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CHARLES H. QUANDEL, P.E.

Education

MSCE, Lehigh University, 1972
BS, United States Naval Academy, 1969

Registration

Professional Engineer: Pennsylvania, Maryland, Delaware, Illinois, New York, Kentucky, Florida, Ohio, Michigan, Colorado, Mississippi, Arizona, Maine, and Wisconsin

Affiliations

Transportation Research Board- Intercity Rail Passenger Systems Committee
High Speed Ground Transportation Association – Chairperson, 2003 to 2006
American Public Transportation Association-High Speed/Intercity Rail Committee
American Public Transportation Association – Rail Conference Planning Subcommittee
American Association of Railroad Superintendents-Member
American Railway Engineering and Maintenance of Way Association-Member
Chicago Railroad Superintendents Association - Member
American Society of Civil Engineers
American Society of Mechanical Engineers

Project Experience

Midwest Regional Rail Initiative Phase 7: Program manager for the 3000 mile Midwest Regional Rail System designed to service nine states with a combined population of 60 million. Using Chicago as its hub, the MWRRS will provide improved reliability for rail passenger with speeds up to 110 mph. The project includes conceptual engineering and capital costs estimates of the South to the Lake Reroute between Chicago and Porter, IN; preliminary alternatives analysis of potential high speed rail routes in Wisconsin, Minnesota, Ohio, Missouri, and Iowa; capital cost updates of all routes within the Midwest including review and comments by the Class 1 railroads that service the Midwest : and review of various technology options for the Midwest.

Twin Cities-Duluth High Speed Rail Project: Deputy project manager and project engineer for the preliminary engineering and environmental analysis of a high speed rail connection between Minneapolis/St Paul; Superior, WI; and Duluth, Mn. Quandel services include the conceptual engineering and capital cost estimates to build a high speed rail system on BNSF property. The concept engineering will include preparation of typical cross sections and profiles of principle bridges on the route.

Rocky Mountain Rail Authority's High Speed Rail Feasibility Study, Denver, CO: Deputy project manager providing planning and engineering services to the Rocky Mountain Rail Authority (RMRA), to determine the feasibility of implementing high speed passenger rail service along Colorado's Front Range from Wyoming to New Mexico and along the I-70 Corridor from Denver to the Utah state border including secondary corridors to major tourist destinations. The services include the development of initial alignment plans and profiles and capital cost estimates for technologies capable of travelling at speeds between 79 mph and 250 mph. Quandel coordinated the concept planning with BNSF and Union Pacific.

Ann Arbor to Detroit Regional Rail Project for the Michigan Department of Transportation: Project Manager for the initial phase providing project direction, assistance and consultation for the implementation of a regional passenger service between Ann Arbor and Detroit by October 2010 and other passenger rail endeavors such as the Washenaw County– Livingston County Commuter Rail Project (WALLY).



Ann Arbor-Detroit Regional Rail Project GEC: Principal in charge and Quality Control engineer for a Michigan DOT program to introduce commuter rail service in the Ann Arbor-Detroit corridor on track owned by Norfolk Southern, Conrail Shared Assets and Canadian National. The GEC assignment includes the preparation of FTA required planning documents: Project Management Plan, Contract Management Plan, Risk Management Plan, and Quality Management Plan. In addition, the work includes negotiations with the host railroads and the preparation of design criteria and conceptual geometric plans for new layover track facilities and stations. The system requires the construction of the West Detroit connecting track and bridge over Junction Ave. The GEC reviewed the design plans prepared by a design consultant for compliance with passenger and freight design criteria.

2008 Florida Rail Plan, Florida Department of Transportation: As a sub-consultant to Cambridge Systematics, project consultant support on the impact of rail investment and rail needs related to passenger rail in Florida and provide input into tax credit bonding strategy for the development of intercity passenger rail systems.

State of New York 2008 State Rail Plan & Policy, New York State Department of Transportation: Project consultant providing support to the NYSDOT Policy, Planning, and Performance division for the preparation of the 2008 Rail Plan including review and comment on the draft plan and organization and facilitation of the transportation planning and policy partner's workshop and the rail industry workshop.

