High-Speed Intercity Passenger

SPEEDLINES

SEPTEMBER 2019 ISSUE #26

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CHINA

In the early decades of New China, building railways was one of the key tasks for the Chinese government to modernize the country. • • •

FRA

New regulations amending Passenger Equipment Safety Standards (49-CFR-238) in November 2018.

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The FAST Act Surface Transportation Bill expires in 2020, and its replacement could change everything about America's trains.

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UAC TurboTrain was an early high-speed, gas turbine train manufactured by United Air.

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SPEEDLINES MAGAZINE

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CHINA'S FIRST INTERCITY TRAINS USING HIGH-SPEED RAIL OFFICIALLY OPENED IN SOUTH CHINA'S HAIKOU CITY, HAINAN PROVINCE ON JULY 1, 2019. THE SUBURBAN TRAINS ALSO FORM THE FIRST RAPID URBAN RAIL TRANSIT ROUTE IN HAINAN PROVINCE.

Above: GO Transit is an interregional provincially run public transit system in the Greater Toronto and Hamilton Area (GTHA) conurbation, with operations extending to several communities in the Greater Golden Horseshoe. The GO network employs double-decker diesel trains and coach buses; it connects with other regional transit providers such as the TTC and VIA Rail.

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From the desk of Al Engel

SEPTEMBER 2019

HS&IPR COMMITTEE & FRIENDS

Whenever I go to the post office I ask about recent commemorative stamps. Recently I was pleased to see that the USPS saw fit to commemorate the 150th anniversary of the completion of the transcontinental railroad. That anniversary occurred in May and coincidentally earlier in the year we celebrated the 50th anniversary of the Metroliners on the NEC, this country's first high-speed rail service.

In July we celebrated the 50th anniversary of the first Lunar landing on July 20, 1969. Some of our readers will not be old enough to remember the moment, but I remember exactly where I was when I viewed the live feed of the lunar landing on network television. What a proud moment for our country to realize this spectacular vision. President John Kennedy is quoted as saying, "We choose to go to the Moon...We choose to go to the Moon in this decade and do the other things, not because they are easy, but because they are hard; because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, . . . "

Building a transcontinental railroad was hard too, but we did it because we saw the promise it held for the economic development of our country. It led to the evolution of a large rail network providing access for the majority of the population. While the space program has continued unabated since that lunar landing with total investment approaching $1 trillion, high performance passenger rail development in the United States since the Metroliner launch has languished. As most of you know, this has not been the case in the rest of the world, with more than 27,000 miles of HSR in service.

Our challenge as a committee is to divine the strategy and tactics that build the political will to support a national HSR program. A program that draws on "the best of our energies and skills" as well as public and private investment to build a national network that connects our urban and rural population centers. We should do it, not because it's hard to do, but because it is necessary in order to avoid the hard realities of total gridlock and further climate degradation as our population continues to grow.

It was good to see many of you at our committee meeting in Toronto where we shared as a group our big ideas for building political will. We concluded that part is not easy, but there are U.S. success stories we can refer to as we speak with our elected officials and business leaders. Progress in the NEC, the Florida Virgin/Brightline service, California's HSR construction, Texas Central HSR and other intercity passenger services covered in this or earlier SPEEDLINES issues show a path for moving ahead. What is more, investing in HSR no longer entails a technical risk because the global implementation experience is available to us; hence, we start very high on the learning curve.

Our APTA advocacy took a big step forward with the adoption of a robust legislative ask for intercity passenger rail adopted by the full APTA Legislative Committee at the Toronto Rail Conference. We are asking for continuation of the Rail Title with a rail trust fund and a $32 billion authorization over six years in the next surface transportation bill. We thank Karen Hedlund for her diplomacy and persistence in leading the charge to get the APTA Legislative Task force to see the wisdom of our request. For more about the recommendation to Congress along with further APTA procedures, check out the story in this issue.

Thanks to our SPEEDLINES team for another fine issue. Take a look in this issue #26 about more of what's coming up. Our committee will have a presence at the AASHTO Rail Council meeting mid-September in Hartford, Connecticut where we will have the chance to sample the rail service implemented by our immediate Past Chair, Anna Barry. Our agenda for the next HS&IPRC meeting at the APTA Annual in New York Oct 13, 2019 is taking shape along with several sessions. And while you're making notes, plan to attend the 6th HSR Policy Forum on Dec 4, 2019 in Washington, D.C. Hope to see many of you at these events and my best wishes for an enjoyable and reinvigorating fall."

APTA LEGISLATIVE COMMITTEE

RAIL CONFERENCE - JUNE 23-26, 2019

Contributed by: Karen Hedlund, Co-Chair APTA Commuter and High-Speed Rail Legislative Subcommittee

PROPOSES ROBUST RAIL PROGRAM FOR REAUTHORIZATION

At APTA's Rail Conference in Toronto, Ontario in June 2019, APTA's Legislative Committee advanced to the APTA Board an historic $32.3 billion rail program for inclusion in the next Surface Transportation Reauthorization bill. The proposal would return annual federal funding for rail to levels not seen since the 2009 American Recovery and Reinvestment Act. The proposal recommends that Congress authorize a total of $21 billion over six years for a newly named High-Performance Passenger Rail Grant program. In addition, $7.1 billion would be authorized for the Consolidated Rail Infrastructure and Safety Improvement Program (CRISI), and $4.2 billion would be allocated to the Federal-State Partnership for State of Good Repair. The proposal would create new set asides in the CRISI program for commuter rail PTC operations and maintenance ($1 billion), and passenger rail-highway grade crossing projects ($1.6 billion). The proposal would also continue support for a reauthorized Railroad Cooperative Research Program ($31.7 million).

PASSENGER RAIL TRUST FUND

A critically important feature of the proposal is the creation of a long-sought Passenger Rail Trust Fund, which would become the repository of dedicated revenues to support passenger rail programs. General Fund moneys in the total amount of $18.7 billion would be made available to support a total of $13.6 billion in "contract authority" over the six-year period. (The APTA Legislative Committee does not identify any source of revenues for the Passenger Rail Trust Fund except to state that such moneys should not come from motor vehicle user fees that are deposited in the Highway Trust Fund, for which it advocates an increase of at least 25 cents/gallon to meet current shortfalls.)

RRIF FINANCING

The Railroad Rehabilitation and Improvement Financing (RRIF) program has long been underutilized. Programmatic improvements to address barriers to the use of the RRIF program include:

- Specify in statute that RRIF loans may be used for the non-federal share of a project if the loan is repayable from non-Federal funds.

- Authorize federal funds for credit risk premiums under RRIF to leverage RRIF loan assistance.

- Authorize BUILD grant funds to be used to fund the subsidy cost of federal credit assistance under RRIF, consistent with the TIFIA program.

- Permanently extend eligibility for Transit-Oriented Development projects for RRIF loans and loan guarantees.

- Require the Secretary to repay the credit risk premium for recipients that have satisfied all obligations that attached to RRIF loans.

PRIVATE ACTIVITY BONDS (PABs)

The use of tax-exempt private activity bond financing has proved an important tool for the development of privately financed rail projects such as the new Brightline/Virgin Trains service connecting Miami to Orlando and Tampa. The same company is also seeking PABs to finance its Las Vegas to Southern California project.

The APTA draft proposal would urge Congress to enhance the availability and use of PABs for public transportation and intercity passenger rail projects with significant private participation by:

- Expanding the eligibility of mass-commuting facility PABs beyond their current use (construction of rail and bus infrastructure and facilities) to include acquisition of rolling stock.

- Removing mass-commuting facilities from the federally-imposed state volume cap for PABs, thereby aligning these public transportation and intercity passenger rail activities with airports, docks, and wharves which are not subject to the PAB state volume caps.

- Reducing the "capable of 150-mph" speed requirement to 110 mph for high-speed intercity passenger rail facility PABs to allow more projects to be eligible, especially privately-operated passenger rail services running on shared rights-of-way with freight railroads.

VALUE CAPTURE TAX CREDITS

APTA would recommend that Congress also provide federal tax incentives for certain equity investments in public transportation and intercity passenger rail projects by creating tax code incentives to attract "tax-oriented equity" into public transportation and intercity passenger rail projects (i.e., equity investments whose return is based principally or solely on federal tax benefits). The proposal would also establish a public transportation version of Economic Opportunity Zones, or its equivalent, in which investors in real estate projects in the vicinity of a public transportation or intercity passenger rail station, would be eligible for tax credits and/or accelerated depreciation upon making an investment that benefits the local agency for capital purposes in an amount equal to a specified percentage of the real estate investment.

ADVANCE ACQUISITION OF RIGHT OF WAY

APTA has recognized that one of biggest hurdles to implementing passenger rail projects in a timely fashion is the time it takes and the increased cost of acquiring right of way. The proposal would authorize acquisition of railroad right of way (ROW) in advance of final environmental permitting under circumstances similar to those permitted for highway and public transit projects.

NATIONAL COMMITMENT TO INTERCITY PASSENGER RAIL

Finally, the proposal would authorize a study to address the actions needed to upgrade and restore intercity passenger rail for the demands of a 21st Century.

The Beijing-Tangshan intercity railway is under construction in Fengrun District of Tangshan, Hebei Province, June 3, 2019. The 148.7-kilometer intercity railway linking Beijing and the port city of Tangshan is expected to be operational in 2020.

