



The Feasibility of Moving Freight on High-Speed Rail Networks

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Executive Summary

Background

As high-speed rail (HSR) networks that provide passenger transport are developed and put into operation, they provide another modal opportunity to move freight as well as people. While existing freight rail operations will always move larger, heavier cargoes, an opportunity exists to transport a selected subset of cargo via HSR. For example, high-value and/or time-sensitive goods may be well suited to HSR, particularly over midrange distances. HSR may also work well for transporting the goods of freight integrators, such as United Parcel Service (UPS), FedEx and the United State (U.S.) Postal Service (small package delivery). High-speed rail has the potential to increase freight capacity and reduce the number of trucks on congested roadways while generating a stream of revenue that could aid in capital and operating costs.

Caltrans is interested in learning more about HSR networks that move freight as well as passengers. To support this effort, CTC gathered information on HSR networks, both in the U.S. and abroad, that have implemented shared use of the rail corridor, trains or rail cars. This review of recent research and other publications included an examination of the operational considerations for HSR networks carrying both passengers and freight, and the potential benefits of the shared use of an HSR network.

Note: For purposes of this investigation, “high-speed rail” refers to dedicated track that accommodates speeds above 150 mph. However, publications that address the shared use of regional higher-speed rail networks (speeds from 110 to 150 mph) are also included in this Preliminary Investigation to inform the overall examination of the shared use of HSR networks.

Summary of Findings

Through a literature search, we identified recent research and other publications that address the use of HSR networks to move passengers and high-value freight.

Analyzing the Impact of Transporting Freight on High-Speed Rail Networks

Models, Methods and Strategies

Researchers have examined China’s high-speed railway for its utility in transporting express or high-value freight. A 2014 conference paper presents an HSR express freight business model and proposes several implementation methods. A second conference paper, published in 2013, studies the feasibility of a high-speed railway container train run on the Wuhan-Guangzhou high-speed railway. Researchers examining innovative operating methods in connection with a proposed HSR line between Lisbon, Portugal, and Madrid also considered the feasibility of introducing cargo in the operation of a proposed passenger HSR line. In the proposed scenario, cargo would use the same rolling stock as the passenger-based stock, and containerized cargo would only use open slots behind the passengers’ service. However, this project was scrapped in 2013 by Portugal’s government as an austerity measure, and some of the subsidies for the project were switched to freight transport.

Economic Considerations

Analysis of the social and economic benefits of using HSR to carry express freight was considered in a September 2014 conference paper. In a 2012 journal article, researchers contemplated whether a high-speed train dedicated to passenger flows was preferred over a “high-performance” train that would carry both passengers and cargo. A cost-benefit analysis showed that the high-performance project was the most profitable option. The economic challenges of cost recovery for a passenger-only HSR network are examined in the final publication we cite in this section.

Operational Considerations

The authors of a 2014 conference paper note that China’s Nanchang Railway Bureau and Guangzhou Railway Group Corporation have experimented with HSR to transport express freight and have achieved some success. However, there are issues associated with train operation if HSR express freight trains are organized and operated as passenger trains. To address this, the authors describe a comprehensive optimization model of an HSR express freight train operation diagram using indexes of time limitation and cost-effectiveness. In a 2013 conference paper, the authors describe a model that can assist in identifying and scheduling maintenance activities for a railroad track. Researchers note that the model can be particularly helpful in areas where shared high-speed passenger and freight operations are being considered.

Environmental Considerations

A December 2014 journal article describes a method to determine energy consumption of a new HSR line during the preproject phase. Two project variants are compared in terms of total energy for a 50-year service life and the type of rail traffic, including passenger and freight flows.

Lessons from Europe

Examinations of the implementation of HSR in Europe include an assessment of mixed-traffic HSR lines in Germany and a discussion of the transition of the French postal operator La Poste, an early adopter of HSR for delivery of high-value cargo, to a multimodal delivery strategy. While La Poste is moving away from focused use of HSR for mail delivery, a new European endeavor—the Euro Carex project—aims to substitute HSR services (300 kilometers per hour (kph), or 186 mph) for some short-haul European air freight flights.

Shared Use of Non-High-Speed Rail Networks in the United States

Recent reports produced by cooperative research programs supported by the Transportation Research Board (TRB)—the National Cooperative Highway Research Program (NCHRP), the National Cooperative Freight Research Program (NCFRP) and the Transit Cooperative Research Program (TCRP)—provide guidance on capacity modeling and feasibility screening and suggest business models for the shared use of rail corridors in the United States. While not specifically addressing the shared use of an HSR line, these publications may prove helpful in identifying critical issues to examine and potential pitfalls to avoid. This section also includes a recent journal article that considers the use of HSR lines in the U.S. for freight such as fresh produce, and publications related to a project in progress that is investigating the feasibility of using an urban railway system (in this case, California’s Bay Area Rapid Transit, or BART) for movement of air freight in and out of international airports.

