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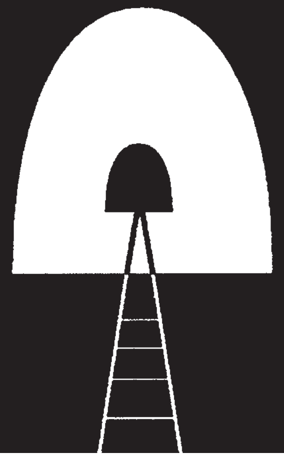

CONTENTS

The Transportation Research Board's Committee on Intercity Passenger Rail (AR010) is concerned with research that will lead to better planning and implementation of intercity rail passenger systems, with particular emphasis on the full range of high-speed systems and new technology. Research will include demand analysis, financial considerations, economic effects (such as user and social benefits), and public–private partnerships and should address impacts on other rail operations and the environment, coordination with other modes, rail–highway interfaces, corridor versus system concerns, technology assessment, and implementation strategies.

Intercity Rail Passenger Systems Update is published intermittently by the Transportation Research Board to disseminate information about current research and development in intercity rail passenger systems. Matthew J. Melzer, editor; Anthony D. Perl, Chair, TRB Committee on Intercity Passenger Rail; Elaine King, TRB staff officer. Any findings and conclusions are those of the authors and not of TRB. Submit news items to Elaine King, Transportation Research Board, 500 Fifth Street, NW, Washington, D.C. 20001, telephone 202-334-3208, or e-mail eking@nas.edu. **www.TRB.org**

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Also In This Issue

Back to page 1

FROM THE CHAIR

Dear Readers:

North American passenger trains are entering a new phase of achievement. In the past two decades, incremental advances in technology and operations have yielded success on particular routes and in specific regions. Rail initiatives—such as the restoration of passenger train service to Maine or the introduction of a new generation of high-speed Acela trains along the Northeast Corridor—have demonstrated the potential of the passenger train. Moving beyond project-specific results to realize rail's potential as a mode of intercity travel, however, has proven challenging. The United States and Canadian governments have recently embraced new approaches to rail passenger modernization, and both the scope and pace of change promise ambitious results. With unprecedented global challenges posed by climate risk, economic crisis, and energy security, the stakes of such redevelopment efforts are indeed high.

Research holds the key to the successful reinvention of North America's intercity passenger trains. There is much to be learned about operating, managing, and financing major intercity passenger rail enhancements. Lessons from overseas—and from past efforts closer to home—are waiting to be applied, while significant gaps remain in the knowledge of how to bring North America's passenger trains into a role of greater mobility.

The most expensive way to discover what will work is through trial and error. The alternative—a robust analysis of significant technical, operational, and managerial challenges—would yield some of the best returns on investment available in the transportation sector. North America's rail passenger research capacity may appear modest in comparison to this sudden need for know-how, but TRB's repository of academic, private sector, and government-based passenger train expertise represents a high-value asset. Acquiring new knowledge about North America's passenger trains will help guide development efforts toward a bright future.

—Anthony Perl, Chair
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EDITOR'S INTRODUCTION

The year 2009 is shaping up to be a banner year for passenger train development. In the shadow of economic trauma, the traveling public continues to push Amtrak ridership ever higher on many routes—even with lower gas prices. Meanwhile, a new presidential administration has already made passenger rail investment a significant priority.

As Randy Wade explains, states that have forged ahead with years of investment in passenger rail finally have the opportunity of being rewarded with substantial federal partnership, bringing passenger rail closer to investment parity with other modes of transportation and laying the groundwork for new high-speed and higher-speed rail service.

Tom Cornillie showcases the vital work of the federally mandated Next-Generation Corridor Equipment Pool Committee. Just as public outlays for trains increase, the committee will arrange for states, Amtrak, or other entities to leverage economies of scale and team up for future orders of a range of standardized rolling stock—much as multiple transit agencies benefit from procurement of standardized buses. This will relieve the growing burden placed by continuing demand on the stretched and dated Amtrak fleet.

