Summary

Wacker Drive has been a major roadway in the heart of Chicago's downtown area for over 80 years. The north-south section of Wacker Drive from Randolph St. to Congress Blvd. was completed in 1955, and prior to the project, in need of a complete reconstruction.

The deteriorated viaduct structure was replaced, lifting the vertical clearance by more than one foot by utilizing a post-tensioned deck structure. The lower level through lanes and service drive were separated, alleviating congestion, expediting traffic and improving safety. New lighting and ventilation equipment improves visibility and air quality. Upper level traffic and safety was significantly improved by removing ramps to the lower level at Jackson, Adams, Monroe and Washington. The ramp at Monroe was replaced with a new one-way ramp to Lower Wacker Drive access controlled by a traffic signal. Upper level aesthetics were improved with the addition of landscaped medians, sidewalk planters and decorative light fixtures.

The reconfiguration of the Congress Parkway Interchange improved traffic safety and created new green space. The Franklin ramp onto westbound Congress was removed to eliminate the double-merge with Lower Wacker Drive ramp onto westbound Congress. Additionally, the Lower Wacker ramp was reconfigured to have a longer merge lane.

This roadway and bridge project is one of the most complicated ever completed by the City since it involves complex staging to keep 60,000 vehicles (ADT) Wacker Drive, 75,700 vehicles (ADT) Congress Parkway and a staggering 150,000 pedestrians moving through the construction zone daily.

The construction a $303M complex bridge/highway project of this magnitude in the heart of one of the largest cities in the world on time, and within budget, is a feat rarely if ever accomplished, as was the case with the Wacker Drive and Congress Parkway Reconstruction.

Why This Project is Worthy of an Award

Innovation, Quality, and Professional Excellence

The viaduct deck is a cast-in-place concrete slab, post-tensioned in both directions. High strength (6,000 psi), high performance concrete with reduced chloride permeability was specified as a means of ensuring the structure would better withstand the harsh Chicago winters. Typically, a two-foot deep, four-foot wide longitudinal rib runs along each of the six column lines with a 13-inch to 16-inch deck spanning between the ribs. This design required an increased effort by all involved accommodating the post-tensioning tendons, epoxy-coated reinforcement and several deck penetrations, while avoiding conflicts.

Use of the post-tensioning system allowed for a shallower construction depth, which proved critical to increasing clearance on the lower level from 12'-6" to a more modern 13'-6." Due to grade beams below the lower level and building plazas above, most of the increased clearance had to be derived from reduction in the structure's depth.

In order to increase the service life of the new viaduct structure, the slab was designed to zero tension under all service loads for both the top and bottom surfaces. This design objective was accomplished through the use of three separate post-tensioning systems:

- The primary system consists of banded tendons in the longitudinal ribs. Each rib has between five and eight, 3-inch diameter profiled ducts, which each contain nine, 0.6-inch diameter low relaxation grade 270 post-tensioning strands. These tendons were stressed at each end to a force of 370 kips.
- The secondary system is in the transverse direction and extends along the entire length of the viaduct with profiled four-strand flat ducts. The ducts are spaced between 1'-0" and 2'-0" on center, depending on the forces required. These tendons were single-end stressed to 164 kips with a monostrand jack.
- The third element of the system consists of non-draped distributed tendons in the longitudinal direction. These are five-strand tendons, single-end stressed, to a force of 205 kips, and spaced roughly 2'-0" on center between the ribs. All ducts were grouted after the stressing operations were complete.

Utilizing a combination of streamlined aesthetics, practical design and state-of-the-art engineering practices, the new Wacker Drive is a testament to engineering and transportation innovation. Post-tensioning was a critical element to accomplishing the project's main objectives, affording exceptional flexibility in the design of every major infrastructure component. The project team was able to accommodate heavy loads, unbalanced spans and geometric anomalies by adjusting the horizontal layout and vertical drape of the strands, which is not feasible using other systems. In addition, the post-tensioning systems allowed for re-use of existing foundations, increased vertical clearance and additional park space.

