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Assessing the Costs and Benefits of Alternative Approaches to High-Speed Rail

With high-speed rail (HSR) on the national agenda in the U.S. for the first time in quite a few years, and with the support of the executive branch of the US government, it is of value to turn our attention to studying various alternatives in terms of how services might be provided with particular focus on the Northeast Corridor (NEC) of the U.S. This corridor, one of the economic engines of the nation and the most densely populated part of the U.S. as well, has potential as a region to deploy high-speed rail. This deployment can take various forms.

Building high-speed rail in the international image of the Shinkansen in Japan and TGV in France is one possibility. This would involve new infrastructure and train sets. Another is to create so-called incremental high-speed rail (some call it “higher-speed rail”) in which existing services coupled with some infrastructure changes permit a superior level-of-service than exists now (say, with Acela) and at lower costs than the international quality mentioned above.

There are many technical and market development issues inherent in the NEC but further, institutional issues abound in the corridor with nine states, various large city governments, freight movements and other issues to deal with to say nothing about the organizational structure that would support operations.

In this research, we consider technological alternatives as well as institutional alternatives in the NEC

We used advanced techniques in understanding complex sociotechnical systems (CSS) to try to gain new insights into this already well-studied corridor. Among the advanced techniques used was the CLIOS Process for representing the NEC situation followed by scenario planning and real options analysis as ways of studying how flexible designs can help in dealing with uncertainty..

Scenario planning in the style developed by Royal Dutch Shell and since further developed by others focuses on identifying “driving forces” which have considerable impact and also considerable uncertainty associated with them. Then one builds several narratives based on these driving forces to illustrate various ways in which the future might develop; we view this as a way of educating decision makers to go beyond “past is prologue” thinking but *not* as prediction. In this first attempt at scenarios, the driving forces selected were limited to economic growth and political support. Further research will go on to look at further driving forces and scenarios.

Even these early scenarios demonstrated the considerable uncertainty associated with this program. This uncertainty suggests the need for a flexible approach to building and operating the NEC. *Real options* were used to create and value this flexibility. Also approximate dynamic programming (ADP) was considered as a way to avoid the “curse of dimensionality”; that is, there are so many possibilities, computational issues may prove intractable. ADP can be a useful approach in this situation.

The results are described in detail in a TRB 2013 paper entitled *Analysis of High-Speed Rail Implementation Alternatives in the Northeast Corridor: The Role of Institutional and Technological Flexibility*.

- Analysis of High-Speed Rail Implementation Alternatives in the Northeast Corridor: the Role of Institutional and Technological Flexibility (.pdf [ESD-WP-2012-23](#))

Also an extensive report was prepared for those interested in more detail

Sussman, J., Archila, A.F., Carlson S.J., Peña-Alcaraz, M., Stein N. (2012a). Transportation in the Northeast Corridor of the U.S.: A Multimodal and Intermodal Conceptual Framework.

<http://mit.edu/hsr-group/documents/jiti.pdf>

Related papers by members of the research team

Sussman, J. et al. The “CLIOS” Process: A User’s Guide

<http://mit.edu/hsr-group/documents/clios.pdf>

- NEC FUTURE Tier I Scoping Process: Public Comment (.pdf [ESD-WP-2012-27](#))

Comparative Study of High-Speed Passenger Rail Deployment in Megaregion Corridors: Current Experiences and Future Opportunities (.pdf [ESD-WP-2010-09](#))

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