

Oklahoma Long Range TRANSPORTATION PLAN



Moving Oklahoma
FORWARD

Technical Memorandum

Environmental Issues and Mitigation Activities

Prepared for:

Oklahoma Department of Transportation

Prepared by:

**CDM
Smith**

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The Technical Memos were written to document early research for the 2015-2040 Oklahoma Long Range Transportation Plan (LRTP). Most of these memos were written in 2014; all precede the writing of the 2015-2040 Oklahoma LRTP *Document* and 2015-2040 Oklahoma LRTP *Executive Summary*.

The 2015-2040 Oklahoma LRTP *Document* and 2015-2040 Oklahoma LRTP *Executive Summary* were composed in Spring 2015.

If there is an inconsistency between the Tech Memos and the 2015-2040 Oklahoma LRTP *Document* or 2015-2040 Oklahoma LRTP *Executive Summary*, the reader should assume that the *Document* and *Executive Summary* contain the most current and accurate information.



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1 INTRODUCTION

The Oklahoma Department of Transportation is responsible for the design, construction, operation, and maintenance of the state's 12,265 miles of highways, 6,828 bridges, and 212 miles of state owned railroad. ODOT administers a variety of other modal programs including passenger rail, public transit, and waterways.

This technical memorandum discusses the following:

- Environmental policy actions including current and potential mitigation activities related to transportation investments;
- Growing quantity of seismic events in Oklahoma and potential impact to transportation infrastructure;
- Extreme weather events and possible transportation-related adaptation strategies to prepare for such events; and
- Oklahoma's current air quality status in relation to transportation.



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2 TRANSPORTATION AND ENVIRONMENTAL POLICY ACTIVITIES IN OKLAHOMA

Signed into law on January 1, 1970, the National Environmental Policy Act of 1969 (NEPA) established a national environmental policy and a framework for considering the environment in decision-making for Federal actions. The NEPA process is intended to help public officials make decisions that are based on understanding of environmental consequences, and take actions that protect, restore, and enhance the environment.¹ Environmental reviews for federally funded projects, including design of a transportation facility or a maintenance/preservation project, should involve an interdisciplinary and interagency process. This process includes input from the public and project stakeholders, as well as other agencies, to ensure that all environmental and any other identified issues are addressed.

The Federal Highway Administration (FHWA) implemented regulations specific to transportation projects, Environmental Impact and Related Procedures (23 CFR 771). This requires FHWA and other transportation agencies to consider potential environmental impacts to the social, cultural, and natural environment, while taking into account the public's need for safe and efficient transportation. ODOT works with the FHWA to comply with NEPA and other environmental regulations and requirements.

In the development and operation of the transportation system, ODOT considers social and human environmental issues including but not limited to community activity centers, parks and recreation areas, underground storage tanks, socioeconomic impacts and environmental justice. ODOT's cultural resources program reviews proposed transportation projects and programs in relation to historic and archeologic properties and locations. Natural environmental resources such as water, air, noise, and threatened or endangered species of animals and plants are considered in the project development process.

The most recent federal transportation bill, Moving Ahead for Progress in the 21st Century Act (MAP-21), was signed into law on July 6, 2012. It provides funds and transforms the policy and programmatic framework for investments to guide the development and growth of the country's transportation infrastructure.

Two of MAP-21's main objectives are protecting the environment and reducing delays in project delivery. MAP-21 promotes accelerating project delivery and encourages innovation through the increased use of Categorical Exclusions, programmatic approaches, and planning and environmental linkages.

The majority of highway improvement projects in Oklahoma generally involve bridge replacement or highway widening. ODOT has a committed, reliable Eight Year Construction Work Plan and four year Transportation Improvement Program; and related scoping and environmental review processes are utilized to streamline project development and to provide a more efficient project delivery.



Better planning and coordination provides a collaborative approach to decision making, which can reduce unexpected complications and project delays through effective communication with the natural, cultural and historic resource agencies. One of the most valuable tools that ODOT uses is an early reconnaissance data collection process. This provides vital data early in the project planning process. (See Attachment A.)

2.1 CULTURAL RESOURCES

Cultural resources include but are not limited to: historic properties, buildings, structures, archeological sites, historic cemeteries, and places of religious and cultural significance. In accordance with 36 CFR Part 800, ODOT's Cultural Resources Program conducts cultural resources surveys, performs National Register of Historic Places (NRHP) evaluations, and recommends measures to avoid, minimize, or mitigate adverse effects to historic properties for federally funded projects. Historic properties are a particular subset of cultural resources, and include those properties that have been formally listed or have been determined eligible for listing on the National Register of Historic Places (NRHP).

Typical projects that are the subject of a cultural resource survey include roadway reconstruction and resurfacing, sidewalks, new roadway construction, and bridge rehabilitation and replacement. While ODOT documents several types of cultural resources during their studies, bridges are the most frequently encountered historic property.

Due to the lack of state and federal funding between 1985 and 2005, the condition of the highway infrastructure experienced a consistent decline, resulting in deteriorating pavement conditions and more than 1,500 bridges were classified as structurally deficient or functionally obsolete. Beginning in 2005, legislative initiatives were passed that provided ODOT funding to repair and improve the transportation system. This has resulted in the 823 bridges being replaced or rehabilitated between 2006 and 2013.

As part of the bridge replacement planning process, ODOT's Cultural Resources Program conducts investigations to locate and assess cultural resources across the state for eligibility to the NRHP, including architectural structures and archeological sites. In May 2007, ODOT completed an evaluation of truss and arch bridges across the state. Of the 1,061 bridges documented in the study, 213 bridges were determined to be eligible for the NHRP. Highway maps showing the locations of these bridges can be found here: <http://www.odotculturalresources.info/spans-2007-maps.html>. ODOT is currently conducting a study of Depression-era New Deal Works Program bridges in the state.

Many functionally obsolete or structurally deficient bridges cannot be rehabilitated to current standards and replacement is the most feasible and prudent option. "ODOT routinely produces historic bridge narratives and photographic documentation as mitigation for adverse effects to bridges eligible for inclusion on the NRHP. While new bridges have been, or will be, constructed for these projects, counties and local landowners may agree to leave some of these bridges in place."²



ODOT also offers a program called Adopt-a-Bridge, to provide an alternative to the demolition of Oklahoma's historic bridges. While these bridges may no longer safely accommodate vehicular traffic, the smaller truss bridges are sufficient for pedestrian access.

ODOT's Cultural Resources Program also conducts archeological investigations to evaluate the significance of archeological sites and assess eligibility for listing in the NRHP. Archeological sites are eligible for inclusion in the NRHP if they contain intact cultural deposits that can provide significant information about past occupations and cultures.