Gaps in Findings

While delivery of high-value cargo via HSR is not a new idea (France's post office, La Poste, has been transporting mail via HSR for three decades using converted rail cars), we found limited analysis of the shared use of dedicated HSR networks to transport both passengers and freight. While such use is under consideration in China, and had been discussed for a proposed HSR line between Lisbon and Madrid, the impacts of shared use have not yet been addressed in the literature. The Euro Carex project in Europe is focusing on the use of HSR for transporting high-value cargo, but we have not identified publications or online information that address the impacts of passenger and high-value freight flows sharing a dedicated HSR network. Additional information may be available when this project is more fully launched in 2017 or 2018.

Next Steps

Moving forward, Caltrans could consider:

- Following the progress of the Euro Carex project to learn more about the types of facilities and stock needed to transport high-value freight on an existing HSR line.
- Examining in greater detail the methods used to assess the feasibility of introducing cargo to the operation of the HSR line that had been proposed between Lisbon and Madrid.
- Reviewing the domestic use of shared higher-speed rail lines to inform an examination of the shared use of dedicated HSR networks.
- Tracking the BART project that proposes to use an urban railway system for movement of air freight.
- Examining more thoroughly the benefits and disbenefits of modal diversion from truck to rail and the strategies needed to attract shippers to use rail. Discussion could include the impacts related to emissions, congestion, safety, pavement damage to roadways, passenger service, and rail network capacity.

Detailed Findings

Analyzing the Impact of Transporting Freight on High-Speed Rail Networks

The publications cited in this section begin with recent conference papers that address strategies, models and methods for HSR networks in China, Portugal and Spain to carry both passenger traffic and high-value or express freight. Following these general resources are conference papers and journal articles that assess the economic impact of using HSR networks for freight, examine the operational considerations associated with moving express freight on existing HSR lines, and identify methods for assessing the environmental impact of passenger and freight flows.

Models, Methods and Strategies

“Analysis of Conducting High-Speed Rail Express Business in China,” Fangqing Song, *CICTP 2014: Safe, Smart, and Sustainable Multimodal Transportation Systems*, 2014.

Citation at <http://cedb.asce.org/cgi/WWWdisplay.cgi?320694>

From the abstract:

In the context of the rapid development of China’s high-speed railway (HSR) network and the booming express market, it is necessary to introduce effective ways to increase HSR revenue and improve express service with lower cost and less harm to the environment. This paper presents an innovative HSR express business model and proposes several implementation methods. The necessity and feasibility of this service is analyzed and [analytic hierarchy process (AHP)] is used to illustrate the advantages of HSR express.

“Development Strategies of Container Trains Based on the Wuhan-Guangzhou High-Speed Railway,” Lingyan Li and Wuruo Li, *ICTE 2013: Safety, Speediness, Intelligence, Low-Carbon, Innovation*, October 2013.

Citation at <http://dx.doi.org/10.1061/9780784413159.063>

From the abstract:

With changes in socioeconomic structure, the frequency and speed of travel required is increasing. This is reflected not only in passenger travel, but also in high value-added goods transportation. In this paper, the authors discuss freight statistics from the view of transfer freight volume, trends [in] freight volume, and induced freight volume between Wuhan and Guangzhou [China] and analyze the period characteristics and structural features of the run of the Wuhan-Guangzhou high-speed railway. The paper then studies the feasibility of a high-speed railway container train in the view of transport organization and technical conditions, and by [using the strengths, weaknesses, opportunities and threats (SWOT)] analysis method, the shortcomings of its running are pointed out. According to the analysis, development strategies are proposed.

Note: The two citations that follow address a proposed HSR line between Lisbon, Portugal, and Madrid. Included in the discussion are the implications of moving cargo as well as passengers. A 2013 article in *The Portugal News Online* (see <http://www.theportugalnews.com/news/high-speed-rail-u-turn/27691>) indicates that this HSR project was canceled by Portugal's government. From the article:

Portugal's government has changed its mind within the space of two days, saying today that plans to build a network of high-speed passenger rail lines has been canceled and will not be revived, with some of the European Union subsidies for the project to be switched into freight transport.

“High Speed Rail Lisbon – Madrid: An Innovative Method,” Diana Silva Leal, Luis Picado-Santos and Bruno Filipe Santos, *EPAM 2012: 4th European Pavement and Asset Management Conference*, 2012.