Completion of the Wacker Drive Reconstruction project marks a significant milestone in Chicago's efforts to revitalize its expansive transportation infrastructure. Lower Wacker Drive is now a streamlined throughway for both public and personal transit, incorporating 21st century signalized intersections and service drives with controlled access points. A fresh streetscape now provides aesthetic improvements for pedestrians on the upper level, as well as safer pedestrian features such as larger refuges between traffic lanes at the intersections. It would be hard to find another project that was able to accomplish so much across so many disciplines.

Sustainability, and Respect for the Environment

This roadway and bridge project required accommodating 150,000 pedestrians moving through the construction zone daily originating from or returning to the two primary downtown commuter railroad stations. Wacker Drive also abuts 18 major office skyscrapers including the Willis Tower and 12 parking garages. Daily access for workers and deliveries was accommodated. Every construction stage required creative solutions, extensive advance notice thru media, website and personal meetings with stakeholders, expedited new stage implementation overnight or weekend to minimize business disruptions, monitoring new traffic and pedestrian patterns for problems, and making revisions immediately to minimize inconvenience to the public.

The project maintained daily access for employees, building deliveries and pickups and also emergency access for first responders in case of an emergency event occurring. Building

employees needed to be trained how to exit the building in case of an emergency. Access plans had to be maintained and updated with every stage change so emergency police and fire first responder knew the routes to get to the building, access locations and accessible fire hydrant locations. Any confusion or delays would result in dire consequences. Extensive construction coordination, and sometimes daily, modifications to access were required and implemented.

A major goal accomplished during this project was the re-use of existing drilled shafts, which resulted in substantial savings in both time and cost. In order to accommodate modern roadway geometrics, many of the columns were relocated, which required construction of new grade beams. This reconfiguration would have added substantial load to the existing drilled shafts and re-use would not have been possible. However, post-tensioning made the use of a thinner slab possible, significantly decreasing the load to be supported by the drilled shafts.

Along with reconstructing roadways to be safer and more efficient, the Wacker Drive reconstruction incorporated a number of green elements and practices. The Congress Parkway Interchange reconstruction created a new three-acre, publicly accessible park between Franklin and Wells. Additional green space was created at Upper Wacker Drive by replacing ramps to Lower Wacker at Jackson, Adams and Washington with landscaped medians. Other green elements included: LED traffic signals, which last longer and are more energy efficient than incandescent bulbs; a storm water management system designed to direct the "first flush;" the most polluted runoff during a storm into the combined sewer system instead of the Chicago River; and use of recycled steel and concrete in construction.

Transparency and Integrity in the Management and Project Implementation
This roadway and bridge project was one of the most complicated ever completed by the City since it involves complex staging to keep 60,000 vehicles (ADT Wacker Drive), 75,700 vehicles (ADT) Congress Parkway and a staggering 150,000 pedestrians moving through the construction zone. Further, Wacker Drive abuts major offices, the Chicago Mercantile Exchange, Lyric Opera and 18 skyscrapers including the Willis Tower, 12 parking garages. Daily access for workers and deliveries was accommodated. Wacker Drive's proximity to the Chicago River and the two primary downtown commuter railroad stations, Union Station and the Ogilvie Center created additional challenges.

More than a year in advance of construction contracts, private utilities began relocation their facilities to eliminate conflicts with new foundations and utilities. The advance Utility Reconstruction Contract, then constructed two 16-inch water mains and a separated storm and sanitary sewer system. Each building received new services. The project included 15 bridge post-tensioned deck pours ranging in size from 300 to 1,700 cubic yards of High Performance Concrete. The approval, testing, constructability and placement of all ducts strands and reinforcing steel, grouting after deck pours, post-tensioning, and closure pours required pre-pour coordination meetings, expediting RFI's for placement issues and cooperation between all parties. These pours offered unique challenges of routing up to 100 concrete trucks to the site within allotted time requirements during rush hour traffic.