Reinhard Clever shares his research findings, reporting that new high-speed rail systems—such as those in California—will be most attractive to the public if they offer robust permutations of potential station pairs within the network and are fully integrated with regional and local rail systems.

Finally, Deborah Matherly provides a valuable retrospective on a collaborative effort to improve the safety and operating efficiency of Egypt's railways, underscoring how rail systems can benefit from international partnerships. With new investments anticipated for U.S. passenger trains, more cross-border collaboration on best practices can be expected in the future.

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ALSO IN THIS ISSUE

Back to page 1

CONGRESSIONAL CHANGES BRING NEW OPPORTUNITIES FOR STATE-SUPPORTED RAIL

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States throughout the country have long supported the enactment of a federal funding program for state-supported intercity passenger rail service. The assumed model has always been a program of 80 percent federal funding and 20 percent state funding, patterned on the federal highway program that would place intercity passenger rail on a level playing field with other modes of transportation. Plans have been developed, and modest state-funded service improvements have been made in partnership with Amtrak. Until late last year, however, there was little progress in congressional enactment of a federal funding program.

In October 2008, that began to change. Congress passed, and President George Bush signed, the Passenger Rail Investment and Improvement Act of 2008 and The Rail Safety Improvement Act of 2008 (RSIA). This legislation reauthorized Amtrak and, for the first time, provided 80 percent–20 percent grant funding for states with an authorized level of $3.4 billion over 5 years, through the creation of two new programs: the Section 301 state capital grant program and the Section 501 high-speed rail grant program. RSIA presented another important breakthrough by mandating that Class I railroads implement interoperable positive train control (PTC) systems wherever intercity passenger or commuter operations are present. PTC systems are essential for safe passenger rail operations at speeds greater than 79 mph.

The enactment of the American Recovery and Reinvestment Act (ARRA) in February 2009 further underscored the increased interest from Congress and the administration of President Barack Obama in U.S. intercity passenger rail development. This economic stimulus legislation provided $8 billion in all-federal funding to states, groups of states, compacts, and public agencies for intercity and high-speed rail development. High-speed rail development has become a signature element of Obama's transportation vision. In April, Obama released the U.S. Department of Transportation (USDOT)'s high-speed rail strategic plan, "Vision for High-Speed Rail in America," which outlines the administration's strategy for ARRA passenger rail funding. This ARRA funding is available through September 2012, but the application process is already well under way. There were 278 pre-applications submitted in early July totaling $102 billion. First-round applications were due in late August and the second round by October 2. Obama further emphasized his commitment to an ongoing high-speed rail funding program by including $1 billion for intercity passenger rail in his FY 2010 budget proposal.

ALSO IN THIS ISSUE

◆

Back to page 1

A key policy focal point for ongoing state passenger rail corridor development funding will be the authorization of a new federal Surface Transportation Program (STP). The National Surface Transportation Policy and Revenue Study Commission set the stage for STP in early 2008, when it released a report to Congress identifying more than $357 billion in intercity passenger rail funding needs through 2050. The Commission recommended that a new intercity passenger rail program be included in the 6-year STP authorization bill and that $5 billion be provided annually for intercity passenger rail development grants to states.

A major change in U.S. intercity passenger rail policy is under way—$8 billion in federal funding have already been enacted and additional funding is likely. It will be incumbent upon the states to make sure that this funding is put forward for the most productive projects possible, to ensure that Congress and the Obama administration continue their efforts to implement what has become a shared vision for U.S. intercity passenger rail development.

ALSO IN THIS ISSUE

◆

Back to page 1

NEXT-GENERATION CORRIDOR TRAIN EQUIPMENT POOL: ARE WE READY?

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A mandate in RSIA calls for the establishment of a Next-Generation Corridor Equipment Pool (NGCEP) Committee to "design, develop specifications for, and procure standardized next-generation corridor equipment." The formation of this committee, made up of representatives from Amtrak, the Federal Railroad Administration (FRA), manufacturers, and other stakeholders, is part of the response to a long-standing demand for a corridor rail service improvement plan.