Citation at <http://trid.trb.org/view.aspx?id=1240092>

From the abstract:

In the recent decades, high speed rail investments have been a subject of great interest from European Union. Given that these investments usually involve large public funding, once decided, it is really important to plan the system in the most efficient way. The motivation for the study meets the interest in the MATE—Multi-Attribute Tradespace Exploration—method and its applicability in the development process for the several products and situations. The method, first developed at MIT (Massachusetts Institute of Technology), has been shown to enable a better conceptual decision-making in aerospace system applications; however it has never been applied to the analysis of a transportation problem, especially as in this analysis of a high speed rail project. This paper describes different applicability of MATE method to analyse the future Lisbon–Madrid high speed rail line. The study was part of the EXPRESS research project, set up under the MIT-Portugal Program. The work done addresses the feasibility of the introduction of cargo on the operation of this line admitting that the rolling stock will be of the same type as the passenger's rolling stock. Containerized cargo will only use open slots beyond passengers' service. This application uses integrated technical data, both from different rail operators and from stakeholders that have no direct role in decisions regarding the rail system but have a strong interest in taking part of the high speed rail line decision process. The feasibility of the MATE method for dealing with this complex transportation issue and associated constraints will be discussed in the paper together with the results obtained.

Related Resource:

“EXPRESS Project: A Model of Collaborative International High-Speed Rail Research,” João de Abreu e Silva, Guineng Chen and Joseph Sussman, *European Transport Conference 2011: Seminars*, 2011.

<http://abstracts.aetransport.org/paper/download/id/3674>

The EXPRESS project brings together Instituto Superior Tecnico of Lisbon, the University of Coimbra, MIT and RAVE (Portugal's high-speed rail development agency). EXPRESS aims to support efforts to deploy HSR in Portugal with research in five key areas: strategic planning of HSR; innovative HSR financing; measuring economic and land-use development impacts of HSR; dynamic demand forecasting under uncertainty and cross-modal competition; and configuration of high-speed freight services.

Page 7 of the conference paper describes the benefits of introducing freight service on HSR:

The introduction of freight service on HSR could reduce congestion, accidents, and environmental externalities of freight transportation by diverting traffic from trucks. The economic evaluation of HSR investment has been covered from various perspectives: general assessments (Vickerman, 1997); cost-benefit analyses of existing or projected lines (de Rus and Inglada, 1997), including in Spain (Beria, 2008), California (Levinson et al, 1997), the UK (Steer Davies Gleave, 2004), and the EU (de Rus and Nash, 2007); and regional effects of HSR investment (Blum et al, 1997).

The introduction of freight-rail services on the Lisbon-Madrid HSR line will open new trade markets and commercial opportunities. Such a system of cost-effective transportation could provide significant public benefits in a key trade corridor by enhancing economic development, improving air quality, and reducing energy consumption. We aim to evaluate alternative freight configurations on HSR that could also influence passenger demand (if for example, passenger trains are delayed by rail freight movements) and also the spatial impacts of HSR.

Economic Considerations

“Impact of High-Speed Rail Express on Regional Development,” Qingwei Zhong and Xingjian Huang, *ICLEM 2014: System Planning, Supply Chain Management, and Safety*, pages 1195-1202, September 2014.

Citation at <http://dx.doi.org/10.1061/9780784413753.181>

From the abstract:

With the large-scale, high-speed railway construction and rapid development in recent years, rail transport has been found to be a new and reliable mode of transport. With the pace of reform on freight policies, high-speed rail is no longer confined to passengers and high-speed rail express officially appeared in front of the public. Analysis of the social and economic benefits after the carry out of the high-speed rail express and study of the impact of logistics within the region and combined with the actual conduct of the current high-speed rail express will bring some proposals and specific measures for improvement.

“Economic Assessment of Railway Policies: High Speed or High-Performance: A Case of Study,” Pablo Coto-Millan, Pedro Casares and Vicente Inglada, *Open Transportation Journal*, Vol. 6, pages 23-30, 2012.

<http://benthamopen.com/contents/pdf/TOTJ/TOTJ-6-23.pdf>

The aim of this paper is to answer the following question regarding a project in Spain: Which is more viable: a high-speed train for passengers between Santander and Madrid, or a high-performance train for passengers and cargo between Santander and Madrid? Researchers used a cost-benefit analysis to conclude that the passengers-cargo option is preferred to the passengers-only alternative. From page 7 of the PDF:

The results of the cost-benefit analysis carried out clearly show that the high performance railway project in its combined passenger and cargo option is the most economically profitable option.

