RELOCATION OF UNION PACIFIC MAINLINE
FOR THE MODERNIZATION OF O’HARE AIRPORT

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ABSTRACT

The Union Pacific’s two-track Milwaukee Subdivision freight main line between Proviso Yard (west of Chicago) and Wisconsin runs along the West side of Chicago’s O’Hare International Airport. About eight miles of this former Chicago and North Western route were relocated 50 years ago to make room for the initial construction of O’Hare as Chicago’s main commercial airport. The City of Chicago has begun a $6.6 billion program to modernize O’Hare, which will require about three miles of the same rail line to be relocated two more times over the next three years – once onto a temporary alignment, and then to a final alignment around the airport’s expanded perimeter.

This paper addresses the challenges of designing and constructing the railroad relocation project amongst a wide range of overlapping airport and local construction projects. In addition, the railroad relocation is related to the overall O’Hare Modernization Program (OMP) megaproject by discussing the background and organization of the OMP. It is the authors’ intention that AREMA members, many of whom have flown in and out of O’Hare, will benefit from learning about the experiences described in this paper, especially the unique aspects of designing a railroad project near an airport.
I. OMP Background

For his heroic act of almost single-handedly saving the aircraft carrier U.S.S. Lexington and the 2,000 sailors, aviators and their airplanes on the ship from an incoming attack by nine Japanese bombers in February 1942, Lieutenant Edward H. (Butch) O'Hare was designated the U.S. Navy's first "Ace" pilot of World War II, and was awarded the Congressional Medal of Honor. O'Hare gave his life in air combat later in the war when he was just 29 years old. Today he is memorialized in the name of one of the world's busiest airports - O'Hare International, in his hometown of Chicago, Illinois (1).

The airport, which during World War II was known as Orchard Field (hence the airport code ORD), had been constructed in the rural community of Orchard Place, about 16 miles west of downtown Chicago, for use by the Douglas Aircraft Company to produce military aircraft for the war. One of the reasons for selecting this location was its proximity to rail service. When the war ended, Chicago quickly established itself as the world's busiest civil aviation operation, but it was the city's Municipal Airport, later to become Midway, which held the title. The Chicago city council saw the potential for air travel and decided a second major facility would be needed. In 1946, they bought Orchard Field from the US government along with 7,000 acres of adjacent land. Three years later, $2.4 million was spent to acquire more land and Orchard Field was re-named O'Hare in honor of the young war hero. The airport opened to domestic commercial flights in 1955. By 1962, most scheduled operations were transferred from Midway to O'Hare, making O'Hare the world's busiest airport.

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.
The City of Chicago's O'Hare Modernization Program (OMP) was first announced on June 29, 2001. The OMP will reconfigure O'Hare International Airport's intersecting runways into a more efficient and modern, parallel configuration, similar to airfields at Dallas/Fort Worth and Atlanta Hartsfield airports. The $6.6 billion program will substantially reduce delays in all weather conditions and increase capacity at the airfield, allowing O'Hare to meet the region's aviation needs well into the future. In the future, the OMP will add a new western terminal facility with more airline gates and parking.

The OMP is acquiring 433 acres of land in Chicago and various municipalities surrounding the airport under the guidelines of the federal Uniform Relocation and Real Properties Act. Funding for the OMP comes from a variety of sources including Passenger Facility Charges, General Airport Revenue Bonds, and federal Airport Improvement Program funds. No local or state taxpayer dollars are being used to fund the OMP.