For many, the quality of a passenger train (cars and locomotives) is the essential measure of the value of rail service. Passenger trains—and passenger cars in particular—seem easy to understand. Issues such as seat softness, the amount of legroom, or adequate lighting do not seem like technical ones. As objects, trains have their own appeal: it is difficult not to be impressed by the fighter-jet appearance of the latest Japanese Shinkansen, or the air of efficiency surrounding the German Intercity Express service. Indeed, one can hope that the next generation of U.S. corridor equipment will have the amenities that have long been considered standard by the rest of the world.

The mission of the NGCEP Committee is standardized next-generation corridor equipment. (Photo: Comstock, Inc. 2000)

Back to page 1

However, the U.S. has already had its next generation. In the mid-1970s, the introduction of Amfleet and Superliner cars and the renovated Heritage fleet revolutionized the American passenger train. By the early 1980s, Amtrak's trains had a uniform exterior appearance and interior design that felt modern—or, at least, that broke with earlier railroad traditions. More importantly, these cars revolutionized how passenger trains functioned by using a locomotive-powered 480-volt AC train-line head-end power to replace a myriad of heating and air-conditioning systems that once relied on axle-driven or propane power motors on each car and steam boiler-equipped locomotives. In short, Amtrak successfully standardized its operations with modern mechanical systems. Moreover, Amtrak's implementation of head-end power coincided with the renovation or construction of new coach yards and shops at major stations specifically designed around Amtrak's needs.

Revisiting this history raises a few questions: what made the previous "next generation" become old? Is the age of cars the only reason that today's passenger trains do not function as well as they could? Or is the functionality of passenger cars impeded by the complex environment in which passenger trains operate? While it is easy to judge whether a car looks modern, it is harder to appraise the impacts of varying climatic conditions, maintenance facility designs, component wear, operational demands, and employee culture on the car. By and large, the data to evaluate the factors that influence passenger train reliability do not exist outside of car shops and the offices of mechanical officers, making the data largely out of reach of those who guide policy decisions.

Fortunately, it is still possible to formulate questions and carry out research that can provide data necessary to make effective policy. The NGCEP committee brings new attention to passenger car mechanical issues at the highest levels of the industry. It is likely that procurement of the next-generation equipment will be a multiyear effort; this will allow for sufficient time both to complete research and to begin implementing recommendations. While rebuilding shops and yards may not be appealing, and the modification of working practices will come with its own controversies, such actions will be necessary in order to enable the long-term success of next-generation equipment. TRB passenger rail committees are in an excellent position to take on technical research questions, and to make findings accessible and relevant to decision makers.

Also In This Issue

Back to page 1

THE INTERNAL DISTRIBUTION ADVANTAGE OF HIGH-SPEED RAIL: A CALL FOR CONVERGENCE

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High-speed rail has been able to capture substantial market share in Asia and Europe, where downtown-to-downtown connections offer a significant advantage over the competing mode of air travel. All that European and Japanese high-speed rail systems had to do was to serve the already existing central stations, and their access advantage over air travel systems seemed to have been handed to them on a golden platter. Downtown-to-downtown connections, however, do not offer a great access advantage in decentralized, widely dispersed U.S. metropolitan areas. In North America—outside of the Northeast Corridor—most business trips do not originate or terminate in the central business district, and so a much more sophisticated approach is necessary for high-speed rail to be competitive with air. Simply transposing the European or Japanese experience to North America probably will not be successful—the internal distribution advantage of high-speed rail needs to be studied carefully. Before defining internal distribution advantage, the question of what high-speed ground transportation can do that air cannot do, or can do only with great difficulty, must be answered. These are the competitive advantages that high speed rail may have vis-à-vis air:

- **Speed**: Between metropolitan areas up to 200 km apart, high-speed rail is as fast as or faster than jet service. Examples include the city pairs of New York–Philadelphia, Paris–Lille, or Cologne–Frankfurt. Between the airports of Frankfurt and Cologne, the fastest connection is by train. Between metropolitan areas up to 400 km apart, high-speed rail is about as fast as commuter aircraft service.
- **Subway**: After entering metropolitan areas, trains can become subway trains—even going underneath city streets—and directly serve high-density areas with as many stops as may be required by the traveling public.
- **Split Up:** Unlike planes, trains can also split up into many pieces once they reach a metropolitan area, each piece serving a different commuter rail corridor.