In the project’s base case scenario, simultaneously considering the transport of passengers and cargo, the updated value of its net social benefits is 366.59 million Euros. This corresponds to an [internal rate of return (IRR)] value of 5.10%.

The final balance of the project is therefore positive and makes evident the economic performance that will be brought about by its implementation.

High-Speed Rail: The Fast Track to Economic Development? Paul Amos, Dick Bullock and Jitendra Sondhi, *The World Bank*, July 2010.

<http://www->

wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2010/07/26/000334955_20100726032714/Rendered/PDF/558560WP0Box341SR1v08121jul101final.pdf

This report addresses some of the economic challenges of cost recovery for a passenger-only high-speed railway. Some of the analysis addresses the effects of implementing HSR in developing countries. From page 15 of the report (page 20 of the PDF):

The evidence is that it is very difficult for a stand-alone high-speed railway to recover much of its capital costs from the passenger revenue stream alone, except in the very densest corridors. On some lines internationally, a high-speed line may create other positive net revenue streams that can be factored into the financial returns, such as in China where there is strong latent demand by freight customers for the capacity released by the transfer of many passengers to a new line. But for the most part, governments contemplating the benefits of a new high-speed railway, whether procured by public or private or combined public-private project structures, should also contemplate the near-certainty of copious and continuing budget support for the debt.

The use of the HSR network for both passengers and freight appears to be considered from a more general perspective (i.e., considering the flow of heavier freight and not simply high-value freight). To manage the heavier freight loads, the authors note that the shared use of an HSR network would require moderation of the line's maximum speed. From page 19 of the report (page 24 of the PDF):

Either way, the incremental cost of construction of high-speed rail systems can only be recovered in an environment of intensive use of the capacity created. A route that operates for 16 hours a day with an average of five pairs of trains per hour, each carrying 500 seats, will have a commercial capacity of about 80,000 passengers per day or some 30 million passengers per year. If effectively marketed it might expect to attain an average two-thirds load factor. In our view, whilst the day-to-day working expenses of a high-speed line can be covered at a relatively low traffic volume, a developing country must reasonably expect at least 20 million passengers per year with sufficient purchasing power, just to have the possibility of covering the working expenses and interest costs of providing that capacity with high-speed service, and probably double that number to have any possibility of recovering the capital cost.

If extra capacity in a corridor is clearly required, but market potential is not large enough to justify dedicated passenger use, a new railway could be designed for freight as well as passenger operation. In such a case the maximum speed would need to be moderated.

Operational Considerations

“Comprehensive Optimization Model of Diagrams of High-Speed Railway Express Freight Trains Operated in Passenger Train Patterns,” Si Ma, Tiesen Zeng and Yan Chu, *ICLEM 2014: System Planning, Supply Chain Management, and Safety*, pages 327-334, September 2014.

Citation at <http://dx.doi.org/10.1061/9780784413753.050>

From the abstract:

With the rapid development of high-speed railways, high-speed railway express freight trains—which operate as passenger trains to transport some fast goods, such as intercity parcels—bring a probable rewarding opportunity. In this paper, the high-speed railway express freight train's operation diagram comprehensive optimization model is built based on the value of time consumption and economic benefits for transportation enterprises. The genetic algorithm was employed to get a solution to the model, then a model dedicated algorithm was designed and its effectiveness was verified by experimental practice. The China Railway Express Company will set up high-speed railway express business in 20 cities from April 1, 2014. Using high-speed railway to transport express freight is one of the best ways for those in the transportation industry. High-speed railway transport express freight is not affected by factors such as traffic jams or air traffic control, and the degree of punctuality is very high in addition to extreme weather conditions. Using the high-speed railway to transport express freight has very strong competitiveness from the aspects of timeliness and cost. Many domestic scholars have discussed the feasibility of using high-speed railway to transport express freight. They all agree that using high-speed railway to transport express freight is completely feasible according to its advantages, future development, and tariff. Nanchang Railway Bureau and Guangzhou Railway (Group) Corporation experimented with the use of high-speed railway to transport express freight and achieved some accomplishments. However, if high-speed railway express freight trains are organized and operated as passenger trains, there is an issue of how to optimize the train operation diagram. This paper attempts to build the comprehensive optimization model of a high-speed railway express freight train operation diagram to solve the problem according to the indexes of time limitation and cost effectiveness of a transportation enterprise.

“Development of an Integrated Railroad Track Maintenance Model,” Alexander H. Lovett, M. Rapik Saat, C. Tyler Dick, Conrad Ruppert and Christopher P. L. Barkan, *2013 World Congress on Railway Research*, November 2013.