PASSENGER RAIL DEVELOPMENT

RAPID EXPANSION IN CHINA

Contributed by: Michael Lee, HNTB

China has been continuously expanding its vast high-speed rail (HSR) network. Based on the International Union of Railways (Union Internationale des Chemins de Fer - UIC) data, the total length of high-speed rail in China has reached 19,289 miles as of January 2019. The HSR in China has connected 550 major and medium-sized cities and has connected all cities with populations over 100,000 inhabitants. China's HSR network served about one billion passengers during 2018. In addition to HSR, China also maintains 67,000 miles of conventional rail network for mixed traffic of intercity passenger services and freight. In 2018, about one billion passengers opted to ride the conventional intercity rail services for lower fares, where the highest speed of conventional rail lines is 125 mph. With the increased HSR routes being built, the country will see more passengers riding HSR lines versus conventional rail. However, given its 1.3 billion population and increasingly busy economy, the country is witnessing a significant increase of demand for mobility, so China is also investing to maintain its conventional rail network for intercity passenger services to augment the HSR services. China uses standard gauge (4 ft 8.5 in) for both HSR and conventional lines. The HSR lines in China are all dedicated tracks and totally grade-separated. The HSR lines are fully integrated with the conventional rail network; they are all dispatched at same operations control centers operated by the 18 Railway Bureaus (which are comparable to the Class I Railroads in the United States).

China's HSR network currently utilizes 2,800 pairs of high-speed trainsets with 2 x 8 car formation. HSR lines are identified with train numbers starting with letters D or G. The D lines are running at 150 mph and G lines are running at 200 mph or 220 mph. There are

AERIAL VIEW OF HSR NETWORK

some price differences, but they are not significant. D lines are governed by the Chinese Train Control System (CTCS) Level 2 signaling system, which is an equivalent to the European Train Control System (ESCS) Lever 1 signaling system. G lines are governed by the CTCS Level 3 signaling system, an equivalent to the ETCS Lever 2 signaling system. High-speed trains are downward compatible, which means a G train can run on D lines and conventional lines, a D train can run on conventional lines but cannot run on G lines. China recently launched a new signaling system named "CTCS + ATO" for selected lines. ATO stands for Automatic Train Operation, where high-speed trains will automatically start, increase speed, decrease speed, and stop under pre-defined schedules and route maps. Under the ATO mode, a train operator would just sit in the operator's console and essentially do nothing, only intervening when there are special conditions. China is researching and testing

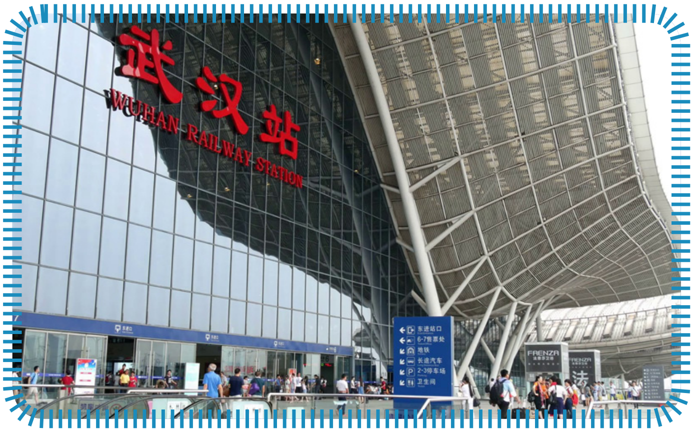
250 mph trains with the intention of further increasing operation speed for the future.

The development of the HSR in China has significantly impacted its domestic airline services, resulting in the reduction or elimination of short domestic flights. The HSR has become the much preferred and competitive alternative for many people, particularly business travelers. The most well-known and busiest HSR line in China is the Beijing and Shanghai HSR line, boasting 819 miles, a 220 mph travel speed, and 3 minutes headway. The travel time is 4.5 hours from downtown to downtown, and a one-way ticket costs $86 for a second class seat (which is comparable to a first class airline seat). In comparison, a flight between Beijing and Shanghai would take 2 hours with a one-way economy ticket costing between $150 and $250. Adding in the travel time to and from the airport, the total air travel time between Beijing and Shanghai is easily over 4.5 hours. HSR service is nearly 100 percent on time whereas delays in air travel occur often. In 2018, the total number of domestic airline passengers in China was 500 million. In comparison, the total number of domestic airline passengers in the United States was 740 million.

China launched HSR service in Hong Kong in September 2018. Operated with G79/80 train numbers between the Beijing West Station and the Hong Kong West Kowloon Station daily, it is currently the only high-speed rail service between Beijing and Hong Kong. The Beijing and Hong Kong HSR line is 1,516 miles in length, with a travel time of approximately 9 hours, and a one-way second class seat costs $157. The Hong Kong HSR service also includes other destinations such as Shanghai (8 hours), Guilin (3.5 hours), Kunming (7.5 hours), and Guangzhou (48 minutes).

The development of HSR in China also saw nearly 300 new rail stations built just for high-speed rail services. Many of these new and glamorous HSR stations look like modern airports with advanced passenger service systems. The investment of HSR lines and HSR stations have drastically improved the rail travel experience in China. However, the country also saw an $800 billion debt associated with the construction of high-speed rail. The large debt has been a major issue and risk for the country. It was reported that most HSR lines are not making profit operationally except several busy lines. The Beijing and Shanghai HSR reported an approximate $1 billion profit in 2015.

The development of HSR in China also prompted the development of intermodal transportation hubs in megacities where airports, HSR stations and metro stations co-locate and provide integrated transportation networks and smooth transitions from one mode to another mode. The first such case is the Hongqiao Hub, a major intermodal passenger transport hub situated in western Shanghai. The hub consists of the Shanghai Hongqiao International Airport, the Shanghai Hongqiao HSR station, three metro lines, and a reserved maglev station for future expansion. The hub's terminals are designed such that passengers can easily walk from one mode to another mode without a need of using any shuttle service. Similar hubs are now in operations in other Chinese cities, such as Hangzhou, Guangzhou and Shenzhen.



WUHAN HSR STATION

INTEGRATED PUBLIC TRANSPORT

In addition to the development of HSR over the last decade, the country also invested heavily to build


INSIDE WUHAN RAILWAY STATION, HUBEI, CHINA

urban metro systems and networks to ease traffic and provide better mobility for urban residents. In 2008, the country had a total of only 5 metro lines in two cities: Beijing and Shanghai. Today, the country has nearly 200 metro lines in revenue service in 38 cities with a growth rate of 15-20 new lines each year. Beijing Metro had only 3 lines at the time of the 2008 Olympic Games, while today it has 22 lines with 395 route miles and 391 stations, moving 10 million people each day, exceeding metro systems in Paris, London, and New York. In addition to conventional heavy metro systems, which are mostly underground tunnel systems, China also has seen a flourish of different light urban rail technologies on surfaces or on viaducts, such as light rail, maglev, monorail, hanging rail (like monorail but trains are suspended on rails), trams, and trackless trams. The light urban systems are more often seen in smaller cities or as feeder lines to the heavy metro systems in large cities. The country seems to be enjoying an appetite for new technologies and is becoming a global laboratory of urban rail technologies.

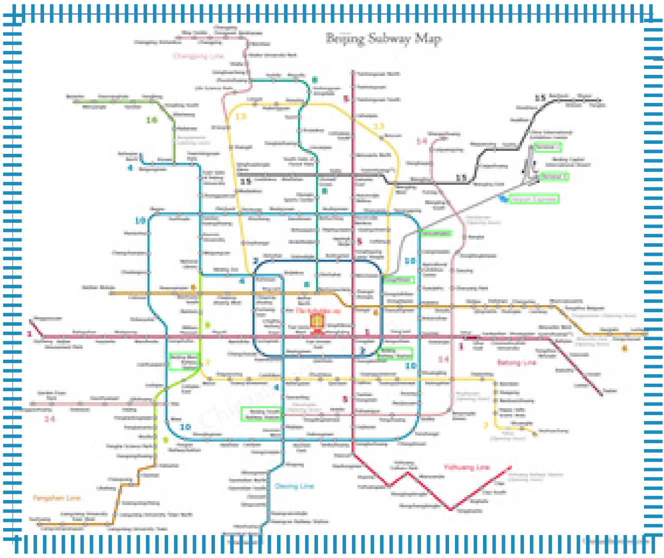
BEIJING METRO MAGLEV LINE

With significant route miles built for intercity HSR network and urban metro network, a missing link has been commuter rail which is common in large European and North American cities but was initially uncommon in China. In recent years, several mega-group-city-regions are being developed such as Beijing-Tianjin-Hebei, Changsha–Zhuzhou–Xiangtan, and Pearl River Delta. The country is likely to see a boom of commuter rails in coming years, which are intended to link HSR lines and metro lines with operating speed around 100 mph.

QINGDAO METRO SKYTRAIN

INCREMENTAL APPROACH TO BIG BANG

China had gone through an interesting history in the development of HSR. The country's rail network was quite primitive until the late 1990s when the Ministry of Railway (MOR) of the Chinese government started to invest and improve it. MOR first enhanced the existing rail network to increase its operation speed. MOR undertook six major "speed-up" steps to gradually increase the operation speed from 60 mph to 125 mph. At the same time, the MOR started investment projects to self-develop HSR technologies. Significant efforts were made between the late 1990s and early 2000s. Several high speed train prototypes, code-named China Star, were already built and being tested. In 2003, the then MOR minister retired and Liu Zhijun was prompted from deputy minister to minister, the most powerful position in the country's rail industry. Liu immediately changed the country's HSR development strategy. He ordered the shutdown of all self-developing Chinese programs and started to implement a technology importing strategy, code-named "Import, Digest and Innovate." From 2003, MOR invited nearly all leading global rail technology suppliers from Europe, Japan, and the United States to China for massive-scale negotiations. With a centralized procurement approach, MOR effectively leveraged their super-sized buying power during the negotiations. Eventually most global technology suppliers agreed to the MOR's



requirement on technology transfer and localization rate to win HSR construction contracts in China. Most contracts were awarded to pairs of a foreign supplier and a Chinese supplier. The contracts typically included a 70 percent localization requirement either inside a Sino-foreign joint venture established by the two parties or inside the local supplier. Five years later, in June 2008, the country saw its first high-speed rail line from Beijing to Tianjin launch its revenue service, just two months before the country hosted the Beijing Olympic Games. The Beijing and Tianjin HSR line is 100 miles long. Once the HSR service started, travel time between Beijing and Tianjin was reduced from 2 hours to a mere 30 minutes.

