ACTT WORKSHOP

Oklahoma

May 25-27, 2004 | Oklahoma City, Oklahoma

U.S. Department of Transportation
Federal Highway Administration

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Executive Summary

The Accelerated Construction Technology Transfer (ACTT) is a strategic process that uses innovative techniques and technologies to reduce construction time on major highway projects while enhancing safety and improving quality. The process is implemented by conducting 2-day workshops for State departments of transportation (DOTs). The American Association of State Highway and Transportation Officials (AASHTO) and the Federal Highway Administration (FHWA) jointly fund ACTT workshops.

In May 2004, the Oklahoma Department of Transportation (ODOT) hosted a workshop that applied ACTT principles to its Crosstown project, which will realign I-40 running along the southern edge of Downtown Oklahoma City and points further south.

The $400 million project will replace this primarily elevated section of I-40 on offset alignment to the south. A large section of the new facility will be depressed. The existing facility was built in the 1960s, and designed for an ultimate traffic volume of 76,000 average daily traffic (ADT). Today's ADT exceeds 110,000 over this section, which passes over 250 fracture critical members of the longest twin bridge structures in the State. Additionally, 90 percent of this section of I-40 is rated as a critically-high crash facility. The existing facility will be removed at the completion of the mainline construction and a six-lane at-grade boulevard will be constructed on the existing alignment for local traffic. Key project challenges include:

- Complete and open the mainline to traffic by September 2008.
- The existing railroad corridor must be realigned five blocks south of its current location. Rail operations in the corridor must continue uninterrupted both during and after construction.
- A six-lane boulevard must be constructed to replace the existing stretch of I-40.
- The project calls for a 112 km/h (70 mi/h) design speed.
- A direct connection must be established to Bricktown and downtown.
- Methods must minimize disruption to downtown and Bricktown traffic during construction.

The workshop was held on May 25-27, 2004, in Oklahoma City, Oklahoma, and brought together 75 transportation professionals from across the nation. The primary objective of the workshop was to draw on the expertise of participants to help ODOT achieve its primary goal of opening the mainline to traffic by September 2008.

Gary Ridley, ODOT Director, expressed support for the workshop as he welcomed the participants. During the opening session Shirley Ybarra, Transportation Research Board (TRB) A5T60 task force member and former Virginia Department of Transportation (VDOT) Secretary of Transportation, gave the keynote address on "Why ACTT? Why Now?" Following the opening remarks, a project overview by the project management team and a bus tour of the project concluded the opening day.

Over the course of the workshop, participants broke into skill set teams to examine how the ACTT concept could be implemented to accelerate various aspects of the project. The skill sets selected by ODOT prior to the start of the workshop were: Railroad/Utilities; Structures/Geotechnical; Innovative Contracting/Financing; Long Life Pavement/Maintenance; Traffic/ITS/Safety/Public Relations; Environmental; Construction/Materials; and Roadway Design/Geometrics. Each skill set team focused on how the ACTT process applied to the specific

concerns of their area of expertise, while collectively the teams searched for methods/measures to help ODOT achieve its goals of maintaining traffic with minimal disruption; accommodating local/regional/national/international events; providing access to emergency facilities; opening I-40 to traffic by September 15, 2008; constructing the facility within budget; and maintaining a safe work zone.

Workshop participants remained focused throughout the workshop and made numerous recommendations, many of which were deemed viable and will be pursued, according to ODOT. As the host agency, ODOT will examine the recommendations and determine which will be implemented on its Crosstown Project.

With the workshop completed, it now remains for ODOT to sift through the various ideas/recommendations and decide which ideas should be implemented in future planning, design, and construction phases of the "I-40 Crosstown Expressway Relocation."

CHAPTER 1

ACTT Goals and Objectives

Highway construction continues to produce significant disruptions in communities across the Nation as Departments of Transportation (DOTs) work to update an aging infrastructure system. While highway construction is unavoidable, excessive construction time is unnecessary and often can be dangerous. It is costly, prolongs workers' exposure to traffic, and subjects travelers to substandard conditions. The Accelerated Construction Technology Transfer (ACTT) initiative aims to minimize travel delays and community disruptions by reducing cost and construction time and improving quality, traffic control, and safety.

1.1 BACKGROUND

ACTT is a process that encourages the use of innovative technologies and methods to accelerate the construction of major highway projects to reduce user delay and community disruption. A complete accelerated construction approach involves evaluating the planning, design, and construction activities within a highway corridor using multiple strategies and technologies. Successful ACTT deployment requires the thorough examination of all facets of a highway corridor with the objective of improving safety and optimizing cost effectiveness while minimizing adverse impacts for the benefit of the traveling public.

Recommendations by Transportation Research Board (TRB) Special Report 249 called for creating a strategic forum to promote accelerated construction in the highway infrastructure. TRB Task Force A5T60 was formed with the objectives of:

- Facilitating removal of barriers to innovation.
- Advocating continuous quality improvement and positive change.
- Enhancing safety and mobility.
- Encouraging the development of strategies that generate beneficial change.
- Creating a framework for informed consideration of innovation.

Fully supporting the task force's mission and objectives, the Federal Highway Administration (FHWA) and the Technology Implementation Group (TIG) of the American Association of State Highway and Transportation Officials (AASHTO) joined the task force in an outreach effort. The result was the formation of a national resource pool known as the "National Skill Sets Council" and completion of two ACTT pilot workshops (one in Indiana and one in Pennsylvania). Following the pilot workshops, TRB Task Force A5T60 transferred the concept to FHWA and AASHTO to continue the effort by conducting future workshops.

With the successful completion of several ACTT Workshops, including ones in Texas, California, Montana, Washington, and Tennessee, ODOT hosted an ACTT Workshop in Oklahoma City, Oklahoma, in May 2004. This workshop focused on ODOT's I-40 crosstown project located between interchanges with I-44 and I-35, at the southern edge of downtown Oklahoma City.

The goals of this ACTT workshop were as follows:

- Shorten construction time.
- Insure safety for work zone and future maintenance.
- Promote early recognition of constructibility.
- Maintain traffic flow and speed through the work zone for through and local traffic.
- Eliminate existing and future congestion on the Interstate and local system.
- Promote early buy-in on geometrics and minimize liability.
- Identify phases that can be completed early to accelerate the overall construction.

- Identify project challenges early on.
- Get solid recommendations from the teams to accelerate the consensus reaching process.
- Have a successful workshop with innovative suggestions.
- Have this workshop be a process for future projects (share lessons learned with other States).
- Identify ideas to insure flexibility for future needs.
- Build within budget.
- Establish constraints early on (environmental, public commitments).
- Build on cooperation with partners and stakeholders.
- Improve public information.
- Encourage construction staging to reduce construction impacts and meet local needs.
- Identify ways to encourage contractor innovation (prior to and during construction).
- Explore the delivery process/construction management/alternate process.
- Explore environmental alternatives for sediment control/water quality.
- Maintain/enhance quality.
- Identify funding alternatives.

CHAPTER 2

Project Details

The project is to relocate a portion of Interstate 40 that currently is located at the southern edge of downtown Oklahoma City. The existing facility that is being replaced consists primarily of an elevated structure that was built in the 1960s. These twin bridges are the longest in the State of Oklahoma and carry more than 110,000 vehicles per day. These vehicles pass over 250 fracture-critical members that were designed for an ultimate traffic of 76,000 vehicles per day. Six of seven segments of I-40 in this area are rated as critically high-crash sections. In addition, the existing facility does not provide sufficient shoulder widths to afford refuge or offer passage in the event of an incident.

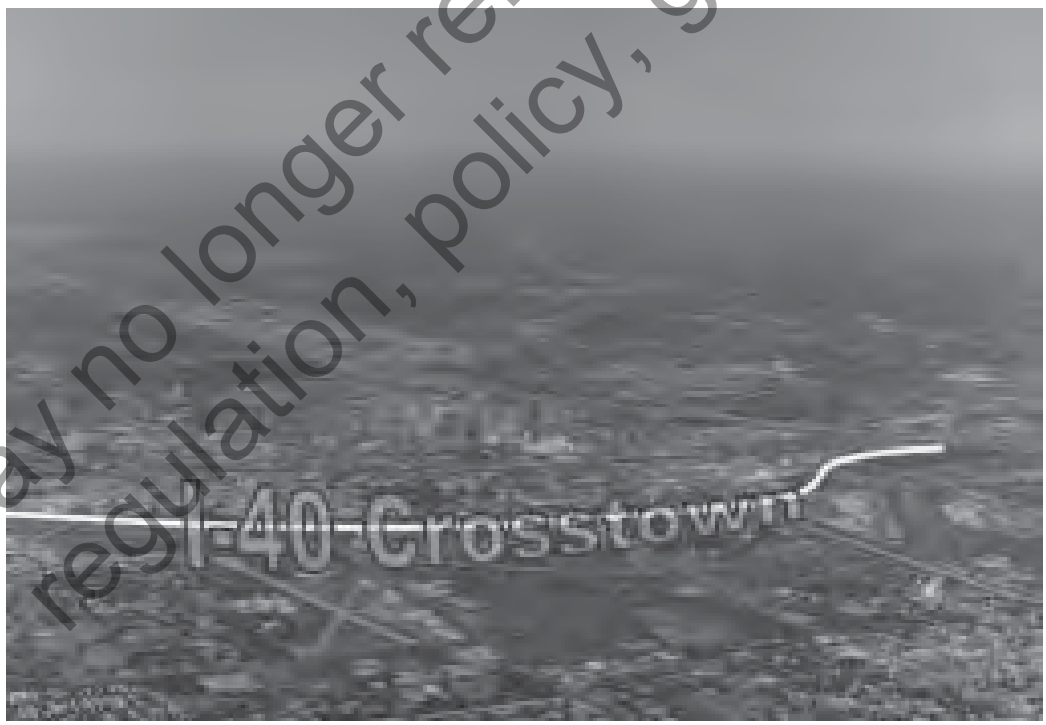
The planned improvements include a realignment of 7.2 km (4.5 mi) of the Interstate and conversion of the existing Interstate alignment to a boulevard to access downtown Oklahoma City. The project boundaries have been established through the environmental process. The I-40 Crosstown Expressway project will extend from the east side of the I-40/44 junction to the west side of the I-40/235/35 junction. However, project designs have not been completed.

The project schedule is currently under development. The goal of ODOT is to achieve a mainline Interstate facility fully usable by the traveling public in September 2008.