<http://railtec.illinois.edu/articles/Files/Conference%20Proceedings/2013/Lovett-et-al-2013-WCRR.pdf>

This report describes a model developed to assist in identifying and scheduling maintenance activities for railroad track. The model's three modules—an integrated track quality and degradation module, a maintenance activity selection module, and a scheduling optimization module—provide a comprehensive maintenance model and eliminate the need to look at each step independently. By allowing for advanced maintenance planning and improved track reliability, the model is expected to reduce maintenance costs and improve safety. Researchers note that the model could be particularly helpful in areas where shared high-speed passenger and freight operations are being considered.

Environmental Considerations

“Eco-Design Model of a Railway: A Method for Comparing the Energy Consumption of Two Project Variants,” R. Bosquet, A. Jullien, P-O. Vandanjon, M. Dauvergne and F. Sanchez, *Transportation Research Part D: Transport and Environment*, Vol. 33, pages 111-124, December 2014.

Citation at <http://dx.doi.org/10.1016/j.trd.2014.08.003>

From the abstract:

This article introduces an innovative, generic and systemic method dedicated to determining the energy consumption of a railway line during the pre-project phase by taking into account the complete life cycle of the rail infrastructure, including construction, maintenance and operations. The method developed (called PEAM) focuses on assessing project variants during the design stage and therefore integrates both the geometric longitudinal constraints of the line and the thicknesses/volumes over the entire itinerary as design parameters for input into the various construction scenarios. PEAM combines methodologies stemming from life cycle assessment with a consumption model derived from physical modeling. The models associated with this method are then applied to study the energy consumption of a new high-speed line located in France that also has major implications for the European connections currently under investigation as well. Two project variants are compared in terms of total energy for a 50-year service life and a given characteristic rail traffic, including passenger and freight flows. Results obtained reveal a 30% difference between the two variants, which prior to applying PEAM were considered to be relatively similar.

Lessons from Europe

Below we highlight discussions of the impact of mixed-traffic HSR lines in Germany; the transition of the French postal operator La Poste from a focus on HSR to a multimodal delivery strategy; and a new European project—Euro Carex—that will use HSR to replace some short-haul European air freight flights.

“Success Factors of the German High Speed Rail System,” Ottmar Grein, *Conference on High-Speed Rail in Europe and the Czech Republic*, May 2014.

<http://www.cedop.info/wp-content/uploads/2014/05/Grein-DB-HSR-in-Germany.pdf>

The author of this presentation comes to the following conclusions with regard to mixed traffic on HSR lines in Germany (see slide 16):

Construction and operation of mixed traffic high-speed lines show advantages but also disadvantages compared to passenger dedicated lines:

- Higher capacity and shorter transport time for freight trains.
- Better utilization of expensive infrastructure (higher revenues).
 - Reduction of line capacity without segregation of fast and slow trains.
 - Higher infrastructure cost in mountainous areas.
 - Less time slots for maintenance.

“La Poste to Streamline Courier Products and Invest in Rail Transport,” *Post & Parcel*, June 24, 2014.

<http://postandparcel.info/61633/news/companies/la-poste-to-streamline-courier-products-and-invest-in-rail-transport/>

An early adopter of the use of HSR to deliver high-value cargo, La Poste, the French postal operator, recently announced changes in the use of HSR in measures “designed to improve mail and parcel services for consumers and businesses.” From the article:

Meanwhile, La Poste has adopted a new multimodal transport strategy in which it aims to develop its rail, road and air infrastructure, and even use river transport.

The strategy sets goals for a doubling of rail freight connections as the national postal service seeks to improve the environmental impact and reliability of its transport networks.

....

The changes to the rail network coincides with the end of La Poste’s use of the TGV high speed train after three decades, which the postal operator said no longer met the changing needs of mail customers.

In future, La Poste said the volume of mail transported by rail will increase, with expectations that from 2017 the volume of mail and cargo will rise by 30% compared to the current capacity on the TGV.

“UK-Europe High-Speed Rail Freight Plan,” Robert Wright, *The Financial Times*, March 25, 2012.

<http://www.ft.com/intl/cms/s/0/21a6eac6-742f-11e1-bcec-00144feab49a.html#axzz3O4rThxOJ>
(registration required)

This article provides background on the Euro Carex project, which plans to use existing HSR lines to transport air freight.

Highlights from the article:

A group aiming to substitute 300kph rail services for some short-haul European air freight flights hopes to launch its first services between the Continent and the [United Kingdom (UK)] later this decade, it has announced after bringing a freight-carrying French high-speed train to the UK.