2.2 THREATENED AND ENDANGERED SPECIES

As of July 22, 2014, Oklahoma is home to 22 threatened or endangered species (three plants and 19 animals) under protection of the Endangered Species Act (ESA) of 1973.³ ODOT's Environmental Programs Division oversees compliance with Section 7 of the ESA on behalf of FHWA. Some of the more frequently encountered endangered species include the Arkansas River Shiner, Neosho Mucket Mussel, Interior Least Tern, Leopard Darter, Lesser Prairie Chicken, and the American Burying Beetle and the Critical Habitat for these species.

2.2.1 Recognized American Burying Beetle Mitigation Program

As an example of mitigating environmental impacts, ODOT has an approved process related to addressing the American Burying Beetle (ABB) whose habitat is found in 31 counties in the eastern portion of the state.⁴ For all projects within a U.S. Fish and Wildlife Service defined conservation priority area, ODOT will mitigate incidental take of ABBs by withdrawing credits from ODOT's pre-approved mitigation bank account for credits purchased from USFWS approved mitigation banks. Mitigation must occur prior to any ground disturbing activities resulting in the incidental take occurring of the species. These activities include geotechnical investigation and utility relocations as well as construction. For projects that are not located within a conservation priority area, the ODOT Biologist surveys the proposed project's action area before initial ground disturbance, or withdraws the necessary mitigation credits, based on the cost effectiveness or the urgency of the project.

The use of the Conservation Banks has offered an efficient and effective means of minimizing disruptions to beetle habitats and also providing a tool for maintaining environmental functions of the ABB in the state⁵.

2.2.2 Migratory Birds

Cliff and Barn Swallows are small nesting birds protected by the federal Migratory Bird Treaty Act (MBTA) of 1918. It is a violation of the federal law to harm these birds or to significantly modify their habitat by impairing essential behavioral patterns, including breeding, feeding, or sheltering. The habitat of Cliff and Barn Swallows is mostly open country and marshes, especially near bridges and culverts. These migratory birds have come to the forefront of recent conversations due to ODOT's intensive bridge replacement program.



In Oklahoma, the nesting season for the Cliff and Barn Swallows runs from April 1 to August 31 which is also prime construction season. As a result, project schedules have been impacted in order to avoid the nesting season, which can result in increased project costs at ODOT's expense.

Current practice includes using netting to restrict the birds access to nesting sites, or delaying work that requires destruction of nests to outside the nesting season. More information is needed to determine which construction activities do not cause harm to the birds, and which activities should be avoided. ODOT will continue to develop coordination activities with regulatory agencies that will improve project scheduling and the timing of project letting to comply with the MBTA and reduce any project delays.

2.3 STORM WATER

Storm water runoff occurs when precipitation or snow melt runs over the ground. Impervious surfaces prevent storm water runoff to naturally filter back into the earth, which naturally filters the pollutants from the water. Polluted storm water can have negative effects on the human and natural environments. ODOT's goal is to detect and eliminate illegal discharges. An illegal discharge is a discharge to ODOT's storm drain system that could lead to pollution in Oklahoma's lakes, streams and rivers.

2.3.1 Storm Water Best Management Practices

ODOT uses best management practices (BMPs) to control and manage storm water. These include structural devices, maintenance procedures, and management practices that prevent or reduce the harmful effects of storm water runoff; such as pollution, erosion and flooding. BMPs may include the following:

- Detention and infiltration ponds, wide grass ditches, catch basins, and culverts;
- Maintenance operations that keep highways clean of sand, litter and debris that could make its way into streams and rivers;
- Increasing the monitoring and maintenance frequency of structural BMPs; and
- Pollution prevention practices on road construction projects.⁶

In an effort to educate the public and highlight the importance of storm water management, ODOT sponsors three programs to educate and provide the public opportunities to get involved. These include: Adopt-a- Highway, Trash-off (annual statewide cleanup day to remove litter from the streets), and a statewide annual Trash Poster Contest.

2.4 WETLANDS

In addition to cultural resources and threatened and endangered species, ODOT staff works with various agencies including the Oklahoma Department of Environmental Quality, the Environmental Protection Agency and the US Army Corps of Engineers (USACE) to preserve the water and wetland quality throughout the state.



ODOT works closely with the USACE when dredged or fill material is placed into waters of the United States. In Oklahoma, intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds are all considered waters of the United States.

As part of this process, ODOT complies with 404 permit requirements of the Clean Water Act. In doing so, ODOT must demonstrate avoidance, consideration, and minimization measures for aquatic resources and develop mitigation plans for compensate for unavoidable aquatic resource impacts.

Restoration and protection of wetlands are particularly important because close to 67 percent of Oklahoma's wetland acres were lost to development between 1780 and 1980.⁷ In Oklahoma, there is currently no formal monitoring and assessment program for wetlands. However, over the last five years a great deal of work has been done to better characterize the wetland resources throughout the state.

The Oklahoma Wetlands Program (OWP) was formally created in 1990 when the Oklahoma Legislature directed the Oklahoma Conservation Commission (OCC) to prepare a wetlands management strategy. Oklahoma's original wetlands management plan (Oklahoma Comprehensive Wetland Conservation Plan) was completed and accepted in 1996. The OCC, with assistance from partners, is working to respond to the expressed needs of landowners, developers, other state and federal agencies, local governments, and non-governmental organizations.

The most recent update was completed and accepted in 2013 and is now called Oklahoma's Wetland Program Plan (WPP). The WPP includes specific activities and timelines to guide Oklahoma wetlands management from 2013 to 2018.⁸ The WPP is organized into actions and activities that fall under the core elements for a wetland program outlined by the USEPA.

2.4.1 Current and Potential Wetland Mitigation Opportunities

A wetland mitigation bank contains wetlands that have already been created or restored. Wetland restoration is defined as "the manipulation of a former or degraded wetland's physical, chemical, or biological characteristics to return to its natural functions" (USEPA 2008; pp 1). Protection is defined as "removing a threat or preventing the decline of wetland conditions" (USEPA 2008; pp 1).

Over the past few years, interest in developing long-term mitigation opportunities and solutions has increased in Oklahoma; both a mitigation bank and an In-Lieu-Fee program have been proposed to the USACE. In-Lieu-Fee mitigation is a type of mitigation in which the permittee pays a fee to a third party to replace the wetland functions impacted as a result of the permittee's project (instead of conducting project-specific mitigation or buying credits from a wetland mitigation bank). The USACE Tulsa District Mitigation and Monitoring Guidelines are designed to improve predictability of mitigation requirements for permit applicants and to increase the likelihood of success of the mitigation plan (USACE, 2004).