The modernization of O'Hare's airfield will be a phased process. In 2003, the OMP reached an agreement with the airlines at O'Hare to fund Phase One of the program. Phase One includes $2.9 billion of design and construction. The major Phase One elements are comprised of two groupings, including:

North Airfield

- Construct Runway 9L/27R and associated taxiways
- Construct North Airfield control tower
- Runway 14L-32R threshold displacement
- Relocate large-diameter municipal water main
- Relocate Mt. Prospect Road employee access roadway and Guard Post 1
South Airfield

- Relocate Union Pacific rail line
- Remove existing berms
- Relocate air cargo facilities
- Relocate Bensenville Ditch
- Extend Runway 10L/28R
- Construct Runway 10C/28C and associated taxiways

The OMP received their Record of Decision from the Federal Aviation Administration on September 30, 2005. Phase One construction began immediately afterward, and will continue for several more years. At the present time, construction is underway on numerous projects in both the North and South Airfields. As of May, 2007, the OMP had awarded $652.8 million in construction contracts. The airport will remain fully operational throughout the OMP construction period. In addition to the new construction, during the time of OMP construction, the airport, like a railroad or other transportation facility, will continue to perform normal maintenance and construction activity on their existing infrastructure.

The O’Hare Modernization Program is a City of Chicago initiative, separate from the City’s Department of Aviation which is responsible for airport operations. The OMP is led by a Director, who reports to the Mayor. Deputy Directors and support staff oversee various functions in the OMP, supported by a consultant Program Management Oversight (PMO) team responsible for design management, coordination and project controls. A consultant Master Civil Engineer (MCE) team performs preliminary design, review of final design and project integration for all of the work in the project. The MCE also performs field survey and geotechnical investigations for OMP projects, and develops project standards and standard specifications. Task order engineering consultants perform final design for each element in the program. A consultant construction management team oversees construction activities.
II. Railroad Background

Two railroad lines crossed the airport site in Orchard Place prior to O'Hare's initial expansion in the 1950's. The Chicago and North Western Railroad's double track "New Line" ran due north through the site. The New Line (originally called the Des Plaines Valley Railway) was built in the early 1900's to allow trains on C&NW's freight line from Wisconsin to bypass Chicago and directly access Proviso Yard in suburban Northlake, Illinois. The Chicago, Milwaukee, St. Paul and Pacific Railroad (the Milwaukee Road) also had a three mile-long, two-track freight line through the site, on an S-curve alignment from Bensenville Junction, also known as Tower B-17, at the west end of the Milwaukee's Bensenville Yard, northward to a connection with C&NW's New Line. The Milwaukee used the New Line as a shortcut for Wisconsin-bound freight trains, operating on trackage rights from Bensenville to Techny, Illinois. In 1954, the initial airport expansion required the relocation of about eight miles of the C&NW's New Line westward around the airport's expanded property. The Milwaukee's connection track was relocated accordingly. Since 1995, the New Line has been owned by the Union Pacific. It is officially known as the Milwaukee Subdivision of the Chicago Division. The Milwaukee Road's connection tracks switched ownership twice, first to Soo Line and then to Canadian Pacific, the current owner. Both lines remain freight-only.

Heading northward from Proviso Yard, the Union Pacific's two-track line currently crosses over Green Street on a 60 foot, 3-span deck plate girder bridge, and then crosses Canadian Pacific's Bensenville classification yard on an 89 foot through plate girder bridge and a 131 foot riveted through truss bridge (Figure 1). The line then crosses Metra's Milwaukee West line on a 76 foot through plate girder bridge and then Irving Park Road on a 2-span, 145 foot through plate girder bridge. The bridges were constructed in 1911, except the Irving Park Road bridge, which was built in 1954 as part of the initial relocation around the airport. The line curves westward, crossing Division Street at grade at an unsignalized crossing, and then curves northward along the western perimeter of the O'Hare airport. Two Canadian Pacific tracks from B-17 Junction in Bensenville join the Union Pacific line at CP Bryn Mawr. The Union Pacific line then curves
eastward around the northwest corner of the airport and then continues north and northwest towards Deval Junction in Des Plaines and ultimately into Wisconsin. The current project will be the second time in the New Line’s history that it was relocated for airport improvements.

