ABSTRACT

The O’Hare Modernization Program (OMP) is one of the largest construction projects in the country at one of the world’s busiest airports, and is managed by the Chicago Department of Aviation (CDA). The OMP is transforming O’Hare International Airport from a system of intersecting runways into a modern parallel runway configuration.

The UPRR freight mainline between Proviso and Wisconsin runs along the southwest side of O’Hare. Eight miles of this route was relocated 50 years ago to allow for the initial construction of O’Hare. History repeats itself as the current OMP plan requires the relocation of 2.5 miles of the same rail line.

In 2007, the UPRR was relocated to an interim alignment that allowed the airport expansion to continue construction while properties needed for expansion were being acquired. The final rail realignment was completed in Spring 2012. Five miles of double track mainline was laid, including two new railroad over highway bridges; two new railroad over rail bridges; one shoo-fly bridge; and numerous retaining walls.

This paper addresses the challenges of designing and constructing the railroad relocation amongst a wide range of overlapping airport and local construction projects. The presentation will also discuss the solutions, coordination and cooperation necessary to complete this mega-project from the different representatives’ perspectives. AREMA members, many of whom will be flying into and out of O’Hare for
the conference, will benefit from learning about the unique aspects of designing a railroad relocation project near one of the world’s largest airports.

INTRODUCTION

O’Hare Airport Modernization

Chicago O’Hare International Airport (O’Hare) is one of the busiest airports in the world, not only measured by number of passengers, but in aircraft movements as well. The $6.6 billion O’Hare Modernization Program (OMP), once complete, will modernize the airport with six east-west parallel runways and two crosswind runways. This modern parallel runway configuration will reduce flight delays and increase capacity. The OMP Plan also includes a future western terminal that would greatly enhance access to the airport and provide a direct link to the surrounding suburban areas including DuPage County and western Cook County.

O’Hare’s existing airfield has seven runways, which all intersect except for one. The current runway configuration grew out of the philosophy, at the time, for airports to have runways in many different compass orientations so that landings and takeoffs could be adjusted for changing wind directions. Modern airfield layouts typically take advantage of improvements in jet aircraft engine power and more sophisticated navigational aids.

Union Pacific Railroad

The Union Pacific Railroad’s (UPRR) double tracked Milwaukee Subdivision main line between Proviso Yard (west of Chicago) and Wisconsin runs along the south and west side of O’Hare. Approximately eight miles of this former Chicago and North Western route were relocated more than 50 years ago to make room for the initial construction of O’Hare as Chicago’s primary
airport. The OMP plan required relocating about three miles of this Milwaukee Subdivision two more times – once onto a temporary interim alignment and then to a final alignment.

The existing alignment of the double-track mainline, heading northward from Proviso Yard, included a 60-foot long three-span deck plate girder bridge over Franklin Avenue, then crossing Canadian Pacific’s (CP) Bensenville classification yard on an 89-foot long through plate girder and a 131-foot long riveted through truss bridge. North of the Bensenville Yard, the UPRR crosses Metra’s Milwaukee District West Line on a 76-foot long through plate girder bridge and Irving Park Road on a two-span, 145-foot long through plate girder bridge.

The bridges were constructed in 1911, except for the Irving Park Road bridge, which was built in 1954 as part of the initial relocation around the airport. The track alignment curves westward then northward the western perimeter of O’Hare. The UPRR continues north and northwest towards Deval Junction in Des Plaines and ultimately into Wisconsin.

**The Village of Bensenville, Irving Park Road and the Bensenville Ditch**

Expansion of the airport also meant relocation of two other equally important pieces of existing infrastructure, Irving Park Road and the Bensenville Ditch. Irving Park Road (Illinois Route 19) is a regional arterial four-lane roadway. Owned and maintained by the Illinois Department of Transportation, Irving Park Road carries over 35,000 vehicles per day. The Bensenville Ditch is a major waterway under the jurisdiction of the Illinois Department of Natural Resources. It drains over two square miles of suburban development along with much of the airport and has a history of flooding.
Re-alignment of all three elements, the UPRR, Irving Park Road and Bensenville Ditch, were located within a corner of the Village of Bensenville, requiring the acquisition of 611 parcels of property including over 300 residential homes and some industrial properties.

**INTERIM UPRR AND BENSENVILLE DITCH RELOCATIONS**

In 2003, TSD Rail Specialists (TSD) was selected by the OMP to be the design engineer for final design of the rail relocation project. TSD is a joint venture led by TranSystems and includes the firms Delta Engineering, Rubinos and Mesia, Wang Engineering, and Parsons Brinckerhoff.

