8. SAFETY, SECURITY, AND ENVIRONMENTAL ISSUES

This chapter addresses three key issues for the ODOT – safety, security, and environmental activities. The State of Oklahoma has witnessed how safety and security concerns can impact transportation and mobility. In recent years, flooding, tornados, and incident-related congestion have accentuated the importance of a safe and secure transportation system. Because of these types of events, as well as driver behavior, and the potential for other system interruptions, safety, security, and environmental responsibility are important issues for Oklahoma.

8.1. SAFETY

Improved transportation system safety is a primary goal in Oklahoma and for the 2015-2040 LRTP. ODOT values life, and strives to minimize traffic fatalities and serious injury crashes. This section discusses ODOT's update of the Strategic Highway Safety Plan and safety trends.

8.1.1. ODOT's Strategic Highway Safety Plan

Oklahoma takes a systemic[1] approach to safety. This technique utilizes analysis of high-risk roadway features and correlates them with particular crash types; then follows up with addressing and mitigating high risk features. Oklahoma has utilized systemic solutions as well; particularly those that are low cost and result in high benefits.

ODOT incorporates a broad multimodal, integrated approach to safety that touches all Department levels and functions. Guidance for this type of integration is provided in the reference manual *Statewide Opportunities for Integrating Operations, Safety, and Multimodal Planning*, published by the U.S. DOT, FHWA.

This manual documents safety and operation strategies at the following five levels:

- Overall DOT environment;
- Statewide opportunities;
- Regional opportunities;
- Corridor and sub-level opportunities; and
- Project opportunities.

Integration of safety and operations, as envisioned by FHWA, spans across all travel modes and includes all of the state DOTs primary organizational units - planning, design, and operation.

Oklahoma's first SHSP was published in 2007. It included a primary goal with measureable subgoals related to fatalities and injuries, and outlined five focus areas. The primary safety goal was to "reverse the increasing trend of traffic related fatalities and injuries…" and the subgoals were:

- Achieve a 20 percent reduction in the 2004 Oklahoma fatality rate from 1.71 lives lost per 100 million vehicle miles of travel (HMVMT) to 1.37 per HMVMT by 2015 (**see Table 8-2**), and
- Achieve a 20 percent reduction in the 2004 Oklahoma serious injury rate from 40.46 serious injuries per HMVMT to 32.37 per HMVMT by 2015 (**see Table 8-3**).

The five focus areas were:

(1) Unsafe driving behavior (impaired drivers, aggressive drivers, speeding drivers, fatigued drivers, distracted drivers, and drivers not using seatbelts);

(2) Intersection crashes;

(3) Crashes involving young drivers;

(4) Lane departure crashes; and

(5) Crosscutting strategies (Actions that improve safety in several focus areas - Reduction in overall fatalities and injuries, improvement

of crash data and its availability, and development of a safer overall vehicle fleet).

8.1.2. Safety Plan Implementation Results

Several success stories from the 2007 SHSP indicate that ODOT is on the right path. For example, the total number of crashes between 2007 and 2012 has declined by six percent.

Overall, motor vehicle crashes declined between 2007 and 2012 in Oklahoma. **Table 8-1** presents the total number of crashes from the date of the first Oklahoma SHSP in 2007 through the last complete year for which data are available in 2012. Despite some year-to-year increases in crashes, the total crashes were lower than the initial year. Overall, 2012 concluded with a 5.9 percent decrease in crashes as compared to 2007.

Both Oklahoma's fatality rate (number of fatalities per HMVMT) and the number of traffic related fatalities declined between 2007 and 2012. The fatality rate decreased 7.5 percent and the number of fatalities declined 7.6 percent.

Table 8-2 depicts Oklahoma's fatality rate, the national fatality rate, and the raw number of traffic related fatalities in Oklahoma crash data for the six-year period from 2007 to 2012.

Table 8-1. Number of Crashes in Oklahoma, 2007-2012

Year	Total Crashes	
	Number	Annual Percent Reduction
2007	75,059	---
2008	72,667	3.2
2009	71,218	2.0
2010	69,807	2.0
2011	68,967	1.2
2012	70,669	-2.5
% Reduction 2007-2012	**5.9%**	

Note: This chart displays total crashes, not total vehicles involved in crashes or total individuals involved in crashes.
Source: CDM Smith analysis based on data from the Oklahoma Highway Safety Office.