III. UPRR Relocation – Concept Design

An Airport Layout Plan (ALP) is a federally-approved set of drawings and documents that sets forth the airport’s existing conditions and development plans. The Federal Aviation Administration (FAA) requires that an airport keep its ALP updated at all times. For a large and
complex project such as the OMP, the O'Hare ALP document is quite the drafting marvel in that all of the program elements are shown in color-coded plan view on a single sheet of paper (Figure 2).

It was recognized early on that relocating the UPRR's line that runs along the southwest corner of the airfield, in conjunction with land acquisition in this area, would provide the much-needed room for the improved airport facilities. In creating the O'Hare ALP, the OMP looked at several conceptual options for relocating the UPRR tracks, both to the east of the airport and to the west. An east side relocation would have involved using the former Wisconsin Central (now CN)
north/south line located east of the airport, through Schiller Park and Des Plaines, with new
connections to the Union Pacific at the north and south ends. This line sees a heavy volume of
freight trains as well as Metra North Central commuter trains. A west side relocation would push
the existing UPRR line to the southwestern perimeter of the expanded airport property, in an area
where the airport already needed to acquire land for airport operations. The west-side relocation
was determined to have the fewest impacts, and it was this option that was included in the ALP.

In 2002, the Master Civil Engineer (MCE) consultant team began preliminary designs for each
sub-project in the OMP. As part of the preliminary design work for the railroad relocation, the
PMO worked with the MCE to refine and value-engineer the rail alignment shown in the ALP at
that time. The MCE determined that the alignment could be improved by reducing the skew of
the proposed Union Pacific bridges over Canadian Pacific’s Bensenville Yard and Metra, which
would enable shorter, less expensive and more constructable bridges to be used. This caused
the northern approach to the bridges to extend further into (future) airport property, but this land
was not developable anyway due to its proximity to future Runway 10R/28L. Union Pacific,
Canadian Pacific and Metra all preferred the change. A favorable cost/benefit review as well as a
determination that the change did not violate aircraft navigational clearances led to the adoption
of the alignment change in a subsequent update of the O’Hare ALP in October 2003.
IV. UPRR Relocation – Interim Alignment

In 2003, TSD Rail Specialists was selected by the OMP to be the task-order consultant for final design of the rail relocation project. TSD is a joint venture led by TranSystems and includes the firms of Delta Engineering, Wang Engineering, Rubinos and Mesia and Parsons Brinckerhoff. TSD received notice to proceed with their first task for the project late in 2004. The reason for the lag between selection and NTP was that it had become evident to the OMP that two of the key, critical-path elements of the OMP project were going to be delayed, and some re-thinking about the direction of the Union Pacific relocation was needed. Figure 3 summarizes the projects in the Southwest Airfield that were critical to runway construction.

![Figure 3: Southwest Airfield Critical Path Projects](image)

The first obstacle to overcome was land acquisition. 611 parcels were required for the South Airfield area (see Figure 4). Due primarily to legal challenges, and secondarily to the logistics of purchasing this number of properties, it became clear that land acquisition would not be completed in time to construct the railroad relocation shown in O’Hare’s ALP according to the original schedule.
The second obstacle was the proposed grade separation project involving Irving Park Road, York Road and the Canadian Pacific line between B-17 Junction and CP Bryn Mawr. This location is one of the 25 most-needed roadway/railroad grade separations as identified in the Chicago Region Environmental and Transportation Efficiency (CREATE) Program. Two main roads (York and Irving Park) intersect immediately adjacent to the at-grade crossing of Irving Park Road with the Canadian Pacific's two-track connector line between Tower B-17 at the west end of Bensenville Yard and their connection with the Union Pacific's New Line at CP Bryn Mawr. Trains moving through this crossing do so at slow speeds, as the curvature south of the crossing is severe, coupled with the fact that most trains are either entering or leaving Bensenville yard at slow speeds. This location becomes a major bottleneck to motor vehicle traffic whenever trains are present, which can occur up to 20 times per day.
The O’Hare ALP calls for the Union Pacific line to be relocated westward, to an alignment directly along the east of the Canadian Pacific’s line in this area. Recognizing that new at-grade railroad crossings for the UPRR across Irving Park Road would be unacceptable, and that construction of the UPRR line as shown in the ALP would be an integral part of the grade separation project, the OMP reached out to local and state agencies, as well as to the Canadian Pacific Railroad, to include a solution for a complete grade separation of the existing CPRR and new UPRR in the ALP. The aggregation of the work at this location would lead to efficiencies in design, construction and schedule control.