The 2008 Beijing Olympic Games is an important turning point for China's rail development. Ever since 2008, the country has invested over $200 billion each year to grow its HSR network and to build urban metro systems. China follows a robust "five year plan" (FYP) system where the government plans and executes major infrastructure investment projects. Once FYPs are approved by the highest governmental authority body, the country executes FYPs diligently with little political disruptions. The opening dates of each specific HSR line or each specific metro line are included in FYPs and they are regarded as a serious commitment to the public, which are rarely delayed. China's current FYP shows that the country expects to expand the HSR network to 24,000 miles by 2025, and to 28,000 miles by 2030. Based on their track record, you can expect that it will happen, and it will happen on time.

THE MAJORITY OF HSR LINES IN CHINA ARE ON VIADUCT TO MINIMIZE LAND USE

TECHNOLOGY AND DOMESTIC MANUFACTURING

The success of HSR in China has also boosted the country's rail technology suppliers and their capabilities. The transformation has resulted in an earthquake impact to the global rail industry. The most noticeable case is the success of CRRC, the largest rail vehicle manufacturer from China. Over the past five years, CRRC has successfully won contracts from large transit authorities such as MBTA, CTA, SEPTA, and L.A. Metro. CRRC has won these contracts over competition with Bombardier, Kawasaki, and Hyundai Rotem. The success of CRRC has prompted Siemens and Alstom to consider merging together to better compete with CRRC. Unfortunately, the merger proposal was not approved by the European Union, citing monopoly concerns in the European market where CRRC has not yet achieved any success. Nevertheless, the country's global strategy "Belt Road Initiatives" has had success in some areas but also encountered some failures as well, particularly in their biddings to the DesertXpress and the California High Speed Rail projects. Although the technology transfers have helped the Chinese rail suppliers significantly, they still rely on foreign suppliers for a significant amount of key components, such as propulsion systems, brake systems, safety platforms, and critical circuit boards, which could be subject to political risks, particularly giving the ongoing trade war between China and the United States.

TRACKLESS TRAM IN ZHUZHOU

A HIGH-SPEED COMMUTER TRAIN SERVICE HAS LAUNCHED IN SOUTHERN CHINA.

A HIGH-SPEED COMMUTER RAIL HAS BEEN PUT INTO OPERATION IN HAIKOU, HAINAN, CHINA. THE TRAINS FOR THE CITY'S FIRST HIGH-SPEED COMMUTER RAIL OPERATE AT A MAXIMUM SPEED OF 160 KPH ALONG A 38 KM ROUTE BETWEEN THE CITY CENTER TO ITS SUBURBS. TRAINS OPERATE AT 15- MINUTE INTERVALS 6:30-23:00 EVERY DAY. A HIGH-SPEED SUBURBAN TRAIN CAN ACCOMMODATE A MAXIMUM OF 7567 PASSENGERS AT FULL CAPACITY.

CHINA

China renamed and restructured its national railway corporation as part of its efforts to make the country's government-run enterprises run in a more market-oriented fashion, its state-owned railway with registered capital of 1.7 trillion yuan ($245.46 billion).

The company, which oversees the management of China's sprawling railway network, said it would have a corporate structure with a board of directors and the Ministry of Finance would perform investor duties at the company.

CRC was created after China's former railway ministry was dissolved in 2013 and has been central to Beijing's efforts to use infrastructure investment to support a slowing economy.

Shanghai Securities News reported in February that the debt of CRC reached 300 billion yuan in 2019, compared with 240 billion yuan in the previous year.

It was noted that a substantial amount of assets such as older rail car maintenance facilities scattered across its numerous bureaus and the new structure could help centralize and market its management of such properties.

NEW H S R TECHNOLOGIES

EFFICIENT IMPLEMENTATION

OPPORTUNITY FOR A WORKFORCE DEVELOPMENT PLAN

Contributed by: Eduardo Romo

The development and implementation of new high-speed rail (HSR) systems involves the planning, design and construction of major infrastructure, the manufacture of sophisticated rail vehicles and the development of accurate signaling and communication networks in a very demanding integration framework to achieve long-term safe and reliable operation. Efforts from planning to services delivery take more than a decade and require the contribution of thousands of professionals with many different disciplines, roles, and backgrounds.

Based on recent experience, introducing this new kind of high performing passenger rail service has been transformational. Not only have the new HSR lines been a great commercial success, they also have presented the railway sector with opportunities to improve both technical and managerial disciplines and practices. In fact, in some countries where passenger rail systems were performing at a very modest level before HSR was introduced, this new concept has meant a big change and a new age for the rail industry, from planners, designers and builders to manufacturers and operators. There are a number of examples of countries where the passenger rail system has evolved from nearly disappearing to becoming an internationally recognized success and national landmark.

Obviously, this process has required the continued effort of hundreds of professionals with different roles who have transitioned from older methods of doing things to embracing state-of-the-art skills.

HSR, A SYSTEM INVOLVING NEW INFRASTRUCTURE FEATURES AND INNOVATIVE TECHNOLOGIES

For these new lines the design speed is currently around 250 mph. This means that trains are running at over three times the maximum speed of conventional trains and cars and one half of the cruising speed of modern jet airplanes. Keeping the trains moving smoothly at these speeds at high safety levels and standards has required developing a set of innovative technical solutions to reach a reliable and highly efficient rail transportation system.

Although speed is a key parameter to reach attractive travel times for the passenger, it is also the source of some challenging -sometimes unforeseen- phenomena that have to be addressed from the technological side to provide effective solutions. For instance, new dynamic effects that appear on bridges and viaducts at this higher range of speed or the importance of track stiffness continuity along the line or the aerodynamic effects of trains entering and exiting tunnels at high speeds are issues that must be addressed. In addition, methods to communicate and control the vehicles can add complexity to operations management practices.

These trends have required the development of innovative technologies and management practices to address all these new situations. A large effort has been conducted in the field of research and development (R&D)

to find solutions to physical challenges. After this stage, the next step is for design engineers and construction managers to put them in place.

HIGH-SPEED RAIL REQUIRES A QUALIFIED WORKFORCE

Implementing HSR involves consideration of new technical solutions in most of rails' subsystems and components. From civil works to signaling, from track to traction power and from rolling stock to communication networks, a new generation of engineering techniques has to be properly applied to achieve a high-performance system. This can only be achieved with a highly skilled staff of professionals with different technical backgrounds to cover a wide number of roles from planning to operation.

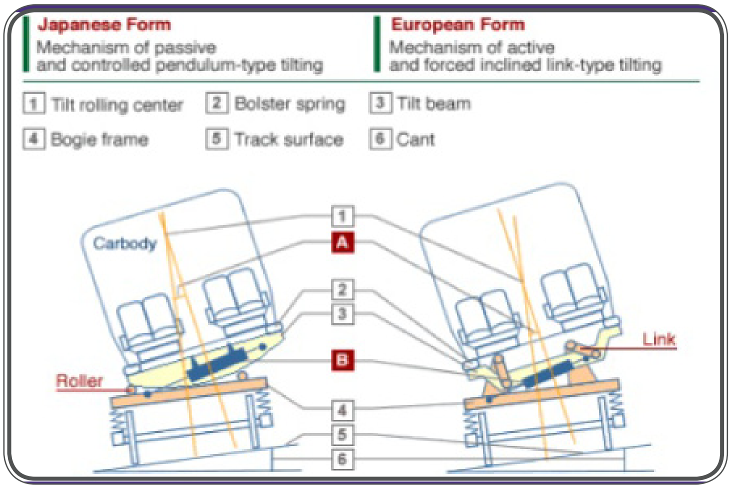
Implementing a HSR network -even a single line- is a massive and technologically complex undertaking, which takes time and involves thousands of professionals. This affords the rail industry with an opportunity to enhance the professional skills of its workforce. Some lessons can be learned by viewing what other HSR networks have achieved and any trends that could be used as a resource.

In some cases, the tight schedules defined to start operating the new lines have made it difficult to plan in advance for the necessary workforce development programs needed by employees. There needs to be a way to get professionals qualified by defining specific training programs beforehand. This is especially relevant in the HSR engineering field.

WORKFORCE DEVELOPMENT MULTIPLE APPROACH. INTERNATIONAL OVERVIEW AND RECENT INITIATIVES IN CALIFORNIA

The number of professional discipline profiles involved in the implementation of HSR systems and the roles performed by these professionals is vast. For the purpose of updating qualifications they can be classified in two groups: those who are approaching the system as a whole and those involved in a specific subsystem or a component. Accordingly, workforce development could be organized around two different activities: general courses for a comprehensive understanding of the system and specialized training courses for professionals with a consistent background in detailed subsystems or components of the HSR system.

Both kinds of initiatives have been carried out in most of the countries where HSR has been built and is now in



operation or those that are currently under planning or design stages. For instance, in Spain HSR technical education has been available at the master level for many years. The United Kingdom is embarking on ambitious plans to develop a university-industry cooperative educational framework.

Also, in California, where a bold high-speed rail plan is under construction, some early initiatives have been carried out in the field of workforce development. For instance, the collaboration between Mineta Transportation Institute, University of San Jose (MTI) and HST California (an agreement between Fundacion Caminos de Hierro and Eurif, two Spanish entities) has already delivered four specialized training courses in recent years with the sponsorship of California High-Speed Rail Authority (CHSRA), APTA, UIC, local universities (University of San Jose, CSU Bakersfield and UC Berkeley) and international and American companies.