Through TEA-21 and special appropriations, ODOT has received $114 million in funding for the project, of which approximately $103 million is available after application of obligation limitation. To date, almost $80 million has been obligated on various project activities. Current estimates place the total cost of the realignment at $350 million. Therefore, ODOT still requires approximately $250 million to complete the project.

Highway accident rates for the existing facility are rated as critically high in six of the seven segments of I-40 in this project area. The existing I-40 Crosstown Expressway bridge has exceeded its design life and is deteriorating. The roadway sections in this project are functionally deficient for numerous reasons.

Figure 1. I-40 Crosstown



This corridor provides the primary access for downtown Oklahoma City and is the primary east-west route in the State. The project extends on I-40 from the junction with I-44 to the junction with I-35/235. Therefore, protracted construction times on this segment of I-40 would affect the Interstate system extending in six directions, as well as generate unnecessary delays and high user costs.

The realignment of the I-40 Crosstown Expressway has a direct impact on the local, State, regional, and national levels. This project constitutes a portion of one of the only all-weather, east-west, coast-to-coast Interstate highways in the Nation. Within this corridor, I-40 intersects with two other major Interstates. This key crossroads extends in six directions to provide access from coast to coast and from Mexico to Canada. Additionally, the I-40 Crosstown Expressway provides the primary access for downtown Oklahoma City, as well as Tinker Air Force Base, one of the foremost maintenance and repair facilities within the United States Department of Defense.

The I-40 Crosstown Expressway carries in excess of 110,000 vehicles per day. As such, unnecessary delays for the traveling public will cause millions in additional user costs.

This project is scheduled for completion in time for a ribbon cutting ceremony in September 2008. Additionally, the associated boulevard should be completed by June 2009. Therefore, it is imperative that ODOT utilize the most fiscally responsible, aggressive approach possible in order to achieve the desired results. Because this project provides the primary access to downtown, it has been a given constraint that traffic will continue to utilize the existing facility until such time as the new facility is constructed and tie-ins can be completed.

Since this project is located on the south edge of downtown Oklahoma City and provides the primary access for downtown, it will receive more attention and scrutiny than any project in the history of ODOT. As the primary east-west route in the State as well as the primary access for downtown Oklahoma City, the construction time for this project greatly influences the economic well-being of Oklahoma. At the standard pace for urban area construction under normal circumstances, this project would likely take approximately 9 years to construct.

During construction of the tie-ins at each end, delays would be experienced by more than 110,000 vehicles per day. The user costs on this phase of the project will be significant. The user costs on the demolition of the existing bridge and construction of the boulevard will also be significant.

A section of this work is near Bricktown and the existing Oklahoma City canal system. The corridor intersects with a proposed OKC canal extension project. The Interstate facility will be carried over the proposed canal extension, allowing passage by both water taxis and pedestrians. Development of retail, entertainment, and commercial establishments in this entertainment district is progressing along the canal system as Oklahoma City had hoped. The presence of a protracted construction project adjacent to the area would have a dampening influence on development.

2.1 CORRIDOR ANALYSIS

An I-40 study commissioned by ODOT analyzed various alternatives for improving the transportation capacity and safety of the corridor and proposed the best transportation improvement from the alternatives evaluated.

Description of Study Corridor
The study area corridor is located in Oklahoma City, Oklahoma, Oklahoma County. The corridor limits are:

- North: NW 10th Street.
- South: SW 15th Street.
- East: Interchange with I-235/I-35 (near Lincoln/Byers).
- West: Meridian Avenue.

The corridor's transportation system consists of the roadway system (I-40 and a network of city streets), the rail system serving the Burlington Northern/Santa Fe and Union Pacific Railroad companies, and a transit system called Metro Transit provided by the Central Oklahoma Transportation and Parking Authority (COTPA).

Existing Transportation Facilities
I-40 is the primary east/west route in Oklahoma and a National Highway System component spanning the Nation from North Carolina to California. It traverses the State of Oklahoma from Arkansas on the east, through Oklahoma City, to Texas on the west, and converges with other nationally-designated highways. I-44, I-35, and I-40 intersect in Oklahoma City and extend in six directions from Mexico to Canada and coast to coast, making Oklahoma City a key crossroads for Interstate and international travel. I-35 and I-40 are key corridors in the North American Free Trade Agreement (NAFTA) and are expected to experience significant increases in national and international travel, and thus are critical to the U.S. and global economy.

I-40 is an essential route for truck traffic, with major freight terminals located south of the central business district along the corridor. Truck freight movement studies have historically focused on six main routes: I-35, I-40, I-44, I-240, U.S. Highway 77, and State Highway 66. The 1994 Oklahoma Trucking Survey revealed freight companies most frequently use I-35, I-40, and I-44.

I-40 provides access to the downtown Oklahoma City area and Tinker Air Force Base, one of the foremost maintenance and repair facilities within the United States Department of Defense. Additionally, I-40 provides indirect access to the Will Rogers World Airport.

The area north of the existing I-40 alignment is the downtown area, comprised primarily of institutional sites such as the city and county jails, city hall, police station, civic center, county courthouse, and the Myriad Convention Center. The area south of the existing alignment is a combination of residential dwellings, industrial sites, parklands, and the North Canadian Rover and its open space.

For several years, Oklahoma City business and civic leaders have recognized the need to attract new businesses and expand existing businesses to create jobs for Oklahoma City residents. In 1991, the Oklahoma City mayor appointed several task forces to develop recommendations for the Metropolitan Area Projects (MAPS). This later evolved into the MAPS Committee in 1992, with the goal "to improve the economic well being of area residents by developing a successful plan for funding and constructing new and improved convention, tourism, sports, cultural, and educational facilities."

In late 1993, the Oklahoma City citizens approved a one-cent sales tax to finance the MAPS construction, which is designed to make the area more attractive to people who live and work in Oklahoma City. The projects are catalysts for accelerating development in the Bricktown area (the study area's northeast corner) and for stimulating economic growth. Some projects that may affect the study area include: "The Link" (the

transit connection between the I-40/Meridian Avenue hotel and restaurant district to downtown Oklahoma City); Downtown Canal (the North Canadian River extension to water plazas to create a mix of shopping, sightseeing, dining, and urban attractions); Myriad Indoor Sports Arena; Bricktown Ballpark; and North Canadian Riverfront Development. Other area projects are the Myriad Convention Center Renovation, Metropolitan Learning Center, and the Civic Center Music Hall Renovation.

The MAPS adoption and sales tax approval for its funding implemented the redevelopment and revitalization plans. Although past city officials' efforts to promote economic development have faded or have been restructured, the momentum and assurance of the MAPS success have been strengthened by the continuing recovery efforts since the April 1995 bombing of the Alfred P. Murrah Federal Building.

In December 1998, Oklahoma City citizens voted on and approved the sales tax extension necessary for completing MAPS.

Specific Transportation Problems

The Oklahoma City I-40 section from the I-235/I-35 interchange, west 11.5 km (7.2 mi) to Meridian Avenue, known locally as the Crosstown Expressway, was constructed 30 years ago and consists of elevated and at-grade sections providing a six- to eight-lane full-access controlled freeway. Although state-of-the-art when initially constructed, this transportation facility has exceeded its design life and has several design features that do not meet current design standards as defined by the American Association of State Highway and Transportation Officials' (AASHTO), A Policy on Geometric Design of Highways and Streets.

Bridge Section

The primary concern, which initiated the study, is the existing condition and design of the bridge structure from west of Byers Avenue, west to Western Avenue. This structure is deteriorating and showing signs of fatigue, which indicates the progressive failure of a structure resulting from heavy repetitive loads. The bridge deck was rehabilitated with a high density overlay in 1977, but is now beyond its design life, is delaminating, and is in need of continuous maintenance. The substructure deterioration consists of:

- Exposure of reinforcing steel because of the spalling of the concrete pier caps.
- Leaking deck joints, which provide corrosive conditions for the pin-and-link hanger systems.
- Missing bolts from the bridge's steel girder section.

The bridge structure consists of two adjacent structures, often referred to as "twin structures," which provide the travel lanes for the opposing travel directions. The north structure carries the westbound traffic and the south structure carries the eastbound traffic. The structure, constructed in 1955, is approximately 2,670 m (8,900 ft) long and is a "fracture-critical member" structure. "Fracture-critical member" means that the failure of one structural member can cause a collapse of that structure section. In 1989, the bridge was closed to evaluate and repair a crack in one of these members. The I-40 structure has approximately 250 "fracture-critical members" that have exceeded the expected fatigue life. Because a bridge section could collapse by one of these members failing, the ODOT conducts a safety inspection every 6 months.

Roadway Section
The roadway is functionally deficient because the existing I-40 roadway design consists of:

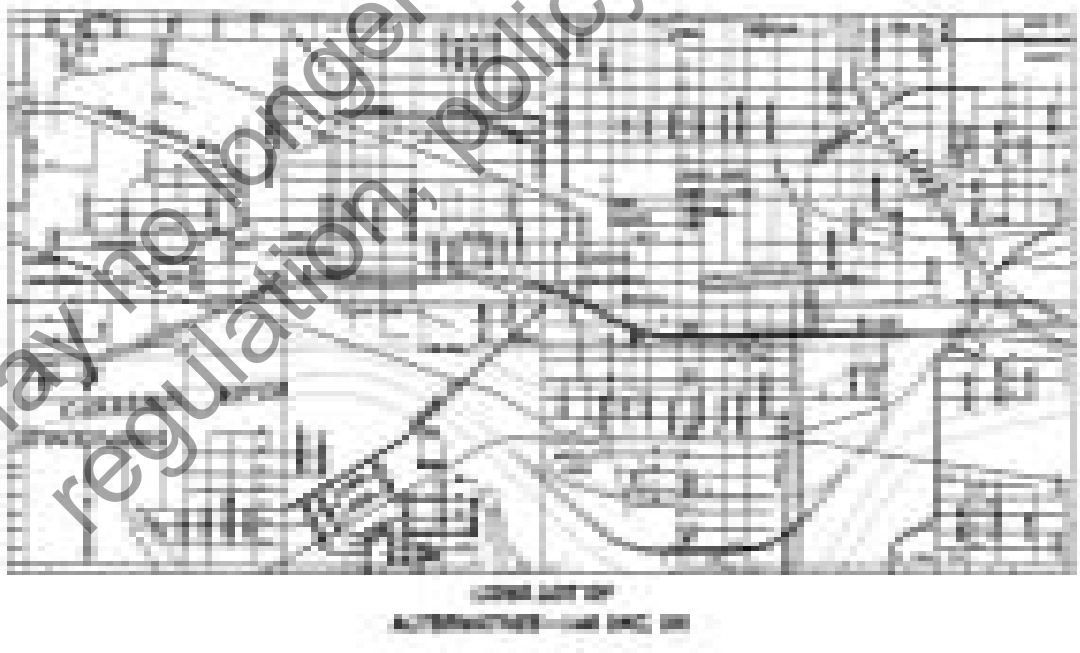
- Vertical curves that restrict sight distance.
- Inadequate ramp spacing that limits the construction of acceleration and deceleration lanes and inhibits the safety of the weave movements for the vehicles entering and exiting the facility.
- Inadequate or no shoulders.