The construction was coordinated by the Construction Program Manager (PGM) with all team members through Chicago Department of Transportation's (CDOT) web-based Construction Database connecting all parties involved instantly and accelerating the response turnaround times. CDOT provided a full time Coordinating Engineer as part of the PGM expedited FHWA/IDOT/City of Chicago issues and permits. CDOT/TranSystems responded to the contractor's requests and change orders in a timely and fair manner. Based on mutual cooperation, all issues were resolved without turning into conflicts, and change orders were awarded. This atmosphere of cooperation and fairness was essential to the successful delivery of the project. Construction value engineering by the PGM saved significant money through the innovative use of contract pay items. The standardization of all project documentation for multiple construction contracts streamlined the entire documentation, change order contractor payments and contract closeout process. Weekly meetings were held with adjoining property owners to review any of the next week's scheduled construction activities which may have affected them and to discuss any coordination issues.

A Single Project Field Office was provided by the PGM, to house the PGM and Consultant Construction Engineering (CCE) Teams, and the CDOT Supervising Resident Engineer in a single location including a server for maintaining an electronic Program Master File System. The sharing of a common field office and master electronic file system enhanced project communication, relationships and saved time.

The PGM required the contractors to provide a baseline schedule and update the schedule on a monthly basis to ensure the on-time delivery of the project. The PGM closely monitored and controlled the schedule by reviewing the baseline schedule provided by the contractors using Primavera P-3 scheduling software, and requested and reviewed updates to the schedule on a regular basis to ensure on-time delivery of the project. The review of the schedule update ensured that RFIs, submittals, and any outstanding items were reviewed and responded to in a timely manner. Any issue affecting the schedule was discussed and resolved in weekly meetings. A project level scheduler reviewed the baseline and the updates and ongoing construction activities on a daily basis. Any possible impact was brought to the attention of the PGM. The contractor was very involved in resolving all potential scheduling issues, and as a result the project was delivered on time.

In weekly construction review meetings the contractor provided three-week look ahead schedules of construction activities. These schedules were reviewed by the PGM independent scheduler to identify potential issues. The PGM Team resolved all potential issues related to the construction activities in a timely manner to allow the project always to proceed forward.

Conclusion
The Final Construction Cost is $303M and the project was completed on schedule. This final cost was below the funding programmed for the project. The construction of a complex bridge/highway project of this magnitude in the heart of one of the largest cities in the world

under budget and on time is rarely, if ever accomplished, as was the case with this Wacker Drive Viaduct and Congress Parkway Interchange Reconstruction Project and the project exceeded all City project expectations.

The innovative Construction Program Management approach implemented and utilized included all parties involved in the project including the client and contractors. The concept developed a solid partnership between the City, Consultants and Contractors, which was of great benefit to the City resulting in the successful completion of this Project.

What Services did the Member Firm Provide to the Project.

CDOT engaged **TranSystems** as Construction Program Manager (PGM), responsible for all project construction engineering activities, maintaining project schedules, chairing construction program meetings, coordination and resolution of issues, traffic surveillance, supervision of consultant construction engineering teams, public and workforce outreach, coordination with adjacent property owners, maintaining construction budget and project quality assurance. Reporting directly to CDOT, the PGM was the primary point of contact for the project, and the Consultant Construction Engineering Teams (CCE), hired to perform resident engineering services for the four construction contracts.

TranSystems prepared a Project Management Plan Manual for use by all project team members to standardize the construction management procedures, flow charts and forms for the project. The four major functions to be performed in the Project Management Plan were 1) Program Management, 2) Program Control, and 3) Quality Assurance performed by the PGM, and 4) Construction Resident Engineering performed by the four CCE Teams. These four teams were led by the Prime firms of **Alfred Benesch**, **Infrastructure Engineering**, **Parsons Brinckerhoff** and **Burns and McDonnell**. Construction review meetings for each contract were conducted weekly to monitor schedule, cost, submittal and RFI responses, and expedite construction issues. CDOT, IDOT and FHWA attended these meetings.

The **TranSystems** proactive Program Management Approach delivered the project on time and on budget despite many challenges, setbacks as a result of adjacent projects being delayed, and changed conditions. The success of this project was due to the exceptional overall plan of the PGM that had one goal - successful on time, on budget completion, in a safe manner.