Midwest Regional Rail Initiative, Positive Train Control Study, WI: Technical advisor and quality review in preparing a study of Positive Train Control (PTC) technologies under development for use in the United States market. Under current FRA regulations, high speed intercity passenger rail requires the use of advanced signal technologies where train speeds exceed 79 mph. The current technology in general use for high speed applications employs costly, track circuit based cab signaling. New, developing technologies are based on GPS or inertial navigation train location determination, high speed digital radio communications and microprocessor controls. The study is evaluating recent progress in the industry and making recommendations to enable Wisconsin to proceed with its planned high speed rail operation connecting Chicago, Milwaukee and Madison.

Midwest Regional Rail Initiative, Chicago-Milwaukee Truesdell Connection Study, WI: Technical advisor and quality review in preparing a study of possible rail connections between the Canadian Pacific Railway Chicago and Milwaukee Subdivision and the Union Pacific Railroad New Line. Under the planned future high speed passenger rail service in the Midwest, high speed passenger trains and freight trains operating on the Canadian Pacific Railway owned corridor between Chicago and Milwaukee are expected to require additional capacity to avoid conflicts and service delays. Early studies suggested that the freight service could operate on the UPRR New Line between Truesdell (near Kenosha) and Shermer (near O'Hare Airport). The study, commissioned by Wisconsin DOT, is developing scaled track plans and capital cost estimates.

Chicago-Milwaukee Tier 1 Environmental Assessment, WI: Principal and quality control engineer preparing a Tier 1 Environmental Assessment to support increased intercity passenger service in the Chicago-Milwaukee corridor. The study evaluated the environmental impacts of increasing train frequencies from the existing 7 round trips to 10 round trips per day with required infrastructure improvements to provide capacity for the freight and commuter rail services in the corridor. The study included an analysis of possible corridor alternatives, development of proposed improvements in track schematic format and an assessment of environmental impacts in accord with FRA guidance as published in the Federal Register. Capital improvements were coordinated with the host railroads, Canadian Pacific and Metra.

City of Dearborn Intermodal Rail Passenger Facility Conceptual Design Report for Track, Signal and Passenger Station Platform

Principal in charge and Quality Control Engineer for the City of Dearborn Intermodal Rail Passenger Facility. The City of Dearborn is planning to construct a new passenger station on a site west of the current Amtrak facility on the historic Michigan Central Line, now the Norfolk Southern Dearborn Subdivision. The station will serve as a passenger intermodal facility, connecting commuter rail, intercity rail and local bus modes. The City plans to construct the new facility in a phased program timed to serve the growth in demand for passenger services and the availability of funding. For the purposes of interface with the host freight railroad, Norfolk Southern Corporation, and



the intercity passenger rail service provider, Amtrak, and the future commuter services provider, the program is divided in three significant phases.

- Phase 1a constructs a new 24 ft by 400 ft platform and station on the north side of track 2, east of Elm St, closing both the existing Dearborn and Greenfield Village stations.
- Phase 1c reconstructs track 1 from CP Mort, west to Oakwood Blvd., modifying the platform width to a minimum of 10 ft to accommodate the new track, and closes the crossing at Elm St.
- Phase 3 constructs a new station track to the north of track 1 with suitable crossovers and turnouts. A wide platform is constructed between the station track and track 1. The station facilities are constructed, including a pedestrian overpass from the station mezzanine level to the platform and to a landing south of track 2, serving as a pedestrian entrance to Greenfield Village.