The roadway's safety and efficiency in handling the existing traffic demand and the projected future traffic are concerns, since the facility was originally designed for a 76,000 ADT volume. Additional traffic resulting from the MAPS' successful downtown development will further add to the corridor traffic. The current ADT volumes range from 93,800 to 112,700 vehicles per day on the existing I-40 alignment. The truck traffic volume ranges from 7.5 to 8.3 percent for the eastbound direction of travel and from 7.8 to 9.0 percent for the westbound direction of travel. I-40 is an essential truck traffic route with approximately 60 percent of the truck traffic originating from out of State. The highway facility is identified as a congested roadway in the Congestion Management System developed by the Association of Central Oklahoma Governments (ACOG) for the Oklahoma City Area Regional Transportation Study (OCARTS) area.

Safety issues are highlighted by an accident rate analysis, and efficiency can be measured using a capacity analysis.

Accident Rate Analysis
Typically, highway accident rates are calculated based on the number of accidents per 100 million vehicles. The ODOT statewide map, "Road Segments with Critically High Crash Rates-State Route Numbered System Only," indicates that six of the seven I-40 roadway sections within the corridor limits are rated as critically-high crash sections. To merit a critically-high crash rating, the roadway segment must be at least 1.6 km (1 mi) long and have at least five crashes. For analyzing traffic conditions between each major intersection arterial within the I-40 corridor, the Portland to May section is divided at I-44.

Figure 2. Long List of Alternatives



Capacity Analysis

Level of Service (LOS), based on facility speed and travel time, is a term used to describe and quantify the congestion level on a particular facility section. The Highway Capacity Manual (HCM) defines six levels of service, ranging from LOS A (best) to LOS F (worst). Volume to capacity ratios (v/c) are typically the prime indicator of highway LOS, with volume being the actual number of vehicles that traverse a specific roadway section. Capacity is calculated based on an upper threshold of vehicles per hour per lane for the same roadway section. In general, the lower the v/c ratio the less congestion is indicated. The range from A to E is quantified by ratios of 0.0 to 1.0; a v/c ratio greater than 1.0 in which traffic volumes exceed capacity are considered to operate at LOS F.5

2.2 ALTERNATE D-THE LOCALLY PREFERRED ALTERNATE

Lanes: 10 lanes (3 local/2 express for each direction)
Length: 6,270 m (20,900 ft) (from I-235 to May Avenue), 6.3 km (3.96 mi)
Residential Displacements: 29 (23 minority) for alignment, 14 additional for mitigation
Business Displacements: 44 (43 small and 1 medium)
Community Facility Displacements: 1 church
Estimated Total Cost (Feb. 1998): $236.5 million
Construction Time: 5 to 7 years

Highlights:

- Constructed in railroad corridor five blocks south of existing alignment.
- Retains rail access within existing rail corridor.
- Combination at-grade or semi-depressed throughout entire length.
- Six-lane boulevard in place of existing Interstate alignment.
- Provides for multiple access points to downtown Oklahoma City.
- Can be designed for 112 km/h (70 mi/h).
- Direct access to Bricktown and other downtown improvements.
- Easy to construct in stages.
- Minimal disruption to existing I-40 or downtown during construction.
- Net total user cost over a 30-year life cycle is a $35 million benefit ($80 million benefit less $45 million cost due to construction).

Access to Downtown

The proposed Alternative D design will provide full interchanges at Shields Boulevard and at Western Avenue. The proposed boulevard from I-235 to Agnew Avenue will provide improved access to Bricktown and the downtown area from eastbound and westbound traffic.

Relocations and Displacements

All alternatives involve residential and commercial displacements. The ODOT Relocation Assistance Program is available to all residents and businesses required to relocate when their homes or business sites are acquired for a transportation project. This program is conducted in accordance with the Uniform Relocation Assistance and Real Property Acquisitions Act of 1970, as amended. This program, provided to all displaced residents and businesses without discrimination, provides these residents and businesses with the maximum financial amounts and advisory assistance services that they are eligible to receive.

Alternative D would have the greatest residential displacement impacts. The business displacements include employee displacements. There are no controls or provisions for employee displacements, except for working with the business owner. It is unknown if these business owners will relocate and reopen within or outside the I-40 project area or opt to close. Alternative D would have the least minority employee displacements.

Cost

Cost included user costs, right-of-way and relocation costs, and construction costs.

User Costs

User costs, as used in the I-40 corridor analysis, are those costs incurred by motorists using I-40 and the adjacent and feeder roadway system. These costs include travel delay and vehicle operating and maintenance (O&M) costs.

The I-40 user cost analysis included an extensive I-40 traffic model simulation during each alternative's construction period to determine the total study area vehicle hours of travel (VHT) and the total study area vehicles miles of travel (VMT). The FHWA source documents and data were used to establish unit values for three cost categories: costs associated with hours of travel delay or hours saved; vehicle operating and maintenance cost increases because of extra stops (incurred during the construction period only); and vehicle operations and maintenance costs resulting from more vehicle miles traveled. These values were used to estimate the "economic" or monetary costs (and long term benefits) to users of the I-40 corridor.

Alternative D's construction period is estimated at 5 years. Additionally, Alternative D has the greatest user benefit ($80 million). When the user costs and benefits of the alternatives are viewed over a 30-year life cycle, only Alternative D has a positive user cost/benefit result, with net life-cycle benefits of approximately $35 million.

Right-of-Way and Relocation Cost

A certified real estate appraiser estimated the right-of-way and relocation costs. These costs are based upon visual property inspections, the appraiser's past experience, thorough area knowledge, and a review of recent sales of similar properties. Whole acquisitions were assumed as opposed to partial acquisitions that leave the owner a portion of his original property; therefore, no damages to remaining properties are included. Additionally, most parcel sizes within each alternative's proposed alignment are less than 30 m (100 ft) x 42 m (140 ft). Pursuant to State statutes and Title 23 of the Code of Federal Regulations (CFR) guidance, whole acquisitions are undertaken when the partial acquisition cost plus the severance damages cost exceed a total (whole) acquisition cost. The right-of-way cost portion is based on a price per square foot for a building and a price per linear foot for land.

The estimate's relocation cost portion was prepared by visually inspecting each proposed alignment and noting the apparent nature of each structure's occupants. In addition, interviews were conducted with moving professionals. A review of ODOT's actual historical costs of relocation benefits for similar displacements was also used to develop these estimates.

Construction Cost

The alternative's construction costs are based on material price per unit of measure. The construction components include demolition of the existing facility; utility relocation; mainline roadway work, including traffic control, marking, lighting, and signing; work on cross street structures; and construction of access facilities, including ramps and signalization.

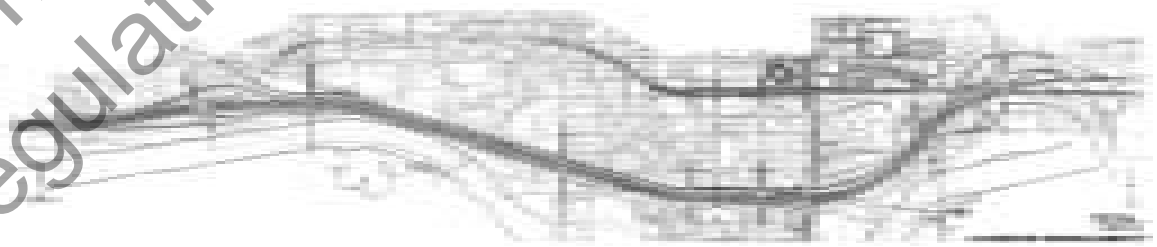
Preferred Alternative

As a result of the Tier-Two evaluation, ODOT selected Alternative D as the locally preferred alternative because:

- This alternative provides a ten-lane facility approximately 660 m (2,200 ft) south of the exiting I-40 alignment and involves converting the existing I-40 facility to a downtown business route. This business route would maintain the current at-grade freeway from Agnew to Western Avenues and bridge structure from Western Avenue to west of Walker Avenue, and reconstruct the existing I-40 facility from west of Walker to I-235 as an at-grade six-lane boulevard with at-grade intersections at the downtown cross streets.
- Alternative D provides the best access to downtown Oklahoma City and Bricktown.
- Full interchanges are proposed at Shields Boulevard and Western Avenue.
- The proposed I-40 facility will be designed for 112 km/h (70 mi/h) and consists of at-grade and semi-depressed sections.
- The overall cost is lower, including user costs and construction costs. The estimated cost (right-of-way/ relocation and construction cost) is $236 million. The net user cost over a 30-year life cycle is a $35 million benefit.
- The project's 5- to 7-year construction period is the shortest of the build alternatives.
- Construction activities will least affect traffic, resulting in less disruption to existing businesses and employees.
- The proposed facility will carry the design year traffic while providing additional service for both through and local traffic.

Additionally, Alternative D would use an existing transportation corridor rather than acquiring all proposed additional right-of-way from non-transportation land uses or local-level streets and roadways. Alternative D involves acquiring an estimated 55 acres of exiting zoned land use (excluding vacant land) for additional right-of-way. Of these 55 acres, 7 acres are for residential land use, 1 acre is for commercial land use, and 47 acres are for industrial land use.

Figure 3. I-40 Crosstown – Working Alignment D



CHAPTER 3

Workshop Meeting Details

ODOT hosted an ACTT Workshop for the I-40 Crosstown Expressway Relocation from May 25-27, 2004, in Oklahoma City, Oklahoma. Appendix A includes a list of the attendees.

In a pre-workshop meeting with the ACTT Management Team on March 26, 2004, ODOT selected the Railroad/Utilities, Structures/Geotechnical, Innovative Contracting/Financing, Long Life Pavement/Maintenance, Traffic/ITS/Safety/Public Relations, Environmental, Construction/Materials, and Roadway Design/Geometrics skill sets for the I-40 Crosstown Expressway Relocation ACTT Workshop.