Table 8-2. Fatality Rate per HMVMT, 2007-2012

Year	Oklahoma Five Year Fatality Rate Trend	Oklahoma Actual Annual Fatality Rate	National Fatality Rate	Oklahoma Fatalities
2007	1.7	1.6	1.4	766
2008	1.7	1.6	1.3	750
2009	1.6	1.6	1.1	737
2010	1.5	1.4	1.1	668
2011	1.4	1.5	1.1	696
2012	1.4	1.5	1.1	708
% Reduction 2007-2012	**15.1%**	**7.5%**	**16.8%**	**7.6%**

Source: National Highway traffic Safety Administration, December 2014. http://www-nrd.nhtsa.dot.gov.
ODOT Collision Analysis and Safety Branch, December 2014.
Historical trend based on statistical analysis of crash data from 1997 to 2011.[2]

Oklahoma's fatality rate decreased between 2007 and 2012, but at a slower rate than the national rate, which also declined during this period. Raw numbers for fatalities for the six-year period also show an overall decrease, from 766 in the year 2007 to 708 in 2012; with each year lower than 2007.

The traffic related serious injury rate in Oklahoma (number of serious injuries per HMVMT) and the number of traffic related serious injuries declined between 2007 and 2012. The serious injury rate decreased 9.8 percent, while the total number of serious injuries declined 7.6 percent.

Table 8-3 depicts Oklahoma's serious injury rate and the raw number of traffic related serious injuries in Oklahoma collisions for the six-year period from 2007 to 2012. Because there is variation in the way each state calculates serious injuries, a national comparison is not included.

Table 8-3. Serious Injury Rate per HMVMT, 2007-2012

Year	Oklahoma Serious Annual Injury Rate	Oklahoma Serious Injury Number
2007	37.9	17,663
2008	35.0	16,398
2009	34.2	16,077
2010	34.7	16,557
2011	34.1	16,190
2012	34.2	16,314
% Reduction 2007-2012	**9.8%**	**7.6%**

Source: ODOT Collision Analysis and Safety Branch, December 2014.

Oklahoma's serious injury rate decreased between 2007 and 2012, as did the number of serious injuries. The general trend is toward reducing serious injuries, despite some interim year increases. Again, the historical trend analysis suggests ODOT is on track to achieve the 2007 Oklahoma SHSP goal to reduce serious injury rate per HMVMT to 32.37 by 2015.

Traffic safety issues that focus on the following topics are discussed on subsequent pages: pedestrians, bicyclists, highway freight, hazardous materials highway safety, railway-highway crossing safety, and railroad safety for hazardous materials.

Pedestrian and Bicycle Safety

Pedestrian and bicyclists are vulnerable travelers on roads and highways, and those non-motorized forms of travel are becoming more popular each year. As shown in **Table 8-4,** pedestrian crashes on Oklahoma's road system have remained relatively constant between 2007 and 2012. Fatal pedestrian crashes declined in 2008 and 2009 (which correlates with a period of fewer vehicle miles of travel), but are at the same level in 2012 as 2007.

The report on bicycle crashes from the 2007-2012 period presents a mixture of encouraging results and challenges. Total bicycle crashes are down 19.8 percent when comparing 2007 to 2012, as shown in **Table 8-5**. Injury and property damage only bicycle crashes show a slight reduction between 2007 and 2012. Eleven fatal crashes were reported in 2009, which was a six-year high; however, there were less fatal crashes in the next three years with a six-year low of only one fatal crash in 2011.

Table 8-4. Pedestrian Involved Crashes, 2007-2012

Year	Fatal		Injury$_1$		PDO$_2$		Unknown		Total Pedestrian Involved Crashes
	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number
2007	67	10.01	398	59.49	165	24.66	39	5.83	669
2008	49	7.62	396	61.59	184	28.62	14	2.18	643
2009	32	5.35	392	65.55	162	27.09	12	2.01	598
2010	68	10.15	376	56.12	212	31.64	14	2.09	670
2011	47	6.86	403	58.83	181	26.42	54	7.88	685
2012	67	9.50	393	55.74	194	27.52	51	7.23	705
Average Annual	**55**		**393**		**183**		**31**		**662**
% Reduction 2007-2012	**0.0%**		**1.3%**		**-17.6%**		**-30.8%**		**-5.4%**

Notes:
1. Includes all incapacitating and non-incapacitating injuries.
2. Possible crash injury included with Property Damage Only (PDO) data.
Source: CDM Smith analysis based on data from the Oklahoma Highway Safety Office.