Quandel Consultants developed typical track sections; capital cost estimates; and phased track, signal and platform plan drawings to define the work. The track work includes modifications to the existing trackwork and roadbed to restore a previously existing main track and crossovers, as well as a new station track and turnouts

Project Experience – High Speed & Intercity Rail – 1998 to 2007

Madison to Milwaukee High Speed Rail Connection for the Wisconsin Department of Transportation and Amtrak: Served as project manager for the preliminary engineering and environmental study of the 85-mile rail corridor needed to accommodate the integration of 20 high speed passenger trains with an estimated 43 freight trains within the 45-mile segment of Canadian Pacific Railway right of way between Milwaukee and Watertown, and the rebuild of a 40-mile segment of railroad between Watertown and Madison for 110 mph operation. The preliminary engineering included rail planning and operations analysis; rail capacity analysis; station alternatives analysis for Madison; concept design of stations; aerial and ground survey of entire corridor; bridge and structures design; signal and communications design; private and public grade crossing design; track work and alignment analysis and design; drainage design; utility interface; geotechnical analysis and report and real estate impact analysis and report. The project was extensively managed using the *engineering planning* process. The total project cost is estimated at more than \$300 million.

Chicago to Milwaukee to Madison Rail Capacity, Conceptual Engineering, and Environmental Assessment for the Wisconsin Department of Transportation: Served as project manager for engineering services for operations simulation, line capacity analysis, and signal block layout of the Chicago to Milwaukee to Watertown (Canadian Pacific Railway) corridor on which Amtrak currently operates; an environmental analysis from Chicago Union Station to Milwaukee Amtrak Station for the purpose of increasing Amtrak service from seven (7) to ten (10) round trips and provide six (6) round trips to Madison; and public information and community involvement. The project was coordinated with the Wisconsin and Illinois Departments of Transportation; Federal Railroad Administration; AMTRAK; Canadian Pacific Railway; and METRA.

Detroit-Chicago High Speed Rail Corridor Program Study: Served as project manager for a high speed rail study conducted for AMTRAK, Michigan Department of Transportation and the Indiana Department of Transportation to provide planning and engineering services for the update of the Detroit-Chicago High Speed Rail Program that included concept engineering and corridor analysis of the South of the Lake Corridor between Chicago and Porter, Indiana; review and analysis of the existing right-of-way improvement program between Porter and Detroit; ridership and revenue forecasts; and integrated benefit/cost and financial risk analysis. Multiple alignments were evaluated for the South of the Lake Corridor. Field inspections were conducted on the various alignments, concept engineering of each alignment was completed, and capital cost estimates were prepared. The project was extensively managed using the *engineering planning* process. The current capital cost estimates for the alignments range from \$700 million to \$800 million.

Midwest Regional Rail Initiative for the Nine States of the Midwest Regional Rail System: Served as project manager and project engineer during the course of the development of the MWRRS, and in 2005, as project



manager, recommended adoption of an implementation plan for Phase 1 to *incrementally* increase Amtrak service from 7 to 10 round trips in the Chicago-Milwaukee corridor with 6 new round trips between Milwaukee and Madison ; to increase Amtrak service from 3 to 8 round trips in the Chicago to St. Louis corridor; and to increase Amtrak service from 4 to 9 round trips in the Chicago to Detroit corridor. To accomplish this incremental build-out of Phase 1, the engineering program includes conducting a technical analysis of the South of the Lake Corridor between Chicago and Porter, Indiana of the infrastructure requirements of the full build out of the MWRRS; conducting a technical analysis of the Chicago Union Station for the full build-out of the MWRRS in order to clear environmental actions to allow increased service in Phase 1; conducting a limited capacity analysis between Chicago and Joliet for the Phase 1 actions; and conducting a capacity analysis to clear Phase 1 actions in the Chicago to Milwaukee corridor. The major plan elements for all phases of the MWRRS include the use of 3000 miles of existing rail rights-of-way to connect rural, small urban, and metropolitan areas; operation of a "hub and spoke" passenger rail system providing service to and through Chicago to locations throughout the Midwest; introduction of modern train equipment operating at speeds up to 110 mph; provision of multi-modal connections to improve system access; and improvement in reliability and on-time performance. The services included conducting an infrastructure assessment of various routes and alignments over the entire nine state system and prepared a feasibility level, milepost-based, infrastructure improvement plan and cost estimates. The infrastructure cost estimate in 2002 dollars of Phase 1 is \$2 billion and the estimate for the entire MWRRS is more than \$6.5 billion. The last phase of this project was managed using the **engineering planning** process.

