance in favor of more urban locations. For smaller cities, these forces alone may not be enough. The increment in accessibility provided by a HSR station can reintroduce incentives for compact centralized growth (*16*).

[2] Implementation of HSR in Portugal is currently postponed for the immediately foreseeable future due to fiscal austerity. Nevertheless, lessons can be drawn from the process up to this point.

Long timelines and the importance of initial conditions

Project design and evaluation are iterative processes. Under the long-term uncertainty characteristic of large infrastructure projects, technical alternatives will necessarily evolve over time as new information and new situations require. The case of Portugal makes it amply clear that exogenous economic and political trends can drastically affect both the timing and design of an infrastructure project. Therefore, taking a robust systems perspective means that we not only design organizations to govern HSR infrastructure and operations, but that we also think carefully about the streams of planning decisions (the processes) into which the project will enter. Effective strategic planning is more than a matter of finding, with some 'black box,' the 'optimal' design solution and then choosing the best delivery vehicle for that design (although this is undoubtedly close to reality for certain parts of the technical system). Rather, design and implementation will also be an exercise in discovery and continual adaptation (*17*). In particular, integrating HSR into local contexts will involve uncovering and responding to local knowledge and needs, taking advantage of available policy instruments at the local level, and continually adapting to the changing development prospects and the realization of actual HSR demand.

Whether intentionally or unintentionally, HSR will build on what is already in the areas served (local economy, demographics, local transport). As policy makers and engineers, we are interested in the 'levers' that can be intentionally influenced and built upon. Existing processes and evaluations mechanisms affect the level to which diverse channels of knowledge are incorporated into ongoing and iterative system design. Dunn discusses the difference between deliberate and emergent strategies (*18*, adapted from *19)*. Deliberate strategy is intentional and *objective-driven*. It can be reflected in both plans and in rules or processes adopted by an organization (*20*). Over time, as an organization responds to changes in its environment, it will continue to make decisions. Some will be based on the original plans and adopted rules while others are adapted to suit new conditions. The actual trajectory of decisions is what Dunn refers to as emergent strategy.

The inevitability of emergent strategy in projects we discuss in this paper does not invalidate or reduce the need for deliberate strategy. Quite the opposite: components of deliberate strategy including initial decisions regarding technical alternatives, the definitions of performance, and decision-making processes can set the stage for better emergent strategy. In the case of HSR, ongoing decision-making will depend, in part, on the networks of communication and control in place between various stakeholders. It will also depend on the degree to which initial decisions anticipate and establish the flexibility to deal with both *known* and *unknown* unknowns. The case studies presented in the following section reveal ways in which initial conditions can act as important determinants of HSR success by shaping system's ability to adapt to realizations of currently uncertain futures.

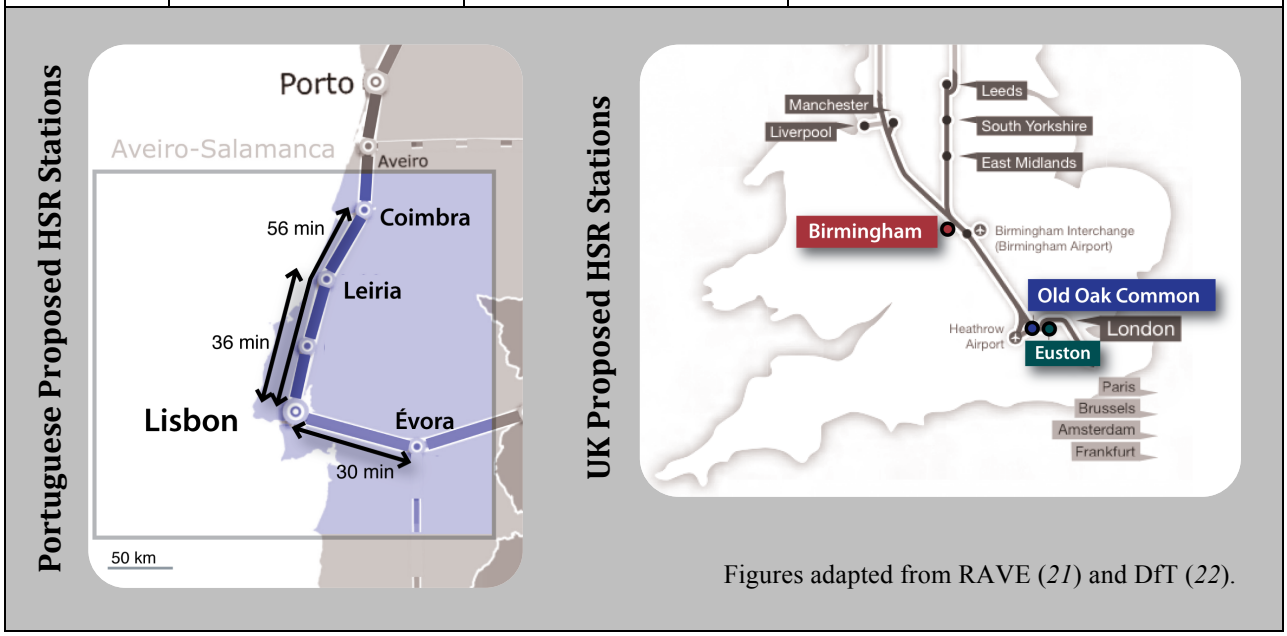
UNCERTAINTY AND MULTI-SCALAR HSR PLANNING – INSIGHTS FROM PORTUGAL AND THE UNITED KINGDOM