With the special involvement of Small Business Enterprises, about 200 professionals involved in the design or construction of the new San Francisco to Los Angeles high-speed line have taken advantage of short training courses focused on new technologies in such areas as structures, traction power or signaling-communications which are delivered by international experts -from France, Germany and Spain- with broad expertise in these fields.

This effort required to successfully implement modern HSR transportation infrastructure can be an opportunity not only to provide high performance passenger services efficiently but also to update and strengthen the qualifications of the professionals involved in these very technical projects.

VIRGINIA IS LEADING ON PASSENGER RAIL

BUT, IT NEEDS CONGRESS' HELP.

Contributed by: Danny Plaugher

While Indiana (Hoosier service) and Pennsylvania (Keystone and Pennsylvanian services) are cutting or eliminating their Amtrak regional trains, Virginia is doubling down on better rail service.

On June 19, the Commonwealth Transportation Board voted to approve the state's Six-Year Transportation Improvement Program (SYIP). Included in the SYIP was the Virginia Department of Rail and Public Transportation's (DRPT) request of $774 million in projects to sustain, improve and expand our Amtrak passenger rail network.

This funding sustains passenger rail service for 6.8 million Virginians and 82.5% of our jobs. It also increases our Amtrak service by 16 percent, including a fifth train to Hampton Roads and a second train to Roanoke/Lynchburg. Lastly, this money begins upgrading our stations, and invests heavily in our rail infrastructure to increase our trains' reliability, safety and speed in addition to constructing more than 11 percent of the DC2RVA high-speed rail corridor.

Since 2009, Virginia has invested $872 million to improve our passenger rail network. What has that gotten the taxpayers of Virginia?

First and foremost, these investments have expanded service by 31 percent, including returning passenger rail trains to South Hampton Roads and Roanoke, which lost Amtrak service in the 1970s. Further, they have helped to generate more than $7.8 billion in economic benefits, which created or sustained more than 78,000 jobs. This includes more than $1.7 billion Amtrak directly spent in Virginia over the last decade, either in purchasing goods and services from our businesses or employing our citizens.

Second, ridership on our Amtrak trains has grown by 54 percent since 2009. Our trains' passengers have helped to remove more than 4.6 billion passenger miles from our roadways, which in return lowered our fuel consumption by 98.7 million gallons and reduced our CO2 emissions by 878,000 metric tons.

Last, even though passenger rail received less than 4 percent of the $22.5 billion that the commonwealth has spent on our transportation system over the past decade, it's the fastest growing mode of transportation during that time frame. Our 54 percent growth in ridership far outpaces the passenger growth at our airports (up 11 percent) or the increase in vehicle miles traveled on our roadways (up 4 percent), which proves that Virginians want an alternative to congested highways and ever shrinking legroom.

That's not a bad return-on-investment (ROI) for our four pennies from every transportation dollar. In fact, our investments keep paying dividends. Year-over-year ridership on our Amtrak Regionals is up 5 percent through May, but the big economic and environmental ROI for Virginia will come from the proposed projects included in the Long Bridge, Washington-Richmond, Richmond-Raleigh, and Richmond-Hampton Roads federal passenger rail studies.

These four studies identify key projects that will increase passenger rail service by 62 percent, improve the reliability of our Amtrak trains to above 90 percent, raise the average speed of our trains by 21 percent, and improve the safety and accessibility of our trains. Additionally, these projects are conservatively estimated to increase our ridership by nearly a million trips each year.

Virginia is doing everything it can to improve our passenger rail network, but we need strong leadership from our Congressional delegation.

In the 2020 Surface Transportation Reauthorization, there must be measurable resources dedicated to a federal passenger rail improvement program so that states like Virginia don't have to go it alone. A strong federal funding partner will be vital to expanding the Long Bridge, completing construction on the DC2RVA high-speed rail corridor, and kick-starting the Richmond to Hampton Roads high-speed rail project.

The never-ending infrastructure week has been fun, but it's time for our leaders in Washington to get it back on track.

VIRGINIA PASSENGER RAIL PROJECTS

THE VIRGINIA DEPARTMENT OF RAIL AND PUBLIC TRANSPORTATION (DRPT) IS WORKING TO IMPROVE INTERCITY PASSENGER RAIL SERVICE IN VIRGINIA AND THROUGHOUT THE EAST COAST TO OFFER A VIABLE, EFFICIENT TRANSPORTATION CHOICE THAT IS COMPETITIVE WITH AIR AND AUTO TRAVEL. AS PART OF THE NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) PROCESS, DRPT WILL ENGAGE THE COMMUNITY TO HELP COMPLETE THE FINAL PHASE OF A RIGOROUS ENVIRONMENTAL ANALYSIS AND PRELIMINARY ENGINEERING EFFORT THAT REFLECTS THE REGION'S VISION FOR THE WASHINGTON, D.C. TO RICHMOND SEGMENT OF THE SOUTHEAST HIGH SPEED RAIL (SEHSR) CORRIDOR.

LONG BRIDGE STUDY

The District Department of Transportation (DDOT), in coordination with the Federal Railroad Administration (FRA), is completing a comprehensive study for the rehabilitation or replacement of the Long Bridge over the Potomac River. The existing two-track railroad bridge, owned by CSX Transportation (CSXT), serves freight, (CSXT), intercity passenger (Amtrak) and commuter rail (Virginia Railway Express [VRE]). The 1.8-mile study area is between the RO Interlocking near Long Bridge Park in Arlington, Virginia and the L'Enfant (LE) Interlocking near 10th Street SW in Washington, DC. Public comments on the DEIS, Draft Section 4(f) Evaluation and PA will be accepted until October 28, 2019.

RICHMOND / HAMPTON ROADS

The Tier 1 Study for Richmond / Hampton Roads is final. It evaluated potential routes for higher speed rail service in both the Richmond to Petersburg to South Hampton Roads Corridor along Route 460, and the existing Amtrak Corridor from Richmond to Williamsburg to Newport News along I-64. Amtrak has implemented a second daily frequency to Norfolk since March 4, 2019. In addition to New service to Norfolk, there is an optimized schedule for the Newport News station as well. New passenger rail service in these locations could ultimately provide rail connections to the Southeast, Northeast, and Mid-Atlantic regions as an extension of the Southeast High-Speed Rail Corridor (SEHSR) currently being studied.

ACCA YARD BYPASS

The Acca Yard, includes construction of two bypass tracks, three crossovers between Richmond and Petersburg, and eight miles of double track south of Petersburg. The improvements will benefit freight passenger operations on CSX's A-Line Corridor which parallels I-95. Addiitionally, the Commonwealth secured two additional round trip passenger train slots between Richmond and Norfolk, Virginia. As part of the initial agreement with Norfolk Southern to return Amtrak service to Norfolk in 2012, as well as the agreement with CSX to fund Acca Yard improvements, Amtrak began another daily frequency to Norfolk on March 4, 2019.

HYPERLOOP

Contributed by: Peter Voorhees

Hyperloop technology continues to gain attention globally as an emerging high-speed transportation mode. Simultaneously, in December 2018 the U.S. Department of Transportation (DOT) issued an order establishing the Non-Traditional and Emerging Transportation Technology (NETT) Council to:

a. Identify and resolve jurisdictional and regulatory gaps associated with nontraditional and emerging transportation projects pending before DOT, including with respect to:

- Safety oversight;
- Environmental review; and
- Funding issues.

b. Coordinate the department's internal oversight of NETT projects and outside engagement with project stakeholders.

c. Develop and establish department-wide processes, solutions, and best practices for identifying and managing NETT projects.

DOT recognizes that hyperloop does not cleanly fit into any existing transportation agency, and so the NETT Council was created to provide new transportation technologies with a cross-agency one-stop shop for questions around commercial deployment. A key driver in creating the NETT Council is interest in hyperloop technology and the council is expected to bring clarity to certification and regulation of hyperloop technology in the U.S. Given that, let's review what the broadly used term "hyperloop" means in its latest definition.

A handful of technologists are developing an intercity ultra-high-speed mode for the delivery of passengers and palleted freight. This mode is intended to travel in perfect conditions in excess of 600 mph. This top speed is faster than conventional airline cruising speeds of 545-575 mph and not far from the speed of sound (767 mph). The mode would travel autonomously in a contained tube via magnetic levitation and electric propulsion.

Pennsylvania Turnpike Commission has committed to AECOM exploring a link between Philadelphia-Pittsburgh using the new technology; this would commit to approximately $2 million over four years, providing the commonwealth with a concept.

The tube is not designed to propel vehicles pneumatically, but rather to establish a semi-vacuum environment to reduce air resistance. The interiors of bus-sized vehicles would thus be pressure controlled, much like airliners. The hyperloop service plan assumes point-to-point travel, with switches and branches from a mainline required for reaching access points. Other emerging autonomous guideway modes, such as Elon Musk's rubber tired Boring Company concept, don't match the hyperloop definition.

One technologist, Virgin Hyperloop One (VHO), has developed a full scale hyperloop test facility: the "DevLoop," a half-km test segment in the Nevada desert north of Las Vegas. According to VHO's Director of Project Strategy Diana Zhou, on December 15, 2017 a VHO vehicle reached the speed of 240 mph within the DevLoop and decelerated to a stop before reaching the half-km limit. This speed has since been achieved repeatedly at the facility. A longer corridor will be required to demonstrate faster travel speeds and acceleration/deceleration rates that would be comfortable for human travel. VHO and other technologists are working with their public and private partners to establish longer certification segments up to 10 miles in length. VHO is currently engaged with feasibility studies in multiple U.S. states, the state of Maharashtra in western India, and various governments in the Middle East. Zhou indicates that VHO expects to break ground on a certification segment in India between Pune to Mumbai in 2020. These certification facilities are envisioned as starter segments of commercial corridors.