Tampa to Orlando High Speed Rail: Served as project manager and project technical lead for General Engineering Consultant services provided to the Florida High Speed Rail Authority for the Design, Build, Operate, Maintain, and Finance (DBOM&F) of the initial segment of the proposed High Speed Ground Transportation System (HSGTS) in Florida. Services include concept planning and engineering of several alignments within the corridors; development of station concepts; analysis of locomotive technologies; preparation investment grade ridership studies; management of project development and environmental (PD&E) studies leading to a final environmental impact statement (FEIS); development and issuance of a Request for Qualifications to identify and prequalify potential vendors; development and drafting of procurement documents (Request for Proposals) and standards; review of DBOM&F proposals; manage negotiations with the top ranked DBOM&F team; and assist in the preparation of annual reports for the Authority to submit to the Governors and Legislature. The **engineering planning** process was used in the development phase and to assist in agency coordination with FDOT central office and two district offices, FRA, FHWA, U.S.C.O.E., EPA, and the Florida Department of Environmental Resources. DBOM&F proposals ranging from \$2 Billion to \$2.4 Billion were received for this project.

Orlando to Miami High Speed Rail: Served as the project manager and project technical lead for this study that examined high speed rail technologies; corridors alignment options from Orlando to Miami; capital and operating costs; ridership and revenue projections; and financial benefits from July 2002 when the Florida High Speed Rail Authority authorized a preliminary, planning level study of Phase 2 of the implementation of a High Speed Rail System. Four alignment options were evaluated and seven candidate stations were identified. Capital costs were developed for both electrified and non-electrified service on the four alignment options. The capital costs in 2002 dollars, not including right of way and rolling stock costs, ranged from \$5.1 to \$9.1 billion.

Ohio & Lake Erie Regional Rail – Cleveland Hub Study: Served as project manager for engineering services required to assess the current condition of the railroad infrastructure and rights-of-way and to determine the improvements needed to support both a 79 mph and a 110 mph passenger rail operation for the 800-mile high speed rail system connecting the metropolitan areas of Detroit –Toledo, Cincinnati-Columbus, Pittsburgh-Youngstown, Toronto-Buffalo-Erie to Cleveland. The infrastructure improvements identified in the Ohio Hub Study are needed to increase capacity, upgrade track and signaling and communication systems, and enhance grade crossing warning devices. The capital cost in 2002 dollars was estimated at \$3.3 billion.

Northern Indiana/Northwestern Ohio Routing Study: Served as project manager for the engineering services required to assess the current conditions of the railroad infrastructure and rights-of-way and to determine the improvements needed to support high speed rail operations up to 110 mph along alignments within the Chicago to Cleveland corridor. The northern route assessed was the Norfolk Southern railroad right-of-way through Northern Indiana and Northwestern Ohio to Cleveland. The southern route assessed was a railroad right-of-way formerly



owned by CSX from Gary to Fort Wayne; NS railroad property from Ft Wayne (Mike Junction) through New Haven; NS/M&W right-of-way from New Haven to Liberty Center, Ohio; and the Indiana and Ohio Railroad right-of-way from Liberty Center to the NS right-of-way at Delta (west of Toledo). The infrastructure improvements for the southern route were estimated in 2002 dollars at \$1.2 billion.

Gary Alternative Rail Study, Indiana: Served as deputy project manager and project engineer for the evaluation of several alternative routes for passenger rail service in Indiana within the Cincinnati to Chicago corridor. Under the auspices of the Midwest Regional Rail Initiative (MWRRI) implementation program, the Indiana Department of Transportation (INDOT) requested a comprehensive analysis of route choices that would best serve its home markets while remaining compatible with the greater MWRRI effort. The study assessed the potential benefits of alternative rail service scenarios by evaluating the capital and operating costs, projected ridership and revenues, and the financial and economic returns of each alternative. The **engineering planning** process was used in the initial planning phase of this project.