3.1 OPENING SESSION

The workshop began with opening remarks from Gary Ridley, Director of ODOT, which emphasized the importance of this facility to Oklahoma citizens and businesses, the local and statewide economy, and guests to Oklahoma. His presentation also set the goals and objectives for this project, which are: 1) Safety, 2) Having I-40 open to the public by September 2008, and 3) Staying within the project budget. Following these remarks, Shirley Ybarra, former Virginia Department of Transportation Secretary of Transportation, posed the question, "Why ACTT? Why Now?" before bringing on John Bowman, ODOT I-40 Crosstown Relocation Project Development Engineer, and Keith Angier of MacArthur Associated Consultants to give an overview of this project.

3.2 WORKSHOP PROCESS AND RECOMMENDATIONS

In the next day-and-a-half, the skill set groups met to discuss various aspects of the project and methods for accelerated project implementation. After allowing time for each skill set group to discuss issues and begin forming ideas, participants intermingled to further discuss and consult with other groups on strategies and concepts.

Each group completed reporting forms or provided hand written notes, which are included in this report as Appendix C. Each skill set group was also asked to rank their ideas in order of priority, and to make a presentation to the whole conference. The following are the recommendations relating to each skill set.

3.2.1 RAILROAD/UTILITIES

- Establish early completion incentives.
  - Incorporate drop dead dates.
  - Pay 24-hour work schedules (overtime).
- Proceed with the utility coordination and relocation at the 30 percent design stage.
- Maintain one primary Utility Coordinator (already in place by ODOT).
- Obtain the remaining partial property takes in accordance with utility relocations.
- Take control of utility relocations by:
  - Providing clear objectives and realistic timeframes for relocations.
  - Utilizing established relocation corridors.
- Incorporate water and sewer utilities as part of the roadway contracts.
- Encourage 24-hour work schedules.
- Clear the depressed section of the roadway of utilities via alternative routes (i.e., possibly 7th Street).

3.2.2 STRUCTURES/GEOTECHNICAL

- Advantages of elevating depressed section:
  - Eliminate railroad shoe-fly.
  - Minimize railroad relocations.

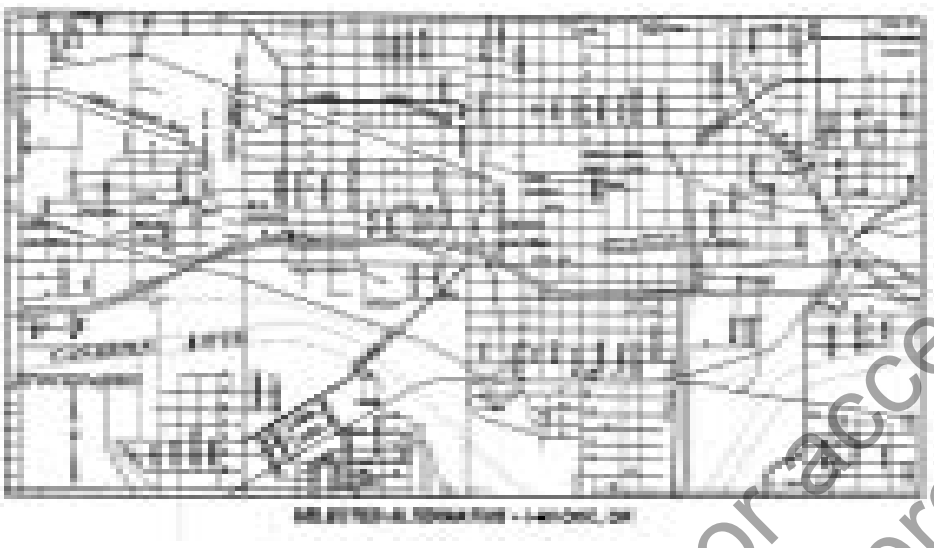
    - 18 months out of the critical path.
    - Eliminate drainage/ground water hazardous material issues.
    - Eliminate Lee Street outfall reconstruction.
    - Improve safety and rescue issues.
    - Pedestrian bridge.
    - Shields Avenue reconstruction.
    - Full interchange at Shields Avenue.
    - Union Station and Cold Storage.
- Disadvantages of elevating depressed section:
    - Revisit environmental document.
    - Noise impacts.
    - Visual impacts.
    - Long term maintenance needs.
    - Need for deicing or anti-icing.
    - Increase the need for borrow.
    - The ramp lengths will change.
- Advantages of identifying staging areas:
    - Saves time and money.
    - Move bigger precast elements for easier delivery.
    - Minimize the impact on local traffic and to existing infrastructure.
- Disadvantages of identifying staging areas:
    - Potential impacts to adjoining property/neighborhoods.
- Early geotech investigation recommending a two-phase investigation:
    - Preliminary (now).
    - Design.
    - Especially around the cold storage plant, structures, landfills, and high fills.
    - There are a lot of things that can be done to accelerate construction in bad soils.
    - Need to know if the excavation from the depressed section can be used for fill.
- Consider alternate foundation types and load testing:
    - Use self consolidating concrete for drilled shafts.
    - Micro-piles are faster and can use smaller equipment for installation.
    - Load testing needs to be completed during the design phase.
- Alternative retaining walls:
    - Eliminate cast-in-place wall design.
    - The plans would identify line, grade, and aesthetics, and the wall selection and construction would be done by the contractor, Roll-In-Bridge.
- Construction for BNSF railroad:
    - Eliminate shoe-fly by constructing permanent structure off alignment and then moving it in place within 24-hour periods.
    - Time and major cost savings.
    - Moves this item off the critical path for the I-40 bridge.
    - There is a risk to the railroad if the structure is not open in time.
- Consider bridge VS walls on all elevated ramps:
    - Need to identify the transition between wall and bridge to minimize cost and time.
- Consider prefabricated structure elements throughout:
    - Full depth precast decks.

    - Segmental concrete box girder superstructure.
    - Prefabricated superstructure.
    - Prefabricated substructures.
- Consider giving prequalified contractors advanced plans and shortening the bid time:
    - Provide 60 percent plans to prequalified contractors.
    - Conduct constructibility meetings to get contractor input.
    - Allows reduction in formal bid time.
- Reduce the number of contracts–saves time:
    - Increases competition.
    - Minimizes soil handling.
    - Reduces conflicts between contractors.
    - Disadvantage: limits opportunities for small contractors.
- Review specs to eliminate time delays:
    - Use HP material and maturity meters.
    - Use accelerated testing technology to address material acceptance, such as maturity meter.
    - There are many time constraints on concrete.
- Conduct a formal bridge type study:
    - Longer spans.
    - Standardization of structure types.
    - Limiting skew angles.
    - Simplify complex framing.
    - Optimize substructures and foundations.

3.2.3 INNOVATIVE CONTRACTING/FINANCING

- Adopt a financing contingency plan:
    - Sources and uses of funds.
    - Fund availability.
    - Cash flow schedule.
- Sources and uses of funds:
    - Dedicated funding.
    - Scheduled regular Federal aid.
    - Grant Anticipation Revenue Vehicle (GARVEE) financing to fund shortfalls:
        - Future Federal funds will pay the debt.
    - Alternative State revenue streams for debt financing:
        - Uncommitted toll revenues from existing facilities.
        - Air rights lease revenues.
        - Renting utility corridors within right-of-way.
        - Private sponsorship of the boulevard.
    - Sources and uses of funds:
        - Alternative local revenue for construction of boulevard.
        - Private sponsorship of the boulevard.
        - Shadow tax on parking fees.
        - Tax increment financing.
        - Special assessment district.

Figure 4. Selected Alternative



    - Public/private partnership.
  - Debt financing:
    - Municipal bonds.
    - Transportation Infrastructure Finance and Innovation Act (TIFIA).
    - Commercial paper.
    - 63-20 financing.
  - Fund availability:
    - What will it take to make alternate revenue sources available?
    - When will those funds become available for use?
    - Legislative action for GARVEE, toll revenues, or lease financing.
  - Cash flow schedule:
    - What is the timing of project expenditures?
    - Track monthly.
- Project delivery mechanisms:
  - Design/build.
  - Partial design/build.
  - Design/bid/build.
  - Construction manager at risk.
  - Reduce number of construction contracts.
  - Reduce delays.
  - Minimize conflicts between contractors.
  - Reduce cost.
  - Greater efficiencies.
  - Improve administration.
- Procurement strategies:
  - Cost + time bidding.
  - Best value.
  - Selections based on qualifications and not just cost.
  - Alternative technical concepts.

- Stipends.
- Guaranteed maximum price.
- Contracting techniques–incentive/disincentive.
- Lane rental.
- No excuse clauses.
- Performance measures.
- Sources for long lead materials dedicated prior to construction.
- Partnering agreements.
- Warranties.
- State retains salvage value of scrap materials.
- Master utility relocation agreements and schedules.

3.2.4 LONG LIFE PAVEMENT/MAINTENANCE

- Construction sequencing (get in, get out):
  - Mainline bridges complete at time of paving.
  - Bridge contractors and paving contractors bound by contract to cooperate/not obstruct.
  - Seasonal limitations for paving must be scheduled/considered.
- Single paving contract:
  - Makes an onsite plant more feasible.
  - Reduces coordination efforts.
  - Improves uniformity.
  - Potentially speeds construction and reduces cost.
  - Barrier: current system encourages multiple contracts to spread the work around.
- Incentives:
  - Magnitude of incentives should be proportional to the magnitude of the project.
  - Correlate properties and performance to develop appropriate incentives.
- Long life pavement:
  - Design life in harmony with other structures along mainline:
    - 50 + year design life attainable.
  - Use of mechanistic–empirical design methodology.
  - Move away from outdated empirical design methods toward mechanistic approach.
  - Dowel jointed concrete pavement recommended:
    - Good performance with local experience.
    - Less sensitive to subgrade stiffness variations due to groundwater proximity.
    - Multiple rehab options at end of service life.
- Pavement drainage:
  - Effective drainage essential for long life pavement.
  - Drainage of particular importance due to depressed road section near ground water elevation and river flood levels.
  - Video inspection for acceptance.
  - Durable drainage outlets (for continued performance).
- Construction controls:
  - Implement new techniques to measure key construction features.
  - Maturity.
  - In-place strength measure.
  - To accelerate construction.