The first obstacle to overcome was the acquisition of the 611 parcels within the south airfield area. Due primarily to legal challenges, and secondarily to the logistics of purchasing this number of properties, it was evident that land acquisition would not be completed in time to construct the UPRR and Bensenville Ditch relocations to their final alignments and meet the OMP original construction schedule.

With land acquisition threatening to delay the Program, OMP strategized with TSD to identify courses of action to keep the expansion on track. The work-around plan that was developed involved relocating the UPRR and the Bensenville Ditch to temporary “interim” alignments. These interim alignments relocated the UPRR and the Bensenville Ditch partway between their existing and final alignments. Both interim alignments stayed north of Irving Park Road on land mostly owned by the airport, thus requiring minimal right-of-way acquisition.

Interim relocation of the railroad and ditch opened up enough additional land in the South Airfield to construct and operate the extension of Runway 10L/28R, to construct and partially operate the extension of Runway 10C/28C, and to relocate an existing Federal Express cargo facility to its ultimate location. The interim alignments were envisioned to be used three to five
years, during which time the land acquisition issues could be resolved and the construction of the UPRR and the Bensenville Ditch to their final positions could take place. Implementation of this plan underwent a cost/benefit review that determined the value of time savings in moving forward with the Program outweighed and the cost of relocating the railroad and ditch one additional time.

**FINAL UPRR RAIL ALIGNMENT**

Final realignment of the UPRR involved relocating the UPRR from its interim location to a permanent alignment at the far south and far west perimeters of the new O’Hare property limits, providing the maximum amount of room for the airport improvements to be constructed. Over 2.8 miles of double-track mainline railroad was constructed to Union Pacific standards using concrete ties and all new track material. The design speed for the rail is 50 mph with a maximum curvature of three degrees and a maximum vertical grade of 0.65%.

Structures included four new rail overpasses at Irving Park Road, Metra’s Milwaukee District West Line, the Canadian Pacific’s Bensenville Yard, and Franklin Avenue, replacing all of the existing bridges. The new structures include a 138-foot long single-span through plate girder, a 112-foot long single-span through plate girder, an asymmetrical two-span (82-feet and 128-feet long, respectively) through plate girder carrying a curved alignment, and a 109-foot long single-span steel girder bridge with a concrete deck. A temporary fifth bridge was built that consisted of a 173-foot long three-span steel plate girder open deck bridge carrying a shoofly rail...
alignment over Franklin Avenue during construction of the permanent bridge over Franklin Avenue.

The UPRR alignment is located mostly on an elevated embankment because the distance between bridges prevents the track from being lowered back down to existing grade. Over 90,000 square feet of precast modular retaining walls were also constructed to support the new railroad embankment.

**Project Challenges**

The total construction value of the track, road and ditch relocations is over $125 million and the work was spread over six main construction packages ranging in size from $12 million to $35 million. Many challenges covering design, construction and coordination were encountered along the way. Some of the most interesting and unique barriers are described in the following paragraphs.
The southern edge of the O’Hare expansion borders Metra’s rail line carrying commuters between downtown Chicago and the northwest suburbs. Proposed Runway 10R/28L is located in an east west direction, less than 300 feet from the final alignment of the UPRR. FAA vertical and horizontal clearances to the proposed runway created an area, approximately a half-mile in length, where Metra, UPRR, Irving Park Road and the Bensenville Ditch were located within a tightly constrained corridor known as the “pinch point”.

The available width of the corridor was less than 250 feet and had to accommodate a waterway with a top width of over 100 feet, four roadway traffic lanes plus a median, two UPRR mainline tracks plus an access road, and two existing Metra tracks. Under unconstrained conditions, these individual elements could easily require 400 feet in total width. Making the situation more complicated was the fact that UPRR is on an elevated embankment 15 to 20 feet above Irving Park Road and the Metra tracks. The solution was multi-faceted and included:

- Bury the Bensenville Ditch in a 4,500-foot long, double 11-foot by 7-foot box culvert. The double-box culvert was both expensive and regulatory challenging to obtain approval to bury a major waterway for over $\frac{3}{4}$ of a mile in length.
- Limit the amount of right-of-way needed for the elevated UPRR embankment by constructing retaining walls on both sides of the track.
- Purchase 20 feet of right-of-way and easements from Metra and shift the UPRR as far south as possible, away from the runway.
• Limit the median width between eastbound and westbound Irving Park Road to 18 feet. Normally a 30-foot wide median, this narrower median was acceptable to IDOT because there was not a possibility for future turn lanes in this stretch with the runway to the north and the railroad to the south.