François Coart, strategy director of Europorte, an arm of France's Groupe Eurotunnel that is participating in the Euro Carex project, said the group had identified sites at four mainland European airports and in south-east England as terminals for the service, which it hopes to launch in 2017 or 2018.

....

The project has backing from several express parcel delivery services—including the U.S.'s UPS and FedEx and the Netherlands' TNT Express—as well as the four airports that could be served—Amsterdam Schipol, Paris Charles de Gaulle, Liège Airport and Lyons Airport. Euro Carex aims to shift to rail both some of the feeder flights that bring parcels and air freight to the express package providers' main hubs, as well as some of the truck and van movements to and from the airports.

....

It was “not rocket science” to build the relatively simple rail terminals required, Mr. Coart said. Each would cost between €30m and €50m to build.

Mr. Coart was speaking after Euro Carex for the first time brought a French TGV train to London to demonstrate how loading and unloading would work. The train is one of the handful of the 30-year-old first wave of French high-speed trains that has been converted to carry mail for La Poste, France's post office. The train had called at both Lyons and Charles de Gaulle airports before heading through the Channel tunnel to London.

....

Unlike the existing postal service TGVs, these would have doors large enough to accept air cargo containers from aircraft. The train would be able to carry around 120 tonnes of packages, around the same as seven Boeing 737 aircraft or seven articulated trucks.

Related Resources:

Euro Carex: Cargo Rail Express, The European High-Speed Rail Freight Network, Euro Carex, 2013.

<http://www.eurocarex.com/>

This web site describes the Euro Carex European freight service, which uses the existing HSR network to carry air freight. The project shifts air cargo that is currently transported by truck and short- and medium-haul planes to high-speed trains. The first phase runs until 2015, and connects the Amsterdam-Schiphol, Liège, Paris-Roissy-CDG, Lyon-Saint Exupéry airports, as well as the London basin. In a second phase, Carex will spread to Germany and additional airports in France; the third phase brings in airports in Spain and Italy. One Carex train can carry 100 tons of freight.

As the web site notes, the Euro Carex project requires:

- A specific rolling stock to transport air pallets and air containers in high-speed trains.

- Dedicated rail terminals called “railports” in the immediate vicinity of airports and HSR lines.
- Committed and determined public and private partners.

The Technical File portion of the web site (see the left navigation bar) provides details on the project’s principles, facilities, operations and results.

“Project of High-Speed European Rail Freight Service Connected to Airports and Logistic Areas,” Euro Carex: Cargo Rail Express, December 2011.

http://www.eurocarex.com/pdf/pressreview/100103240178_carex-pressreview.pdf

This presentation includes a history of the Carex project and offers details of the project’s network, the Carex railports in Europe, and the rolling stock used for the service. Data offered in the closing slides of the presentation includes:

- Initial investments:
 - The Euro Carex trains: Between 600 and 700 million € for 20 units according to the manufacturer and options selected. Maintenance costs are not included.
 - Railway connection to the high-speed line: Cost varies from 10 million to over 100 million € per site depending on the length and complexity.
 - Railport terminals: Between 15 million € for a basic terminal with two tracks and 25 million € for a bigger one.
- Estimation of annual expenses for the first phase (operations):
 - €125 M in 2015, with the first phase of the Euro Carex network.
 - Of this cost, €86 M is for rolling stock, train maintenance, driving, energy, train paths (slots), branch line maintenance.
 - The Euro Carex trains will emit approximately 35 times less carbon than the aircrafts and trucks currently used.

“SNCF Faces New Challenges,” Keith Fender, *International Railway Journal*, December 22, 2009.

<http://www.railjournal.com/index.php/blogs/david-briginshaw/sncf-faces-new-challenges.html>
<http://trid.trb.org/view/2009/C/911893>

From the abstract:

The views of David Azema, Director of Finance and Strategy at French National Railways (SNCF), are presented in regard to development of SNCF’s freight business and high speed services. Major changes are scheduled for rail freight in an effort to obtain a sounder financial footing, but wagonload freight will at the same time not be exited. These changes include increased combined and container transportation, Autoroute Ferroviaire piggyback service development, and a Carex interairport high-speed freight project. Introducing “short-line operators” is a key part of the plan for improved wagonload traffic viability. In regard to high speed, a fleet of 35 international trains will be used, from 2015 on, mainly on cross-border routes. Incumbent operators will be impacted by the change of mindset required by liberalized passenger operations.

Shared Use of Non-High-Speed Rail Networks in the United States

The publications cited in this section address the shared use by passengers and freight of higher-speed networks (speeds less than 150 mph). Some of the lessons learned from this type of shared use may inform an investigation of the shared use of a dedicated HSR line.