VHO's service corridor vision includes intercity passenger travel as well as light weight cargo between distribution centers near major airports. Zhou shared that the company is currently evaluating initial U.S. deployments in the midwest where large markets are separated by flat, open land. She shared that VHO's vision is to be the technology provider in a public-private project and service delivery consortium. VHO's goal is to provide transport that is 5 to 10 times more energy efficient than airline travel, and potentially powered in part by renewable electricity generation.

In addition to VHO's US feasibility studies, other technologists are also partnering with governmental agencies to perform corridor feasibility studies in the central US and Canadian provinces. Simultaneous studies are examining hyperloop connections between Chicago and Pittsburgh, via both Columbus and Cleveland. Meanwhile, the Pennsylvania Turnpike Commission has begun reviewing potential scenarios for hyperloop operations in the Commonwealth, including a connection between Pittsburgh, Harrisburg, Philadelphia and other cities via the Appalachians. These U.S. connections under analysis present a stunning picture for surface transportation: downtown-to-downtown passenger trips in corridors exceeding 500 mph? that would be faster than airline travel. Coming editions of SPEEDLINES will follow the progress of one or more full capability hyperloop certification corridors globally and in the US.

IN THE SPOTLIGHT

YOU SHOULD GET TO KNOW US

EMILY STOCK

SENIOR MANAGER

"Virginia's shared-use rail corridors carry passenger and freight traffic, which means that improvements for network fluidity lift all tides – both freight and passenger rail. It also means that improvements must be made incrementally to keep the system functioning."

VIRGINIA DEPARTMENT OF RAIL AND PUBLIC TRANSPORTATION

MICHAEL LEE

SENIOR RAIL SYSTEMS MANAGER

"The remarkable development of high-speed rail in Asian and European countries has significantly improved the mobility and economy of those countries. I look forward to playing a role in this great project while at HNTB and seeing this great dream to be realized in the near future."

HNTB CORPORATION WEST DIVISION - OAKLAND OFFICE

JASON ORTHNER

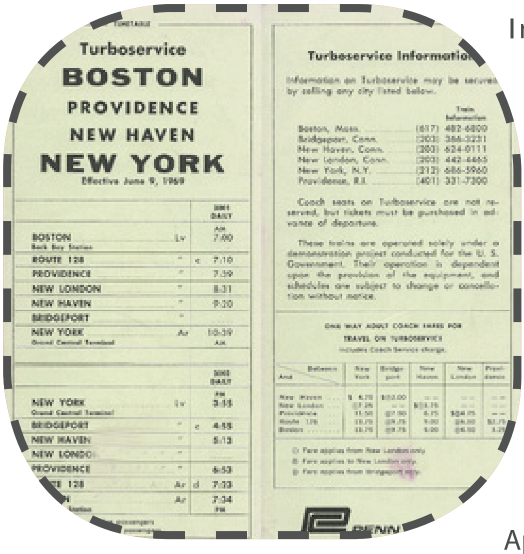
DIRECTOR, RAIL DIVISION

"North Carolina has taken an incremental approach to providing improved intercity passenger rail services, making targeted investments in safety, infrastructure and North Carolina-branded equipment. Our train services and passenger stations have received some of the highest customer satisfaction numbers in the country this past year."

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

UNITED AIRCRAFT TURBOTRAIN

Contributed by: By David Wilcock, VHB



In the March 2019 edition of Speedlines, an article about the 50th Anniversary of the Metroliners was published. There was a second 50th anniversary of high-speed passenger rail equipment that occurred on April 8, 1969 when the United Aircraft TurboTrain debuted in Boston – New York City service. Both services were the result of the High-Speed Ground Transportation Act of 1965 that was spearheaded by Sen. Claiborne Pell of Rhode Island. The primary purpose of the act was to demonstrate high-speed passenger rail service between New York City and Washington D.C. It was originally envisioned to be under three hour service along the former Pennsylvania Railroad (PRR). Sen. Pell included a provision for a similar demonstration service between Providence, RI and Boston, MA on the New Haven Railroad. This provision was later expanded to provide service between New York City and Boston. Unlike the highly successful Metroliner service that operated between New York City and Washington DC until 2006, the TurboTrain service between Boston and New York City only lasted until 1976.

The Department of Commerce's TurboTrain demonstration service proposal on the New Haven was more modest than its counterpart on the PRR. United Aircraft's contract called for the delivery of two complete sets of equipment – two domed power cars and an intermediate coach. The TurboTrain's design included a new pendular suspension system which allowed the car bodies to more effectively tilt as the train passed through curves. Earlier attempts at developing high-speed passenger equipment had experienced problems with the wheels lifting off the rails when moving through curves at a high rate of speed. The TurboTrain was constructed to be bidirectional with an engineer's cab on both ends. United Aircraft assigned the development of the equipment to its Sikorsky Aircraft Division located in Stratford, CT, deep in the heart of the New Haven operating territory. Actual construction of the car bodies and outfitting of the two sets of equipment was sub-contracted to the Pullman Standard Company since United Aircraft had no prior experience building railroad equipment.

In addition to the two sets being built for operation on the New Haven, the Canadian National Railway placed an order for five sets. The CN sets were to be comprised of two domed power cars and seven intermediate coaches. The construction and outfitting of the CN sets was sub-contracted to the Montreal Locomotive works.

The first TurboTrain set was tested on the Rock Island Railroad and the PRR in early 1967. In August 1967, several sets made their way to a new maintenance base that UA established in Providence Rhode Island for testing on the New Haven between Providence and Boston. During the testing on the New Haven, the TurboTrain reached a top speed of 157 mph on a straight stretch of jointed track between Attleboro and Mansfield. It later tested at 170 mph on the Raceway in New Jersey. As a result of the highly successful testing, it was decided to expand the proposed operation of the trains to New York City from Boston. Top speed was set at 125 mph based on the generally deteriorating condition of the New Haven's right-of-way.

In April 1967 the Department of Transportation was created and took over the Northeast Corridor Demonstration Project. The DOT's goal was for 3 hour and 15 minute service between New York City and Boston. Despite the highly successful testing that had taken place, the New Haven Railroad drew up a 3 hour 55 minute schedule. The schedule included five intermediate stops to New York City and six intermediate stops on the return trip.

Several VIP and press trips were operated during the first six months of 1968. By the Fall of 1968, the DOT and New Haven agreed that the TurboTrains were ready to debut. The debut however never happened under the New Haven's oversight as it was absorbed into the newly created Penn Central Railroad on January 1, 1969. After several months of adjustment, the demonstration service made its debut on April 8, 1969 under Penn Central operation. The demonstration project transferred to Amtrak when it took over intercity passenger rail operations on May 1, 1971. Amtrak discontinued use of the TurboTrains in 1976 citing maintenance issues and costs. The seven sets sold to the Canadian National remained in service under VIA Rail operations until 1982. Unlike the Metroliner's 50th anniversary, there wasn't even an informal recognition of the TurboTrain's debut on the Northeast Corridor.

[Author's Note: Anyone interested in a detailed history of the United Aircraft TurboTrain demonstration project on the New Haven is referred to the New Haven Railroad Historical & Technical Association's Shoreliner publication Volume 29 Issues 2 and 3.]

IN THE EARLY 1980'S VIA STILL RAN THEIR UNITED AIRCRAFT TURBO TRAINS.

NEW ROCHELLE, NY - UNITED AIRCRAFT TURBOTRAIN RAN IN NY-BOSTON SERVICE BETWEEN 1969 UNTIL SEPTEMBER, 1976.

HOW NOT TO ADVANCE CORRIDOR PLANNING...

NEW YORK STATE'S EMPIRE CORRIDOR

TIER ONE / EIS PROCESS ENTERS ITS 10TH YEAR!

Contributed by: Bruce Becker / Vice-President of Operations, Rail Passengers Association

Over the past seven decades, New York State's intercity rail passengers have seen it all! From the New York Central's historic 'Great Steel Fleet' of the post-war era, to its sharp decline in the 1960s, to the bleak Penn Central years and into the modern Amtrak era. While much has changed, many things have stayed the same.

Today's Amtrak Empire Corridor service has a rich history, which dates back to the New York Central's introduction of Empire Service in December 1967. Service frequencies across upstate are virtually unchanged since then, while trip times have consistently lengthened. The good news is that ridership has steadily increased from the early 1970s, when 2-car trains were often the norm.

After the first oil crisis in the early 1970s, New York State recognized that there was a need to improve rail service across the state. In what was at the time a bold initiative, the state partnered with Amtrak in a major improvement program, with Amtrak purchasing the Rohr Turboliners to be operated solely in New York Service Empire Service on state-funded rehabilitated tracks. The result was the first 110 mph Amtrak operation in the country outside the Northeast Corridor, on segments of the route south and west of Albany.

The corridor flourished for many years on well-maintained Conrail track and additional frequencies were added in the increasingly busy Hudson Valley segment. But, age and poor fuel economy finally caught up with the Turboliners, just as the break-up of Conrail led to CSX's ownership of the majority of the route in 1999. In a harbinger of conditions to come, CSX officials openly talked about how Conrail had 'over-maintained' the line for the benefit of the Amtrak trains. Rail advocates during this period urged the state's leadership to recapture the enthusiasm for passenger rail expansion exhibited in the 1970s but with little success.