Subsequently, however, the completion of the required environmental study (performed by others) for the work at this location was delayed to an extent that indicated the grade separation project could not be constructed within the OMP’s required timeframe. As previously noted, this work was on the OMP’s critical path. The grade separation was needed to relocate the Union Pacific tracks, which was needed to construct the South Airfield runways and other facilities.

Thus, with land acquisition and the Irving Park Road grade separation wrenches in the works, the OMP strategized to identify actions that could keep things on track. Fortunately, three years beforehand, the OMP recognized that the grade separation project and land acquisition schedules had a high level of schedule uncertainty. At that time, they had formulated a rough work-around strategy in case these became real impediments to the program’s schedule. The workaround plan involved relocating the Union Pacific line to a temporary, “interim” alignment about half-way between the existing UPRR line and the final ALP alignment (Figure 5). This interim alignment would stay entirely north of Irving Park Road, on land mostly owned by the airport already, thus requiring minimal land acquisition and at the same time completely avoiding any impacts to Irving Park Road. The interim alignment would open up enough additional land in the South Airfield for the OMP to construct and operate the extension of Runway 10L/28R, to construct and partially operate Runway 10C/28C, and to relocate most cargo facilities. The proposed southernmost runway, Runway 10R/28L, could not be constructed, but this was
acceptable because this runway is in Phase 2 of the OMP, to be constructed at a future time. The interim alignment was envisioned to be used for two or three years, during which time the remaining issues with the Irving Park Road grade separation and land acquisition could be resolved, and construction of the final ALP alignment could take place. The OMP performed a cost/benefit review of implementing the interim alignment plan and determined that the value of the time savings in moving forward with the Southwest Airfield projects outweighed the cost of relocating the railroad one additional time.
The decision to proceed with an interim relocation was not completely without serious issues that needed to be resolved. Naturally, Union Pacific Railroad buy-in was needed. In addition, there were two cemeteries potentially in the path of the interim alignment. These cemeteries had historical significance and impacts to them were of concern to the religious congregations to which they were connected. Another issue was the public road (Division Street) that crossed the existing Union Pacific line at an unsignalled public grade crossing. The road’s primary purpose was to provide access to the cemeteries. The location of the interim alignment also affected the constructability of air cargo facilities. The existing cargo facilities stand in the way of new runways and taxiways and need to be relocated. The interim alignment conflicted in part with the relocated cargo facilities.

Several variations of the alignment of the interim rail line were studied by the OMP’s Master Civil Engineer. The alternatives made various amounts of additional land available for Southwest Airfield construction, by varying the amounts of land acquisition the rail line would need. Ultimately, an interim alignment was chosen that required only a small, undeveloped portion of one industrial property. The interim alignment was located south of both cemeteries, and a new grade crossing at Division Street was designed to continue to allow public access to the cemeteries. Air cargo facility impacts were mitigated through additional construction phasing and the use of certain temporary parking locations for the cargo facilities until the final build-out occurs after the interim rail line is removed. A landside road to serve the cargo facilities was designed to provide access to the cemeteries, so after the cargo road is constructed, the Division Street grade crossing can be removed.