**UPRR Shoofly/Construction**

**Staging**

Staging of the construction was a major challenge. All modes of transportation, including air traffic, three freight railroads with an active classification yard and an industrial lead track to a major candy maker, a commuter rail line, and 35,000 vehicles per day, had to be operating safely and smoothly during all construction activities.
To maintain two active UPRR tracks a 1,500-foot long temporary shoofly alignment was constructed at the south end of the project. Rail traffic was shifted onto the temporary alignment for a 12 month period while the new rail bridge over Franklin Avenue was constructed. The shoofly construction required two major structural elements. A three-span plate girder bridge with an open deck was constructed over Franklin Avenue and 600 feet of 20-foot high soldier-pile retaining wall was installed to support the shoofly tracks.

The shoofly alignment was complicated by several issues. An industrial lead track located within the length of the shoofly and had to be maintained. The industrial lead supplied materials to an active Nestle candy plant. The plant operated year round, but its peak seasons were before Halloween, Christmas and Easter. Track outages were allowed only in late Spring and had to be carefully coordinated with Nestle.

The soldier-pile temporary retaining wall was constructed along the existing property line of the UPRR and bordered on Interplex Daystar’s 60,000 square foot production facility. Interplex Daystar is a custom metal stamping and insert molding company specializing in precision stamping and rotary insert molding. Their facility, located within 30 feet of the temporary wall, was extremely sensitive to potential vibration caused pile-driving activities. A number of solutions were investigated to mitigate impacts due to vibration including limiting pile driving activities to off-peak hours. The ultimate solution was to pre-core the piles to a ten-foot depth to minimize vibrations. This technique was utilized to avoid potential impacts to an existing Magellan gas product pipeline that was located within a few feet of

Figure 7 – UPRR Through Plate Girders at Irving Park Road
the pile driving activities. Eventually, the Magellan pipeline was relocated because it interfered with the proposed Franklin Avenue bridge.

**PROJECT TIMELINE**

The modernization of O’Hare International Airport has been a phased process with the Program being first announced on June 29, 2001. Funding agreements with the airlines for the initial Phase One design and construction were reached in 2003. A Record of Decision from the Federal Aviation Administration was received on September 30, 2005 with Phase One construction beginning immediately afterward. In 2007, two miles of the Union Pacific Railroad double-track mainline was relocated to the interim alignment to enable the airfield expansion to continue while residential and commercial properties in the Village of Bensenville in the southwest corner of the airport was being acquired.

Two of the first three runways were completed in 2008 along with a new North Air Traffic Control Tower. In 2010, the property acquisition in the southwest airfield was completed allowing Irving Park Road to be relocated and the Union Pacific Railroad and the Bensenville Ditch to be placed on their final alignments. May 8, 2012 marked the cutover from the interim configuration to the final railroad alignment. Relocated Irving Park Road and Bensenville Ditch are scheduled to be completed by the end of September 2012.

**STAKEHOLDER INVOLVEMENT**

Proactive stakeholder involvement and cooperation was the most impressive accomplishment of the project and the key to its success. Airport Commissioner Rosemarie Andolino and City of Chicago Mayors Richard Daley and Rahm Emmanuel displayed strong leadership and support throughout the process. Transparency by the airport and coordination with all stakeholders
maintained a level of trust and cooperation among all involved parties. The Union Pacific Railroad exhibited an outstanding and active level of involvement. Over a six-year period, regular bi-weekly meetings were held with UPRR to advance issues with the project. Other key stakeholders included the Illinois Department of Transportation, Metra, and the Canadian Pacific.

SUSTAINABILITY

One of the guiding principles for the O’Hare Modernization Program is sustainable design. The Chicago Department of Aviation (CDA) was the first in the nation to develop sustainability guidelines for airports when it unveiled its Sustainable Design Manual (SDM) in 2003. The SDM was replaced in 2009 with the new Sustainable Airport Manual (SAM). CDA’s goal is to incorporate sustainable, cost effective initiatives in every aspect of airport planning, design and construction. The UPRR relocation project embraced the airport’s sustainability initiatives. Nearly 100 percent of all recoverable materials including dirt, concrete and asphalt was utilized on site, diverting it from landfills and saving thousands of truck trips. Central concrete and asphalt crushing operations were established on site and controlled so that contractors would not have to haul materials off-site for recycling. A detailed earthwork management plan was developed that allowed the nearly two million cubic yards of embankment material moved during construction
of the UPRR, Irving Park Road and Bensenville Ditch to remain on-site with no imported materials.