The following studies are based on meetings with government stakeholders in Portugal and the UK. In Portugal interviews were conducted with representatives from the national rail infrastructure agency and with local officials in Évora, Leiria, and Coimbra in January 2012. A more complete account of material from these interviews can be found in (*5*). Subsequently in January 2013 additional interviews were conducted with representatives from the UK national

238 HSR planning agency (HS2 Ltd.), Transport for London, the City of Birmingham, and Centro,
239 the regional transit regulator serving the area around Birmingham.
240
241

TABLE 1 Summary of Case Studies

Station Location	Role in Urban Hierarchy	Distance from Major City	Increment in Accessibility from HSR
Coimbra	3rd largest city in Portugal, dominant city within the Centro region	200 road kilometers (124 miles) north of Lisbon and 125 road kilometers (78 miles) south of Porto	HSR would bring Coimbra within 56 minutes of Lisbon (compared to 1:50 hours by car or 2 hours by train).
Leiria	Secondary city within the polycentric Centro region of Portugal	135 road kilometers (84 miles) north of Lisbon	HSR would bring Leiria within 36 minutes of Lisbon—a considerable increment from current conventional rail service, which is slowed by intermediate stops and requires transfers for 2 out of the 5 daily trains.
Évora	Small city of 50,000 known for its historic center, university, and scenic agricultural setting	135 road kilometers (84 miles) east of Lisbon	HSR would provide a considerable increment in accessibility, offering 30-minute travel times and 12 trains per day, compared to 4 trains currently with a travel time of nearly 2 hours.
Birmingham	Second largest city in the UK and the dominant city within the region of the West Midlands	110 miles (180 km) north of London	HSR would offer access to central London in less than 50 minutes, compared to 1:40 hours by train or 2:10 by car.
Old Oak Common	A neighborhood - part of the Greater London Authority (GLA)	Approximately 8 miles (13 km) northwest of central London	Old Oak Common would provide congestion relief to the central HSR station at Euston and is viewed as an opportunity to create a strategic transportation interchange for west London.



Figures adapted from RAVE (*21*) and DfT (*22*).

Table 1 summarizes key aspects of the five proposed HSR stops analyzed, including their location, role within the urban hierarchy, and the increment in accessibility expected from planned HSR service.

Cooperative multi-scalar planning and robust system design

The case of Coimbra offers an example of formalized multi-scalar planning. The simultaneously local and national/global relevance of HSR creates conditions in which local and national planning entities share interests and therefore have incentives to partner in ongoing planning efforts. Viewing the Coimbra municipal government as an indispensible partner in the development of Portuguese HSR, the national infrastructure agency REFER chose to enter into a formal cooperative protocol with the City of Coimbra. Together they are managing an urbanization plan for the HSR station-area. The plan includes provisions for a multimodal hub and a new area of development (Interview, REFER, unpublished data).

Interesting in its own right as a form of inter-jurisdictional collaboration, the Coimbra Urbanization Plan is also attractive as a potential solution to the problem: how can local and national plans regarding HSR and station-areas be coordinated in a manner that effectively deals with long-term uncertainty? A formalized relationship between the City of Coimbra and REFER enables coordination of both initial design decisions and ongoing management. Bi-directional communication helped support a station design that can work in multiple future scenarios—including the suspension of the HSR project itself. The future of HSR in Portugal and the Coimbra Urbanization Plan remains uncertain due to fiscal constraints. Nevertheless, the joint planning process did yield a more flexible design approach: if the more general Coimbra station plan goes ahead with conventional rail and bus transit but without HSR, it will be designed so as to not preclude future expansion to accommodate HSR passengers (Interview, REFER, unpublished data).

Thus, collaboration between a national HSR planning entity and local governments is likely to not only improve the integration of HSR into local land use and mobility systems but also to produce more robust station and station-area designs that can perform under multiple future scenarios.

External station locations as a constraint on future benefits

Évora and Leiria are two smaller cities in Portugal with proposed HSR service of less than one hour's travel time to Lisbon—a considerable accessibility improvement from present service levels (Table 1). Despite the promising increment in accessibility, however, Évora and Leiria present interesting cases of the "last mile" problem and the effect that station placement can have both on development prospects and on the potential involvement of local governments in HSR-supportive planning.