Also In This Issue

Back to page 1

Berlin Hauptbahnhof, or central train station. In centralized areas such as Europe, downtown-to-downtown rail connections give high-speed rail an access advantage over air travel. (Photo: Rail Europe)

- **Quick Stop:** High-speed trains can serve rural areas and mid-size cities more efficiently than airplanes. For example, the penalty for an additional stop on a high-speed rail segment might be only a little more than 5 minutes. By contrast, the equivalent penalty on an air route would be about half an hour.
- **Fully Automatic:** Rail is also the easiest mode to make fully automatic. Essentially, train controls must only concern themselves with one-dimensional operation, while automobiles need two-dimensional controls and planes, three-dimensional controls. Fully automatic operation enables service to be extremely frequent with very short trains, much like people movers.

The competitive advantages of high-speed rail are not as theoretical as they may first appear. This will be discussed in a little more detail below.

The subway and quick-stop advantages illustrate this mode's adaptability to frequent stops. The competitive advantages of speed and quick stop are very well understood and are taken into consideration in every high-speed rail study.

Defining the Internal Distribution Advantage of High-Speed Rail

The internal distribution advantage of high-speed rail—defined as the competitive advantages of subway and split up—is generally not considered in current high-speed rail studies. A metaphor will illustrate the main point of this explanation: dogs are both stronger and faster than cats. On a wide-open field, dogs have a complete advantage over cats. In reality, however, dogs do not seem to be able to catch cats as frequently as their strength and speed advantage would suggest.

Also In This Issue

From the Chair

◆

Editor’s Introduction

◆

Congressional Changes Bring New Opportunities for State-Supported Rail

◆

Next-Generation Corridor Train Equipment Pool: Are We Ready?

◆

The Internal Distribution Advantage of High-Speed Rail: A Call for Convergence

◆

Egypt Railway Study: Technical Assistance for Safety Improvements and Rail Traffic Management

◆

Back to page 1

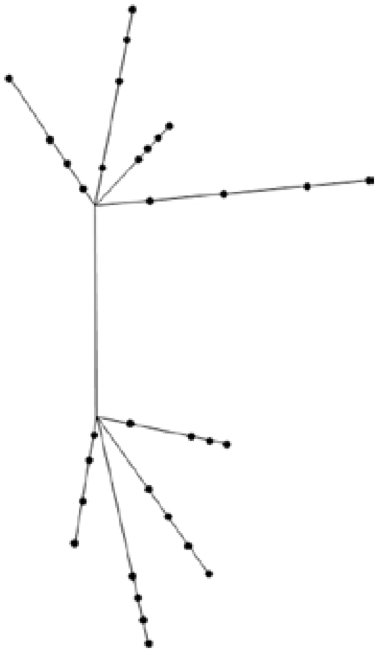
This is because cats can do things that dogs cannot, such as climb trees, squeeze underneath fences, or jump onto rooftops. Most high-speed rail planning in the U.S. proposes to have dogs and cats—or air and rail—compete on a wide-open field.

Extensive research has begun to quantify how important the access advantage was to the success of the high-speed rail system in Japan. Doctoral research performed by the author suggests that access and egress distance-related utility can contribute as much as 41 percent of the total absolute utility of air travel or 43 percent of the total absolute utility of high-speed rail travel, given certain assumptions about what constitutes a typical air or high-speed rail traveler.

The degree to which high-speed rail utility in Japan appears to depend on large rail stations’ pull on travelers is of great concern to U.S. transportation planners. The public transportation system of the entire metropolitan area converges upon these stations, making them the transportation hub of the region. In the U.S., only Grand Central Terminal in New York City—and, to a lesser extent, Union Station in Washington, D.C.—would be able to duplicate this draw.

If the utility of high-speed rail travel in the U.S. depends on the magnetism of large downtown stations as much as it appears to in Japan, innovative solutions must be found in order to replicate this effect. One solution, particularly suited to the relatively low density and vast dispersion of U.S. metropolitan areas, is presented below.