Wisconsin Rail Plan: Served as the project manager for the engineering assessment of the Chicago to Minneapolis/St. Paul corridor via the Janesville and Eau Claire routes. This assessment supplemented the work included in the Tri-State II High Speed Rail Feasibility Study and the Madison-Milwaukee Rail Corridor Study. The engineering analysis was conducted in cooperation with the affected railroads and WISDOT. The engineering assessment provided an inventory of existing conditions of the rail infrastructure and the capital investments required for the route to support 79 mph and 110 mph passenger train speeds. The infrastructure elements assessed included the track work, passenger stations, railroad bridges over and under, roadway/railroad at-grade crossings, and train control (signal and communications) systems. The route length was 395 miles, mostly on Union Pacific right-of way from Chicago to Harvard, IL; Harvard to Madison through Janesville; Madison to Portage to Camp Douglas, Camp Douglas to Eau Claire; and Eau Claire to St Paul, MN.

Milwaukee to Green Bay Passenger Rail Alternatives Analysis: Served as project manager for the engineering assessment of the Milwaukee to Green Bay route which is a branch line route component of the Chicago to Minneapolis/St Paul corridor, with the Green Bay route splitting at Duplainville, approximately 29 miles west of Milwaukee. The MWRRI Study analyzed 79 mph passenger train operation from Duplainville to Green Bay. In addition to the Duplainville to Green Bay route, an alternative route that departs the Chicago to Minneapolis/St Paul corridor at Grand Ave, approximately 3 miles west of Milwaukee through Granville and West Bend and joining the Duplainville route at Fond du Lac was assessed. This alternatives analysis involved the engineering assessment of the current conditions on these routes and, through a conceptual engineering analysis, determined the infrastructure improvements necessary to operate passenger trains at a maximum speed of 79 mph and also at maximum speed of 110 mph. This alternative analysis also involved the engineering evaluation of the feasibility of rerouting long-distance freight trains along the Black Creek right-of-way near Green Bay.

Kansas City to St Louis Inspection and Infrastructure Analysis of Union Pacific Railroad Right-of-Way: Served as project manager for engineering services needed to conduct an inspection with Amtrak to determine if the additional track infrastructure required to co-mingle the proposed high speed passenger trains with the current and future movements of UP freight trains could be constructed within the railroad right-of-way and to estimate an order of magnitude cost of the additional track infrastructure. A detailed inspection report and order of magnitude cost estimate were completed.

Tri-State II High Speed Rail Feasibility Study, Wisconsin and Minnesota Department of Transportation: Served as project manager for engineering services to undertake a conceptual engineering and environmental analysis for implementing high speed rail service in a corridor between Minneapolis/St. Paul, Milwaukee and Chicago. Technologies evaluated ranged from 110 mph to 186 mph operation. The conceptual engineering included elevated structures for 186 mph technology for the Milwaukee and Minneapolis urban areas; crossing of the Mississippi River at LaCrosse, Wisconsin; and a tunnel in west Wisconsin. The conceptual analysis included cost estimates of each alternative.

Rochester Rail Link Feasibility Study for the Minnesota Department of Transportation: Served as project manager for the engineering assessment of two routes along the Highway 52 corridor to determine the potential for use as a high speed rail connection between Minneapolis-St Paul International Airport and Rochester International



Airport. The two alignments chosen for the engineering assessment were the Tri- State High Speed Rail route and the Highway 52 route. The current conditions along each route were assessed, infrastructure improvements necessary for high speed passenger rail operations operating at speeds of 150 mph and 185 mph were determined, and the capital costs of these improvements were estimated.

Minnesota High Speed Rail Study: Served as deputy project director for the Minnesota High Speed Rail Study, requested by the Minnesota Department of Transportation to evaluate the feasibility of high speed rail service connecting Minneapolis-St. Paul with Duluth, St. Cloud, Mankato and Rochester.