Fast forward to the enactment of the American Recovery and Reinvestment Act (ARRA) in 2009. ARRA made $8.0 billion available for intercity city passenger rail projects. In August 2009, New York State applied for over $560 million in ARRA funding for 38 distinct passenger rail improvement projects. In the application seeking ARRA funding support for advanced planning for the Corridor, the state envisioned improvements being completed in time to allow for higher speeds and expanded service in the then far-out year of 2018.

In early 2010, the state was awarded $151 million for 7 projects, which included a $1.0m federal match for the advancement of a Tier 1 Environmental Impact Statement (EIS) and Service Development Plan for the Empire Corridor. The state moved quickly during the summer of 2010 to get the EIS process underway and by that October six scoping meetings were held as the first step in public outreach for the study. In the initial project newsletter, a highly optimistic timeline stated that a draft EIS would be released in the summer of 2011; public hearings on the draft would follow that fall; the final EIS would be distributed in the spring of 2012 with a Record of Decision to follow that summer. Initial consideration was given to alternatives with top speeds of up to 220mph.

But the entire EIS project quickly went 'off the rails'. The draft EIS was finally published in early 2014, with the study alternatives having been narrowed to three major improvement levels offering top speeds of 90 mph, 110 mph and 125 mph. The 125 mph alternative assumed an entirely new right of way across upstate New York, while the 90 and110 mph models were premised on utilizing the current CSX (and former New York Central) mainline. Public hearings on the draft EIS were held in March of 2014 across the state. At that time the release of a Final EIS and Record of Decision were envisioned for 2016; only four years later than initially estimated! The draft EIS hearings proved to be the last state-initiated public outreach and communication regarding the entire EIS process. Yes, for now over 5 years the public has heard nothing officially from the state about the status of the study.

Revised Final EIS release dates have slipped from 2016, to 2017, to 2018 and then into 2019. Over the past 18 months, the state has pointed fingers at the Federal Railroad Administration (FRA) for the latest delays, while the FRA has contended that the state is also to blame.

The most recent public insult saw the target release date slip once again, from the end of this July to next May, which if true would put the elapsed time for the entire EIS process at nearly 10 years.

SO YOU ASK, WHAT HAS CAUSED ALL OF THIS DELAY?

There is not enough time or space to detail all of the issues, but here are the highlights (as I see them):

- Perhaps the foremost challenge has been as the result of an October 2009 agreement between CSX and the state, whereby the state agreed that in order to operate trains at over 90 mph on CSX-owned property, the state would be required to construct a 'separated and sealed corridor for passenger services… at least 30 feet off-set from existing freight tracks'. The practical implication of this requirement is that any new, dedicated, passenger track for higher than 90 mph service would likely end up being at least partially off the current CSX right of way, necessitating the acquisition of adjacent property; a daunting and extremely expensive prospect. This agreement did provide for top speeds of up to 90 mph on CSX tracks, as long as all necessary improvements and ongoing additional maintenance costs were publicly-funded. It should be noted that this agreement called for the FRA and Amtrak to also accept these terms, but neither party ever signed the agreement.

- As noted at the beginning, New York State has enjoyed 110 mph passenger service since the mid 1970s on segments of the Corridor and there is a prevalent belief among some current (and past) state officials that they can somehow force (maybe even by sheer will power) CSX to allow 110 mph speeds on the right of way west of Schenectady across the state, despite the 2009 agreement.

- The Draft EIS does show that increasing speeds to 90 mph would reduce trip times enough, that when coupled with greatly improved reliability and added frequencies, ridership would significantly grow. But 90 mph top speeds are certainly far from 'world-class' high performance passenger rail. However, whether adopting this practical, beneficial and achievable 90 mph option is politically acceptable is unknown.

- CSX for its part has stayed consistent over the years – 'We own the railroad, so you must play by our rules'. The state's insistence otherwise has only hardened CSX's resolve to not give in to such pressure. And to say that CSX has been a somewhat reluctant partner in the entire EIS process is a vast understatement.

- And last but certainly not least, the FRA apparently is in no hurry to advance the EIS either.

WHAT HAPPENS NEXT?

New York State advocates have long supported a practical compromise, which started with the Empire State Passenger Association's (ESPA) '90 Now' campaign several years ago. ESPA believes that incremental improvements focused on achieving top speeds of 90 mph in the coming years; increasing capacity for both passenger and freight traffic and eliminating the numerous slow-speed segments on the Corridor will provide the greatest overall near-term benefits. ESPA doesn't rule out possible future 110 mph operations as being desirable, but the group ardently opposes any EIS outcome which requires 110 mph operations as a prerequisite for investment and improvements.

So, stay tuned…Maybe, just maybe, in a little under a year from now a Final EIS will be released; a Record of Decision will be issued and planning can get underway to actually start advancing a selected alternative and plan!

REGULATORY ADVANCEMENTS

FRA PASSENGER EQUIPMENT SAFETY STANDARDS

Contributed by: Larry Kelterborn, President, LDK Advisory Inc.; Jennifer Hu, Director of Railroad Legal and Regulatory Affairs, Texas Central; Eloy Martinez, Manager - Vehicle Mechanical Engineering & System Assurance, LTK Engineering Services.

The Federal Railroad Administration (FRA) published a new set of regulations amending Passenger Equipment Safety Standards (49-CFR-238) in November 2018. The new regulations established standards for Tier I alternative compliant trainsets and also added a new tier of passenger rail equipment standards, Tier III, to address interoperable high-speed equipment.

The new rule is based on consensus reached by the FRA's Railroad Safety Advisory Committee (RSAC) and resulted from many years of development. Based on research conducted by FRA, the RSAC Passenger Safety Working Group established the Engineering Task Force (ETF) in 2009 to develop regulatory requirements for light weight equipment fitted with state-of-art crash energy management. Major international car builders were involved in the effort, including Alstom, Ansaldo Breda, Bombardier, Kawasaki, Siemens, Stadler and Talgo. Domestic and international railroads including Amtrak, Long Island Rail Road, Central Japan Railway Company, Texas Central Railroad and California High-Speed Rail Authority were also involved in the process. Additionally, associations such as the American Public Transportation Association (APTA), Association of American Railroads (AAR), American Association of State Highway and Transportation Officials (AASHTO) and labor organizations such as Brotherhood of Locomotive Engineers and Trainmen, United Transportation Union and Transportation Communications International Union/BRC, as well as a number of industry consulting firms actively participated in the ETF effort. The initial work under ETF resulted in the report entitled "Technical Criteria and Procedures for Evaluating the Crashworthiness and Occupant Protection Performance of Alternatively Designed Passenger Rail Equipment for Use in Tier I Service."

The FRA had undertaken several waiver petition requests by various entities (Caltrain, Capital Metropolitan Transportation Authority, Denton County Transportation Authority, etc.) seeking to use alternatively designed equipment with crash energy management features, a regulatory process that is resource intensive. As a result of these efforts, FRA decided that developing regulatory requirements for alternatively compliant Tier I trainsets through the ETF for inclusion in 49 CFR Part 238 – Passenger Equipment Safety Standards, would be in the industry's best interest.

Based on the research conducted by the FRA and analyses conducted by various car builders and consultants participating in the ETF, it was demonstrated that the crashworthiness of light weight trainsets equipped with crash energy management features provide at least as good crashworthiness characteristics as conventional North American equipment (built to the traditional 800-kip buff load). The work of the ETF also demonstrated that the proposed regulatory approach pertaining to the crashworthiness of Tier I alternative compliant trainsets could be met with minor structural modifications to most equipment designed to European standards EN 12663 and EN 15227.

Based on the knowledge that European conventional and high-speed passenger rail equipment fitted with crash energy management are built to the same crashworthiness standards (EN 12663 and EN 15227), the FRA also expanded ETF's mandate through the RSAC Passenger Safety Working Group to address high-speed interoperable equipment. The recent amendments to Part 238 now include, among other things, crashworthiness requirements for Tier III trainsets that are capable of operating in mixed service with other passenger and freight trains at speeds up to 125 mph and that would be required to operate in an exclusive right-of-way without grade crossings at speeds above 125 mph. Such operations would have the potential cost saving benefit to permit a high-speed operator to share existing railway rights-of-way at lower speeds to access city centers.

The development of regulatory requirements related to high-speed passenger rail equipment has been divided into two phases due to the amount the work involved. The recent "Tier III rule" only addresses a portion of requirements necessary for Tier III operation; those in which ETF consensus was reached at the time of the recent rulemaking. In addition to crashworthiness standards, the new rule includes Tier III equipment requirements regarding fire safety, glazing, brake system, interior fixtures attachment, emergency systems and alerters.

Additional Tier III requirements have been addressed in subsequent ETF efforts and are expected to be included in a further amendment to passenger equipment safety standards. Areas addressed by the ETF for potential inclusion in the next rulemaking include such things as hardware/software safety; safety appliances; cab equipment; cab noise; electrical systems; inspection, testing and maintenance; and movement of defective equipment.

In order for Tier III equipment to operate in mixed service with conventional passenger and freight equipment, the suspension system on such vehicles must also be capable of operating safely over conventional North American track structure. The ETF has therefore developed suspension and qualification requirements for such operations, for which they have been in discussion with AAR, to ensure freight railroads agree with the safety and qualification requirements necessary to demonstrate safe operations over their lines. Further amendments to passenger equipment safety standards are also expected to address pre-revenue service approvals, which should clarify requirements for the equipment design review and qualification processes.

Due to the significant difference in design and technology for high-speed trainsets compared to conventional equipment, many of the requirements in the new (and pending) rule are performance-based rather than the traditional prescriptive nature of current FRA railroad safety regulations.

As part of the ETF discussions, FRA, industry, labor and other stakeholders, also recognized the need for a regulatory approach for standalone systems. In both the notice of proposed rulemaking published in December 2016 and the final rule published in November 2018 to address Tier I alternative compliance and high-speed trainsets, FRA addressed the idea of a standalone system. FRA noted that a standalone system has the potential to "optimize its operations to high levels of performance without necessarily having to adhere to requirements generally applicable to railroad systems in the U.S." Dedicated, standalone systems have the potential to transplant an entire service-proven system, thereby significantly reducing project risk.