A 700-acre tract of land was purchased in Nowata County in northeast Oklahoma with the intent of using acreage from this area for multiple ODOT projects. Use of



parcels of land from this tract can provide wetland mitigation for transportation projects located in the Oologah watershed.

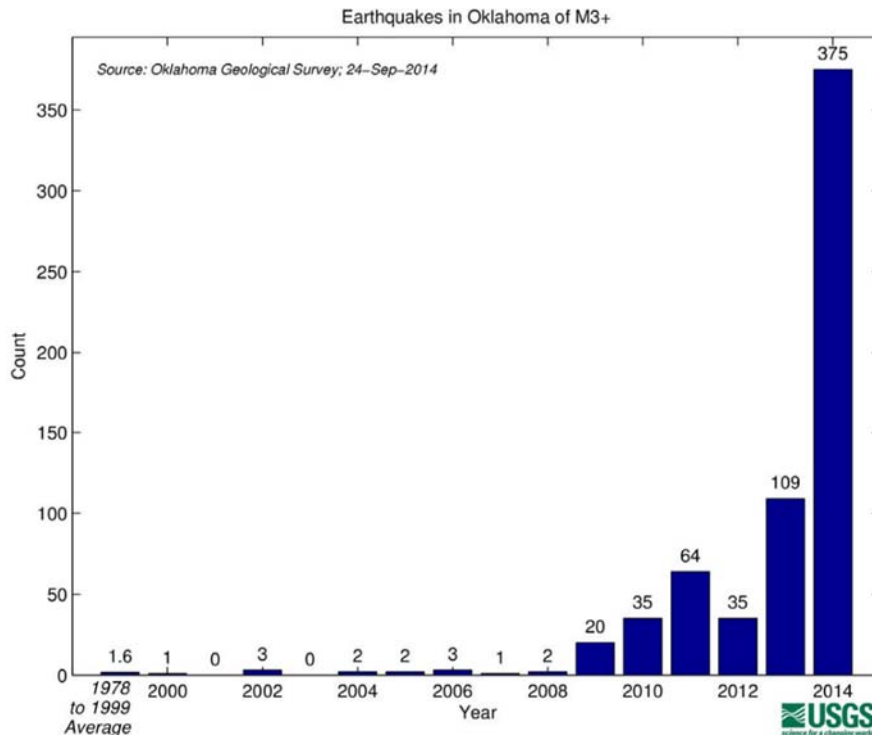
A mitigation center (slightly different than a mitigation bank) has been established in Oklahoma by Excel Mitigation. The wetlands in the 206-acre Excel Mitigation Center are created or restored as participants sign-up for mitigation. The 206-acre service area was created along the Deep Fork of the Canadian River and includes all or portions of the following 12 counties: Logan, Lincoln, Oklahoma, Cleveland, Pottawatomie, Seminole, Hughes, Okfuskee, Creek, Okmulgee, McIntosh and Haskell.



3 SEISMIC EVENTS

Figure 3-1 shows the number of 3.0 magnitude or greater earthquakes between 1978 and 2014. Please see Appendix B, for a table which correlates the magnitude of an earthquake to the strength of shaking (effects on people and structures). Since October 2013, Oklahoma has seen a dramatic increase of approximately 50 percent in seismic events, with the majority of recent seismic events occurring between Oklahoma City and Tulsa. In 2013, the greatest number of magnitude 3.0 or higher earthquakes totaled 109. As of May 2014, the USGS and Oklahoma Geological Survey analysis reported that 375 earthquakes of magnitude 3.0 or greater have occurred during the first five months of 2014.

Figure 3-1: Number of Earthquakes, Magnitude 3.0 or Greater, in Oklahoma from 1978 - 2014



USGS statistically examined the recent earthquake rate changes and concluded that the quakes do not seem to be due to typical, random fluctuations in natural seismicity rates. Figure 3-2 shows the seismic activity locations in Oklahoma since 1970. The majority of recent seismic events have occurred between Oklahoma City and Tulsa.

After a magnitude 4.0 or greater earthquake, ODOT dispatches crews to inspect key bridge structures within a five-mile radius of the earthquake's epicenter. During the inspection, the crews document any new cracks, settling, or displaced debris and improvements are scheduled as needed to ensure the structure is safe and can accommodate proper loads.



Figure 3-2: Location and Magnitude of Earthquakes in Oklahoma
from 1970 – June 17, 2014