    - Temperature management for curing control.
- Nondestructive dowel locator:
    - Ensure proper functioning of transverse joints.
    - Prolong working life of joints.
    - MIT-Scan device.
- Portland cement concrete (PCC) mixture considerations:
    - Design a highly *durable* mixture that is still constructible.
    - Specification requirements to include:
        - Air void spacing (freeze-thaw durability).
        - Optimized aggregate gradation (permeability, reactivity, shrinkage, cost, workability).
        - Aggregate type–limestone (coefficient of thermal expansion).
- Performance specifications:
    - Drainage.
    - Air void spacing.
    - Dowel alignment.
    - Curing.
    - Smoothness.
    - Surface Texture.

3.2.5 TRAFFIC/ITS/SAFETY/PUBLIC RELATIONS

- Traffic and safety:
    - Traffic/phasing assessed.
    - Use full closures and combine closures where capacity exists.
    - Accelerate alternate route construction.
    - Traffic control designed early on to identify conflicts.
    - Pedestrian needs and construction traffic.
    - Identify responsible/accountable:
        - Entity (contract administration).
        - Entire project and phases.
    - Lighting plans:
        - Including north/south routes (temporary and permanent).
    - Traffic control plan–how is it implemented?
        - Master contract scheduler has oversight.
        - Independent traffic control contractor.
        - Issues–clause for damage of devices.
        - Performance based–includes pedestrians.
- Intelligent transportation system (ITS)–implement smart work zones:
    - Establish elements of permanent system before major ground breaking:
        - CCTV cameras.
        - Dynamic message signs.
        - Smart work zones.
        - Roadway weather sensors.
    - Continue with regional traffic management program.
    - Provide traveler information.
    - Implement dedicated service patrols.
    - Implement incident management (performance based).

- Coordinate emergency response.
- Dedicated towing agency/contract.
- Establish Web info/e-mail.
- Public outreach–I-40 crosstown project–we'll get you there!
- Launch intensive media outreach now to inform public of upcoming construction.
- Develop information plan for motorists, residents, and business owners.
- Provide accurate and timely information via e-mail and fax lists.
- Educate the public on freeway condition, need for expedited project, and potential impacts.
- Direct motorists to alternate routes without scaring people from businesses and entertainment venues.
- Focus people on the positive aspects of project.
- Form Crosstown Impact Council–discuss emergency response, hazmat, etc.
- Conduct project tours–legislators, teachers, business organizations.
- Design project Web site, use its camera images, include easy to understand project scope and phasing, "contact us" information, and before and after pictures.
- Institute a toll free 24-hour information line (511?).
- Conduct regular public information project meetings.
- Design a project logo to use on Web site and collateral materials.
- Disseminate traffic reports twice a week and as needed via fax, e-mail, and the Web.
- Partner with media–traffic reports in newspapers, monthly meetings on site.
- Develop media kits and talking points for department and project spokespersons.

3.2.6 ENVIRONMENTAL

- Identify limits of old landfill in area of Byers, Canal, and proposed I-40.
- Conduct immediate, comprehensive hazmat subsurface investigation.
- Identify appropriate areas for contractor staging sites; obtain permits.
- Implement early corridor hazmat remediation contract before construction and during construction.
- Accelerate pedestrian bridge.
- Drainage; consider combining final design with sediment control–permanent desilitation basins.
- Provide dust and noise monitoring during construction.
- Provide continuity of design team and construction oversight team.
- Construct noise walls and fencing early.
- Confirm 404 permit is obtained in a timely manner and 401 permits are addressed appropriately and in a timely fashion.
- Define in railroad agreement who is responsible for old ties.
- Evaluate potential for burning wood debris on project site vs. landfill disposal.

3.2.7 CONSTRUCTION/MATERIALS

- Railroads and utilities:
  - Sit down meetings for construction review.
  - Master agreement for railroads and utilities.
  - Incentive/disincentive supplemental agreements.
  - Resolve issues with utilities within railroad right-of-way.
  - Time commitment–solidify on ODOT's part.
  - Give railroads an incentive for early completion of relocation.

- Constructibility review:
  - Review at 30 percent and 70 percent by local contractors and independent reviewers.
  - 90 percent specification review.
  - Develop specifications along with plans.
- Contracts:
  - Reduce number of contracts based on logical construction sequence.
  - Incentive for contractor cooperation and early completion while obtaining high quality.
  - Dispute resolution board and partnering used to keep project moving.
- Innovative processes:
  - Use GPS and electronic data gathering and record keeping to speed up surveying, project documentation, and progressive/final contractor payment.
  - Contractor would include purchase price of excess right-of-way in bid and assume ownership of parcel(s) when project is complete.
- Contract Administration:
  - Use electronic submittals with 15-day turn around.
  - Single resident engineer point of contact for entire project.
  - Raise limit of change orders. Give the division engineer a $100,000 limit and the director a $500,000 limit on change orders without Commission approval.
  - Use contractor's test results for acceptance with ODOT oversight.
  - Allow 70 percent subcontracting by special provision. The prime contractor will still have primary responsibility for contract materials availability. Use material procurement contracts to obtain long lead times before work begins on construction projects.
  - Have preestablished borrow sites designated before project is let to contract.
- Miscellaneous issues:
  - Use canal water for mixing concrete.
  - Let initial contracts for drainage, rail, water lines, and sewer lines early to clear the way for future projects.
  - Give civic groups an active part early on to obtain buy-in so that ascetic elements are manageable, cost effective, maintainable, properly defined, and constructible.
  - Partner with DEQ to develop project-specific erosion control plan to keep project within guidelines and on schedule.

3.2.8 ROADWAY DESIGN/GEOMETRICS

- Change laws to allow for design/build.
- Standardize design and construction:
  - Bridges and bridge beams.
  - Storm sewer (prefabricated inlets).
- Relocate railroad out of corridor as soon as possible.
- Sequence:
  - Railroads relocated.
  - Drainage channel/box.
  - Center section (move dirt to final location).
- Use maximum rate for calendar days with incentives (based on user delays).
- Request geotech, soil borings, hazardous materials, and ground water testing for the corridor (center section first).

- Insert hazardous materials remediation into contract.
- Start each project at the same time (street closures).
- Look at the convertibility of I-35/I-40/I-235 interchange for future configuration. Investigate impact on current project.
- Remove Shields eastbound (loop) on ramp, use Boulevard eastbound (loop) on ramp.
- Full interchange at Robinson instead of Shields.
- Clean up Boulevard eastbound to I-40E/I-35S (possible CD road). Consider moving PGL and point of rotation to crown in highway (crown two lanes from median).
- Remove eastbound frontage road between Pennsylvania and Western (consider CD roads).
- Convertibility of I-40/I-44 interchange. Investigate impact on current project.
- Eliminate Agnew interchange and make Pennsylvania a full interchange:
    - Eliminate Agnew eastbound off.
    - Eliminate Agnew westbound on.
    - Eliminate Agnew westbound off.
    - Revise eastbound off ramp to Pennsylvania via Boulevard.
    - Combine Penn westbound on ramp with westbound Boulevard.
- Add auxiliary lanes:
    - Add auxiliary lanes between Pennsylvania and Western on both sides.
    - Add auxiliary lanes between Western and Robinson on both sides.
- Robinson Avenue interchange:
    - Make Robinson Avenue a full interchange (tight diamond).
    - Improve Robinson between new I-40 and new Boulevard to six-lane facility.
- Shields Boulevard interchange–eliminate ramps at Shields Boulevard.
- I-40/I-35/I-235 interchange–deletions Reno to Byers eliminated:
    - Eliminate Reno realignment.
    - Eliminate proposed I-35 northbound to I-40 westbound.
- I-40/I-35/I-235 revised interchange retain Byers to Lincoln connection:
    - Retain Reno to I-35 southbound.
    - I-40 eastbound to I-35 southbound (south of loop):
        - Add auxiliary lane between Robinson eastbound on ramp to new I-40 eastbound to I-35 southbound ramp.
    - Eastbound Boulevard connection to I-35 southbound.
    - Revised northbound I-35 to westbound I-40 and westbound Boulevard.

A description of each of these skill sets is included in Appendix B.

CHAPTER 4

Next Steps

ODOT will be evaluating the recommendations from each of the skill sets to determine which of the ideas or suggestions should be adopted for use during the remainder of the planning, design, and construction phases of the I-40 Crosstown Expressway Relocation.

Additionally, 6-month and 1-year meetings will be held with ODOT to assess the long-term benefits of the workshop and the extent of the implementation of its recommendations.

APPENDIX A

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APPENDIX B

Skill Set Descriptions

- **Railroad/Utilities Coordination**
  Utility and railroad delays seriously affect accelerated operations. More innovative solutions are required for both short- and long-term time-sensitive construction projects. Other items to consider are industry responsiveness, incentive-based utility agreements, corridor approaches to utility agreements, contracting for utility work, and non-destructive methods of utility relocation. Close railroad coordination is essential for a project, whether because of the need for construction access or because work being done affects the railroad lines.

- **Structures/Geotechnical**
  Accelerating the construction of structures will require deviation from standard practices for design and construction and include early coordination between designers and contractors. A systems approach from the "ground up" will be necessary instead of emphasis on individual components. Prefabrication, preassembly, incremental launching, lift-in, roll-in, etc., are systems or concepts that have a proven contribution to accelerating construction and should be understood and receive priority consideration. Designers have several options in structure types and materials to meet design requirements, but identifying the most accommodating system while minimizing adverse project impacts should be the objective. Subsurface conditions and issues should be explored to assess their impacts on the project. Based on the geography of the project, subsurface investigation may be complicated by traffic volume, environmental hazards, utilities, railroad property, and right-of-way.

- **Innovative Contracting/Financing**
  Innovative contracting and financing align the financing options with the goals of the project by matching anticipated cash flow with project management, while recognizing competing priorities for existing resources. Financing tools could include cost sharing strategies, tolling mechanisms, contractor financing, leveraging techniques, credit assistance, cost management, and containment concepts. Explore the state-of-the-art in contracting practices and obtain a better knowledge of how these techniques could be selected, organized, and assembled to match the specific situations needed on this project. Techniques to be considered include performance-related specifications, warranties, design/build, maintain, operate, cost + time, partnering escalation agreements, lane rental, incentive/disincentives, value engineering, and any other innovative contracting techniques that would apply to the project.