Consider, for example, a high-speed rail line linking Northern and Southern California including several access branches at both ends (see image, below). If a train were to be split into four different pieces, each part serving four distinct stations, then one single train could connect 16 points in Northern California with 16 points in Southern California, for a total of 256 distinct suburb-to-suburb connections. If a train were to be split into two pieces—standard operating



A diagram of a possible high-speed rail route with access branches linking Northern and Southern California.

ALSO IN THIS ISSUE

◆

Back to page 1

procedure today in many countries—then a single train could still serve 64 origin and destination pairs. (Note that Northern and Southern California were chosen simply for illustration purposes, and that only the first car in a high-speed train consist needs to have a pointed aerodynamic nose.)

It is not difficult to picture San Jose, California, as the northern hub of this integrated high-speed rail system. Each branch does not have to follow a separate corridor: for example, one branch could represent express and another could represent local, or skip-stop, service. High-speed rail train sections would not necessarily operate in high-speed mode with velocities greater than 200 km/h on the access branches, but the door-to-door time for the traveler—the only time that really matters—would still be shorter compared with transfers at each end point. Most importantly, however, the trip would be considerably more attractive to the long-distance traveler, especially in light of extensive literature on transfer penalties in air travel for travelers with baggage or even for commuters without luggage.

If such a system were to be built—sharing right-of-way or tracks with existing commuter rail systems on the access branches wherever possible—opportunities for complimentary land-use development could be substantial. The 16 access points described above for both Northern and Southern California would, in a sense, become mini-airports without the enormous space requirements of an airport. If transportation planning were to be properly coordinated with land-use planning, these access centers could become the seed for a less automobile-dependent urban form in the western United States.

According to an old and now mostly obsolete paradigm, the modes of intercity rail in general and high-speed rail in particular have been seen as completely different from urban rail transportation systems. The basic paradigm has always been to optimize rail systems for one particular application: airport people movers; urban transit, such as the San Francisco Municipal Railway; regional rapid transit, such as the San Francisco area's Bay Area Rapid Transit (BART); and intercity transportation, such as high-speed rail. If regional rapid transit systems like BART and urban transit systems like the Los Angeles Metro Red Line were seen as a completely integrated part of an intermetropolitan high-speed rail system, high-speed rail would be much more competitive.

The incompatibilities that have been designed into modern urban transit systems—nonstandard gauges for BART; Washington, D.C. Metrorail; and the Toronto subway—are the most revealing symptoms of the old paradigm. Going hand-in-hand with this old paradigm, high-speed rail systems proposed for the U.S. have been mostly point-to-point systems that copy the European and Japanese models, even though urban densities and land use patterns are vastly different in North America. The new paradigm sees urban, regional, and high-speed rail as one coherent system. It is the author's belief that this more-sophisticated approach is necessary to make high-speed rail work—and work well—in the North American market.

The technical and regulatory impediments to systems integration are formidable, but the results so far have outweighed the obstacles. Replacing classic

Back to page 1

commuter trains with light rail vehicles in Karlsruhe, Germany resulted in a ridership increase of 400 percent on weekdays and 1,200 percent on weekends. Allowing light rail trains on mainline railroad tracks obviated the need for a mode change at Karlsruhe Central Station.

We have to be aware that many of the technical hurdles have already been overcome. Efficient train splitting has been implemented in Denmark with the IC3. The train was developed to split up rapidly while in slow motion in order to speed up ferry boat loading.

Until the 2007 opening of the Channel Tunnel Rail Link—the high-speed rail line between the Channel Tunnel and London—the Eurostar high-speed train had to use the southern England commuter rail system, necessitating compatibility with third-rail power collection. From a technical perspective, this is comparable to Acela Express service between Washington, D.C. and points in Long Island, New York, in terms of third-rail power collection compatibility. Note that rail in this market now faces an access disadvantage, since many travelers may find it more convenient to drive to La Guardia or John F. Kennedy (JFK) airports than to face a trip into midtown Manhattan before being able to transfer to a long distance service.