Project Experience – Transit Projects (1998-2007)

Chicago Transit Authority- Design and Construction Phase Services to Replace/Upgrade Signals: Served as principal-in-charge responsible for project management oversight of engineering services for the design, bid, and construction phase services required for replacement/upgrade of the signal and train control system in the Chicago Loop, including design of new control tower and facilities for track maintenance and signal forces. The construction cost was estimated at \$32.7 million.

Transport 2020, Madison, Wisconsin: Served as project engineer and conducted project management oversight for the preliminary engineering required to support a draft environmental impact and a new starts application to the Federal Transit Administration. The engineering services included preparation of standard sections for track/guideway element; typical plans and sections for grade crossings, stations, and maintenance facility; scaled track schematics depicting tracks, sidings, yard, grade crossings, turnouts, and crossovers; plans for alignment alternatives for a downtown street-running rail alignment, commuter rail on the existing freight right-of way, and a bus rapid transit alignment; four typical station site designs; and cost estimates for each alternative.

METRA Rock Island District, Chicago, IL: Served as project manager for the “recovery effort” associated with the final design of the signal and communications network, track realignment, and rehabilitation of three railroad bridges. A “recovery effort” for the final design of this project was necessary due to the acquisition of a related company and a request by the client to revamp the engineering team assigned to the project. The final design product, including plans and cost estimates, was delivered to the satisfaction of the client, and, at the same time, reversed a loss and met profit expectations. The final bid received by METRA was within the cost estimate.

Ann Arbor-Downtown Detroit AA/DEIS Transit Study: Served as project manager and project engineer for engineering services required to support the initial Lansing-Detroit alternative analysis and the commuter rail transit (CRT) alternative of the Ann Arbor-Detroit environmental impact study and new start application. The engineering services included field inspection, conceptual engineering of trackwork and maintenance facilities, and associated capital cost estimates.

Lansing-Detroit Commuter Rail Study, Michigan: Served as principal-in-charge responsible for project management oversight of the engineering services required to assess the current conditions of the railroad right-of-way and determine improvements necessary to operate commuter rail service. Engineering services included field inspection, conceptual engineering of track improvements, and preparation of cost estimates.

Kenosha-Racine-Milwaukee Commuter Link: Provided project management oversight of the engineering services required to support the alternative analysis and environmental studies for this project. Engineering services included field inspection and conceptual engineering of track work, structures, yards and maintenance facilities for the commuter rail alternative and conceptual engineering for the bus rapid transit alternatives. Capital costs for each alternative were estimated.

New Bedford/Fall River Rail Project, MA: Provided project management and *engineering planning* services to Vanasse Hangen Brustlin, Inc for planning and environmental study of the New Bedford/Fall River Rail project for the Massachusetts Bay Transportation Authority.



East-West Gateway Council of Governments, Northside/Southside Study, St. Louis, MO: Provided project management oversight of a study to re-examine the preferred alternatives in each area and undertake conceptual engineering and environmental analysis of the preferred alternative.

Project Experience – Special Rail Projects – 1998 to 2007

Chicago Regional Environmental and Transportation Efficiency (CREATE) Program: Served as principal –in-charge responsible for project management oversight for the development of accurate engineering base mapping for the CREATE program. CREATE seeks to modernize freight and passenger rail infrastructure throughout the Chicagoland area. The program includes 67 defined projects in 120 miles of rail corridor, totaling in excess of \$1.5 billion. The base mapping was provided using modern LIDAR and GPS surveying techniques.

Advanced Train Control System, Lockheed Martin for the Australian Railroad Track Corporation: Served as project manager for engineering services required to support Lockheed Martin in their effort to develop and deploy a network control system across ARTC's 10,000 Km network. The system will enforce speed and authority limits while providing locomotive engineers additional in-cab decision aids. The engineering services provided to support this effort included data assembly including acquisition of track and signal plans for the system; site inspection involving communication measurements and preparation of site inspection reports summarizing the equipment that exists at each location with initial retain or replace consideration; preparation of trade study reports in cost to benefit analysis; and preparation of various site plans and track side drawings.