Unlike Coimbra, both are slated to have external – outside the urban core—HSR stations. In interviews, local planning officials in Évora expressed concern about the impact of a station located 9 km outside the city. The city feels that it should maintain the strength of its core and for this reason has already turned down one proposal for a new service-industry development in the vicinity of the station. They believed that external development would not deliver benefits to the established urban core (Interview, Évora, unpublished data). Station location can be a powerful determinant of not only local land-use impacts, but also of the level of interest and attention that

local governments pay to HSR-supportive initiatives. Partially due to the planned non-central location of their stations, both Évora and Leiria have favored a 'wait-and-see' planning approach to HSR. With less obvious development potential, an external station creates fewer incentives for local involvement, thus causing a loss of specialized knowledge—as well as lost levers of influence (zoning, local transport or public realm investments, etc.) for the overall HSR planning and implementation process.

Thus, decisions that occur fairly early on in an HSR planning process regarding the siting of station have long-term implications for development outcomes and for the ways in which local or regional stakeholders are likely to be integrated into a national planning and implementation process. This influential decision stems from an evaluation process that struggles to assess uncertain but significant future benefits, relative to more certain and more immediate costs. In particular, the decision gives disproportionate weight to current rather than targeted future conditions. Stations in places like Évora and Leiria are sited outside the city to a) reduce HSR travel times between dominant O-D pairs, b) provide easy auto access to a region as a whole, and c) avoid localized monetary and environmental costs associated with construction in an already built up area.

What such a decision does not acknowledge is the longer-term growth impacts of HSR service, as opposed to the demands coming from existing categories of users who may prefer easy regional automobile access. Central stations have been shown to be better for destination users (as opposed to outbound users who originate in these small cities) and in Spain have also proven better for building up business in smaller cities (*23*). A city is most likely to benefit from new HSR if it its connectivity enables two-way interactions with other cities—particularly with a major metropolis located less than one hour away. Based on evidence from China, Zheng and Kahn argue that secondary cities stand to gain much from participation in a two-fold improved matching process: first, a matching between residential locations in less expensive and less congested cities and jobs in larger metropolis labor markets and second, a matching between various firm functions and the different forms of accessibility and proximity offered across a region integrated by HSR. HSR, they claim, can "encourage firm fragmentation and firm sorting depending on their idiosyncratic demand for megacity access" (*24*).

It is easier to attract new businesses to areas that already have some critical mass of activity, because developers see this as less risky. As that prior concentration tends to be in more central locations, a centrally located HSR station has more to build on to attract investment than the accessibility increment from HSR alone. While entirely new developments are not impossible, they depend to a much more significant degree on securing anchor tenants that inspire enough confidence for other developers to invest. Therefore, while more short-term objectives can be met with an external station placement, longer-term land use and growth objectives point towards choosing a more central location.

It is common in project evaluation to grapple with costs that have greater certainty and predictability than do benefits. This difficulty, we find, is only magnified by the fact that HSR is aimed far beyond the needs of current long distance travelers, to future regional and economic opportunities connections that have yet to be realized or perhaps even fully imagined. The solution is not obvious. If the scope for a cost-benefit analysis is drawn too narrowly, longer term economic and development impacts in station-areas may be neglected. On the other hand, if the scope is too broad, the national planning agency will be faced with intractable uncertainties in predicting land use changes and resulting value added.

The following section of this paper investigates a case from the UK in which local governmental entities and a national HSR planning agency are at odds over the appropriate scope of a cost-benefit analysis and whether or not to consider a more optimistic but also more uncertain set of planned future developments around a proposed HSR station.

Uncertainty and the challenge of integrating local station-area plans

Birmingham sits atop the regional hierarchy of the West Midlands. HS2, the UK's HSR project, offers the chance to enhance this position while also bringing Birmingham within easy commuting distance of central London (*25*).

Two interrelated local Birmingham projects predate the HS2 planning process: the Midland Metro extension and a new economic development initiative on the east side of downtown Birmingham (Figure 1). Phase 2 of the Midland Metro extension is intended to link New Street Station, another key rail interchange in Birmingham, with the HS2 station and beyond (*26*). In the same area is the City Centre Enterprise Zone, set up by the Greater Birmingham and Solihull LEP (a local development body) in April 2011 prior to approval of the HS2 preferred route in 2012. It covers twenty-six sites including three that are adjacent to the HS2 station and collectively referred to as "Eastside" (*27, 28*). Creation of an Enterprise Zone allows the local government to offer incentives for development. Eastside will take advantage of funding for site development, access, and infrastructure; a simplified planning process; broadband Internet service; reduced business taxes; and business development support (*28*). Located in precisely the same geography as the proposed HSR station, these two projects will be affected by the manner in which HS2 is implemented. Moreover, the projects—aimed (partially) at providing an accessible and immediate urban experience for HSR users—are the ideal types of HSR-supportive initiatives and therefore likely to affect the overall success of the HS2 project.