Currently in the planning stages, the Metropolitan Transportation Authority's "one seat ride" between Manhattan and JFK is a good example of systems integration. If the JFK airport people mover were to use the same tracks as the Acela Express, equipped with third-rail power collection, we would begin to understand the meaning of a single, coherent transportation system—it leverages the inherent systems advantages of rail to attract substantially more passengers. To understand this new paradigm, we have to follow one of Apple, Inc.'s marketing slogans: "Think Different."

Train at the platform in St. Pancras Station, the London end of the Channel Tunnel Rail Link. (Photo: Rail Europe)

Also In This Issue

Back to page 1

EGYPT RAILWAY STUDY: TECHNICAL ASSISTANCE FOR SAFETY IMPROVEMENTS AND RAIL TRAFFIC MANAGEMENT

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Egypt has one of the world's oldest railway systems. The entire system includes more than 5,000 km of track lines, but only 15 percent of the lines utilize electrified signaling systems. The rest rely on manually operated mechanical signaling. Three passenger train crashes in 2006—the most horrific, in August of that year, had more than 50 passenger fatalities—resulted in reassignments and reorganization of the Egypt Ministry of Transportation (MOT) and major initiatives to improve railway safety and security and regain public confidence. Significantly, the August 2006 crash occurred in the 15 percent of territory that is signalized, and involved a locomotive equipped with automatic train protection (ATP).

Before the crashes of 2006, Egyptian National Railways (ENR) were carrying approximately 1.5 million passengers per day and 12 million tons of freight per year. After the crashes, MOT and ENR instituted new regulations that spaced trains at greater intervals—among other measures—thereby reducing service and passengers carried to just over 1 million per day. Because of locomotive shortages and other service problems, ENR carried about 7 million tons of freight in 2007. The declining freight market share has been of concern to the management of ENR and MOT, as it has caused revenue losses and resulting increases in truck traffic congestion around metropolitan areas.

A physical token block staff machine at Qalyub, Egypt, where the August 2006 train crash occurred.

Back to page 1

A mechanical signal north of Luxor, Egypt. All of the signals on the rail line south of Cairo are European-style manual block signals controlled from mechanical interlocking towers. Wire-connected signals are are physically connected to levers in the towers.

As part of its response to these accidents, the Egyptian government has pledged to invest $873 million to address problems in ENR and has received another $600 million in loans. Additionally, a development plan for ENR has been discussed between the government of Egypt and the World Bank.

In light of the urgent need to upgrade the country's railway system, the MOT requested immediate assistance. In response, the FRA sent a team of experts to meet with MOT in mid-September 2006. The U.S. Trade and Development Agency, upon the recommendation of a definitional mission consultant, funded a study to help MOT build a railway traffic management system that would help trains run safely and on time, minimize operating expenses, and promote safety oversight and enforcement within ENR in order to minimize further accidents. The technical assistance scope included the identification of the root causes of the August 2006 crash; an evaluation of the existing conditions for ENR; the development of a traffic management system safety plan, comprehensive training program, and public education and information program; and the organization and implementation of an orientation and inspection visit to the U.S., focusing on traffic management systems for signaled and dark territories. The contract was awarded to the Louis Berger Group, with support from Systra USA and Talaat & Imam Consulting Engineers of Cairo, Egypt.

The first visit, in November 2007, identified the major issues and concurrent projects from various European sponsors in order avoid overlap. The second visit, in March 2008, gathered the full team, whose broad and intense agenda involved investigating multiple facets of ENR operations. In June 2008, a delegation of six key staff from MOT and ENR visited the United States for two weeks; a final visit to Egypt in December 2008 presented the investigation's findings, the draft final report, and an Arabic translation of a video describing a PTC technical solution and its benefits.

Back to page 1

ATP test and repair facility. This desk is typical of many others.

The root cause analysis was hampered by lack of access to many documents and tests, since criminal investigations were under way at the time. However, based on interviews, observations, and the rejection of unlikely events that would have required multiple concurrent failures, it was the study team's informed opinion that the most likely cause of the crash was that the ATP on the train (#808) that overshot the red signal and crashed into the other train was either not working when the train was dispatched, or was deliberately cut out during the trip. The study team observed problems with the repair facilities for ATP as well as with trains operating over speed without penalty braking taking place. Furthermore, tracking systems were manual, making analysis, troubleshooting and recovery difficult (see pictures).