Table 8-5. Bicyclist Involved Crashes, 2007-2012

Year	Fatal		Injury$_1$		PDO$_2$		Unknown		Total Bicyclist Involved Crashes
	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number
2007	3	0.63	219	46.20	143	30.17	109	23.00	474
2008	4	1.12	213	59.66	127	35.57	13	3.64	357
2009	11	3.61	175	57.38	106	34.75	13	4.26	305
2010	8	2.45	182	55.83	127	38.96	9	2.76	326
2011	1	0.33	177	57.65	120	39.09	9	2.93	307
2012	5	1.32	201	52.89	133	35.00	41	10.79	380
Average Annual	**5**		**195**		**126**		**32**		**358**
% Reduction 2007-2012	**-66.7%**		**8.2%**		**7.0%**		**62.4%**		**19.8%**

Notes:
1. Includes all incapacitating and non-incapacitating injuries.
2. Possible crash injury included with Property Damage Only (PDO) data.
Source: CDM Smith analysis based on data from the Oklahoma Highway Safety Office.

Freight Highway Safety

Data on freight highway safety are available through the Oklahoma Highway Safety Office in the form of large truck[3] crashes. Between 2007 and 2012, the total number of large trucks involved in crashes has declined by 14.6 percent as shown in **Table 8-6.** The number of large truck injury crashes has also been on a relatively steady decline from 890 in 2007, to 741 in 2012. Fatal crashes involving large trucks, on the other hand, have remained fairly constant since 2007.

Table 8-6. Large Truck Involved Crashes, 2007-2012

Year	Fatal		Injury$_1$		PDO$_2$		Total Large Truck Crashes
	Number	Percent	Number	Percent	Number	Percent	Number
2007	85	1.49	890	15.59	4,735	82.92	5,710
2008	102	2.00	775	15.20	4,221	82.80	5,098
2009	76	1.76	639	14.83	3,594	83.41	4,309
2010	80	1.77	721	15.99	3,707	82.23	4,508
2011	76	1.61	757	16.00	3,898	82.39	4,731
2012	94	1.93	741	15.20	4,041	82.88	4,876
Average Annual	**86**		**754**		**4,033**		**4,872**
% Reduction 2007-2012	**-10.6%**		**16.7%**		**14.7%**		**14.6%**

Notes:
1. Includes all incapacitating and non-incapacitating injuries.
2. Possible crash injury included with Property Damage Only (PDO) data.
Source: CDM Smith analysis based on data from the Oklahoma Highway Safety Office.

Hazardous Material Highway Crashes

Hazardous material highway crashes have increased from 114 in 2009 to 178 in 2012. The vast majority of these crashes do not involve a serious injury or fatality, but the increase in crashes presents a challenge to traffic safety engineers in Oklahoma. **Table 8-7** summarizes hazardous material crashes on Oklahoma roads between 2009 and 2012, as no data were available for years 2007-2008. No ODOT data are available on the length of time a road is closed due to a hazardous material crash. Fatal highway crashes involving hazardous material have fluctuated between 2009 and 2012 with the highest number, nine, recorded in 2012.

Table 8-7. Hazardous Material Highway Crashes, 2009-2012

Year	Fatal		Injury$_1$		Other		Total Hazardous Material Involved Crashes
	Number	Percent of Total	Number	Percent of Total	Number	Percent of Total	Number
2009	6	5.26	20	17.54	88	77.19	114
2010	7	5.88	24	20.17	88	73.95	119
2011	4	2.67	38	25.33	108	72.00	150
2012	9	5.06	40	22.47	129	72.47	178
Average Annual	**7**		**31**		**103**		**140**
% Reduction 2009-2012	**-50.0%**		**-100.0%**		**-46.6%**		**-56.1%**

Note: 1. Includes all incapacitating and non-incapacitating injuries.
Source: CDM Smith analysis based on data from the Oklahoma Highway Safety Office.