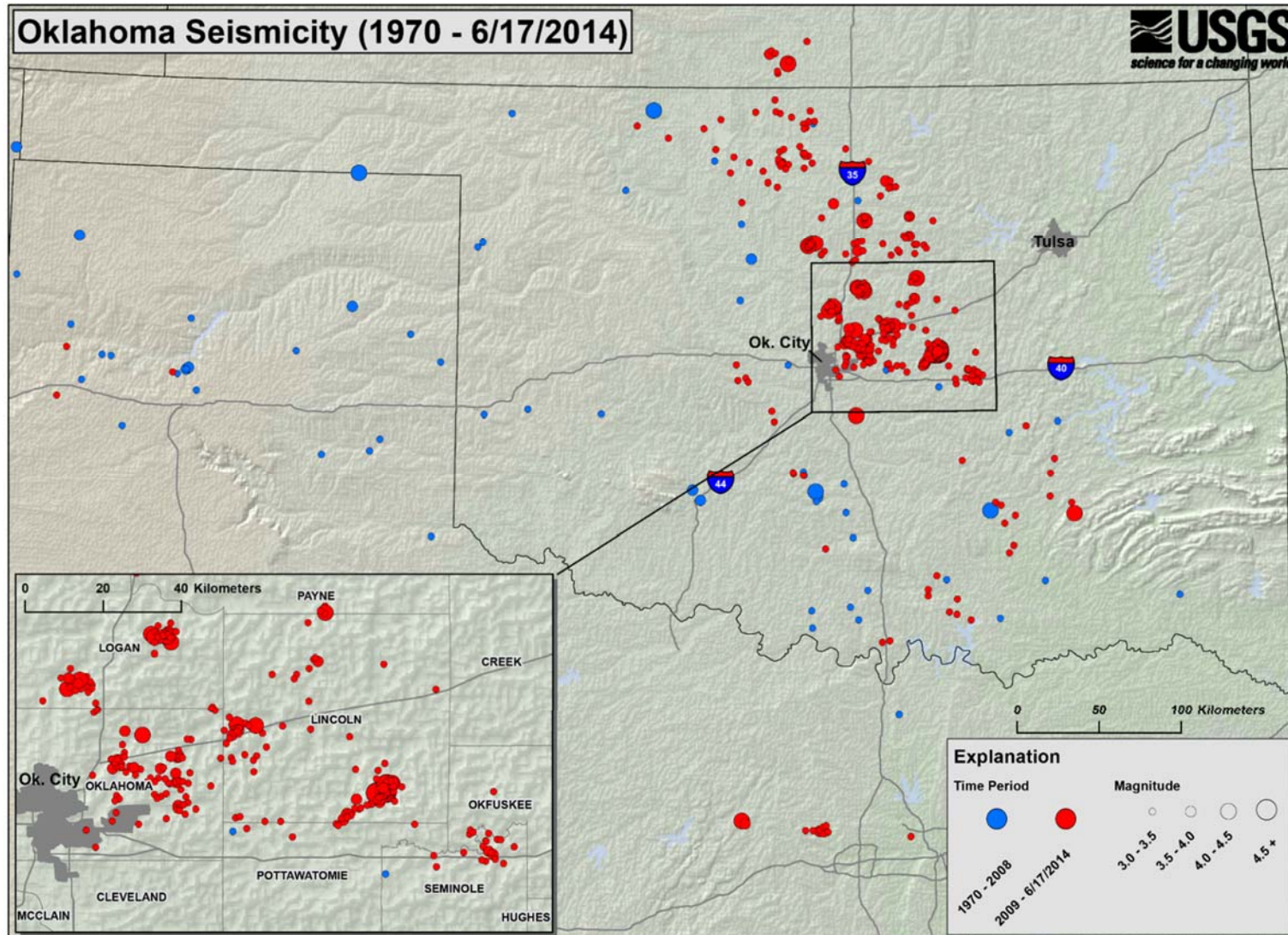




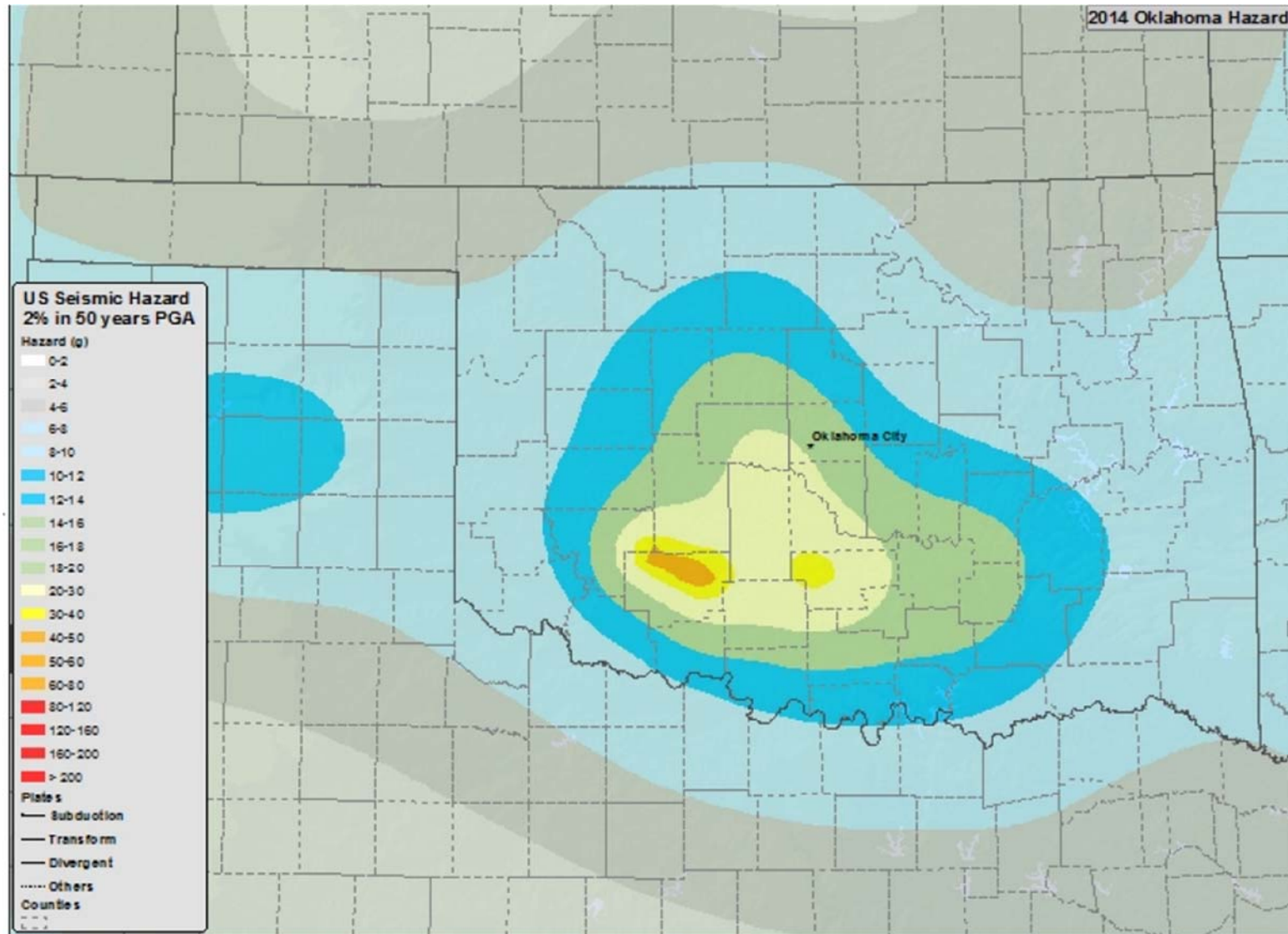
Figure 3-3 shows the USGS earthquake shaking hazard areas in Oklahoma. This provides essential information to ODOT in developing and updating seismic design standards for bridges, highways, and utilities to ensure critical transportation infrastructure maintains operational after extreme seismic events occur.

As shown in Figure 3-3, the seismic hazard map is time-independent, portrays a long-term average hazard and is not affected by the time of the last seismic event. These attributes enable ODOT to use this location information to design resilient bridge structures and roadways to withstand extreme seismic events and in turn maintain the efficient movement of people and goods.

In 2014, ODOT staff and CalTrans staff met to share expertise on seismic events and its impact on the transportation system and bridge designs most susceptible to damage. Based on this information, ODOT engineers are evaluating efforts to update bridge design standards to ensure structures are more resilient to seismic events.