All components of a dedicated system have the potential to be optimized for a specific operation, rather than introducing compromises that might be necessary to operate over the general U.S. railroad network. Such high-speed systems are based on accident avoidance principles and will require significant protections of the entire right-of-way. FRA recognizes that a 'systems approach' to standalone operations "covers more than passenger equipment, and would likely necessitate particular right-of-way intrusion protection and other safety requirements not adequately addressed in FRA's regulations." In the recent rule for Tier III, FRA reiterated its belief that a comprehensive and systems approach is necessary to address standalone systems, either through a technology-specific rule of particular applicability or other regulatory means, and that such an approach allows the transplant of a service-proven system. Based on the recommendation of the ETF, the next rulemaking amending FRA's passenger equipment safety standards is expected to designate such standalone operations as Tier IV systems and include a definition pertaining to the approach by which they will be regulated. These standalone systems would include all high-speed ground transportation systems including steel-wheel-on-rail, magnetic levitation and any other emerging technology regulated by the FRA.

Since 2009, the industry, labor, railroads and other stakeholders, have collaborated and worked closely with the FRA under the auspices of the ETF to amend passenger equipment safety standards. The latest (and pending) rule is based on consensus reached by FRA and all stakeholders cited above. Leading the effort from the FRA has been Robert Lauby, former Associate Administrator for Railroad Safety & Chief Safety Officer, who retired from FRA this March. Lauby's team from the FRA Office of Railroad Safety, along with attorneys from the FRA Office of Chief Counsel and researchers from the U.S. Department of Transportation's Volpe Center have played an instrumental role in establishing new standards for alternative compliant Tier I trainsets and interoperable high-speed Tier III trainsets, as well as defining FRA's long-standing regulatory approach to be taken for dedicated and grade-separated ground transportation systems.

NOTES FROM THE FIELD...

JAPAN RAILWAYS HAS THE MOST EXTENSIVE NETWORK

Contributed by: Stan Feinsod, Development Manager, Transit Systems Engineering (TSE)

FEINSOD SURVEYS JAPAN SHINKANSEN

Many of us have experienced the Japanese Rail Network, but for those who have not and to refresh the memories of those who have, I would like to share my experiences and impressions from a visit July 2 to July 15, 2019.

I used a seven-day JR Rail Pass which was an economical way to pay for all my rail travels, which cost $261.00. I used the pass to go from Tokyo to Kanazawa to Kyoto to Nagoya and finally to Narita Airport. For each segment, I needed to go to the JR ticket office, show the pass and select a particular train and specific seats to get the actual tickets for each service.

I visited the SCMAGLEV and Railway Park in Nagoya, a museum and exhibition dedicated to the contributions that railways have made to the development of Japan.

The overall impression of the rail network can be captured in one word – flawless.

For every aspect of the system the railways have executed a set of services, amenities and facilities to maximize passenger comfort and convenience. Design details are impressive, from the platform waiting lines positioned at door opening locations, to the directional signage inside the stations and on the platforms, to the way connection information is provided.

Train frequency is high, with a headway of about 8 minutes for 16 car N700 and N700A trains on the line from Tokyo to Kyoto. The trains platform silently, once the doors are open and passengers disembark, passengers waiting on the next train line board, and when the doors close, passengers who were waiting on the following train line move to the next train line. The platform operation is smooth and very quick, loading a new train every 8 minutes.

The fleet N700 and N700A (introduced in 1999 and 2013 respectively) is the latest in an evolution of high-speed train sets that started in 1964, a testimony to a commitment to continuous improvement. Full fleet replacement with the newest N700A is scheduled for March 2020.

Each of the segments I traveled were exactly on-time, seat assignments were made for each ticket, crew inspections of ticketing was done with alacrity. Food service was offered from carts. The track-bed was extremely smooth and announcements were made in Japanese and English. Conveniences on the platforms provided food and drink, newspapers and magazines, everything a traveler might want for a last-minute provisioning.

The stations are a hub of activity with retail, food, and other amenities available. Stations are large facilities incorporating connecting services with a high level of design detail. JR is vertically integrated so shopping, retail, and commercial spaces are part of each station. The most impressive part of station operations is the high level of connectivity to urban rail and bus services, taxis and other connecting modes.

Inside the cars is a very comfortable environment

with excellent seating, power available and Wi-Fi on board. Information about location and stations coming up is available at the end of the cars. There are outlets for mobile devices, foot rests, sliding seat-back tables, and reading lights. Everything about the interiors is "first-class" with design details that are exemplary. There is no vibration from the track bed.

The smoothness of the ride is legendary. There is virtually no vibration and the "body inclining system" absorbs car body vibration and helps to eliminate the leaning feeling into curves.

The precision of schedule adherence, the friendly attitude of the crews and the overall feeling of hyper-competence makes this railway system remarkable.

In Nagoya, the JR Central organization has created a railway museum which displays rolling stock used in Japan from the beginning of the railway era. The museum is very hands-on and unique in my experience. It demonstrates the importance of railways in Japan's culture and on a late Saturday morning was crowded with families and many children.

There are specific exhibits on railway history, super-conducting maglev, and a learning experience room to demonstrate how the laws of physics apply to railway design. There is also a vast "diorama", a model railroad operating continuously which shows every type of urban and intercity trains in an exhibit that changes over a full day and represents the geography of the rail-road from Osaka to Tokyo It is amazing.

All of the rolling stock can be boarded and can be inspected. There are 39 separate rolling stock exhibits in a vast hall.

The museum has two simulators, one for a high-speed Shinkansen and one for conventional train driving. I was able to experience the Shinkansen simulator. Sitting in the Shinkansen driver's cabin, I operated the controls and took the train out of the station, along the right-of-way, through a tunnel while accelerating to a maximum speed of 285 km/hr. The graphics were three-dimensional and very realistic. After attaining the maximum speed the simulator allowed me to slow down brake and berth the train at the terminal station. It was a nerve-wracking but exhilarating experience.

I recommend that all advocates of improved intercity passenger railroading in the US, should visit Japan to see how it can be done.

> "The development of the next generation of Shinkansen is based on the four key concepts of exceptional performance, a high-degree of comfort, excellent service, and innovative maintenance."
>
> JR EAST

AMERICAN PASSENGER RAIL

FROM THE GOLDEN SPIKE TO THE 21ST CENTURY RENAISSANCE

Contributed by: Eric Peterson

On May 10, 1869 scores of rail workers, citizens and dignitaries gathered at Promontory Point, Utah to witness the driving of a golden spike and the completion of the nation's first transcontinental railroad, making it possible to traverse the United States in five days.

The transcontinental railroad unleashed the nation's economy and helped speed people from both the east coast and the west coast to settle the vast expanse of the North American continent and to create new communities and new commerce that became the foundation of America's modern economy.

Fast forward 50 years to 1919 when Lt. Col. Dwight D. Eisenhower led a vast military motor pool from the gates of the White House in Washington, DC on a two month journey across the farm lands, prairies, mountains, and deserts of the unpaved US to San Francisco, and would in 1956, as President of the United States, sign the National Interstate and Defense Highways Act, authorizing the construction of 41,000 miles of broad, well-maintained roadway that would ultimately become the preferred choice of travelers across the country and reshape the cities and communities of our nation.

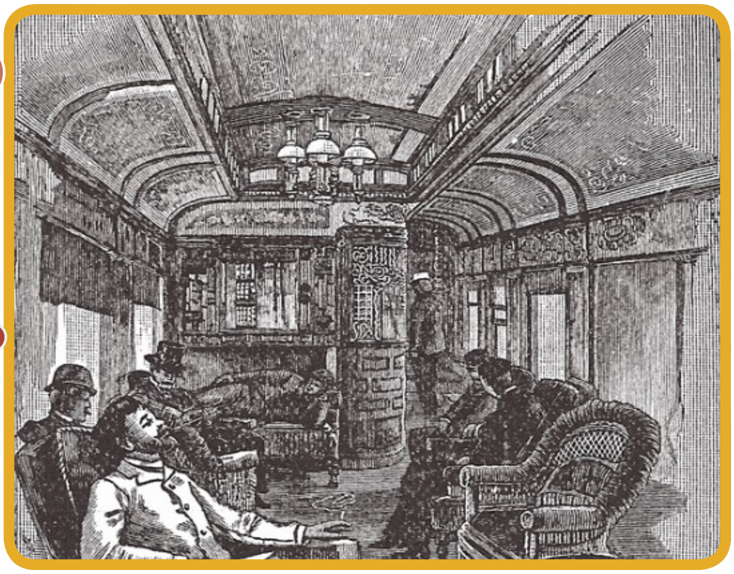
In the 150 years since the completion of the first transcontinental railroad, passenger rail in America experienced tremendous growth followed by near death, and a rebirth that took decades of persistent efforts – efforts to overcome huge obstacles such as competition from automobiles and airplanes.

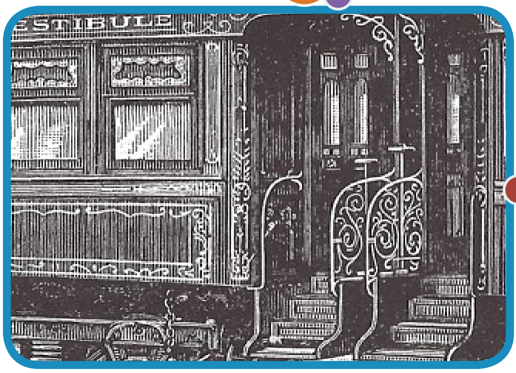
Since the mid-1960s a group of passenger rail enthusiasts have envisioned very fast passenger trains criss-crossing the nation, connecting major and mid-sized cities to one another and to other desired destinations at a pace and cost comparable or better than either autos or airplanes could afford.