- **Long Life Pavement/Maintenance**
  It is feasible to acquire pavement designs approaching a 50 to 60 year design life by telling the contractor what is wanted, rather than how to build the pavement. By identifying and communicating the pavement performance goals and objectives for the pavement, the designer and contractor have the maximum freedom to determine the appropriate methodology. Explore the future maintenance issues on the project also, including winter services, traffic operations, preventative maintenance, and any other concerns that may affect the operations of the project features.

- **Traffic/ITS/Safety/Public Relations**
  Enhanced safety and improved traffic management by corridor contracting should be considered. Developing and evaluating contract models may illustrate the best use of incentives to enhance safety and improve traffic flow during and after construction. Evaluating both the construction and maintenance work may help access traffic and safety issues more fully than the conventional

project-by-project approach. Better information should be provided to the traveling public and politicians on the relationships among crashes, delays, mobility, total traffic volume, truck traffic volumes, and the need for lane closures during construction. Implement integrated ITS systems to communicate construction information to motorists via radio, the Internet, and wireless alerts, along with incident management systems/services. Use of public relations techniques for informing the traveling public should be implemented, including public Web sites, media campaigns, and periodic press releases.

- **Environmental**
  Scope-of-work and construction activities need to reflect environmental concerns to ensure the most accommodating and cost-effective product, while minimizing any socioeconomic impacts. Context-sensitive design explores opportunities to blend the existing environment with the proposed roadway. Recognizing community, environmental, and aesthetic requirements is essential in urban settings.

- **Construction/Materials**
  Accelerated construction may press the contractor to deliver a quality product in confined time frames and areas, while maintaining traffic. Completion milestones and maintenance and protection of traffic are key elements visible to the traveling public. Allowing contractors to have input on design elements that would affect time or quality during construction can improve the effectiveness and efficiency of the overall project completion. The use of automation to enhance construction equipment performance; construction engineering and surveying; data collection and documentation; and contract administration should be explored and implemented. Pursue options to expedite and facilitate turnaround times in material testing for material acceptance and contractor payment. The use of innovative materials should be explored and encouraged on projects to maximize the creative characteristics of the designer and contractor. By identifying project performance goals and objectives, the designer and contractor have the maximum freedom to determine the appropriate methodology for constructing the project.

- **Roadway Design/Geometrics**
  Highway geometrics can greatly affect project funds and integrity. Although designers may have several options in meeting design standard requirements, identifying the most accommodating product while minimizing adverse impacts should be the objective. Utilizing minimum design standards should be left for extreme cases. Local drainage as well as major crossings can be the driving force behind many design decisions. Significant portions of both construction and maintenance funds are expended for drainage-related items.

APPENDIX C

Skill Set Reporting Forms

RAILROAD/UTILITIES

NOTE : This form was unavailable at the time of meeting; therefore, notes are not in specified format.

RR–Utility Motto: C + C + C = C Communication + Cooperation + Coordination = Commitment

Railroad Notes:

- Coordination has already begun with railroad companies.
- They have been relatively helpful to this point.
- Area of concern–UP and BNSF crossings near the cotton mill area.
- Initial funding of project is key for railroad relocations.
- Estimated cost = $20 million???

BNSF

- New alignment for railroad is identified.
- Agreements are in progress. Engineering agreements in place.
- Need to determine what railroad communications are present and need to be relocated.
- ODOT to establish a drop dead date for relocation.
- Possibly offer incentives to encourage timely completions.

UP

- Agreement on relocation route needed (95 percent agreed–still questions on temporary locations).
- Agreements in draft form.
- Estimates have been requested from UP.
- Canal crossing in design.

Questions

- Letting dates?
- Bridge attachments (utilities, etc).
- Funding obstacles.
- What is the hold up from FHWA?
- Are we in communication with the correct railroad officials?
- Is the Gantt chart realistic to railroads? Need their buy-in on timeframe.

Utilities Notes:

- Oklahoma has property take system that is not as difficult as some adjacent States–helpful.
- Partial takes estimated at 40 pieces. Partial takes are often difficult to obtain, and utilities are usually in these areas. This process needs to begin ASAP.
- Oklahoma cannot purchase property on behalf of utilities. They can purchase, allow access, and retain ownership. Team recommended ODOT purchase easements while purchasing right-of-way to expedite process.
- Significant utilities to relocate paralleling proposed corridor–fiber optics, high-volt OHE, sewer mains.
- Depressed section needs wall hydrants. Treat as a tunnel.

- Control of utility relocations by design firm and ODOT is helpful. ODOT can control crossing locations.
- Team suggests water and sewer be made part of roadway contract.
- Scheduling is critical.
- One utility contact (not one person, but team) is needed. Treat complete project as one utility relocation project.
- Immediate funding is necessary for timely design and relocations. Maybe from alternative funding sources.
- Pursue a release for funding now.
- Due to railroad schedule, utilities need to be completely moved from railroad corridors as much as possible. If utilities are waiting on railroad approvals, they could be delayed due to the railroad review process.
- Consider two moves for each utility, one temporary and one permanent, to expedite.
- Look at directional boring to cross from north to south.
- Strategically placed north-south ducts for common use should be encouraged.
- Set realistic design and relocation goals.
- Partial takes should be phased with utility relocation timing.
- Establish utility route up front.
- ODOT to purchase utility easements on behalf of companies….can be very helpful.
- Use alternative corridors (example: 7th Street for depressed area) for utility relocations. Special agreements may be necessary.
- Sell Feds on two moves to get utilities back in R corridor (fiber).
- Communication lines may have difficulty relocating if U.S. Homeland Security goes up.
- Look at seasonal relocations (water, etc.).

STRUCTURES/GEOTECHNICAL		
IDEA (Short Name)	**IDEA (Detailed Description)**	**Implementation Details (Barriers, Skill Set Coordination, etc.)**
Elevate depressed section.	Elevate I-40 on structure or embankment from east of Western Avenue to east of BNSF Railroad. The Union Pacific railroad would remain in place and at existing elevation. Walker and Robinson Avenues would remain depressed with some improvement to grade. Consider segmental concrete box construction for mainline structures.	Advantages: Eliminate shoe-fly and reconstruction for Union Pacific. Eliminate bridge over I-40 for the BNSF railroad. Eliminate unknown cost-time issues associated with railroad relocation. Significantly reduce construction time and increase potential cost savings (18 months out of the critical path for BNSF shoe-fly bridge). Eliminate depressed section drainage issues and ground water impacts. Eliminate reconstruction of Lee Street outfall. Minimize potential hazardous material. Hazardous material incident issues are reduced. Safety and rescue issues are improved. Opportunity to eliminate pedestrian bridge at Hudson Boulevard and provide at-grade access. Reduce the need to reconstruct Shields Avenue. Eliminates impacts and unknown cost to Union Station and Cold Storage. May be able to provide full interchange at Shields and eliminate the interchange at Robinson. Disadvantages: Environmental document would have to be revisited. Noise impacts. Visual impacts. Long-term maintenance needs. Need for deicing or anti-icing. Increase need for barrow. The ramp lengths will change.
Identify staging areas.	Onsite or near onsite.	Advantages: Save time and money. Move bigger precast elements—easier delivery. Minimize impact on local traffic and to existing infrastructure. Disadvantages: Impacts to local neighborhoods.

STRUCTURES/GEOTECHNICAL		
IDEA (Short Name)	**IDEA (Detailed Description)**	**Implementation Details (Barriers, Skill Set Coordination, etc.)**
Early geotech investigation.	A two-phase geotechnical investigation should be conducted along the alignment. One preliminary investigation should be done as soon as possible that addresses all geotechnical, drainage, and hazardous material concerns. A second detailed geotechnical investigation needs to be done for each design phase.	Advantages: Especially around cold storage plant, structures, landfills, and high fills. There are a lot of things that can be done to accelerate construction in bad soils. Need to know if the excavation from the depressed section can be used for fill.
Review specs to eliminate time delays and use accelerated testing technology to address material acceptance such as maturity meter.	There are many time constraints on concrete. They need to be changed to strength limits.	Advantages: Saves time.
Eliminate cast-in-place walls. Use alternative retaining walls for the depressed section.	Typical practice is to design cantilever walls and allow MSE as alternative. The category of wall would not be required. The plans would identify line, grade, and aesthetics, and the wall selection and construction would be done by the contractor.	Advantages: Saves design time. Provide opportunity for achieving most cost-effective alternative and construction time for walls.
Roll-in bridge construction for BNSF railroad over I-40 and over Boulevard.	Eliminate shoe-fly by constructing permanent structure off alignment then moving it in place within 24-hour periods.	Advantages: Time and major cost savings. Moves this item off critical path for the I-40 bridge. Disadvantage: There is a risk to the railroad if the structure is not open in time.

STRUCTURES/GEOTECHNICAL		
IDEA (Short Name)	**IDEA (Detailed Description)**	**Implementation Details (Barriers, Skill Set Coordination, etc.)**
Consider bridge VS walls on all elevated ramps.		Implementation Detail: Need to identify the transition between wall and bridge to minimize cost and time.
Consider prefabricated structure elements throughout.	Consider full depth, precast decks, segmental concrete box girder superstructure, prefabricated superstructure, and prefabricated substructures.	Advantages: Time savings. Improved durability. Disadvantages: New technology to Oklahoma.
Consider alternate foundation types and load testing. Use self consolidating concrete for drilled shafts.	Micro-piles are faster and can use smaller equipment for installation. Load testing needs to be completed during the design phase.	Advantages: Optimize design. Disadvantage: New technology to Oklahoma.
Consider giving prequalified contractors advanced plans and shorten bid time.	Provide 60 percent plans to pre-qualified contractors. Conduct constructibility meetings to get contractor input.	Advantages: Allows reduction in formal bid time.
Reduce the number of contracts.		Advantages: Saves time. Increases competition. Minimizes soil movement. Reduces conflicts between contractor. Disadvantages: Eliminates small contractors.
Eliminate shop drawings for prestressed girders.	Use plan details to the maximum extent possible. Fabricate girders to plan details unless contractor elects to make revisions.	Advantages: Save time and review efforts.

STRUCTURES/GEOTECHNICAL		
IDEA (Short Name)	**IDEA (Detailed Description)**	**Implementation Details (Barriers, Skill Set Coordination, etc.)**
Conduct a formal bridge type study.	For each bridge site, compare alternative spans, structure types, foundation types, etc., relative to cost and construction duration to determine the best structure for each location.	Functional plans reflect a wide variety of structure types, unusual framing conditions, unusually close beam splicing, severe skew angles, short and variable span lengths, and large number of substructure units. Time savings, economy, and increased durability may be achieved by longer spans, standardization of structure types, and limiting skew angle.