Freight Rail Safety – Grade Crossing Crashes

An at-grade railroad crossing is a location where a public highway, road, street, or private roadway (including an associated sidewalk or pathway), crosses railroad tracks at street level. Currently, there are approximately 3,800 at-grade railroad crossings in Oklahoma. Data on railway highway crossing crashes are presented in **Table 8-8**. In 2007, there were six highway railroad crossing related fatal crashes reported, and the number declined to one in 2012, which is an 83.3 percent reduction. On average, each fatal crash caused two deaths (not shown in table). During the same six-year period, railroad crossing crashes resulting in injuries were reduced by 40 percent. Even though the trend of railway highway crashes shows a decline, between 2007 and 2012 total crashes averaged about 43 per year, nearly 4 per month.

Table 8-8. Railway Highway Crossing Crashes, 2007-2012

Year	Fatal	Injury$_1$	Other	Total Crashes
2007	6	15	29	50
2008	8	18	29	55
2009	3	15	21	39
2010	4	16	17	37
2011	3	9	28	40
2012	1	9	26	36
Average Annual	**4**	**14**	**25**	**43**
% Reduction 2007-2012	**83.3%**	**40.0%**	**10.3%**	**28.0%**

Note: 1. Includes all incapacitating and non-incapacitating injuries.
Source: Railway Highway Crossing Crashes 2007-2012; ODOT Collision Analysis and Safety Branch- February 2015

Hazardous Material Railroad Incidents

The number of hazardous material railroad incidents was relatively low in Oklahoma between 2007 and 2012, with 25 total incidents occurring during the six-year time period.[4] Of the 25 incidents, seven were considered serious[5] by the Pipeline and Hazardous Materials Safety Administration (PHMSA) and two required evacuations. However, none of the hazardous material railroad crashes resulted in a serious injury or fatality. **Table 8-9** summarizes the Oklahoma hazardous material railroad incidents by type during the six-year time period. The total number of hazardous material railroad incidents was lower in 2012 than in 2007, with the annual average being four.

Table 8-9. Hazardous Material Railroad Incidents, 2007-2012

Year	Derailment	Serious Gas Released	Flammable Material Released	Fire	Other	Total
2007	0	1	2	0	2	5
2008	2$_1$	1	3	1	0	7
2009	0	1	0	0	2	3
2010	1	2$_2$	3	0	0	6
2011	0	3	0	0	0	3
2012	1	0	0	0	0	1
Average Annual 2007-2012	**0.6**	**1.3**	**1.3**	**0.2**	**0.7**	**4.2**

Notes:
1. One incident had a derailment and fire occur. Recorded as derailment to avoid duplication.
2. One incident released a flammable gas. Recorded as serious gas released to avoid duplication.
Source: CDM Smith analysis based on data from the US DOT Pipeline and Hazardous Materials Safety Administration.

8.1.3. SHSP Update

The ODOT is in the process of updating the 2007 SHSP with the intent of completing it in 2015. The Draft 2014 SHSP retained the 2007 SHSP vision statement: Provide and promote the safest roadway transportation system for all travelers-zero deaths, zero injuries.

The Draft 2014 SHSP also retained the 2007 SHSP's Mission Statement: Develop, implement, and evaluate a data driven multidisciplinary process to maximize road safety through widespread collaboration, integrating engineering, enforcement, education, and emergency response (the 4E approach).

The development of the Draft 2014 SHSP was guided by a Working Group that is comprised of ODOT, Oklahoma Highway Safety Office (OHSO), FHWA, the Federal Motor Carrier Safety Administration (FMCSA), and the Oklahoma Department of Public Safety/Highway Patrol (ODPS/OHP).

The Working Group identified the following statewide safety goal areas to reduce:

- Fatalities;
- Fatality rate;
- Serious injury;
- Serious injury rate;
- Unrestrained occupant fatalities;
- Fatalities involving drivers or motorcycle operators with high (0.08 or greater) blood alcohol content; and
- Commercial motor vehicle collisions.

The first four statewide safety goals are consistent with MAP-21's Safety Performance Measures and the 2015-2040 LRTP Safety Performance Measures. The 2014 SHSP discusses three types of safety improvements strategies.