We present this case to highlight challenges and risks associated with integrating local initiatives into a national HSR planning process. In particular, the Birmingham station demonstrates how uncertainty may block easy integration of local proposals into HSR project evaluation. Birmingham's ongoing metro efforts and development planning in the station-area are examples of the types of local initiatives that could be included into a project's formal evaluation. These complementary efforts hold the promise of increasing the 'upsides' of an HSR project. They possess, however, both outcome-uncertainty—because real estate development is inherently an uncertain endeavor—and stakeholder-related uncertainty from the perspective of the national government—because future actions and investments by local governments may not be guaranteed or fully committed at the time of HSR assessment.

In its consultation response to the Appraisal of Sustainability, which forms the basis of the HSR Environmental Impact Assessment, the regional transit regulator Centro urges HS2 Ltd (the national body charged with planning HS2 is under the control of DfT, the national Department for Transport) to incorporate local land use and accessibility changes related to local regeneration proposals. Centro claims that the wider benefits included in the HSR assessment are conservatively low because land use is assumed not to change:

> The DfT have assumed no changes to land use will occur as a result of HSR which is not consistent with regeneration proposals associated with the High Speed Rail stations in the West Midlands, e.g. Eastside in Birmingham city centre (*29*).

As part of this research a number of meetings were conducted with representatives from Centro and the Birmingham City Council in January of 2013 that offer further insight (Interview, Birmingham, unpublished data). According to these officials, there are aspects of the Eastside and Birmingham metro plans that are highly dependent on the manner in which the HS2 station is built. The outer boundary of the HSR station determines the precise alignment for Centro's planned metro extension. Centro is advocating for the safeguarding of joint work sites for HS2 and the metro, as the projects are likely to occur in close sequence if not simultaneously. Design of the HS2 station will also affect other longer-term growth plans in Birmingham. The Eastside Masterplan includes proposals for an additional entrance on the south side of the HSR station and for improved pedestrian connectivity to Digbeth, a neighborhood where two more Enterprise Zone sites are (*28, 30*). Permeability of the station for pedestrians affects the attractiveness of those sites for future development.

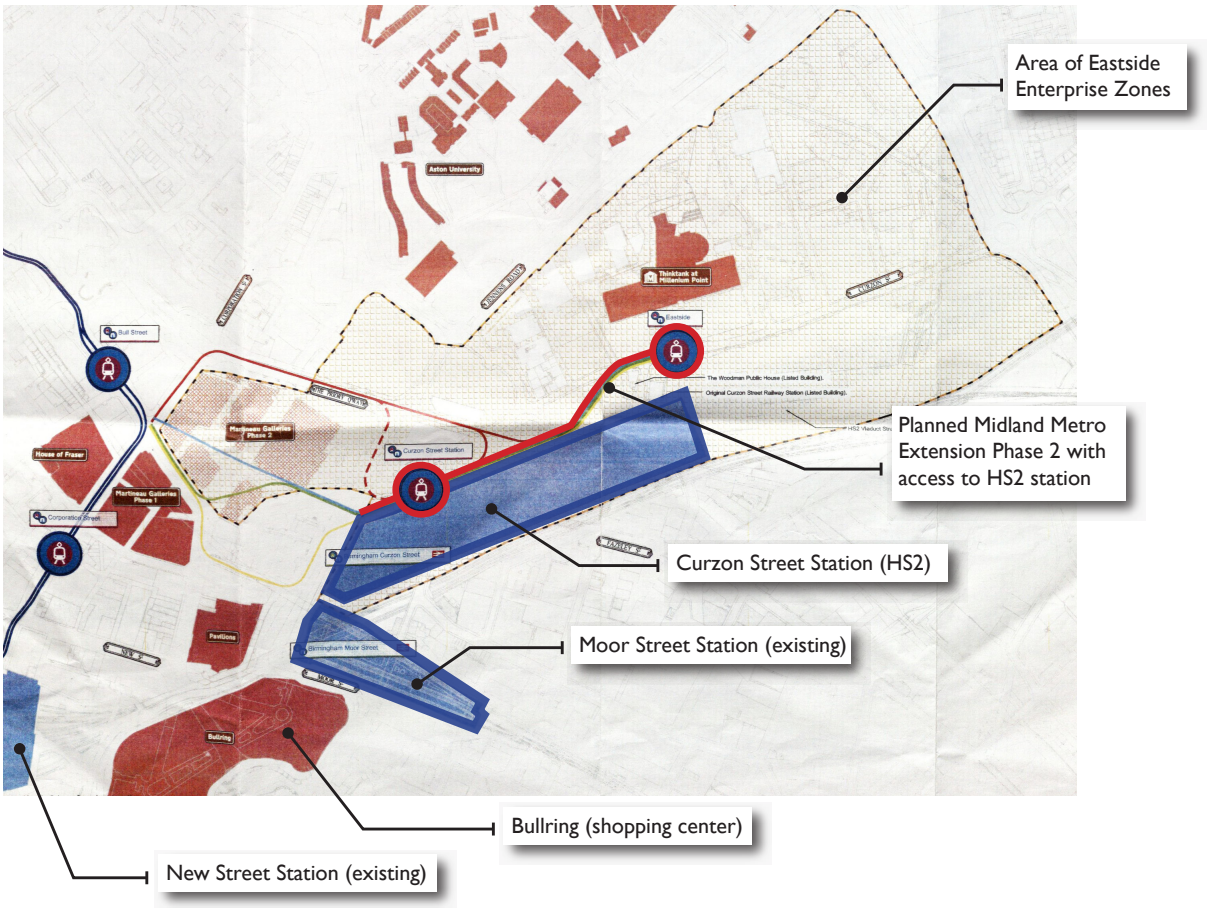


FIGURE 1 Birmingham HS2 station area with Eastside development zone and metro extension (Source: Author, using Centro base-map, *31*)