ENR is taking part in the European Union Twinning Project: Egypt–France for Reforming Railway Safety, a program that focuses on operational safety. Without overlap, the study team noted a serious lack of industrial safety protocols at many of the maintenance shop facilities. Excess scrap; poor lighting; lack of personal protective equipment; scarcity of modern facilities with required equipment; and a lack of safety practices, such as safety training or job briefings, generally contribute to poor working conditions that typically lower productivity and safety. The study team developed a system safety plan and training program based on successful U.S. practices; nominally focused on a traffic management

Daily string charts being prepared by hand.

Back to page 1

TABLE 1 Grade Crossing Accident History in Egypt, 2004–2006

	At Grade Crossings			Not at Legal Grade Crossings			Total		
	Collisions	Injuries	Deaths	Collisions	Injuries	Deaths	Collisions	Injuries	Deaths
2004	64	42	22	85	29	15	150	71	37
2005	69	62	19	75	10	10	144	72	29
2006	51	69	21	73	6	7	124	75	28

Data assembled by Cairo University, Egypt.

system, the plan also had sufficient back-up documentation and a phased implementation plan to expand to full workplace safety.

Most grade crossings are protected by attendants, who place chains across the roadway when a train is approaching; nevertheless, there are significant numbers of road vehicle and train collisions, injuries, and deaths each year, as shown in Table 1. Many of the collisions take place when a vehicle—many of which are in poor repair—becomes disabled on the active tracks with insufficient time to clear before the train comes through. On July 16, 2008, at the Foka level crossing near Marsa Matrouh, Egypt, a speeding truck with malfunctioning brakes pushed cars and buses into the path of an oncoming train; 42 people were killed and many more were injured. Railway crossing warning signs and devices are also badly needed on Egypt's railroads in order for them to comply with current safety standards.

ENR is separately issuing a tender for major grade crossing improvements throughout Egypt. The study team developed a complementary public information program, with a major focus on improving public awareness of grade crossing safety issues. The program also promoted the benefits of the proposed traffic management system and the importance of safe passenger behavior on trains and in stations.

The team separately noted that ultrasonic equipment for testing the integrity of track and wheels was lacking. Likewise, preventive rail grinding programs were not in place.

The U.S. orientation visit delegation met extensively with the FRA, viewing presentations in Washington, D.C. and observing inspections in Missouri; with

The Supervision Planning Group in Cairo, Egypt.

Back to page 1

The U.S. orientation visit delegation at the Amtrak Shop in Wilmington, Delaware.

Amtrak, in Chicago, Illinois and several mid-Atlantic cities; and with the major suppliers and installations of traffic management systems in the United States.

The team developed a prioritized action plan for improving traffic management operations and safety. This included the immediate actions of enforcing existing rules about hours of service and ensuring that equipment is mechanically sound before being delivered to the train driver. The functional specifications, plan, and budget include automating the train control functions in an improved central control center, deploying a PTC system throughout Egypt, and providing clear guidance to MOT and ENR.

MOT and ENR have made a serious commitment and have invested much time, energy, and resources to rebuild ENR as a safe, efficient, and modern railway system serving the people of Egypt; they have engaged partners from throughout the world to do this. For example, at the time of the crash, ENR relied on 700 locomotives, 75 percent of which were more than 25 years old. ENR has recently purchased 80 new locomotives from GE and is involved in an extensive replacement and rebuilding program for locomotives and cars. Investments in signaling, communications, computer technology for better operational systems and procedures, track upgrading and maintenance, training facilities, and human resources and training are being made, along with organizational restructuring.

Centralized train control for trains into and out of Ramses Station, Cairo.

Back to page 1

Newsletter Comments

We look forward to your feedback on the format and the content of this publication. Comments on this newsletter, and most especially, continued contributions by committee members, friends of the committee, and others can be sent to the editor:

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