TSD Rail Specialists was authorized to begin final design for the interim alignment in January 2006. OMP’s Project Management Oversight team manages the task order design contract and coordinates bi-weekly meetings with the Master Civil Engineer, the railroads and other stakeholders.
The length of relocated track from end to end for the interim alignment is about 11,000 feet, and is roughly bounded by the Irving Park Road bridge to the south, and by CP Bryn Mawr to the North. Design followed Union Pacific Railroad and OMP standards. The design speed for the interim alignment is 40 miles per hour for the 3.5 degree curve to the left, north of Irving Park Road, and 50 mph for the two subsequent 3 degree curves to the right, although all track is located within yard limits having a maximum speed of 20 mph by rule. The relocation will increase the length of each track by approximately one tenth of a mile. The vertical gradient varies from 0.06% to 0.30% (existing grades are generally around 0.24%). Vertical alignment was influenced by the need to maintain the required aeronautical clearance envelope above the tracks, at the end of Runway 10L/28R.

A 12 foot wide access road using railroad subballast material will be constructed on the west side of the tracks, with connections to the existing access road to the north and Division Street near the middle of the alignment. A third party fiber optic conduit system will be installed under the access road for the length of the project, to replace conduits in the existing right of way.

A significant challenge from the beginning was coordinating the rail relocation design with the numerous other projects being designed concurrently in the South Airfield. The issues included both physical design interfaces and the timing of adjacent projects with respect to the railroad project. Some of the more interesting issues that were successfully handled throughout the interim rail design project are described below.

**Earthwork:** The existing property on which many of the new Southwest Airfield projects are being constructed contained large earthen berms consisting of over six million cubic yards of material from past airport projects. These berms had served as noise and visual barriers for the airport, but the land they occupied was now needed for the modernization program. The interim alignment traverses through the middle of these berms, which are being removed in a separate OMP project. The Master Civil Engineer and mass grading task order consultant designed
earthwork disposal sites on portions of airport property that will either not be used for facilities, or else will not be needed for construction until later phases of the OMP. Complicating matters for the railroad relocation was that the main disposal site is at the west end of Runway 10L/28R, straddling the proposed interim railroad alignment. The disposal area acquired the nickname "loaves of bread" because of the resemblance of the multiple long, parallel mounds of dirt to these bakery products. The drainage from the loaves of bread had to be both integrated into the interim rail drainage ditch system and be functional after the interim rail line was removed and the vacated right of way was filled up with more excess earth material.

The OMP’s mass grading contractor began work while design for the railroad relocation was still being performed. The OMP decided that it would be most efficient for the mass grading contractor to prepare the grading for the interim rail line in the area of the "loaves of bread" as described above. TSD provided the rail grading design to the mass grading designer who incorporated this into a change order for the contractor. Proof-rolling provisions were incorporated into the railroad contract earthwork specifications to cover the separation of the mass grading contractor work (subgrade) and the railroad contractor’s work (subballast and everything above).

Drainage: The site is relatively flat (or will be after the existing berms are removed). A water channel named the Bensenville Ditch crosses the interim rail alignment and will provide an outlet for slightly more than half of the railroad ditches. Bensenville Ditch largely drains the existing Union Pacific right of way, as well. Corrugated metal pipe cross-culverts will be located under the railroad embankment where required.

The use of inverted siphons instead of conventional culverts in the area of the "loaves of bread" was considered as a means to maximize the new berms’ size and minimize the size of (and excavation for) the longitudinal drainage ditch next to the railroad track. Figure 6 illustrates one of the proposed inverted siphon locations.
Figure 6: Cross Section of Inverted Siphon

With an inverted siphon, also known as a sag culvert, the culvert entrance is below the outlet, which forces the culvert to flow under pressure. Flow in the pipe is modeled using conventional methods for a full flow culvert, while taking into account the differences in head at the entrance and exit, the friction slope, and the minor losses due to the bends in the flow path – which in an inverted siphon can actually be quite “major”. In Figure 6 above, two 90 degree bends are shown. From an energy standpoint, this is the worst case scenario; however, this design allows construction using standard manholes, which are less costly than a custom version with mitered connections.