CONCLUSIONS

The relocation of the Union Pacific Railroad was achieved on schedule and under budget and was done in a manner that minimized disruptions to the Union Pacific and enabled the O’Hare Modernization Program to remain on schedule. The achievement of this outcome was only possible as a result of the tremendous cooperation and focus of all stakeholders to a common goal of making the airport modernization program a success, despite often conflicting agency needs and requirements. It is a model example of how local, state and federal government can successfully partner with private industry for the benefit of the community, and in this case, the entire country.

Figure 1- O’Hare Modernization Program Airport Layout Plan

Figure 2 – UPRR Through Plate Girder Bridge over Metra

Figure 3 – Southwest Airfield Overall Plan

Figure 4 – Precast Modular Retaining Wall Construction in Pinch Point Area

Figure 5 – Pinch Point Cross Section

Figure 6 – Pinch Point Area

Figure 7 – UPRR Through Plate Girders at Irving Park Road

Figure 8 – UPRR over Bensenville Yard New and Old Bridges
UPRR Relocation for the O’Hare Modernization Program

Martin Ross, PE
Vice President/Senior Associate
TranSystems
1475 East Woodfield Road, Suite 600
Schaumburg, IL 60173
O’Hare Modernization Program

- $6.6B Program
- 6 Parallel E/W Runways
- 2 Crosswind Runways
- Plan includes future Western Terminal
Southwest Airfield

- UP, CP and Metra
- Bensenville Yard
- Irving Park Road
- Bensenville Ditch
- Industrial Development
- Residential Homes
- Two Cemeteries
Union Pacific Railroad

- Original Chicago and Northwestern Route
- Double track mainline between Wisconsin and Proviso Yard
Union Pacific Railroad

- Relocated in 1956 along with Irving Park Road
- Bridges over:
  - Irving Park Rd
  - Metra/CP
  - Bensenville Yard
  - Franklin Ave
Interim UPRR Relocation

- **Obstacles**
  - 611 Parcels of Land Acquisition
  - Political opposition from Bensenville
  - Bensenville Ditch Permitting

- **Solutions**
  - Interim UPRR Realignment
  - Interim Bensenville Ditch Relocation
  - Construct 10L/28R Extension
  - Partial Construction of 10C/28C
  - Relocate Fed Ex Facilities
Final UPRR Realignment

- 2.8 miles of double track mainline
- 50 mph
- 3 degree curves
- 0.65% Max Grade
- 4 New Overpasses
  - Irving Park Rd
  - Metra/CP
  - Bensenville Yard
  - Franklin Ave
- Temporary Shoofly Bridge over Franklin Ave
- Relocated Irving Park Rd
- Relocated Bensenville Ditch
Future Western Access

- $2B Program to expand access on west side of O’Hare
- Connections at:
  - Irving Park Rd
  - Franklin Ave
- Overpasses at:
  - Irving Park Rd
  - Franklin Ave/UPRR
- Underpass at:
  - Bensenville Yard
  - Relocated UPRR
Project Challenges
Pinch Point Area

- Challenge:
  - Runway 10R/28L Clearances
  - Limited ROW
  - Elevated UPRR
Project Challenges
Pinch Point Area

- Solutions:
  - Bury Bensenville Ditch
  - Build Retaining Walls
  - Purchase ROW from Metra
  - Reduced Median Width on Irving Park Rd
Project Challenges
Pinch Point Area
Project Challenges
Construction Staging
Project Timeline

- June 29, 2001
  - OMP First Announced
- 2003
  - Funding Agreements reached on Phase 1
- September 30, 2005
  - FAA Record of Decision
- January 2006
  - UPRR Design Begins
- January 17, 2008
  - Interim RR in Operation
- 2008
  - Runways 10L/28R and 9L/27R Open
  - North Air Traffic Control Tower
- 2010
  - Property Acquisition Complete
- May 8, 2012
  - UPRR Cutover to Final Alignment
- October 2012
  - Irving Park Rd and Bensenville Ditch Relocations Completed
Stakeholder Involvement

- Strong City/Airport Leadership
  - Commissioner Rosemarie Andolino
  - Mayors Richard Daley and Rahm Emmanuel
- Union Pacific Railroad
  - Unprecedented Cooperation
  - Bi-weekly Meetings over 6-year Period
  - Furnished all track material
  - Precast Modular Wall Procurement
- Illinois Department of Transportation
  - Western ByPass Coordination
  - Irving Park Road Relocation
- Canadian Pacific and Metra
- Transparency, Trust and Cooperation = Success
Old and New Bridges
UPRR Relocation for the O’Hare Modernization Program

Martin Ross, PE
Vice President/Senior Associate
TranSystems
1475 East Woodfield Road, Suite 600
Schaumburg, IL 60173