- **Hot Spots** – Analyze high crash locations. This is the traditional approach to analyze crash location, type, and frequency.
- **Systemic** – Use a particular solution to address roadway issues associated to a particular crash type, meeting certain criteria. For example, lane departure crashes could be reduced if rumble strips were installed system-wide, where roadway conditions correlate with the crash type.
- **Policy** – Utilize a policy guideline to guide implementation of improvements. In this case, there has typically been sufficient research and successful implementation of a given strategy that a policy can be utilized to address the issue. For example, ODOT has a statewide striping policy.

The Draft 2014 SHSP also includes four emphasis areas:

- Unsafe driver behavior (addressing impaired, aggressive, fatigued/distracted drivers, and occupant protection);
- Intersection crashes;
- Crashes involving young drivers; and
- Lane departure crashes.

A growing trend in many states is to emphasize pedestrian and bicycle safety through planning and program initiatives. ODOT recognized the importance of pedestrian safety in the Draft 2014 SHSP where it discusses two programs: the Tulsa Pedestrian Action Plan[6] and installation of Pedestrian Hybrid Beacons[7] (PHBs).

8.1.4. National Safety Trends

According to the National Transportation Safety Board (NHTSA), annual road deaths in the U.S. rose 3.7 percent in 2012 to 33,561. This rise breaks a trend dating back to 2005 when roadway fatalities had steadily decreased from 43,510 in 2005 to 32,479 in 2011. More Americans were traveling in 2012 as compared to previous years so the rise in fatalities was not unexpected. Moreover, road

fatalities per million vehicle miles of travel rose from 1.10 in 2011, to 1.16 in 2012. In working towards improved safety, states throughout the U.S., including Oklahoma, continue to employ the 4E strategies of engineering, enforcement, education, and emergency response.

8.2. SECURITY

Security is an issue that all states must proactively address as a result of terrorist attacks, natural disasters, and the potential for other system failures. As with most challenges, providing appropriate security on Oklahoma's transportation system requires teamwork. The security objectives in Oklahoma related to transportation should:

- Provide for safer travel for all modes of travel;
- Improve the security of the entire transportation system; and
- Improve the ability of the transportation system to support emergency management response and recovery.

There are hundreds of critical assets in Oklahoma that require protection. Listed in the next three subsections are a sampling of assets and events that should be made secure, to the extent possible, and that should have an evaluation and transportation response plan. This is not an exhaustive list but is intended to be illustrative of the types of assets and events that need special security attention and to identify where the transportation system can support the security of the facility or event.

8.2.1. Military Bases

Listed below are the principal Air Force, Army, and Coast Guard critical assets in Oklahoma.

- Altus Air Force Base;
- Tinker Air Force Base;
- Vance Air Force Base;
- Fort Still Army Base;
- McAlester Army Ammunition Base;
- U.S. Coast Guard Institute Base; and
- U.S. Coast Guard Container Inspection Training Unit.

8.2.2. Universities

There are numerous colleges, universities, and technical schools in Oklahoma that may need attention in terms of how transportation can support its security.

8.2.3. Other Buildings, Sites, Events

A sampling of infrastructure, buildings, and events that should be included in transportation security measures in Oklahoma includes:

- Major Bridges and Dams;
- Public Transportation;
- Rail Lines;
- Interstates;
- Major Airports;
- City Halls in all Major Cities;
- Federal Buildings;
- Hospitals;
- Sport Arenas and Stadiums; and
- Nuclear Power Plants.

8.2.4. ODOT Role in Emergency Management

ODOT has a significant role with regard to the state's emergency management system. According to the Oklahoma Emergency Operations Plan, ODOT serves as the primary state coordinating agency in relation to transportation and public works procedures. Under the transportation function, ODOT is responsible for coordinating with the federal government for assistance in areas such as allocation of civil transportation capacity, processing transportation requests, air and marine traffic control, disaster airlift operation management, hazardous materials action, and damage assessment.

The public works function calls for ODOT to coordinate with the federal government for assistance in the areas of debris removal, engineering and construction, and utilities restoration. Additionally ODOT is currently updating its Intelligent Transportation System (ITS) plan – a vital component of managing emergencies and major incidents. ITS equipment plays a critical role in supporting safety and

security during man-made and natural disasters. During a crisis, accurate information is invaluable and can help protect the public and minimize inconvenience to travelers. When a security incident occurs, ODOT's ITS capabilities should be used to the maximum extent possible to inform the public of traveling options for all modes.