Ultimately the inverted siphons were not used. The energy losses from the 90 degree bends were too high, so the more costly mitered bends, as well as special, improved entrance chambers, would have been required to make the structures work. In addition, the design would have required additional grading in the outlet channel, which conflicted with the original goal of reducing earthwork. Standard culvert designs were chosen instead, along with modifications to the design of the “loaves of bread” earthwork mounds.
The interim rail alignment will cross the existing Bensenville Ditch about half way through the realignment. A conventional timber bridge and precast, three-sided culvert alternatives were examined before a four-cell, 9'Wx8'H, precast concrete box culvert was selected as the most economical alternative.

The relocation of Bensenville Ditch is a separate OMP project in the South Airfield, designed by other task order consultants. The timely relocation of this drainage channel was threatened with similar schedule concerns to those discussed previously for the railroad relocation. The desired relocation of the ditch as shown in the ALP faced land acquisition time constraints and conflicts from other projects, so various “interim” workaround solutions were studied. These interim ditch alignments would have crossed the interim rail line one or more additional times, with each crossing via a substantial box culvert. The timing of the interim ditch relocation would have been such that the proposed ditch near one of the box culverts would not yet have been excavated until after the interim rail line was in service. To accommodate this, the rail relocation engineers designed a cast-in-place box culvert to be constructed under the new rail embankment for use with the future ditch. This box culvert was to have its ends capped and would have been buried until the time when the relocated ditch channel was built in the area. In the end, the design work related to the interim ditch was rendered moot just before construction of the interim rail line, as by that time circumstances had progressed sufficiently for the OMP to be able to decide to relocate the ditch to a more suitable and final alignment away from the interim rail line.

**Utilities:** A third-party fiber optic line runs along the existing UPRR’s right of way. This line will be relocated along the interim alignment, and then along the final ALP alignment in the future. Looking at the ultimate airport facility build-out condition of the interim rail area, the OMP directed that several capped utility casings be installed under the rail line to serve airport facilities to be constructed in later phases of the program.
**Air Cargo Facilities:** The interim rail alignment provides room for partial relocation of the existing air cargo facilities required for the OMP. Throughout the design period for the interim rail alignment, various concepts for providing additional employee and truck parking for air cargo facilities south of the rail line were considered. The Union Pacific agreed to allow the southernmost curve in the project to be 3.5 degrees with a 40 mph design speed, instead of the minimum 3 degree curve and 50 mph design speed used elsewhere. The 3.5 degree curve allowed an additional 165 foot wide area of land to be available for the relocation of the FedEx cargo facility immediately north of the rail line near Division Street.

The relocated air cargo facilities will be served by a new roadway which will run along a portion of the north side of the interim rail right of way. The roadway design was performed by a different task order consultant team. This roadway, along with the rail line, share some earthwork and drainage features in common, and are both “landside” (i.e. outside of the secure airport perimeter – the opposite would be “airside”). Because of their interlinked nature, the OMP directed that the cargo roadway be combined with the railroad relocation into a single construction contract package.

**Aeronautical Clearances:** Federal law requires that the Federal Aviation Administration (FAA) be notified of construction or alteration that might affect navigable airspace via a *Notice of Proposed Construction or Alteration* (FAA Form 7460-1). All proposed construction activities and equipment, as well as the constructed project, must be within the height requirements for airspace outside the Federal Aviation Regulation (FAR) Part 77 surface. The Form 7460 for this project included plan drawings and tabular elevation data, packaged into the design drawings, showing all critical areas for potential air navigation space height restrictions.

There are several horizontal and vertical design considerations required by the FAA involving permanent airspace requirements, in this case for the interim rail alignment in relation to future
Runway 10L/28R. Figures 7 and 8 illustrate the requirements discussed below. These considerations include:

1) Preserving unrestricted departures having a takeoff distance available (TODA), takeoff run available (TORA) and accelerate-stop distance available (ASDA), and

2) Ensuring that clearances of the Runway Safety Area (RSA), the Object Free Area (OFA) and the Terminal Instrument Procedures (TERPS) requirements at the end of the runway are maintained.