National Resources

NCHRP Report 773: Capacity Modeling Guidebook for Shared-Use Passenger and Freight Rail Operations, Justin Fox, Paula Hirsch, Om Kanike, David P. Simpson, Andrew J. Cebula, Alan J. Bing and Emmanuel S. “Bruce” Horowitz, August 2014.
http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_773.pdf

Chapter 5, Taking Shared-Use to the Next Level: Chicago–Saint Louis High Speed Rail, includes this in the chapter’s introduction (see page 68 of the report; page 79 of the PDF):

This guidebook concludes with a discussion of recent and ongoing planning for the Chicago-Saint Louis high speed rail implementation on the UP and CN line. This line will host high speed trains in the near term, along with increasing amounts of freight and conventional passenger services. It is included in the guidebook because its planning effort has embodied many of the themes for successful shared-use corridor planning that were uncovered in the stakeholder outreach effort discussed in Chapter 2. Namely:

- The necessity of building trust between the host freight railroad and the public agency sponsor;
- The importance of taking a longer term view to account for changing rail operating patterns;
- The need to look for factors affecting corridor operations that may reside well outside of the corridor itself; and,
- A highly detailed, rigorous operations simulation testing the robustness to proposed track configurations given differing assumptions for train mix and operating patterns.

And from the conclusion (see page 76 of the report; page 87 of the PDF):

A great deal has been learned in developing Chicago-Saint Louis about the institutional and legal challenges of essentially re-building a privately held main track alignment with over \$1 billion in public investment. Much is still unknown, however, about the long term costs and operating implications of operating significant numbers of both main line freight and higher speed passenger trains over common [Federal Railroad Administration (FRA)] Class VI infrastructure with a maximum allowable speed of 110 mph for passenger trains.

While freight trains operate regularly over portions of the Northeast Corridor, the overall volumes are small in relation to the passenger activity. Conversely, large numbers of passenger trains operate in high-density freight alignments at “conventional” speeds of 79 mph or less, particularly for commuter service operations.

It is always possible to engineer a physical plant capable of handling all classes of trains, if cost is no object. What will be interesting to learn from Chicago-Saint Louis is the long term cost and operations practicality of all the projected services, passenger and freight,

operating on a common physical plant. Chicago-Saint Louis may become the *de-facto* testing ground for the economic limits of shared track access.

NCFRP Report 27: Web-Based Screening Tool for Shared-Use Rail Corridors, Daniel Brod, Alexander E. Metcalf and Edwin “Chip” Kraft, 2014.

http://onlinepubs.trb.org/onlinepubs/ncfrp/ncfrp_rpt_027.pdf

In this project, researchers developed a web-based tool to perform preliminary feasibility screening of proposed shared-use passenger and freight rail corridor projects. Three case studies described in the report demonstrate the tool in action. System outputs include:

- Time-speed-position data of trains.
- Dispatcher authorizations to trains by time.
- Added infrastructure cost estimates.
- Numbers of conflicts.
- Numbers of meets/passes.
- Variety of charts (string, speed, authorities, total delay and components).

The user interface is a standard web page, with access to the system limited to users who are registered and authorized by the system administrator. The tool is available through a FRA web site (see Related Resource below).

Related Resource:

Shared-Use Web-Based Tool, Federal Railroad Administration.

<http://www.fra.dot.gov/Page/P0702>

From the web site:

The Federal Railroad Administration currently sponsors the Shared-Use Web-Based Tool developed by National Cooperative Freight Research Program (NCFRP) at this external web address: <http://su.dtek.biz>.

The NCFRP 30 web-based screening tool is designed to enable State and Regional transportation planners and passenger rail operators to perform preliminary screening of proposed shared-use passenger and freight rail projects. NCFRP Report 27 provides more information about the tool and can be downloaded here:

<http://www.trb.org/main/blurbs/171116.aspx>. The tool assists planners with the preliminary analysis as defined in the Rail Corridor Transportation Plans: A Guidance Manual, a Federal Railroad Administration publication found at: <http://www.fra.dot.gov/eLib/Details/L04161>.

The Shared-Use Web-Based Tool is not intended to support either capital budgeting or facility design beyond the schematic/conceptual level. The tool is appropriate for sketch planning and alternative route analyses.