The Oklahoma Department of Emergency Management (OEM) is the state agency designated to coordinate the response to a natural disaster that occurs in the state. This is achieved primarily through the development and maintenance of a comprehensive statewide emergency operations plan.

8.3. ENVIRONMENTAL ISSUES

ODOT is responsible for the design, construction, operation, and maintenance of highways, bridges, and railroads that are part of the statewide transportation system. Environmental regulations require 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 National Environmental Policy Act of 1969 (NEPA) and other environmental regulations and requirements.

This section will discuss in more detail state level environmental issues including: environmental policy actions and potential mitigation activities related to transportation investments, Oklahoma's current air quality status in relation to transportation; the growing quantity of seismic events in Oklahoma and the potential impact to transportation infrastructure, and extreme weather events and possible transportation-related adaptation strategies to prepare for such events.

8.3.1. Environmental Policy Actions Including Mitigation Activities

In the development and operation of the transportation system, ODOT considers social and human environmental issues including but not limited to communities, 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 archeological properties and locations. The ODOT cultural resources staff also reviews and consults with tribes regarding areas of traditional religious and cultural significance. Natural environmental resources such as water, air, noise, and threatened or endangered species of animals and plants are considered in the project development process.

Many of Oklahoma's highway improvement projects involve bridge replacement or highway widening. ODOT has a committed, reliable Eight Year CWP and four year STIP, 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.[8] When transportation impacts to the natural environmental cannot be avoided, mitigation is often required.

Threatened and Endangered Species

Oklahoma is home to 25 threatened or endangered species (three plants and 19 animals) under protection of the Endangered Species Act (ESA) of 1973. Some of the more frequently encountered endangered species include the Arkansas River Shiner, Neosho Mucket Mussel, Interior Least Tern, Leopard Darter, Lesser Prairie Chicken, the American Burying Beetle and the critical habitat for these species.

Habitat Disruption Mitigation Activities

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.[9] 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 state.[10]

In addition to Threatened and Endangered Species, Oklahoma is home to Cliff and Barn Swallows, which are small nesting birds protected by the federal Migratory Bird Treaty Act (MBTA) of 1918. These migratory birds have come to the forefront of recent conversations due to ODOT's intensive bridge replacement program. 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.

Storm Water

Storm water runoff occurs when precipitation or snow melt runs over the ground. Impervious surfaces prevent storm water runoff from filtering 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.

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 clear 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.[11]

Wetlands

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), wetlands, sloughs, 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 first avoidance, then minimization, and finally mitigation measures to 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. 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 was formally created in 1990 when the Oklahoma Legislature directed the Oklahoma Conservation Commission to prepare a wetlands management strategy. 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. The WPP is organized into actions and activities that fall under the core elements for a wetland program outlined by the EPA.

Wetland Mitigation Opportunities

A wetland mitigation bank contains wetlands that have already been created or restored. 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).

ODOT is also seeking to collaborate with the Nature Conservancy on permittee-responsible mitigation, and is working with the Oklahoma Conversation Commission on opportunities to develop mitigation strategies for ODOT projects.

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 Oolagah 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.

8.3.2. Air Quality

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 threats.[12]

All three MPOs in Oklahoma (Lawton, Oklahoma City - ACOG, Tulsa - INCOG) 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,[13] carbon monoxide, and nitrogen oxides. Although all three Oklahoma metropolitan areas have had annual ozone violations in recent years, all regions remain in attainment status.

Additionally, a monitor is located in Sequoyah County, a part of the Ft. Smith bi-state MPO covering parts of four counties in eastern Oklahoma and western Arkansas. A review of Sequoyah County monitoring data shows that it has not experienced ozone violations.

The metropolitan 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. 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 ODEQ have been working closely with MPOs to curb mobile source emissions and thus avoid a related non-attainment designation. However, the two following summers of 2013 and 2014 were milder, bringing lower ozone levels and all three metropolitan 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.