By 2008, interest in the renaissance of America's passenger rail service grew to the point that Congress and President George W. Bush approved the Passenger Rail Investment and Improvement Act (PRIIA), a measure that set the stage for the initiatives that are now under construction or are being planned to make the passenger rail vision of the 1960s a greater reality in the 2020s, 2030s, 2040s, and beyond.

While there are many forces – political, financial, technologic, and programmatic – that still must be dealt with now and in the years to come, it is no small achievement that, as noted in a recently published Congressional Research Service (CRS) Report (Improving Intercity Passenger Rail Service in the United States (June 25, 2019)), virtually all of the first major federal government infusion of grant funding for intercity passenger rail since the creation of Amtrak in the early 1970s -- $10.4 of the $10.6 billion authorized and appropriated under the American Reinvestment and Recovery Act of 2009 (ARRA), plus the annual appropriations to Amtrak – have led to significant improvements in passenger rail service and facilities throughout the United States. Additionally, various bond and loan guarantee programs have been approved and improved, providing additional funding and financing resources to support infrastructure maintenance and development initiatives that are benefitting passenger rail service delivery. Of the ARRA money, 158 projects across the country were funded. These include initiatives in all 11federally designated high-speed rail corridors including the Northeast Corridor and, the California High Speed Rail program, state-supported

Building the bridges over the rivers and canyons of the Old West was just one peril the construction crews faced as they built the Transcontinental Railroad.





routes, Amtrak's long-distance routes, and two private sector high-speed rail projects that may seek federal loan guarantees – All Aboard Florida/Brightline/XPress West/Virgin Trains/USA, and the Texas Central Railway project.

Looking to the future, including the upcoming reauthorization of the Fixing America's Surface Transportation Act of 2015 (FAST Act), nearly $225 billion dollars of planned passenger rail projects are in the pipeline, as well as requests for improved policy measures that will address certain legal and regulatory hurdles to competition, continue to improve the financing programs for intercity and high-speed passenger rail, streamline the environmental permitting process, and encourage better planning coordination between the states and the designated high-speed rail corridors. Over the course of the past 50 years, American high-speed rail proponents have been driven by the progress other countries around the world have made, and by the question, "if they can do it there, why can't we do it here?"

The incredible creation and expansion of the high-speed rail program in China, the aggressive development and expansion of high-speed rail initiatives throughout Europe, Asia, and the Middle East all offer incentives and a vision for the possibilities in the U.S.

The Federal Railroad Administration (FRA) has granted California authority to assume responsibility for completion of the environmental review of the first phase of the project from san Francisco to Los Angeles. This is definitely a positive sign.

And on the East-Coast, in the Northwest, and in the Mid-West new financing, and new plans are being announced and plans being offered. On top of all that, pressures over climate change are forcing many travelers to turn away from flying to other less environmentally harmful mobility options. Electrified high-speed rail is becoming the preference in Europe, and may someday become the preferred alternative in the United States.

Never in their wildest dreams did the planners and builders of the first transcontinental railroad envision that the passenger rail industry in America would experience the ups and downs of its 150-year-old life. But certainly, the transformative impact of their efforts is once again being felt and will continue to benefit the United States for generations to come.

What About?

HSR RAIL GRADE CROSSINGS

Contributed by : Brent D. Ogden, PE, Kimley-Horn

Although grade crossings are not permitted along Class 8 or Class 9 track, where the maximum authorized speed (MAS) exceeds 125 mph, crossings can be considered with appropriate treatment where speeds for passenger trains exceed 79 mph along Class 5 – 7 tracks under Federal Railroad Administration (FRA) guidance. Design standards established by the American Association of State Highway and Transportation Officials (AASHTO) and incorporated by the Federal Highway Administration (FHWA) (23 CFR 625.4) prohibit grade crossings on Interstate highways; good practice should consider separating all crossings along access-controlled highways regardless of train speed.

WARNING TIME DILEMMA

High-speed rail presents safety engineers with a dilemma – high train approach speeds warrant consideration of longer than usual warning times to allow for train operators to respond to blockage or other situation at a crossing. However, as warning times increase, impatient drivers are more likely to attempt to evade the crossing warning system: Research (Assessment of Warning Time Needs at Railroad-Highway Grade Crossings with Active Traffic Control, Stephen H. Richards, and K. W. Heathington, Transportation Research Record 1254) has shown that when warning times exceed 40–50 seconds, drivers will accept shorter clearance times at flashing-lights and a significant number will attempt to drive around gates. As a result, countermeasures are required to provide adequate control of vehicular traffic to assure crossing safety. Because of the wide variation in train speeds (passenger trains versus freight trains), train detection circuitry should be designed to provide the appropriate advance warning for all trains.

SCHOOL STREET CROSSING PROTOTYPE

The School Street grade crossing in Mystic, CT has served as a prototype for two treatments recognized in FRA guidance:

- Four-quadrant crossing gates

- Vehicle presence detection interfaced with cab signal system

These improvements were installed in 1998 and subsequently evaluated as a demonstration project by the John A. Volpe National Transportation Systems Center (Evaluation of the School Street Four-Quadrant Gate/In-Cab Signaling Grade Crossing System, Adrian Hellman, Anya A. Carroll, and

Debra M. Chappell): The evaluation identified a 100 percent reduction in "Type II" violations (after the crossing gates were horizontal) and more than a 50 percent reduction in "Type I" violations (after activation of the flashing-lights but before gates deployed). The cab signal aspect, which progressively displays "Approach Medium", "Approach", and "Restricting" indications in the event the crossing is blocked, was designed to allow for safe stopping of trains with minimal passenger discomfort. A survey of Amtrak engineers identified a high level (91 percent) of understanding of the system and 72 percent indicated that the interactive system reduced their level of anxiety approaching the crossing.

SCHOOL STREET CROSSING (USDOT 500278J) WITH FOUR-QUADRANT CROSSING GATES DEPLOYED

BARRIER SYSTEMS

Higher train speeds increase the likelihood of a derailment in the event there is a collision. For these reasons, FRA guidelines require use of a "barrier" system for speeds over 110 mph. Desirable characteristics identified by FRA include:

- Barriers systems must operate in concert with the crossing warning system, and the combined system must provide critical information concerning system health and status to the train control system in real time.

- Barriers must stop the heaviest motor vehicle operated on that roadway short of the crossing, taking into consideration the posted speed limit on the roadway.

- Barrier systems must include the capability to detect any object of significant obstruction (car, truck) that remains on the crossing after the barriers go into place.

- Barrier systems must communicate to approaching high-speed trains the presence of any significant obstruction in time for the train to reduce speed (i.e., to approximately 20 mph) or stop before reaching the crossing.

BARRIER GATE EXAMPLE

Barrier gates must meet crashworthiness requirements which were initially established by the 1993 National Cooperative Highway Research Program Report 350, Recommended Procedures for the Safety Performance Evaluation of Highway Features. More recent requirements were published in the 2016 AASHTO Manual for Assessing Safety Hardware, 2nd Edition. Despite all the research and requirements, there are few examples in day-to-day operation beyond prototypes.

GENERAL GUIDANCE FOR HIGH-SPEED RAIL CROSSINGS

The USDOT Highway-Rail Grade Crossing Handbook provides some general guidance: All crossings located on high-speed rail corridors should either be closed, grade separated, or if remaining at grade, equipped in accordance with FRA recommended policies summarized below. The train detection circuitry should provide constant warning time. Where feasible, other site improvements may be necessary at these crossings. Sight distance should be improved by clearing all unnecessary signs, parking, and buildings from each quadrant. Vegetation should be periodically cut back or removed. Improvements in the geometries of the crossing should be made to provide the best braking and acceleration distances for vehicles.

FRA GUIDELINES

Highway-Rail Grade Crossing Guidelines for High-Speed Passenger Rail (FRA, November 2009) provides a table summarizing recommended and required treatments and provides additional information on the following topics:

- Crossing Elimination through consolidation or grade separation
- "Sealed Corridor" treatments
- Safety Improvements at Private Crossings
- Creation of "Sealed Corridors"
- Warning Systems and Other Highway Traffic Control Devices
- Barrier Systems
- Train Control Integration
- Pedestrian and Trespass Considerations

The "Sealed Corridors" approach involves a diagnostic process to assess the appropriate level of safety improvement needed for existing grade crossings which may include closure/consolidation, enhanced warning devices, medians, and grade separation. Examples of Sealed Corridor at-grade treatments include:

- Four-quadrant gates providing full closure
- Three-quadrant treatments using exit gate(s) in combination with opposing long median
- One-way streets with entry gates
- Locked gate system (for private crossings)

FRA recommends an engineering study of interconnection and preemption to determine how preemption should be implemented and timed. Queue clearance may require use of pre-signals and queue cutters where warranted.

Practitioners are encouraged to consider Vehicle Presence Detection (VPD) technology in conjunction with use of exit gates. In addition, FRA recommends use of VPD integrated with the train control system where train speeds exceed 100 mph.

The FRA also encourages the use of Remote Health Monitoring (RHM) technology –RHM continuously monitors the warning system health and provides an alarm to the railroad dispatcher when an intermittent malfunction or a complete failure of the grade crossing signaling system occurs.

FRA guidelines define "Tier I" service pertaining to speeds up to 125 mph where grade crossings are allowable, with recommended warning systems, as shown in the table below. (Tier II and III are reserved for "Core Express" high-speed services up to 150 or 220 mph, respectively, where grade crossings are not allowable.)