The case of Birmingham highlights the importance of considering existing planning streams (at multiple scales) when developing and HSR system design. It also points to the challenges of planning in multi-actor environment. Local initiatives are not within the control of the national government (at least not directly—they are influenced by national funding). Therefore, projects at the local level that do not have fully committed designs and allocated resources carry with them a certain uncertainty. Because of this, the national government of the

UK has been reluctant to include Birmingham's plans. However, not considering local initiatives in this case may constrain future development and actually blocks what would generally be considered "good" HSR planning.

There are, of course, challenges to pursuing a broadened approach that takes into account local initiatives. National planning authorities like HS2 Ltd have a real and legitimate need to narrow the scope of assessments to keep them tractable and on-target. The next section discusses one possible approach to managing the uncertainty of outcomes through inter-jurisdictional scenario planning. Additionally, Old Oak Common provides another example of how outcomes can be dependent to a considerable degree on initial conditions.

Managing uncertainty of outcomes in project evaluation

Old Oak Common (OOC) is located on the boundary between what is considered outer and inner London (*32*) and is in one of the poorest areas in London (*33*). The site includes a unique convergence of transport infrastructure and a significant amount of industrial land. The proposed HSR station at OOC is viewed by Transport for London (TfL) and the London mayor's office as an opportunity to create a strategic interchange for west London and to achieve considerable area regeneration (Interview, TfL, unpublished data). To further this end, London (a powerful but nevertheless non-national government agency) is advocating for an adjustment of the HS2 plans to include London Overground (urban rail) connections at OOC.

From a local authority's perspective the exclusion of HSR-supportive initiatives is undoubtedly frustrating, but there are legitimate barriers to their inclusion. The UK national government is reluctant to include projects like the Midlands metro extension that have not yet been full committed because of the uncertainty of their realization. Similarly, proposals for land use changes carry with them a significant amount of uncertainty and are dependent on the real estate market. Nevertheless, our study of London reveals ways in which the national-level environmental process can include acknowledgment of local development and connectivity efforts. It is, however, important to keep in mind that applying these approaches beyond London will require concerted effort as smaller cities have less leverage and direct access to the national government than London.

The Old Oak Common approach to managing uncertainty (for station-area redevelopment) is via an inter-jurisdictional body called the Opportunity Area Planning Framework (OAPF). An OAPF was created to guide the redevelopment efforts surrounding Old Oak Common station. Local authorities (municipalities), HS2 Ltd., and Transport for London (which operates at the scale of the Greater London Area, above the municipalities) are all members of the framework. As part of the OAPF process, growth scenarios are produced. These then feed back into analysis performed by HS2 Ltd. as a sensitivity test for their proposals—to determine how the system design performs under different scenarios of future development. The tests identify the scale of the environmental and transport impacts and are published as part of the Environmental Impact Assessment. Now on record, these results can hopefully influence the design of HS2 to include future proofing and scalability in anticipation of future growth in the area (Colella, unpublished data). The use of growth and land use change scenarios produced by an inter-jurisdictional planning framework is a promising technique for incorporating local land use proposals into HSR assessment, despite the proposals' uncertainty. By developing solutions amongst multiple stakeholders, the OAPF hopefully produces a more robust set of development scenarios than might be created by a single dominant stakeholder.

Beyond the decision of whether or not to invest in additional regional connectivity, there are other initial decisions that will impact the long-term development potential of Old Oak Common and the success of the HSR project. At OOC planners are faced with determining the most productive use of the land around the station. Judgments from the Opportunity Area Planning Framework process will influence both local zoning designations and infrastructure decisions that affect what can and cannot be built. Residential development is the safest bet in current market conditions and therefore the most attractive with a short-term cost recovery goal. Taking a longer view might result in a decision to pursue more mixed-use development with both residential and commercial (and possibly even some remaining industrial) uses. Commercial development tends to be more speculative and have a longer timeline for returns. It is therefore riskier but also likely more strategic (Interview, TfL, unpublished data).

There is a case to be made for phased implementation, starting with less risky residential developments adjacent to existing neighborhoods, rather than in the more industrial core of OOC. In that way, uses can gradually build on one another. Still, some immediate infrastructure decisions do have implications for even a more incremental development strategy. For OOC, designers must choose whether and how much decking to build above the rail yards that comprise a large percentage of the land closest to the station. Decking is expensive and is not justified by lower density development scenarios. Compared to housing, commercial uses will benefit more from immediate station proximity. Decking is less costly to construct initially during overall station construction than later once demand for higher density development has materialized. The decision to build decking in effect would purchase a real option (*34*) to at a later point build commercial real estate immediately adjacent to the station. This is just one example of how initial flexibility can be a powerful tool in enabling decision-makers to respond to future changes, thus improving overall HSR system performance (Peña-Alcaraz et al. provide others, *34*).