LONG LIFE PAVEMENT/MAINTENANCE		
IDEA (Short Name)	**IDEA (Detailed Description)**	**Implementation Details (Barriers, Skill Set Coordination, etc.)**
Long life pavement (mainline).	Design pavements for the longest life possible in harmony with the structures along mainline. Strongly consider concrete solutions (DJCP with widened slabs), due to local performance history, lower sensitivity to base instability, and rehabilitation potential.	Use M-E Pavement Design (NCHRP 1-37A) procedures for final design (move away from outdated empirical design methods toward mechanistic approach).
Pavement drainage.	Ensure that water effects are considered with properly designed and constructed drainage system, particularly in depressed sections (critical issue).	Ensure proper execution by use of video inspection and performance specifications. Design and construct drainage feature to be less susceptible to damage from maintenance work or errant vehicles.
Construction controls.	Ensure that quality and speed are attained by employing the latest available tools and techniques.	Require use of maturity methods (for strength, to accelerate construction, and curing control), nondestructive dowel bar locator.
Mixture considerations.	To provide a mixture that is producible while meeting the durability requirements of a long life pavement.	Air void specification detailing required spacing factor (AVA), optimized aggregate gradation, and require use of limestone aggregates.
Performance specifications.	Employ performance specifications where possible in a variety of areas to maximize potential for high quality.	Performance specification should be implemented in the following areas, if possible: • Drainage. • Smoothness. • Dowel alignment. • Maturity (strength and temp management). • Curing. • Friction? • Noise?

LONG LIFE PAVEMENT/MAINTENANCE		
IDEA (Short Name)	**IDEA (Detailed Description)**	**Implementation Details (Barriers, Skill Set Coordination, etc.)**
Incentives.	Re-examine the use of incentives/disincentives. Also ensure that the magnitude of the incentives reflect the magnitude of the project.	Attempt to correlate properties to performance to develop appropriate incentives (i.e., provide incentives that motivate contractors to improve the quality).
Single mainline paving contract.	If a single contract is not possible, then minimize number of paving contracts as much as possible. Makes an onsite plant more feasible, reduces coordination efforts, improves uniformity, and potentially speeds construction and reduces cost.	An onsite plant will speed construction, minimize congestion, and encourage innovation. Barrier: Current system encourages multiple small contractors to spread the work around.
Construction sequencing/schedule.	Sequence and schedule paving to minimize conflicts with other work, and to maximize speed of paving.	Finish mainline bridges prior to start of paving. Avoid contractors obstructing each others' work in contract documents. Avoid scheduling paving during winter months to maximize speed of construction.

TRAFFIC/ITS/SAFETY/PUBLIC RELATIONS

- Traffic Concerns:
  - Local versus through traffic.
  - Peak 6-9 am/3-7 pm.
  - Truck traffic.
- Incident management during construction.
- Public not tolerant of delay.
- Accommodating special events.
- Construction sequencing.
- Zone of influence beyond physics limits of project.
- Alternate routes origin/destination patterns.
- Remove tolls.
- Smart work zones.
- CCTV monitoring cameras for oversight of construction activities at the onsite field office.
- Use of portable DMS/CCTV/speed monitoring.
- Interim geometric fixes.
- Coordinate with other work zones.
- Project management.
- North/south two lanes each way confirm consolidation of crossings.
- Operation analysis and systems impacts.
- Beyond physical limits of construction area.
- Movement of traffic east/westbound.
- Truck restrictions (alternate routing).
- Service patrols courtesy of ?? (MOU/MOA).
- Existing alignment use of service patrols to aid safety/PR.
- Coordination use of police/local/State responsibility confirmation.
- Development of Safety Advisory Committee:
  - ODOT, State and local law enforcement, emergency response, Tinker AFB, others.
- Emergency vehicle response notified of route closing and Air Force.
- Confirm traffic north/south and time of day and east/west for closures.
- Work zone delay analysis/queue analysis.
- Consolidate north/south crossing via detour and construct more structures in less time (demand analysis).
- Availability of tow trucks: response requirements or precertified wreckers/incentives, coordination with Tinker AFB.
- Overall traffic management in region to support alt-routes.
- E-mail/fax broadcast.
- Coordinate with media CCTV.
- Coordination with other States.
- Logo for I-40 Crosstown Project.
- PR firms/in-house (local).
- Broadcast announcements, newspapers, AAA, Oklahoma ATA.
- Business survival guide.
- Monthly meetings with local affected groups.
- Postcards to local residence owners.

- Lane rentals and let public know.
- Tours of the construction site, school outreach, outreach of Union Station and Church/Riverside.
- Gazebo to be gathering place/exhibit/artwork/bilingual/fountain.
- Temporary ramp closures/modify routes.
- Education/public information.
- Special events.
- Coordination with business/community/trucking associations.

Major Themes

Public Outreach
- Daily/monthly/long term.
- Coordination with other States.

Maintenance of Traffic Control (entire versus staged versus project)
- Smart work zone.
- Temporary control of traffic.
- Delay/queue analysis at connection points.
- Truck restrictions/routing.
- Third-party traffic control coordination–entire corridor:
  - Performance based/incentive.
- Police/service patrols.
- Phasing of construction.
- Alternate routes/special events.
- Lane rental.

Incident Management/Corridor Management/Reg.
- Fire hydrant/median openings.
- Service patrol.
- Tow trucks/hazmat.
- ITS.

Long Term Operation Plan

Identify Responsible Entity for Accountability
- Subcontractors.

Signing Plan
- Ultimate.
- Phased.

System Operations Analysis
- Access justification report.

Coordination
- Utility/railroad.

- ODOT field staff with authority, right-of-way, right-of-entry.
- Movement of traffic.
- Phasing/staging/control of traffic.
- Minimize the number of contracts.
- Between contractors/agency/public.
- Fixed checkpoints to coordinate between contracts.
- Constructability reviews.
- Master construction schedule(r).
- Third-party maintenance of traffic control coordination.

Recommendations:

- Traffic/phasing assessed and pedestrian needs and construction traffic:
  - Use full closures and combine closures where capacity exists.
  - Accelerate alternate route construction.
  - Traffic control designed early to identify conflicts.
  - Pedestrian needs and construction traffic.
- Identify responsible/accountable entity (contract administrator) for entire project and phases.
- Lighting plans:
  - Including north/south routes (temporary and permanent).
- Traffic control plan–how is it implemented?
  - Master contract scheduler has oversight.
  - Independent traffic control contractor.
  - Issues–clause for damage of devices.
  - Performance based–include pedestrians.
- Public Outreach–I-40 Crosstown Project–We'll get you there!
  - Launch intensive media outreach now to inform public of upcoming construction.
  - Develop information plan for motorists, residents, and business owners.
  - Provide accurate and timely information via e-mail and fax lists.
  - Educate public of freeway condition, need for expedited project, and potential impacts.
  - Direct motorists to alternate routes without scaring people from businesses and entertainment venues.
  - Focus people on positive aspects of project.
  - Form Crosstown Impact Council–discuss emergency response, hazmat, etc.
  - Conduct project tours–legislators, teachers, business organizations.
  - Design project Web site, use ITS camera images, include easy-to-understand project scope and phasing, "contact us" information, and before-and-after pictures.
  - Institute a toll-free 24-hour information line (511?).
  - Conduct regular public information project meetings.
  - Design project logo to use on Web site and collateral materials.
  - Disseminate traffic reports twice a week and as needed via fax, e-mail, and the Web.
  - Partner with media–traffic reports in newspapers, onsite monthly meetings.
  - Develop media kits and talking points for department and project spokespersons.

Intelligent Transportation System (ITS)

- Implement smart work zones.
- Establish elements of permanent system before major groundbreaking:

    - CCTV cameras.
    - Dynamic message signs.
    - Smart work zones.
    - Roadway weather sensors.
- Continue with regional traffic management program.
- Provide traveler information.
- Implement dedicated service patrols.
- Implement incident management (performance based):
    - Coordinate emergency response.
    - Dedicated towing agency/contract.
- Establish Web info/e-mail.

ENVIRONMENTAL		
IDEA (Short Name)	**IDEA (Detailed Description)**	**Implementation Details (Barriers, Skill Set Coordination, etc.)**
1. Locate and characterize waste material in the old landfill in the area of the canal/Byers/ proposed I-40.		Barrier: Information not available. SSC: Geotechnical, Construction. Coordination Comments: Geotechnical: An investigation needs to be done to identify extent of old landfill—agrees. Construction: Agree, needs to be identified and addressed before construction. Recommendation: Do comprehensive investigation to locate, characterize material, and determine the extent and effect the existing landfill will have on construction.
2. Comprehensive subsurface hazmat investigation.	Early identification and remediation before construction starts. Identify suspect areas (i.e., old landfills, drilled shafts, cut area, etc.) identified as potential/suspect contaminated sites. Determine location of underground contaminations, contaminated ground water plumes, and/or other potential hazmat sites that could cause delays and claims if not discovered.	Barriers: Legal right of entry to unacquired property. Funding, scope, and immediate implementation. SSC: Geotechnical, Contracting, Administration. Coordination Comments: Geotechnical: Agree, they are going to do a preliminary and final (if required) hazmat subsurface investigation. Construction: Agree. Recommendation: Complete detailed hazmat subsurface immediately and combine with no. three below to minimize contractor delays and claims.
3. One early contract to do corridor hazmat remediation/removal work.	Work to clear entire corridor before contractor starts and have available onsite for duration of construction to reduce delays and claims. Write new contract and specification to define response time, etc., to avoid delays and claims.	Barrier: ODOT contract for this currently addresses requirements to keep project on schedule, i.e., response time, etc. SSC: Contracting, Environmental, Construction. Coordination Comments: Construction: Recommend. Contracting: Agree. Recommendation: Proceed with developing and advertising this contract.