Figure 3-3: Oklahoma 2014 Seismic Hazard Map



Source: USGS



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4 EXTREME WEATHER EVENTS

In recent years, Oklahoma has experienced some of the most extreme weather in the U.S., from extremely hot summers, high intensity rain, and devastating tornadoes. These extreme weather events impact Oklahoma's intermodal transportation system. Since 2000, 37 presidential emergency declarations have been issued in response to the state's extreme weather events, eight more than the closest state.⁹ Oklahoma's extreme weather is a byproduct of its location – moisture coming from the Gulf of Mexico from the south and dry air from the Rocky Mountains in the west. Oklahoma also experiences the east-to-west storms that cross the Great Plains and also receives the occasional blast of arctic air from Canada. Projected changes in long-term climate and more frequent extreme events such as heat waves, droughts, and heavy rainfall will affect many aspects of life in the Great Plains.¹⁰

Adverse weather conditions such as storms with high intensity rain, icing, high winds, and poor visibility have immediate effects on day-to-day operations, often disrupting large portions of a transportation network. Extreme weather events such as floods caused from high intensity rain, droughts brought on by extreme high temperatures, wildfires fed by vegetation that grew rapidly following early rains and then dried following droughts, and tornadoes also have immediate effects, disrupting transportation and creating large clean-up and rebuilding costs.¹¹

4.1 HIGH INTENSITY RAIN

As reported in TRB's Special Report 290: *Potential Impacts of Climate Change on U.S. Transportation*, high intensity rain events are very likely to increase in frequency and intensity, causing incidents like the catastrophic flood event in June 2010 that caused Oklahoma's Governor to declare a state of emergency in 59 counties. In addition to large river system flooding, these high intensity rain events cause localized flooding events that lead to landslides, slope failures and additional flooding from runoff. These localized flooding events caused by heavy rains with accompanying mudslides can wash out or severely damage roads which could lead to permanent road closures. The increase in high intensity precipitation events could lead to higher soil moisture levels which could affect the structural integrity of transportation infrastructure. At the very least, increased erosion will disrupt road construction and cause travel delays.¹²

Flood events have catastrophic impacts to surface transportation infrastructure because they interrupt the movement of people and goods on Oklahoma highways and railroads. These floods, both localized and large river system, demonstrate how extreme precipitation events are creating new impacts to the transportation system, and how potential impacts need to be addressed in the design, construction and rehabilitation of the transportation network. A GIS analysis of flood levels and the transportation infrastructure could be completed by ODOT to determine the state highway system's vulnerability to these events.



Urban areas typically have less storage capacity for water and more rapid runoff, thus urban streams rise more quickly during storms and have higher peak discharge rates than do rural streams. In addition, because of the amount of impervious surface, the total volume of water discharged during a flood tends to be larger for urban streams than for rural streams.¹³ This underscores the importance of removing debris and litter from urban area drains to minimize flooding impacts areas.

In addition to impacting roadways, rail lines and bridge underpasses, flood events also can impact inland ports and waterways. The McClellan-Kerr Arkansas River Navigation System (MKARNS) is Oklahoma's primary navigable waterway originating from the Tulsa Port of Catoosa and flowing southeast through Arkansas to the Mississippi River. These high intensity rain events could result in short-term flooding to MKARNS which would interrupt barge operations. Due to the intensity of these precipitation events, there is an increase in silt and debris flowing into the channel causing additional silt buildup which changes the depth of the channel at a faster rate than normal silt and debris buildup.

In addition to dredging, the maintenance needs of the locks and dams are also critical. If the locks and dams are not working properly, the entire waterway will be out of commission.

4.2 TORNADOES

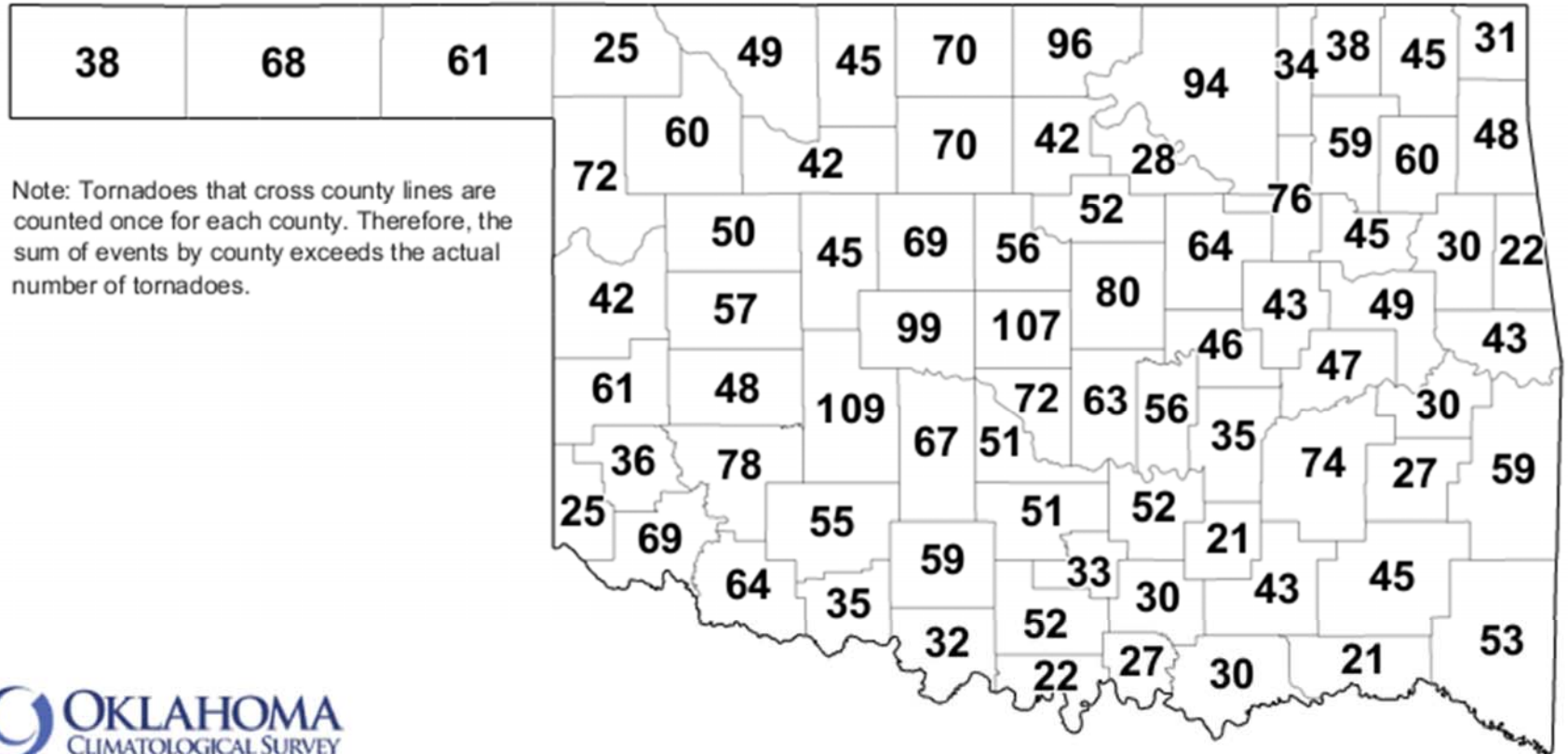
Since 1950, there have been over 3,500 tornadoes in Oklahoma. Tornadoes are a particular hazard in Oklahoma; **Figure 4-1** shows the number of tornadoes recorded in each county between 1950 and 2010.