TCRP Report 130: Shared Use of Railroad Infrastructure with Noncompliant Public Transit Rail Vehicles: A Practitioner's Guide, Booz | Allen | Hamilton, Jacobs Edwards & Kelcey, ICF Consulting and New Jersey Institute of Technology, January 2009.

http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_130.pdf

From the abstract:

This Guide includes a business case for the shared use of non-Federal Railroad Administration (FRA)-compliant public transit rail vehicles (e.g., light rail vehicles) with freight operations and offers a suggested business model for such shared-use operations. The Guide also identifies the advantages and disadvantages of shared-use operations and the issues and barriers that can arise in the course of implementation. The Guide includes a section that identifies and evaluates available and emerging technology, operating procedures, and techniques that could be used to minimize the risks associated with sharing of track between non-FRA-compliant public transit rail vehicles and freight railroad operations. Finally, the Guide includes descriptions and sources of real-world examples of these applications. This Guide will be helpful to transit managers, transit operations planners, transportation consultants, state safety oversight agencies, and federal rail and transit oversight agencies.

Other Publications

“Fast Freight Can Be Very Profitable,” David Burns, *Railway Gazette International*, Vol. 169, Issue 9, pages 51-54, September 2013.

Citation at <http://trid.trb.org/view.aspx?id=1263487>

From the abstract:

In part due to the need for faster deliveries, shippers in the United States are spending \$28 billion annually on long-distance road transportation. If the rail industry can offer a time-competitive service, there is a significant revenue potential, as discussed in this article. This is the case with the shipping of fresh produce, which faces issues of avoiding crushing or bruising, temperature, humidity, and ethylene absorption or generation. The wrong combination of produce in a freight car could result in unsellable product; the right combination could result in a very profitable revenue stream for the railroad. High speed freight requires investment in infrastructure and signalling systems, which would be greater than that for passenger trains. It is suggested that high speed freight rail could be concentrated on passenger routes in order to help defray costs.

Project in Progress: “Bay Area Rapid Transit (BART) Air Freight,” Caltrans.

http://www.dot.ca.gov/newtech/modal/intermodal_connectivity/bart/index.htm

(Note: The final report for this project is being finalized now.)

From the Caltrans web site:

Project description: Trucks are currently the primary mode for air-freight door-to-door service delivery in San Francisco Bay Area for all the integrated/non-integrated carriers, providing connectivity between airports, sorting sites, local distribution (collection) centers and customers. However, trucks have a significant impact on peak period highway congestion, auto drivers’ safety, security and air pollution in the vicinity of major airports and on the highway corridors that lead to them. To mitigate those impacts, it is important to leverage other modes as alternatives.

This research will investigate the feasibility of using the BART (Bay Area Rapid Transit) rail system in place of trucks to move air freight in and out of San Francisco and Oakland international airports. On average, the BART system only uses about 30% of its capacity for passenger movement. Using some portion of the excess capacity for freight movement will increase the efficiency of the BART system and reduce land use and pollution by getting

trucks off the highway. In a congested highway environment, BART may perform better than trucks as it is not impacted by incidents or congestion, helping to meet the limited-time-window delivery of air freight carriers.

Related Resources:

Bay Area Rapid Transit (BART) and Air Freight, Research Notes, Caltrans Program Steering Committee: Modal, June 2014.

http://www.dot.ca.gov/hq/research/researchreports/current_research/Modal/docs/2274_ResearchNotes.pdf

From the document:

The project is almost complete. Six of the seven tasks have been completed including:

1. Consideration of the infrastructure feasibility and, concept of operation from BART's perspective
2. Transshipment and equipment feasibility—the FedEx perspective
3. Overall system operational and logistic feasibility analysis
4. Security consideration for both BART and FedEx
5. Institutional issues examined
6. Investigate opportunities for demonstration and or small scale freight transport operations

The Potential of Using Transit Infrastructure for Air Freight Movement: A Case Study in the Bay Area, Rui Wang, Xiao-Yun Lu and Karthik Sivakumaran, Caltrans, October 2010.

<http://www.path.berkeley.edu/sites/default/files/publications/PRR-2010-38.pdf>

From the abstract:

This report examines the impact and feasibility of using urban railway system for freight movement. In particular, using the Bay Area Rapid Transit (BART) system for FedEx Express air cargo movement is analyzed as a case study. Based on the framework constructed in the study of last phase, social impact (externalities), reliability, and infrastructure feasibility are considered. The social cost related to emission, energy consumption/efficiency, impact on road traffic and land use is considered. The reliability issue is examined from two aspects: transportation delay, and emergency situation handling.

The infrastructure feasibility is analyzed based on the proximity and accessibility of BART yards/shops/stations and FedEx collection/distribution centers, the air freight container size, and the conceptual designs of dedicated BART freight car and transshipment equipment.