ENVIRONMENTAL		
IDEA (Short Name)	**IDEA (Detailed Description)**	**Implementation Details (Barriers, Skill Set Coordination, etc.)**
4. For areas along corridor and at the Byers neighborhood within proposed right-of-way, identify and permit for use as staging area.	Require contractor to grade park area to final park contours before they leave. Pre-clear sites with other agencies. Also other area that city has park plans for (final grading when contractor leaves, etc.). Also Byers neighborhood area. Obtain preapproval and environmental clearance of proposed staging areas.	Barrier: Neighborhood at pedestrian bridge. MOA/MOU city, DEQ, etc. SSC: PR, other agencies—city, DEQ, etc. Coordination Comments: PR: Not at the pedestrian bridge location. Construction: Not at pedestrian bridge location. Right-of-Way: Agrees. Recommendation: Proceed in identifying areas and obtaining permits for them.
5. Accelerate pedestrian bridge.	Allows pedestrian access during construction. More a PR issue for the neighborhood's benefit. Pedestrian bridge is not on critical path.	Barrier: Decision. SSC: PR issue, scheduling—construction and design. PR: Agreed. Construction: Agreed. Recommendation: Advance pedestrian bridge as much as possible without affecting CPM.
6. Final design considerations for drainage on cut section.	Construction phasing—confirm adequate drainage during individual construction phases. Monitoring wells for ground water monitoring. Take steps to prevent flooding of cut section during construction.	SSC: Roadway and Drainage and DEQ. Coordination Comments: Roadway/DEQ: Consider settlement/detention ponds before discharges into the river. Recommendation: Further evaluation with roadway/drainage.
7. Confirm there is an environmental consultant to provide noise and dust monitoring during construction.		Confirmed

ENVIRONMENTAL		
IDEA (Short Name)	**IDEA (Detailed Description)**	**Implementation Details (Barriers, Skill Set Coordination, etc.)**
8. Construction oversight: same team as design continuity.		Confirmed
9. Construct noise walls and fencing early for benefit of adjacent property and pedestrians.	Reduce noise impacts during construction and provide separation between pedestrians and construction area.	Barrier: Schedule—can this be advanced? SSC: PR and Construction. Coordination Comments: Construction: Agreed and are looking at and recommending early construction for these. PR: Agrees for safety and noise control. Recommendation: Proceed with advancing these as appropriate with entire project.
10. Confirm 404 permit is in progress and 401 permits will follow without delays.		Barrier: 404. SSC: DEQ. Confirmed.
11. Salvage of railroad ties should be responsibility of railroads.		Barrier: Appropriate railroad agreements. SSC: Railroad and Utilities. Railroad: Railroad will take ties with them—will be in railroad agreement. Recommendation: Railroad ties must be addressed in railroad agreements.
12. Burning wood instead of putting in landfill.		Recommendation: Environmental will investigate this further.

CONSTRUCTION/MATERIALS		
IDEA (Short Name)	**IDEA (Detailed Description)**	**Implementation Details (Barriers, Skill Set Coordination, etc.)**
Railroad and utilities.	Agreements with contractor. Total buy-in from railroads.	Sit-down meetings for construction review. Master agreement for railroads and utilities. Incentive/disincentive supplemental agreements. Resolve issues with utilities within railroad right-of-way. Time commitment—solidify on ODOT's part. Give railroads incentive for early completion of relocation.
Constructability review.	Constructability review on existing plans, CPM, and quantities. Tie-in to existing alignments.	Review at 30 percent and 70 percent by local contractors and independent reviewers. 90 percent specification review. Develop specifications along with plans.
Contracts.	Too many mainline construction projects. Projects are interrelated and will require cooperation and coordination between two or more contractors. Cooperation of UPRR and BNSF is required for successful completion of project. Disputes between owners and contractors can slow down or stop progress on construction projects.	Reduce number of contracts based on logical construction sequence. Incentive for contractor cooperation and early completion while obtaining high quality. Dispute resolution board and partnering used to keep project moving.
Innovative processes.	GPS/electronic data. Pre-procurement of precast items, etc. Contractor staging area/real estate issues.	Use GPS and electronic data gathering and recordkeeping to speed up surveying, project documentation and progressive/final contractor payment. Contractor would include purchase price of excess right-of-way in bid and assume ownership of parcel(s) when project is complete.

CONSTRUCTION/MATERIALS		
IDEA (Short Name)	**IDEA (Detailed Description)**	**Implementation Details (Barriers, Skill Set Coordination, etc.)**
Contract administration.	Shop drawing and submittal review can delay projects. Oklahoma statutes require that change orders be micro-managed by ODOT senior staff and Highway Commission. Materials tests are being duplicated by ODOT and contractors, causing wasted man hours, disputes, and delays in providing test results. Due to the size and type of work on this project, it will be difficult or impossible for prime contractor to complete 50 percent of work.	Use electronic submittals with 15-day turnaround. Single resident engineer point of contact for entire project. Raise limit of change orders. Give division engineer $100,000 and director $500,000 limit on change orders without Commission approval. Use contractors test results for acceptance with ODOT oversight. Allow 70 percent subcontracting by special provision. Prime contractor will still have primary responsibility for contract.
Materials availability.	There is a possibility that obtaining paving materials and steel will cause delays due to shortages. 2.5 million cubic yards of borrow is required for this project.	Use material procurement contracts to obtain long lead-time items before work begins on construction projects. Have preestablished borrow sites designated before project is let to contract.
Miscellaneous issues.	It will be difficult to obtain water for concrete plants in this area. This project is complex and has many items of work that are sequential. Coordination of aesthetic elements of the project may cause construction and scheduling problems if not properly managed and addressed. This project is being constructed in an environmentally sensitive area.	Use canal water for mixing concrete. Let initial contracts for drainage, rail, water lines, and sewer lines early to clear the way for future projects. Give civic groups an active part early on to obtain buy-in so that aesthetic elements are manageable, cost effective, maintainable, properly defined, and constructible. Partner with DEQ to develop project specific erosion control plan to keep project within guidelines and on schedule.

ROADWAY DESIGN/GEOMETRICS		
IDEA (Short Name)	**IDEA (Detailed Description)**	**Implementation Details (Barriers, Skill Set Coordination, etc.)**
Design/build laws.	Change Oklahoma laws to allow for design build. One prime contractor and design as you go. Contractor decides how he can speed up the construction. Design and construction are done concurrently.	Law must be changed. Consultants are nearly under contract already so contracts need to be modified or cancelled.
Standardize.	Simplify design and construction. Bridges, bridge beams, and storm sewers (prefabricated inlets). Inlets could be oversized and walls could be designed for different height ranges.	None.
Railroad construction.	Move railroads out of corridor as soon as possible.	Early coordination and use existing relationships to expedite railroad issues.
Construction sequence.	1, Railroad. 2, Center section drainage channel/box. Move dirt from excavated sections to future fill areas.	Material may not be suitable for embankment.
Railroad exchange tracks.	How will the UP/BNSF exchange contracts affect the project?	This subject was not discussed but the concern was raised.
Calendar days.	Use maximum rate for calendar days with incentives. Based on user delays.	None.
Request testing.	Request geotechnical, hazardous waste and ground water testing. Begin with the center section since those projects are on the critical path.	Time to initiate contracts.
Start of construction.	Begin all construction at the same time (giving consideration to street closings).	Possible overloading of consulting engineering firms.
I-40/I-35/I-235.	Look at convertibility of interchange. Possibly use CD roads. Investigate impact on current project.	Need detailed planning of interchanges, which would take more time than the current plan would allow.

ROADWAY DESIGN/GEOMETRICS		
IDEA (Short Name)	**IDEA (Detailed Description)**	**Implementation Details (Barriers, Skill Set Coordination, etc.)**
Shields interchange.	Remove Shields interchange in exchange for a Robinson interchange.	City of Oklahoma City may be resistant to this.
Robinson interchange.	Make Robinson a full interchange (tight diamond) instead of Shields. Improves driver expectability and weave distances with I-40/I-35/I-235.	Need to improve Robinson Avenue between the new I-40 and the new Boulevard.
Boulevard eastbound to I-40 eastbound.	Revise ramp from loop ramp to a CD road or a higher speed ramp.	Geometric constraints.
Eastbound Frontage road.	Remove eastbound Frontage Road between Pennsylvania and Western. Consider auxiliary lane between Pennsylvania and Western. Use local streets to access the trails and river improvements.	Resistance from the City of Oklahoma City and the local community.
I-40/I-44.	Look at convertibility of the interchange. Investigate impact on current project.	Time needed to complete design.
Operational analysis.	Review operational aspects (weave distances) on all ramps.	New contract with ODOT to review the operational analysis.
Traffic.	Review traffic analysis to confirm operational issues.	New contract with ODOT to review the traffic analysis.
Hazardous materials remediation.	Insert hazardous materials remediation into contracts to facilitate quicker response and remediation when hazmat sites are discovered.	State agency may choose to complete the remediation.
PGL and point of rotation.	Consider moving the PGL and the point of rotation to the crown (two lanes over from the median).	The point of rotation is already at the crown.

ROADWAY DESIGN/GEOMETRICS		
IDEA (Short Name)	**IDEA (Detailed Description)**	**Implementation Details (Barriers, Skill Set Coordination, etc.)**
Eliminate Agnew interchange.	Eliminate Agnew eastbound off-ramp, Agnew westbound on-ramp, and Agnew westbound off-ramp. Revise eastbound off-ramp to Pennsylvania via the Boulevard. Combine Pennsylvania westbound with the westbound Boulevard.	Local resistance to the elimination of Agnew interchange. May have to change the ROD.
Auxiliary lanes.	Add auxiliary lanes between Pennsylvania and Western on both sides of the highway. Add auxiliary lanes between Western and Robinson on both sides of the highway.	May be geometric constraints with the UP railroad.
I-40/I-35/I-235 interchange deletions.	Eliminate Reno to Byers in exchange for the current Lincoln/Byers configuration. Eliminate the Reno realignment. Eliminate proposed I-35 northbound to I-40 westbound in favor of a revised alignment.	I-40 would have to be raised an additional 12 feet (approximate). Geometric and traffic constraints in revising the I-35 northbound to I-40 westbound.
I-40/I-35/I-235 revised interchange.	Retain the current Lincoln/Byers connection.	I-40 needs to be raised approximately 12 feet.
I-40/I-35/I-235 revised interchange.	Retain the Reno to I-35 southbound ramp.	New abutment needs to be further north and new beams and bridge deck on most northerly span.
I-40/I-35/I-235 revised interchange.	Revise I-40 eastbound to I-35 southbound ramp to the south side of the Boulevard loop ramp. Add an auxiliary lane between Robinson interchange and the I-40 eastbound to I-35 southbound ramp.	Vertical geometry with Byers and horizontal geometry with the lower canal at the river.
I-40/I-35/I-235 revised interchange.	Revise I-35 northbound to I-40 westbound/Boulevard ramp.	Geometric constraints (specifically, vertical geometry).