Tornadoes cause catastrophic damage to any infrastructure in its path, including road, bridges, and rail lines. According to the National Weather Service, Oklahoma has experienced eight violent tornadoes (reaching EF-4 or EF-5 on the Enhanced Fujita scale) from 2007-2012.

When provided enough advance warning, ODOT closes key roads that are located in the projected tornado's path to help reduce the number cars and trucks that may be impacted. ODOT historically has provided assistance to communities in the aftermath of tornadoes.



Figure 4-1: Number of Tornadoes per County, 1950 - 2013



Number of Tornadoes by County

1950-2013

Tallied using data archived at OCS. Created 4:00:42 PM May 21, 2014 CDT. © Copyright 2014



4.3

EXTREME TEMPERATURES

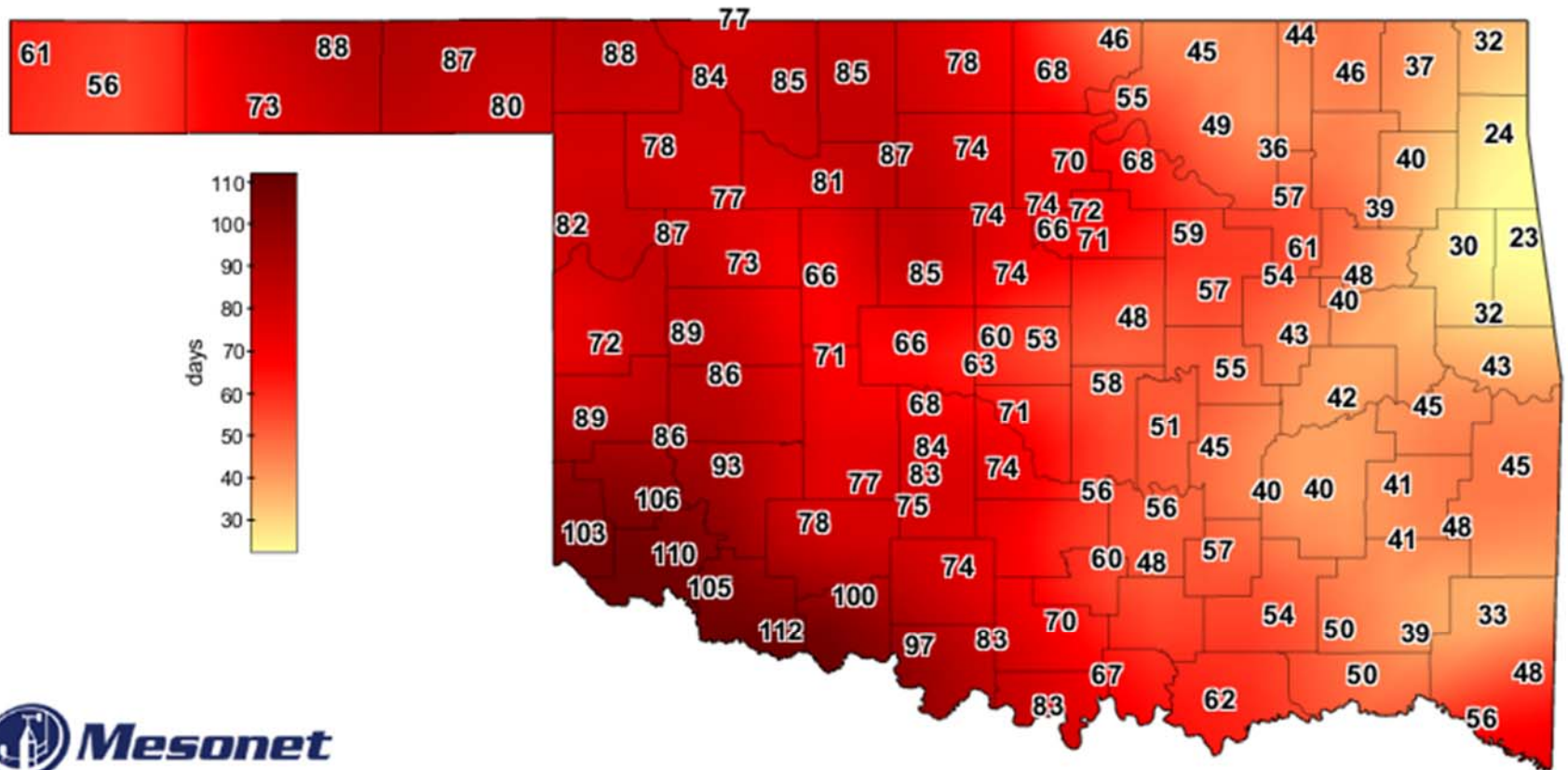
In 2014, every county in Oklahoma (with the exception of two) saw over 30 days with temperatures over 90 degrees. Six counties experienced 100 or more days with temperatures over 90 degrees. (See **Figure 4-2**).

Longer periods of extreme heat in summer damage roads in several ways, including softening of asphalt (which leads to rutting) and expansion of bridge joints, affecting bridge operations. Intense heat can also cause deformities in rail tracks, resulting in speed restrictions.

Design procedures and design standards take into account the ability of assets to cope with environmental stresses and conditions placed on an asset. The design of storm water drainage systems, roads, bridges, culverts, small dams, detention basins, and airport runways all reflect considerations for temperature, precipitation and wind. To the extent that these inputs will be different in the future, designs could change as well.¹⁴ Changes in the frequency or intensity of extreme weather events should influence changes in design and consideration for engineers.



Figure 4-2: Number of Days with Temperatures over 90 Degrees Fahrenheit, 2014



Days With High Temperatures ≥ 90 °F

Warm Season 2014

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5 AIR QUALITY REGULATIONS

The Clean Air Act requires the Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS) for six common air pollutants. Oklahoma is in attainment for all six pollutants which are: particulate matter, ozone, carbon monoxide, nitrogen oxides, sulfur dioxide, and lead. Of the six pollutants, particulate matter pollution and ground-level ozone are the most widespread health threats¹⁵.