CONCLUSIONS

This paper made use of case studies from Portugal and the United Kingdom to examine the role that uncertainty can play in inter-jurisdictional high-speed rail planning. Smaller cities to be brought within one hour's travel of a larger metropolitan area by HSR were the particular subject of this analysis because of their relative disadvantage in terms of resources and influence in the national political arena, and because such intermediate cities have a unique role to play in achieving the sustainability objectives of high-speed rail.

From interviews in Coimba, Évora, and Leiria in Portugal and London and Birmingham in the UK, we find that existing processes and evaluations mechanisms affect the level to which local knowledge can be incorporated into HSR design. We also find that certain initial decisions and cooperative inter-jurisdictional planning can help manage the long-term uncertainty of HSR planning and implementation.

Coimbra offers an example of how national-local collaborative planning can produce station-designs that are more robust and able to perform under multiple future scenarios. Évora and Leiria demonstrate how an evaluation mechanism that values more certain current costs over potential future benefits can result in a station-placement decision that constrains the economic development and environmental sustainability benefits of HSR. Next, an examination of complementary local efforts in Birmingham offers another case in which an insufficiently broad project assessment can block potential long-term benefits from HSR. In that case the uncertainty

of local initiatives that are not yet fully committed hinders the projects' inclusion into a national assessment of HS2. Lastly, the Old Oak Common case from London recognizes that there are real barriers to accounting for uncertain future benefits. The Opportunity Area Planning Framework's approach to scenario planning suggests one method for incorporating uncertainty into a project evaluation. Undoubtedly there will need to be additional creative solutions.

The case studies also focus to a significant degree on establishing flexible initial conditions: The Coimbra collaboration between REFER and the City creates a institutional setup that can more flexibility handle changing designs needs. HSR-supportive local planning in Évora and Leiria is at risk because of the decision earlier in the HSR planning process to locate stations external to the cities. In Birmingham initial decisions about station design may constrain or enable future station-area growth. And finally at Old Oak Common, the initial decision to purchase a "real option" by building decking over the rail yards would provide flexibility to the scope of higher-density commercial development as future market conditions allow.

While these types of initial decisions are undoubtedly important to the long-term performance of an HSR system, there are other factors that enable successful emergent strategies in the implementation of a large-scale infrastructure project such as HSR. With a scope as large as it is, any HSR project is subject to long timelines and high stakes. There will be many phases of design and redesign. Large sums of money, not to mention political and institutional capital, will be committed. And as with all large projects, HSR will be subject to extensive vetting and challenge. With that challenge comes the risk that local input will receive acknowledgment but not follow-through in the actual HSR designs. True HSR-supportive local and regional policies (accessibility or development related) will in most cases require the commitment of additional resources, across scales of government. This extra spending is subject to political challenge, as it can seem secondary to the principal functionality of a HSR system—even though in reality such efforts are integral to the system's performance. Therefore, we will end this paper with a brief discussion of two approaches to ensuring long-term follow through.

The first approach is a formalization of commitments, along a spectrum from making decisions a matter of public record (without necessarily committing resources) to complete commitment of funding to certain aspects of a project. National entities will inevitably be somewhat reluctant to increase the cost (or complexity) of an overall HSR project—particularly given how difficult (or how unfamiliar, methodologically) it can be to quantify the benefit of local HSR-supportive initiatives. Some possibilities for ensuring follow-through include:[3]

- Local representation in decision making groups
- Specific contractual agreements that require the HSR promoter to follow local plans when siting stations, etc.
- Designation of a certain percentage of HSR funds for complementary schemes
- Clear inclusion of local accessibility requirements in HSR authorizing documents

Moreover, even modifying a project evaluation approach to acknowledge the importance of connecting HSR into local contexts can be important. A formal evaluation document such as an Environmental Impact Statement is a form of on-the-record support from the national government. Inclusion makes the case, publicly, that the project's success depends partly on complementary efforts and thus increases the likelihood of allocating necessary resources in the eventual authorization and budget allocation process.

[3] Special thanks to Michael Colella of TfL for providing detailed feedback and input regarding these approaches.

The second approach is more informal and depends on building broader coalitions to support HSR-related initiatives. Earlier research has indicated that HSR is a unique opportunity in that it has the potential to shake up a prior competitive landscape enough to incentivize reconsideration of inter-jurisdictional relationships, both local-local and local-national (*5*). For example: regional stakeholders in the West Midlands of the UK are pushing for a more strategic view of intermodal HSR planning, extending beyond access modes, to consider the effects of released capacity on the conventional rail network. The question of what to do with released rail capacity may be a higher priority in the UK than in Portugal, because of faster overall growth and greater congestion in the UK. However, it raises a more general point about HSR: its implementation is an opportunity to take a step back and evaluate the state of a region's transport (or planning) system, in general.