The horizontal clearance of the RSA and OFA are defined surfaces to reduce the risk of damage to airplanes in the event of an undershoot, overshoot or digression from the runway. The vertical clearances of the TERPS are dictated by two surfaces: the Obstacle Clearance Surface (OCS) and the One-Engine Inoperative (OEI)/Obstacle Identification Surface (OIS). The standard climb of an aircraft is 200 feet per nautical mile after crossing the end of the runway. The OCS rises at a 40:1 slope from the end of the runway and is the minimum surface that no object should penetrate. The OEI/OIS rises at a 62.5:1 slope from the end of the runway and is the extreme surface condition that no object should penetrate for the purpose of an aircraft that is operating in a single engine capacity.

For design purposes, the maximum vertical obstruction assumed for this project was a rail car with a height of 23 feet above top of rail. The railroad horizontal and vertical alignments were designed to meet these requirements.
Figure 7: Runway Clearance Diagram

Figure 8: FAA Clearance Map
The interim rail line intersects the alignment of the Runway 10L/28R Airport Lighting System with Flashers (ALSF-II), which is a high intensity approach lighting system that provides a visual lighting path for landing aircraft. The ALSF-II system is an array of lights that extend 2,400 feet from the end of the runway, rising at a 50:1 slope. Consideration was made to ensure that maintaining the FAA-required spacing of these lights could be achieved near the railroad tracks.

**Track, Signals and Seasoning Period:** Since the interim alignment is expected to be replaced with the final ALP alignment within three years, the Union Pacific allowed the use of wood ties for most of the project. The northern 1,300 feet of the interim alignment overlaps exactly with the final ALP alignment, so this portion will be constructed with concrete ties. All new track material will be used.

A set of intermediate signals is located near Division Street. Union Pacific performed signal design for the replacement of these signals on the interim alignment. Union Pacific will also replace an Automatic Equipment Identification (AEI) car reader located near Division Street with a new installation further north, close to CP Bryn Mawr. This site will be permanent and will not require replacement again when the final ALP track relocation occurs. Union Pacific will install Electrocode track circuits in the relocation area, allowing the existing signal pole line to be retired.

Union Pacific required a 60-day “seasoning period” for the interim railroad alignment, during which time the existing track needs to remain in place (except at the cutover locations at both ends of the project). The purpose of this requirement is to provide some time to evaluate the new construction under traffic, and allow the railroad to revert to operations on their existing alignment in an extreme event such as a sinkhole or excessive settlement on the newly constructed line.

**South Interim Rail Alignment:** To minimize the risk of schedule delay, yet still be prepared for a “best-case” land acquisition situation at the time of construction, the OMP directed that TSD
produce designs for both a “North” interim and a “South” interim alignment. The North interim alignment required the acquisition of only a small, undeveloped portion of one industrial property and therefore provided a high confidence level that it could be built expeditiously. The South interim alignment provided more room to construct the OMP’s Southwest Airfield facilities, but it required acquisition of numerous properties. As the designs progressed, various contract packaging and bidding options were considered, recognizing that the final alignment decision might not be made prior to the bid period; however, it become clear prior to bidding that the most prudent option for the OMP was the North interim alignment only, and plans for the South interim alignment were set aside.

The interim alignment design was completed, and the project was bid and awarded to a contractor in March, 2007. At this time (September 2007) construction of the interim rail alignment is well underway. Track and signal cutovers are planned for late December 2007. A good view of the progress of the railroad relocation, as well as the extensive amount of other construction currently underway, can be had from the window of an airplane landing at, or taking off from, O’Hare.