A non-attainment area is an area considered to have air quality worse than the NAAQS as defined in the Clean Air Act Amendments of 1990 (P.L. 91-604, Sec. 109). Non-attainment areas must develop and implement a plan to meet the current standard, or risk losing some forms of federal financial assistance. ODOT and the Oklahoma Department of Environmental Quality (ODEQ) have been working closely with both the metropolitan planning organizations to curb mobile source emissions and thus avoid a related non-attainment designation. Typically the pollutants that correlate most highly with mobile source emissions are ozone, carbon monoxide, and nitrogen oxides. Since the early 1990s, the Tulsa and Oklahoma City MPOs have implemented precautionary measures to combat ozone issues and keep the regions in attainment status¹⁶ for the 8-hour ozone standard.

5.1 AIR QUALITY, MOBILE SOURCE EMISSIONS, AND OKLAHOMA METROPOLITAN AREAS

There are three metropolitan planning organizations (MPO) with geography entirely¹⁷ in the State of Oklahoma. The two largest MPO areas are Oklahoma City (ACOG) and Tulsa (INCOG); Lawton, in southwest Oklahoma, is a small MPO. All three areas have ozone monitoring stations and work with the Oklahoma Department of Environmental Quality (ODEQ) to maintain air quality standards, with particular attention to the mobile-source pollutants ozone,¹⁸ carbon monoxide, and nitrogen oxides. Additionally, a monitor is placed in Sequoyah County, a part of the Ft. Smith bi-state MPO covering parts of four counties in eastern Oklahoma and western Arkansas. Although all three Oklahoma metro areas have had annual ozone violations in recent years, all regions remain in attainment status. A review of Sequoyah County monitoring data shows that it has not experienced ozone violations.

The metro areas faced a particular challenge to improving air quality levels when the state experienced two record breaking hot summers (2011 and 2012) and design values of all ozone monitors throughout Oklahoma were in violation of the ozone standard, making the regions eligible for non-attainment designation. However, the two following summers of 2013 and 2014 were milder, bringing lower ozone levels and all three metro areas back into compliance with ozone standards.

Both INCOG and ACOG plan to continue to work with ODEQ and the EPA through their Ozone Advance Programs to minimize metro area ozone exceedances and maintain compliance with the ozone standard. The Lawton MPO also sponsors a



Clean Air program and works closely with local, state, and federal agencies to proactively address air quality issues.

5.2 PENDING AIR QUALITY STANDARDS CHANGE

On November 25, 2014, the EPA proposed to strengthen the NAAQS for ground-level ozone, based on extensive scientific evidence about ozone's effects¹⁹. If the proposed stronger standard is approved, it likely will push all four MPOs and several rural counties into non-attainment.

5.3 STATE PROMOTES CLEAN FUEL VEHICLES

In an effort to help improve air quality, Oklahoma plans to replace 90 percent of its current fleet vehicles at ODOT and the Oklahoma Turnpike Authority with compressed natural gas (CNG) vehicles in the next three years.

Natural gas is produced both worldwide and domestically at relatively low cost and is cleaner burning than gasoline or diesel fuel. In 2012, Oklahoma was the fourth highest ranking state in natural gas production. Natural gas vehicles show an average reduction in ozone-forming emissions of 80 percent compared to gasoline vehicles.²⁰ In November 2012, ODOT added 160 CNG vehicles to help update its aging fleet.



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6 SUMMARY

Preservation of the environment and efforts to meet the mobility needs of a growing population, sometimes leads to unavoidable impacts. ODOT works with the public and project stakeholders, as well as resource agencies, to ensure that environmental issues are identified and addressed early in the transportation planning and project development process.

The identification of a full range of potential mitigation strategies should occur early in the transportation planning and project development process, so viable solutions to mobility and connectivity needs can be identified and implemented in a timely manner. To that end, ODOT has utilized mitigation banks as an effective approach to preserve, enhance and restore environmental resources.

Given the important role that weather-related variables have in determining design parameters, more information is needed on how designers can take likely weather changes into account. Engineering design is dependent on inputs relating to the stresses that will likely be placed on assets (e.g., intensity-frequency-duration curves for precipitation). More information and research is needed to inform designers on what approaches might be taken for considering changes in such inputs over time. The consideration in the planning process of a network's reliability and responsiveness to extreme weather events can reduce the system vulnerability in the future.²¹

In addition to design and mitigation activities, ODOT should continue its efforts to improve air quality through the use of CNG vehicles, as well as maintaining a working relationship with ODEQ and EPA in order to proactively address air quality issues.



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APPENDIX A: ODOT Reconnaissance Data List

OKLAHOMA DEPARTMENT OF TRANSPORTATION Environmental Programs Division – Reconnaissance Data List, condensed version

SECTION 1 GEO-REFERENCED GRAPHICS

SECTION 2 AS-BUILT PLANS

SECTION 3 PROPERTY IDENTIFICATION

Within the study area, identify the following properties and the general location of their boundaries:

- 3.1 Property Ownership
- 3.2 Indian & Tribal Ownership, including traditional cultural properties
- 3.3 Identify any Federal Properties and Easements within the Study area
- 3.4 Identify any Wetland Restoration Program (WRP) Sites within the Study Area
- 3.5 Public parks and recreational areas within the Study area
- 3.6 Identify any wildlife and waterfowl refuges within the study area
- 3.7 Identify any cemeteries within the study area
- 3.8 Identify any Airports located within 4 miles of the Study Area
- 3.9 Identify any active or abandoned Rail Roads within the Study Area
- 3.10 Identify any Oklahoma Turnpike Authority (OTA) Properties
(This applies for projects involving the Turnpike)

SECTION 4 UTILITY & TRADE FIXTURE (BILLBOARD) INFORMATION

- 4.1 Utilities
- 4.2 Trade Fixture (Billboard) Ownership

SECTION 5 ACCIDENT HISTORY

- 5.1 Obtain Complete Accident History for the study extent

SECTION 6 EXISTING BRIDGE CONDITION AND HYDROLOGICAL DATA

- 6.1 Obtain the most current copy of the Structure Inventory & Appraisal (SI&A) sheet for each bridge within the study area
- 6.2 Obtain Drainage Areas associated with each bridge within the study area.
- 6.3 Provide FEMA FIRMette for all bridges within the study area
- 6.4 Identification and location of NRCS controlled structures within the Drainage Area
- 6.5 If there is a USGS Gauge on the existing bridge, include the summary sheet of the data from the USGS Gauge. This is available on the USGS website.