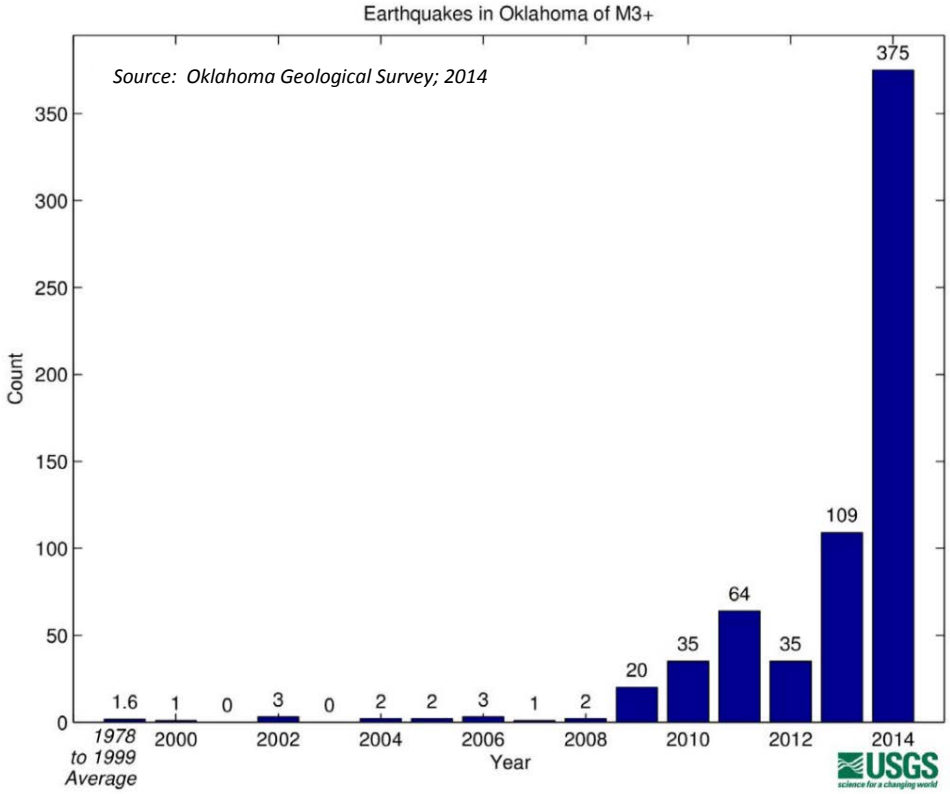
On November 25, 2014, the EPA proposed to strengthen the NAAQS for ground-level ozone, based on extensive scientific evidence about ozone's effects.[14] If the proposed stronger standard is approved, it likely will push all four MPOs and several rural counties into non-attainment.

In an effort to help improve air quality, the State of Oklahoma plans to replace 90 percent of current state agency fleet vehicles with compressed natural gas (CNG) vehicles in the next three years.[15] Natural gas is produced both worldwide and domestically at relatively low cost and is cleaner burning than gasoline or diesel fuel. Natural gas vehicles show an average reduction in ozone-forming emissions of 80 percent compared to gasoline vehicles.[16]

8.3.3. Seismic Events

Since October 2013, Oklahoma has seen a dramatic increase (approximately 50 percent) in seismic events, with the majority of recent seismic events occurring between Oklahoma City and Tulsa. **Figure 8-1** shows the number of 3.0 magnitude or greater earthquakes between 1978 and 2014. In 2013, the greatest number of magnitude 3.0 or higher earthquakes totaled 109. As of May 2014, the U.S. Geological Survey 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 8-1. Number of Earthquakes, Magnitude 3.0 or Greater, in Oklahoma from 1978 - 2014



The 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.[17] After every 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 these inspections, 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.

8.3.4. Extreme Weather Events

In recent years, Oklahoma has experienced some of the most extreme weather in the U.S., including 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. 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.[18]

Flood events have catastrophic impacts to surface transportation infrastructure because they interrupt the movement of people and goods on Oklahoma highways, railroads, and waterways. 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. 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.

Tornados have the potential to 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 sufficient 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.

Long 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. In 2014, every county in Oklahoma saw over 30 days with temperatures over 90 degrees. Six counties experienced 100 days or more with above 90 degree temperatures.

8.4. CONCLUSION

Providing appropriate safety and security on Oklahoma's transportation system is critically important and requires collaboration between numerous federal, state, and local agencies. Oklahoma's extreme weather events, such as extremely hot summers, high intensity rain, and devastating tornadoes, impact Oklahoma's intermodal transportation system. The state transportation safety and security resources help to provide safe travel, maintain the functions of critical assets, and support emergency management in a time of crisis. ODOT has a significant role in the state's emergency operations plan that is maintained by the OEM.