V. UPRR Relocation – ALP Alignment

Upon completion of the interim rail design bid documents, final design for the ALP alignment was initiated. In order to increase the chances of a smooth transition from the Master Civil Engineer in concept design to the task order consultants’ final design, the OMP requires that each task order consultant perform a validation review of the MCE’s concept design prior to beginning final design work. These reviews serve to quickly bring the final designers up to speed on past design decisions and to provide a high level of assurance that major issues not noted during conceptual design are flagged early on. TSD conducted their validation study of the ALP concept design in February 2005 and found it to be sound.
The ALP rail alignment project involves relocating the Union Pacific line from the interim alignment to a permanent location at the far south and west perimeters of the new O'Hare property limits, thus providing the maximum amount of room for the airport improvements to be constructed. The ALP alignment is approximately 15,000 feet long and will be constructed to Union Pacific standards using concrete ties and all new track material. As previously mentioned, the northern 1,300 feet of the interim alignment will continue to be used for the ALP alignment. The remaining interim track material will be salvaged after cutover to the ALP alignment. Design speed is 50 mph for the entire alignment, and the maximum degree of curvature is 3 degrees. Vertical gradients up to 0.65% will be used to enable the relocated line to cross over Canadian Pacific’s Bensenville Yard. A 12 foot wide access road will be located along the north/east side of the alignment except at bridges.

All of the existing UPRR bridges in the vicinity will be replaced with new structures on the new ALP alignment. The new bridges include a 156 foot steel, three-span, open deck temporary bridge over Green Street in Franklin Park (for a shoofly during the construction of the permanent bridge); a 77 foot, single-span, deck plate girder permanent bridge over Green Street; a two-span, through plate girder bridge over Canadian Pacific’s Bensenville Yard, with spans of 82 feet and 128 feet; a 107 foot, single-span, through plate girder bridge over Metra’s Milwaukee West line, and a 158 foot long, two-span deck plate girder bridge over Irving Park Road. Retaining walls will be constructed where right of way is limited between Green Street and Bensenville Yard. Due to the close proximity of the relocated alignment to the existing track at the south end of the project, certain wingwalls for the new bridges over Green Street and Bensenville Yard conflict with the existing structures’ wingwalls. Temporary shoring was designed for these locations and staging was carefully defined in the contract documents to ensure that structural support is maintained when operations shift from the existing alignment to the new one, and during and after demolition of the existing bridges.
By May 2007, the OMP had acquired 410 of the 611 parcels (67%) needed for the full South Airfield buildout. While significant progress had been made with South Airfield land acquisition, the same could not be said - with respect to the OMP schedule - for the Irving Park Road grade separation project. Although Phase I (Illinois DOT parlance for the initial design and environmental phase of a project) design was well along, for a variety of reasons, the work was temporarily stalled and a preferred alternative had not been officially selected. The majority of the ALP rail final design had to be put on hold because of uncertainties about the grade separation project’s track alignment, which during the Phase I design for the grade separation, had changed from that in the ALP.

Once more, the OMP strategized about how to de-link their Union Pacific relocation project from the foreseeable delays in the grade separation project. This time, the best solution was determined to be constructing a grade-separated crossing at Irving Park Road for just the relocated Union Pacific line, by lowering the roadway only as much as needed for the new Union Pacific overcrossing. Roadway profiles developed by the MCE determined that it was feasible to do this without precluding the future grade separation of the Canadian Pacific tracks from Irving Park Road. With this new direction, final design of the entire ALP alignment was able to resume and is on track to meet the OMP’s South Airfield project schedule.

VI. Conclusion

This railroad relocation project is quite interesting by itself. It is even more so as one of the key components of the O’Hare Modernization Program’s massive airport improvement project. At the conclusion of the ALP rail relocation phase, the authors hope to provide AREMA with a final update on this project. Until then, those interested can read OMP construction updates that are periodically posted on the internet at www.cityofchicago.org/OHareModernizationProgram.
References

(1) Information about Lt. O'Hare and the history of O'Hare Airport was gathered from various sources, including the websites www.airwise.com and www.wikipedia.org.

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