Federal Railroad Administration Track Maintenance Study Served as project manager for engineering services needed to support Zeta Tech in a joint evaluation of track maintenance costs for high speed rail systems and to prepare a maintenance cost matrix for the entire 3000 mile MWRRS. The FRA study involved the field evaluation of three corridors within the Midwest and the Seattle to Portland corridor in the West. A key issue in the definition of the requirements for new high speed passenger rail operations is that of track maintenance cost to include both maintenance costs considered to be "operating" costs and cyclic costs which are generally capitalized for accounting purposes but represent an ongoing track maintenance expense. Using data from the field evaluation and other historical freight cost data, a series of matrices of track maintenance costs by tonnage was developed, as defined to include both "operating" maintenance costs and cyclic "capital" costs but excluding the one time upgrade cost of track. Using these matrices, the operating and cyclic capital costs for the 3000 mile MWRRS was developed on a route and subdivision basis.

North American Joint Positive Train Control (PTC) to Canadian Pacific Railway Computer Aided Dispatching Interface Project for the Wisconsin Department of Transportation: Served as project manager for engineering services needed to evaluate dispatching (CAD) system details and dispatch operation requirements for use in developing concepts for PTC application and tie into the Canadian Pacific Railway dispatching software. The program involved coordination with Lockheed Martin, Canadian Pacific Railway signal department in Calgary, representatives of the Federal Railroad Administration, and the Wisconsin Department of Transportation.

Dane County Regional Airport Runway Safety Area Railroad Relocation, Madison, WI: Served as project manager for the initial planning and provided project management oversight for the engineering required to realign and reconstruct the Canadian Pacific Railway Madison-Portage branch through the Cherokee Marsh north of Madison, WI. The project relocated a freight railroad track and grade crossing top provide clearance for the runway protection zone in compliance with FAA regulations. The new alignment crossed a deep wetland using precast concrete bridge segments on steel piles and cast in place pier caps. The 3000 ft bridge was constructed using "over the top" construction techniques. The **engineering planning** process was used in the initial phase of this project.

Project Experience – Magnetic Levitation Technology

SANDAG Maglev Study: Served as project manager for the preliminary engineering and design analysis for a dedicated Intermodal right of way link between San Diego and the proposed Regional International Airport in Imperial



Valley including a feasibility study and cost benefit analysis evaluating the comparative options of dedicated highway or highway lanes, Maglev and conventional high speed rail or any combination thereof.

Tampa to Orlando: Served as project manager and project technical lead for General Engineering Consultant services provided to the Florida High Speed Rail Authority for the Design, Build, Operate, Maintain, and Finance (DBOM&F) of the initial segment of the proposed High Speed Ground Transportation System (HSGTS) in Florida. The services involved the analysis of various high speed ground technology systems including the electromagnetic Transrapid Maglev system

Tri-State I Feasibility Study: Served as deputy project director and project engineer for a study to evaluate the potential for high-speed rail service, including magnetic levitation technology between Chicago and Minneapolis-St. Paul for the Minnesota, Wisconsin and Illinois Departments of Transportation. The study consisted of two broad corridors through Wisconsin. The Study evaluated the use of super conducting magnets and linear motor technology to propel passenger vehicles on elevated to speeds up to 300 mph.

Argonne National Laboratory Design: Served as project director for the conceptual analysis of the Argonne National Laboratory Maglev experimental facility proposed to include an elevated guideway extending for a distance of two miles. The concept involved a three metric ton vehicle, propelled by a linear synchronous motor installed on the guideway proposed to operate at speeds up to 150 mph. The concept was to configure a guideway either as a double TEE or as a box and slab, two meters wide with the prestressed concrete beams supported by piers spaced at distances of 13.5 meters and with the deflection of the span of 1:1000. These conceptual configurations were chosen to provide the capability of evaluating a wide variety of alternative Maglev concepts.

National Maglev Initiative Evaluation: Served as principal-in-charge responsible for project management oversight for evaluation of guideways for structural stability, construction, and maintenance as proposed by Bechtel, Magneplane, Grumman and Foster Wheeler for the National Maglev Initiative, U.S. Army Construction Engineering Research Laboratory.