Preservation of the environment and efforts to meet the mobility needs of a growing population, sometimes leads to unavoidable impacts to the human and natural environment. 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 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.

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.

8.5. ENDNOTES

[1] *Systemic approach to safety: The systemic approach to safety involves widely implemented improvements based on high-risk roadway features correlated with specific crash types. The approach provided a more comprehensive method for safety planning and implementation that supplements and compliments traditional site analysis. It helps agencies broaden their traffic safety efforts and consider risk as well as crash history when identifying where to make low cost safety improvements.*

[2] *The University of Central Oklahoma Math Department served as a data consultant for the group that developed the Draft 2014 SHSP. That group included: the Oklahoma Department of Transportation (ODOT), the Oklahoma Highway Safety Office (OHSO), the Federal Highway Administration (FHWA), the Federal Motor Carrier Safety Administration (FMCSA), and the Oklahoma Department of Public Safety / Highway Patrol (ODPS/OHP). The consultant conducted an analysis of traffic collision and safety data to assist with the development of the Draft 2014 SHSP and related recommendations. Using statistical techniques, the data consultant analyzed data from 1997 to 2012 to determine historical trends. The data used to calculate the trends and confidence bands go back to year 1997.*

[3] *The classification of large trucks does not include personal pickup trucks, buses, and single unit trucks. Commercial vehicle trucks are another way to define the large truck classification. The large trucks include vehicle configurations as follows: Single Trailer Trucks with 3-4 axles, Single Trailers with 5 axles, Single Trailers with 6 or more axles, Multi Trailers with 5 or fewer axles, Multi Trailers with 6 axles, Multi Trailers with 7 or more axles.*

[4] *By comparison, the State of Kansas experienced 47 incidents during the same time period.*

[5] *PHMSA defines "serious incidents" as incidents that involve: a fatality or major injury caused by the release of a hazardous material, the evacuation of 25 or more persons as a result of release of a hazardous material or exposure to fire, a release or exposure to fire which results in the closure of a major transportation artery, the alteration of an aircraft flight plan or operation, the release of radioactive materials from Type B packaging, the release of over 11.9 gallons or 88.2 pounds of a severe marine pollutant, or the release of a bulk quantity (over 119 gallons or 882 pounds) of a hazardous material. https://hazmatonline.phmsa.dot.gov/IncidentReportsSearch/Search.aspx*

[6] *A Pedestrian Safety Action Plan helps local officials identify pedestrian safety problems, analyze information, select optimal solutions, and enhance pedestrian safety programs. http://safety.fhwa.dot.gov/ped_bike/ped_focus/docs/fhwasa0512.pdf*

[7] *A pedestrian hybrid beacon (PHB) is a traffic control device similar to a European pedestrian signal that was imported to the US and adapted by engineers in Arizona to increase motorists' awareness of pedestrian crossings at uncontrolled marked crosswalk locations. A PHB is distinct from pre-timed traffic signals and constant flash warning beacons because it is only activated by pedestrians when needed. http://safety.fhwa.dot.gov/ped_bike/tools_solve/fhwasa14014/*

[8] *See Attachment A of the 2015-2040 LRTP Technical Memorandum Environmental Issues and Mitigation Activities.*

[9] *http://ecos.fws.gov/speciesProfile/profile/countiesByState?entityId=440&state=Oklahoma, last accessed 11/24/2014*

[10] *http://www.fws.gov/midwest/endangered/insects/ambb/abb_fact.html*

[11] *http://www.okladot.state.ok.us/env-programs/stormwater/index.htm, last accessed 11/24/2014*

[12] *http://www.epa.gov/airquality/urbanair/*

[13] *Ozone is a gas made up of three oxygen atoms (O_3). 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.*

[14] *http://www.epa.gov/glo/actions.html#nov2014*

[15] *Secretary of Transportation, Gary Ridley November, 2012. http://www.government-fleet.com/news/story/2012/11/oklahoma-dot-adds-160-cng-vehicles-to-fleet.aspx*

[16] *http://www.consumerenergycenter.org/transportation/afvs/cng.html*

[17] *New Insight on Ground Shaking from Man-Made Earthquakes. Released: 4/23/2015. U.S. Department of the Interior, U.S. Geological Survey, Reston, VA. http://www.usgs.gov/newsroom/article.asp?ID=4202*

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