SECTION 7 CULTURAL RESOURCES

- 7.1 Historic Properties/Structures
- 7.2 Archaeological Sites
- 7.3 Historic Cemeteries
- 7.4 Traditional cultural properties

SECTION 8 HAZARDOUS WASTE/LUST SITES

- 8.1 Identify Hazardous Waste Sites located in the proximity of the study area
- 8.2 Identify Above Ground Storage Tanks (AST), Underground Storage Tanks (UST), Leaking Underground Storage Tanks (LUST) Sites and oil wells located within 1/8th of a mile of the study area
- 8.3 Identify any Current and abandoned coal mines within the study area

SECTION 9 NATURAL RESOURCES

- 9.1 Identify any federally-listed endangered, threatened or candidate species located within the study area and any Designated Critical Habitats for these species
- 9.2 Identify any potential jurisdictional wetlands located within the study area
- 9.3 Create a soils map for the study area using the information available from the NRCS soil survey website at <http://websoilsurvey.nrcs.usda.gov/app/>
- 9.4 Identify any Critical Resource Waters, Section 10 Waters, Scenic Rivers & Arbuckle Simpson Aquifer (not any other aquifer) and associated streams located within the study area
- 9.5 Identify any Oklahoma's 2010 303(d) list of impaired waters
- 9.6 Identify any Oklahoma Sensitive Waters and Watersheds Harboring Endangered and Threatened Species and Their Critical Habitat of Concern required for the Storm Water Permit Conditions

SECTION 10 EXISTING FACILITY DATA

- 10.1 Functional Classification and Roadway Characteristics
- 10.2 Traffic Data within the study area
- 10.3 Alternative Agency Impacts associated with study area:
e.g. MPO, Oklahoma Turnpike Authority

SECTION 11 REPORTS & DELIVERABLES

- 11.1 Prepare a report in the following format
- 11.2 Provide six paper-copy reports containing all the information
- 11.3 Provide an Acrobat pdf file of the complete report on a CD to Project Management Division
- 11.4 Provide a Micro-Station (V8) file and a GIS shape file on a separate Cd to Project Management Division

Source: ODOT, Environmental Programs Division, February 2015



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APPENDIX B: Earthquake Magnitude / Intensity Comparison (p. 1 of 2)

Earthquake Magnitude	Typical Maximum Modified Mercalli Intensity	Abbreviated Modified Mercalli Intensity Scale
1.0 - 3.0	I	I. Not felt except by a very few under especially favorable conditions.
3.0 - 3.9	II - III	II. Felt only by a few persons at rest, especially on upper floors of buildings. III. Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
4.0 - 4.9	IV - V	IV. Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably. V. Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
5.0 - 5.9	VI - VII	VI. Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight. VII. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.



APPENDIX B: Earthquake Magnitude / Intensity Comparison (cont'd, p. 2 of 2)

Earthquake Magnitude	Typical Maximum Modified Mercalli Intensity	Abbreviated Modified Mercalli Intensity Scale
6.0 – 6.9	VII - IX	<p>VIII. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.</p> <p>IX. Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.</p> <p>X. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.</p>
7.0 and higher	VIII or higher	<p>XI. Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.</p> <p>XII. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.</p> <p>XIII. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.</p> <p>XIV. Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.</p> <p>XV. Damage total. Lines of sight and level are distorted. Objects thrown into the air.</p>

Source: United States Geology Survey (USGS) Earthquake Hazards Program Magnitude/Intensity Comparison
http://earthquake.usgs.gov/learn/topics/mag_vs_int.php



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ENDNOTES

¹ 40 CFR § 1500.1(b): Purpose

² <http://www.odotculturalresources.info/bridges.html>, last accessed 11/24/14

³ <http://www.wildlifedepartment.com/wildlifemgmt/endangeredspecies.htm>, last accessed 11/24/14

⁴ <http://ecos.fws.gov/speciesProfile/profile/countiesByState?entityId=440&state=Oklahoma>, last accessed 11/24/2014

⁵ http://www.fws.gov/midwest/endangered/insects/ambbb/abb_fact.html

⁶ <http://www.okladot.state.ok.us/env-programs/stormwater/index.htm>, last accessed 11/24/2014

⁷ Dahl, T.T., *Wetland Losses in the United States 1780's to 1980's*, USDI Fish and Wildlife Service, Washington D.C., 1990.

⁸ https://www.ok.gov/wetlands/documents/Oklahoma_WPP_Final_5-15-13.pdf, last accessed 12/12/14.

⁹ <http://www.governing.com/blogs/view/gov-how-oklahoma-deals-with-americas-most-extreme-weather.html>, last accessed 11/14/14.

¹⁰ USDOT, *Federal Highway Administration (FHWA), Regional Climate Change Effects: Useful Information for Transportation Agencies*. (May 10, 2010), p 123

¹¹ <http://www.ncdc.noaa.gov/oa/userengagement/transportation.pdf>, last accessed 11/23/14.

¹² http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_750v2.pdf p://pubs.usgs.gov/fs/fs07603/

¹³ <http://pubs.usgs.gov/fs/fs07603/>

¹⁴ http://environment.transportation.org/pdf/2013_symposium/AASHTO_EWESymposium_2013.pdf

¹⁵ <http://www.epa.gov/airquality/urbanair/>

¹⁶ The EPA National Ambient Air Quality Standard (NAAQS) for Ozone uses the annual 4th highest daily maximum ozone concentration (based on an 8-hr. average) measured at each monitor. Compliance of the standard occurs when the three-year average (of 4th highs) at all monitors in the region is not greater than 75 ppb. This three-year rolling average is also called the Design Value. When an area's Design Value is not in compliance with the standard, it is in violation and considered eligible for a non-attainment designation by EPA.

¹⁷ The Ft. Smith Metropolitan Planning Organization, a bi-state (Oklahoma- Arkansas) MPO has a small portion of rural geography in Oklahoma. The majority of the area and the City of Ft. Smith are in Arkansas.

¹⁸ Ozone is a gas made up of three oxygen atoms (O₃). In the lower atmosphere, near the earth's surface, ozone is created by chemical reactions between air pollutants from vehicle exhaust, motor gasoline vapors, and other emissions.

¹⁹ <http://www.epa.gov/glo/actions.html#nov2014>

²⁰ <http://www.consumerenergycenter.org/transportation/afvs/cng.html>

²¹ U.S. Climate Change Science Program (CCSP), *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean and U.S. Pacific Islands*. Synthesis and Assessment Product 3.3 (June 2008)