By leveraging the incentives for cooperation provided by HSR to work on wider regional issues, a broader and stronger coalition for change can be created. With more than HSR on the table, the HSR system has a better chance of achieving its potential—while at the same time the inter-jurisdictional partnerships needed to support HSR will gain durability from stakeholders interested in the broader vision of equitable, economically viable, and environmentally supportive regional growth. This approach to HSR development will undoubtedly require additional resources, beyond a bare-bones approach. Still, given the scope of the professed agenda for HSR, it would be inconsistent not to pursue the full extent of benefits that are the claimed target of such a large investment program. As Ureña put it so eloquently in a recent twenty year retrospective on Spanish HSR: "High-speed rail infrastructure should not be considered the end objective, but rather the initiation of a long process of developing actions and strategies to enhance its effects" (*35*). This paper has sought to translate lessons from two specific contexts—Portugal and the UK—into broader lessons on how to do just that.

ACKNOWLEDGMENTS

Special thanks to Isabel Lopes for arranging meetings and serving as my translator in Portugal and to Michael Colella in London.

Thank you interviewees and meeting participants:

PORTUGAL

- Arq. José Manuel Pereira, Director of Land Use Planning and Management and Dr. Nuno Camelo. City of Évora, January 10, 2012.
- Isabel Lopes, Eduardo Pires, and Daniel Ferreira. REFER, Lisbon. January 10, 2012.
- Rafael António Robalo Ribeiro de Azevado. REFER, Lisbon. January 13, 2012.
- Lopes, Isabel Mendes, REFER. January 2012.
- José Vilela, Director; António José Cardoso, Municipal Director for the Land Use Management; Helena Terêncio, and Fernando Rebelo. City of Coimbra, January 13, 2012.
- Dra. Sandra Cadima, head of the Planning, Management and Land Strategy Division; Maria João C.G. Neto de Vasconcelos, Técnica Superior, DPGU, DIPOET. City of Leiria, January 13, 2012.
- Luis Santos and Ricardo Grade. SMTUC, Coimbra, November 2, 2012.

UNITED KINGDOM

- Chris Tunstall and Richard Leonard, Birmingham City Council; Mike Ogden, Maria Pilar-Machancoses, and Toby Rackliff, Centro. Michael Colella, Peter Moth, and Andres Wallace, Transport for London. Birmingham, January 11, 2013.
- Michael Colella, Julian Ware, Andrew Wallace, Peter Moth, and Simon Weaver. Transport for London (TfL), London, January 7, 2013.
- Personal communication, Michael Colella, Transport for London. February 20, 2013.

WORKS CITED

1 U.S. Department of Transportation, Federal Railroad Administration. Northeast Corridor (NEC) Passenger Rail Corridor Scoping Package, p. 11-12.

2 Greengauge 21. “What will be the spatial effects of High Speed Rail in the UK?” Evidence submitted to the Independent Transport Commission. November 2012, p. 2.

3 Ross, C. L. and M. Woo. The Identification and Assessment of Potential High-Speed Rail (HSR) Routes from a Megaregion Perspective. In *Transportation Research Record: Journal of the Transportation Research Board,* Transportation Planning 2012*,* Transportation Research Board of the National Academies, Washington, D.C., pp 3.

4 The United States Conference of Mayors. The Economic Impacts of High-Speed Rail on Cities and their Metropolitan Areas. http://www.usmayors.org/highspeedrail/documents/report.pdf. Accessed 12 November 2013.

5 Stein, N. and J.M. Sussman. Discontinuous Regions: High-Speed Rail and the Limits of Traditional Governance. Presented at the 92nd Annual Meeting of the Transportation Research Board, Washington, D.C., 2013.

6 Vickerman, R. "High-Speed Rail - the European Experience," in *Territorial Implications of High Speed Rail: A Spanish Perspective*, ed. José Maria de Ureña. Ashgate, Burlington, 2012, pp. 17.

7 Rayle, L., and C. Zegras. "The Emergence Of Inter-Municipal Collaboration: Evidence From Metropolitan Planning In Portugal." *European Planning Studies* Vol. 21, Issue 6, 2013. 867-889.

608 *8* Sussman, J.M. et al., *The "CLIOS Process": A User's Guide.* Massachusetts Institute of
609 Technology, Cambridge, 2009.
610 *9* Lessard, et al. "House of Project Complexity – Understanding Complexity in Large
611 Infrastructure Projects," ESD Working Paper Series, 2013.
612 http://esd.mit.edu/WPS/2013/esd-wp-2013-09.pdf. Accessed 12 November 2013.
613 *10* Ureña, J.M., "High-Speed Rail and its Evolution in Spain," in *Territorial Implications of High*
614 *Speed Rail*, ed. José Maria de Ureña. Ashgate, Burlington, 2012, pp. 5-7.
615 *11* Banister, D. and Y. Berechman, Transport Investment and the Promotion of Economic
616 Growth. In *Journal of Transport Geography* Vol 9, No. 3, 2001, pp. 210.
617 *12* F. Plassard cited by Monzón, et al. Social Impacts of High-Speed Rail Projects: Addressing
618 Spatial Equity Effects. Presented at the 12th WCTR, Lisbon, Portugal, 2010.
619 *13* F. Pagliara et al., Megacities and High Speed Rail Systems: Which Comes First? Presented at
620 the Scientific Conference on Mobility and Transport, Munich, Germany, 2012.
621 *14* Hammond, P. Foreword, *High Speed Rail: Investing in Britain's Future*. London, UK:
622 Department for Transport (DfT), 2011.
623 *15* Graham, D.J. and P.C. Melo, Assessment of Wider Economic Impacts of High-Speed Rail for
624 Great Britain. In *Transportation Research Record: Journal of the Transportation Research*
625 *Board, No. 2261, Transportation Research Board of the National Academies, Washington, D.C.,*
626 2011, pp. 15.
627 *16* Stein, N. *Spatial Dimensions of High-Speed Rail: Intermediate Cities, Inter-jurisdictional*
628 *Planning, and the Implications for High-Speed Rail in Portugal*. S.M. in Transportation and
629 Master in City Planning, Massachusetts Institute of Technology, pp. 83-101.
630 *17* Innes, J. and D. Booher. Consensus Building and Complex Adaptive Systems – A Framework
631 for Evaluating Collaborative Planning. *APA Journal*, Vol 65, No. 4, 1999, pp. 412-423.
632 *18* Dunn, T. *The Geography of Strategy: An Exploration of Alternative Frameworks*
633 *for Transportation Infrastructure Strategy Development*. Doctor of Philosophy in Civil &
634 Environmental Engineering, Massachusetts Institute of Technology, pp. 45.
635 *19* Mintzberg, H., B. Ahlstrand and J. Lampel, *Strategy Safari*. Free Press, New York, 1998.
636 *20* Porter, M.E. *Competitive Strategy: Techniques for Analyzing Industries and Competitors*. Free
637 Press, New York, 1980.
638 *21* Rede Ferroviária de Alta Velocidade (RAVE). The Portuguese High Speed Rail Project.
639 Presented, Moscow, 2004.
640 *22* Department for Transport (DfT). High Speed Rail: Investing in Britain's Future. London, UK,
641 2011.
642 *23* Ureña, J.M. et al., "Territorial Implications at National and Regional Scales of High-Speed
643 Rail," in *Territorial Implications of High Speed Rail: A Spanish Perspective*, ed. José Maria de
644 Ureña. Ashgate, Burlington, 2012, pp. 129.
645 *24* Zheng, S. and M.E. Kahn, China's Bullet Trains Facilitate Market Integration and Mitigate the
646 Cost of Megacity Growth. *PNAS Early Edition*, 2013, pp. 1-6.
647 *25* *Birmingham Big City Plan: City Center Masterplan*. Birmingham City Council, 2011.
648 *26* Centro. Midland Metro Reopens After Easter Closure.
649 http://www.centro.org.uk/newsroom/PressReleases/PressRelease56981.aspx. Accessed
650 April 22, 2013.
651 *27* City of Birmingham. *Birmingham City Centre Enterprise Zone*.
652 http://bigcityplan.birmingham.gov.uk/ez-main/. Accessed April 22, 2013.
653 *28* *Birmingham City Centre Enterprise Zone: Prospectus*. Birmingham City Council, 2013.
654 *29* HS2 Ltd. *All Comments Submitted by Respondent 49672/Centro/Transport, Infrastructure Or*
655 *Utility Organisation*.
656 http://highspeedrailresponses.dft.gov.uk/s2css/viewusercomments.asp?usr=49672.
657 Accessed April 25, 2013.

30 *Eastside Masterplan: Curzon District*. Birmingham City Council, 2011.
31 MacDonald, M., Midland Metro Phase 2 High Speed 2 Link Route Options. Reference drawing, Centro, 2012.
32 NUTS: London Directory. Office for National Statistics. http://www.ons.gov.uk/ons/guide-method/geography/beginner-s-guide/eurostat/london/index.html. Accessed November 10, 2013.
33 London Borough of Hammersmith & Fulham. *High Speed Rail for H&F*. http://www.lbhf.gov.uk/Directory/News/HS2.asp. Accessed April 21, 2013.
34 Peña-Alcaraz, M. et al. Analysis of High-Speed Rail Implementation Alternatives in the Northeast Corridor: The Role of Institutional and Technological Flexibility. Presented at the 92nd Annual Meeting of the Transportation Research Board, Washington, D.C., 2013.
35 Ureña, J.M., "Preface," in *Territorial Implications of High Speed Rail: A Spanish Perspective*, ed. José Maria de Ureña. Ashgate, Burlington, 2012, pp. xix.